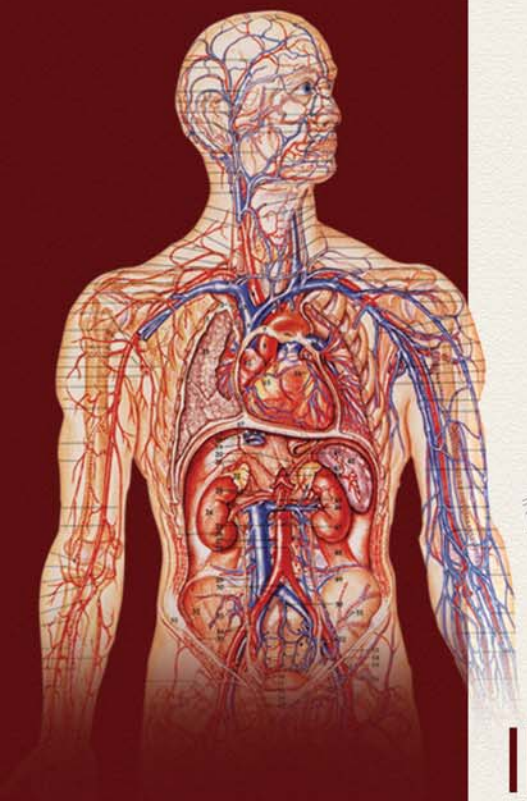

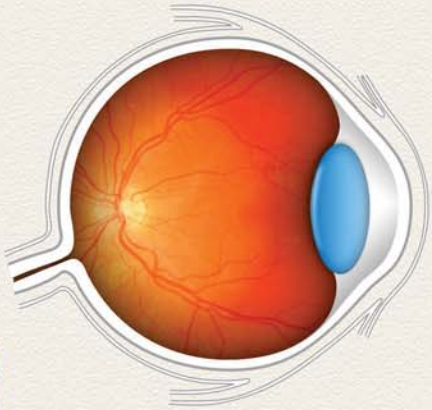

INTRODUCTION TO BASICS IN OPHTHALMIC ASSISTING

(INCLUDES BASIC ANATOMY & PHYSIOLOGY OF HUMAN BODY AND EYE)

OATS

Ophthalmic Assistant Training Series

ARAVIND EYE CARE SYSTEM

The Training in Ophthalmic Assisting Series and Training in Eye Care Support Services Series were born from the vision and inspiration of one very special man, Dr. G. Venkataswamy, founder of Aravind Eye Hospitals and guiding light in the world of eye care and community ophthalmology.

We dedicate this effort to him.

Intelligence and capability are not enough. There must also be the joy of doing something beautiful. Being of service to God and humanity means going well beyond the sophistication of the best technology, to the humble demonstration of courtesy and compassion to each patient.

- Dr. G. Venkataswamy

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Ophthalmic Assistant Training Series (OATS)

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This series of modules can be improved with your help. If you have ideas or suggestions for ways the OATS could better meet your needs, please write to Aravind Communications, C/O Aravind Eye Hospitals or email to communications@aravind.org. We welcome your comments and experiences.

Foreword

The discipline of eye care requires a number of appropriately trained personnel working as a team to deliver comprehensive eye care. The services that are delivered must include the promotion of eye health, the preservation of sight and the prevention of vision loss, restoration of sight when it is lost, the enhancement of vision and functional vision, where feasible and facilitation of rehabilitation through vision substitution. Various cadres of trained personnel, with complementary skills contribute to the work of the team.

In an ideal world, with infinite resources there would be a temptation to use the most highly trained personnel to carry out these tasks. This is neither appropriate nor cost effective, given that human resources for health care comprise the most expensive component of the recurring health budget.

It has been possible to select, train and deploy different cadres of human resources, to carry out tasks in a safe and effective manner to help achieve the goal of eliminating avoidable blindness. One of such cadres is variously referred to as Ophthalmic Assistants, mid level personnel or by their primary functions, such as Nurses, Refractionists etc. Where they exist and function in a stipulated manner, it is acknowledged that they constitute an effective backbone for eye care services. However a critical element to their success lies in the adequacy and appropriateness of the training imparted to them.

There have been several training programmes put in place around the world to train such mid-level personnel depending on the one hand, on the human resource needs for eye care in the country, and the local human resource policies, rules and regulations, on the other.

The Aravind Eye Care System, over the years has developed a cadre of Ophthalmic Assistants who have specific job descriptions. To enable them to perform effectively as part of the eye care team, their training has been task oriented with defined requisite knowledge, skills, competencies and attitudes, to carry out the tasks.

This manual sets out in several sections a step by step method for imparting such task oriented training through didactic, hands on and practical training in real life situations. The sections relate to tasks required of such personnel in different settings in the eye care delivery system such as the out-patient department (general and specialist clinics), wards, operating rooms, optical departments etc. Considerable emphasis has been paid to diagnostic technology, which is increasingly a part of the armamentarium in eye care practice.

Finally the manuals include sections for self assessment as well as for continuing monitoring of the achievements of task oriented objectives. The manual lends itself to translation into local languages where required proficiency in English may not exist. The Human resource Development team at Aravind Eye Care System need to be complimented on their efforts to share there wide and successful experience in this field with others who are already involved in or are planning to venture into such training programmes, particularly in the context of VISION 2020: the Right to Sight.

Dr. Ramachandra Pararajasegaram MB., FRCS., FRCP., FRCOphth. DSc. (Hon)
Past President, IAPB, Co Chair,
Human Resource Programme Committee, IAPB.

Preface

In recent years there have been significant advances in eye care, both in technology and in the increasing resolution to address the scourge of needless blindness. Achievements in medical technology have vastly improved diagnosis, treatment and surgery in all aspects of eye care, and efforts like the global initiative "VISION 2020: The Right to Sight" -- which calls for the elimination of avoidable blindness by the year 2020 -- have galvanized support for those working to improve the quality of eye care at the grassroots level around the world.

It has become increasingly evident that trained personnel is one of the most important elements in achieving this goal, and that the effective practice of eye care is a team effort that must combine the talents of ophthalmologists, ophthalmic assistants, ophthalmic technicians, orthoptists, counsellors, medical record technicians, maintenance technicians, and others.

Currently the focus in human resource development continues to be on the training of ophthalmologists. But in many successful eye hospitals it has been shown that four or five trained ophthalmic assistants are engaged to supplement and support the work of an ophthalmologist. When such assistants are used effectively by eye care centres, doctors can treat more patients in less time while still ensuring a high standard of care. It is therefore vital that more attention be paid to the structured training of other ophthalmic personnel.

Over the past three decades, Aravind Eye Hospital has developed and refined a system of structured training programmes for ophthalmic assistants and support services personnel. These series were created to bring together the lessons we have learned over the years, and to share our insights with other eye care programmes and the community at large.

Dr. G. Natchiar
Vice-Chairman, Aravind Eye Care System

Blindness Prevalence

World wide it is estimated that at least 38 million people are blind and that an additional 110 million have severely impaired vision. In all, about 150 million people are visually disabled in the world today, and the number is steadily increasing because of population growth and aging. Overall, the data shows that more than 90% of all blind people live in developing countries and that more than two-thirds of all blindness is avoidable (either preventable or curable). Unfortunately, little information is available on the incidence of blindness around the world; it seems probable, however, that there are some 7 million new cases of blindness each year and that despite every intervention, blindness in the world is still increasing by 1 to 2 million cases a year. Thus, trend assessment points to a doubling of world blindness by the year 2020 unless more aggressive intervention is undertaken.

A major cause of preventable blindness is cataract. Presently, an estimated 7 million cataracts are operated on each year. There is a backlog of 16 million cases that have not yet been operated on. If this backlog is to be eliminated in the next two decades…a staggering 32 million cataract operations must be performed annually by the year 2020.

In addition, there must be an improvement in technology because more than 50% of cataract surgeries in the least developed countries today are still performed without intraocular lens implantation. Thus, most of the developing countries need more surgery facilities, supplies and equipment, and an increased number of trained surgeons. Furthermore, particularly in sub-Saharan Africa, India, China and other parts of Asia, the volume of cataract surgeries must increase greatly. Although considerable progress is being made in some of these countries, the provision of good quality, affordable cataract surgery to all those in need will nevertheless remain the main challenge for ophthalmology world wide for many years to come.

An important aspect of combating cataract blindness is human resource development. To increase the efficiency of ophthalmologists in clinical work, further training of support staff such as paramedical ophthalmic assistants, ophthalmic nurses and refractionists is essential.

Introduction

In the past three decades, a number of auxiliary professionals such as ophthalmic assistants, opticians, certified orthoptists, research assistants and ultrasonographers have come to be identified as allied health personnel in ophthalmology. Although each of these groups provides a specific meaningful role in the ophthalmic field, it is the ophthalmic assistant (OA) who carries out or helps with certain tasks that were traditionally and uniformly performed by the ophthalmologist.

These tasks involve collecting data and recording measurements on patients, preparing patients for surgery, assisting with surgery, offering postoperative care, and counseling patients. However, these tasks do not involve any judgments or conclusions such as diagnosis, disposition of treatment, or prescription. Ophthalmic assistants do not (and can not) supplant the physician but rather supplement the ophthalmologist by rendering support services. Their broad areas of work include outpatient and refraction departments, operation theatre, wards, and patient counseling.

The ophthalmic assistants in all these areas make vital contributions to the achievement of high quality, high volume, and financially sustaining eye care in large volume settings.

Ophthalmic Assistant Training

Objective

To provide eye care programmes/hospitals/practitioners in developing areas with lessons learned regarding the work of trained ophthalmic assistants and their critical contributions to high quality, large volume, sustainable eye care.

To describe the valuable role of trained OAs and patient counselors in outpatient and refraction departments, operating theatres, wards and patient counseling. To illustrate ways for existing programmes to increase their volume, quality and sustainability through the development and utilization of paramedical personnel.

To provide curriculum and materials for training the OAs in all areas. To elicit feedback from users regarding the strengths and weaknesses of this first edition.

Definitions

The ophthalmic assistant (OA) is a skilled person whose academic and clinical training qualifies to carry out ophthalmic procedures. These are done under the direction or supervision of an ophthalmologist or a physician licensed to practice medicine and surgery and qualified in ophthalmology.

At Aravind, based on their skills and performance, an ophthalmic assistant with at least five years of experience is upgraded to an ophthalmic technician. At Aravind the term nurse usually refers to registered nurse (RN) fully trained elsewhere in all aspects of nursing care. However, the term is some times used at Aravind in traditional operating theatre terminology, as in scrub nurse, running nurse, etc.

Ophthalmic assistant training

Recognizing the importance of ophthalmic assistants in eye care service delivery, Aravind established its in-house training program to meet its own need for trained Ophthalmic Assistant staff. Yearly two batches of 17 to 19 year old candidates (35-40 students in each batch) who have cleared their high school examinations (plus two) are selected based on the eligibility criteria deemed appropriate by the institution.

Structure of the OA training programme at Aravind

Basic training: Four months observation and classroom learning

Specialisation: Eight months demonstration training and practice

Probationary Period: One year on the job training under constant supervision

The basic training portion includes studies and practice in

- Basic general anatomy and physiology
- Ocular anatomy, eye diseases and emergency management
- Skills such as
    - Visual acuity testing
    - Tonometry
    - Lacrimal duct patency
    - Blood pressure management
    - Bed making
    - Human relations, communication skills and compassion

On completing the four-month basic training, students take one of the specialization courses:

- Outpatient care (OPD)
- Operation theatre assistance
- Inpatient care (Wards)
- Refraction

The next eight months are spent training in the specialty with lectures in the morning and supervised practical work in the afternoon. For the final 12 months, candidates work under close supervision.

The Aravind model of Ophthalmic Assistant staffing

The role of trained Ophthalmic Assistant staff in facilitating high quality, large volume sustainable eye care is central to Aravind's successful large volume eye services. The principle of division of labor helps to maximize the skills of the ophthalmologist by developing a team approach with auxiliary personnel. Efficient eye care service delivery depends on optimum utilization of all categories of resources – human resources, equipment, instruments, beds and financial.

At Aravind, the concept of human resource development evolved in response to increasing need for OAs and to provide adequate clinical experience to develop their professional competence.

Human resource development is one of the important components of large volume eye care. The history of Aravind's Ophthalmic Assistant training can be traced back to 1970-1972 when its founder, Dr. G. Venkataswamy , was Professor and Head, Department of Ophthalmology, Madurai Medical College.

Trained and skilled human resources are critical and therefore must be utilized optimally. Typically, an ophthalmologist's repertoire of work involves administrative tasks, skilled but repetitive tasks, and judgement-based tasks. An ophthalmologist's unique competence lies in judgement-based tasks such as interpreting investigative findings and decision-making tasks such as delineating the line of treatment or surgery.

Administrative and repetitive tasks can often be done (and better also) by a non-ophthalmologist who has been adequately trained.

In large volume eye care programs, efficient and knowledgeable Ophthalmic Assistants play a vital supportive role in many areas of ophthalmic care.

About the Ophthalmic Assistant Training Series (OATS)

The Ophthalmic Assistant Training Series responds to the desire of many organizations and institutions around the world to provide high quality, high volume eye care.

The contribution of the ophthalmic assistants to this work is fundamental.

The Ophthalmic Assistant Training Series is a set of manuals explaining the principles and techniques for increasing high quality, high volume eye care through the use of paramedical staff.

Each module is based on the practices of Aravind Eye Hospitals in South India.

The intent of this series is to provide a format for Ophthalmic Assistant Training based on Aravind Eye Hospital's "best practices", based on over 30 years of growing, changing, and learning from mistakes.

The five modules of OATS

1. **Introduction to Basics of Ophthalmic Assisting** : This is the foundation of the entire Ophthalmic Assistant Training. All the trainees are given general knowledge and training for the fundamentals necessary for their duties, as well as specific information about all activities required in their work.

2. **Clinical Ophthalmic Assisting (Outpatient and Inpatient Services)**:

Out-patient Department (OPD): This includes theory and practice of initial patient evaluations. An introduction to refraction is presented as well as steps for assisting the doctor.

Ward: This contains all the information necessary for the smooth running of a Ward. Pre and post operative procedures and patient instructions, as well as management of emergency and post operative complications are discussed. Ward set-up and management and laboratory functions are covered.

3. **Surgical Ophthalmic Assisting**: Contains background and practical steps to the smooth running of a sterile theatre. Personnel requirements, roles and duties of theatre personnel including management of emergencies and medications, and assisting in specific procedures are detailed.

4. **Optics and Refraction:** All aspects of refractions are covered, including step- by step instruction for subjective and objective refraction, room set up, and equipment required. All types of refractive error are described as well as the methods of assessing them. The theories and practice of visual fields, ultrasonography, contact lens fitting, low vision aids and optical dispensing are included.

5. **Role of Counselling in Eye Care Services:** Helping patients help themselves. The importance and types of patient interaction are discussed in detail. Basics of communication and specific examples are presented.

About Training in Eye Care Support Services Series (TECSSS)

The Training in Eye Care Support Series (TECSS) responds to the desire of many organizations and institutions around the world to train support services personnel to provide high quality, high volume eye care.

The Training in Eye Care Support Series is a set of manuals explaining the principles and techniques for the effective procedures to be followed by the support services personnel.

Each module is based on the practices of Aravind Eye Hospitals in South India.

The intent of this series is to provide a format for Training in Eye Care Support Services based on Aravind Eye Hospital's "best practices", based on over 30 years of growing, changing, and learning from mistakes.

The three modules of TECSSS

1. **Housekeeping in Eye Care Services**: The invisible "bottomline" for patient safety and satisfaction. Cleanliness, appearance, maintenance, attitude are all essential for the entire hospital and OPD. Duties, responsiblities and specific tasks are covered.

2. **Medical Records Management in Eye Care Services**: A complete guide to establishing and running an efficient medical records department: information retrieval, generating statistics, personnel requirements, importance of accuracy.

3. **Optical Sales and Dispensing:** This gives clear guidance about the various spectacle lenses and frames, how to fit the lens into frame, the technical measurement and sales procedure.

INTRODUCTION TO BASICS IN OPHTHALMIC ASSISTING

(INCLUDES BASIC ANATOMY & PHYSIOLOGY OF HUMAN BODY AND EYE)

Ophthalmic Assistant Training Series

Acknowledgements

We take great pleasure in presenting the 'Introduction to Basics of Ophthalmic Assisting' which is the consummation of many years of experience and tireless efforts by Aravind's ophthalmic assistant training department.

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We express our sincere thanks to Dr.Pararajasegaram for contributing foreword to this manual.

We take this opportunity to thank Aravind Publications Department particularly Mr.Lakshmanan, Consultant Editor, for his contribution to the final edition and to Ms. Gowri, Ms. Meenakshi, Mr. Ramraj and Mr. Veeranayagam whose team effort has resulted in the fruition of this manual. We are grateful to Ms. Pattammal for co-ordinating the contribution from various sources and also for her contribution in editing the manual.

Finally we sincerely thank the senior leadership team of Aravind Eye Care System particularly our Vice –Chairman Dr. Natchiar for the constant support and encouragement.

The Ophthalmic Assistants team

Aravind Eye Care System

INTRODUCTION TO BASICS IN OPHTHALMIC ASSISTING

(Includes Basic Anatomy & Physiology of Human Body and Eye)

CONTENTS

CHAPTER 1 HOSPITAL ORIENTATION

OUTLINE

Hospital setup
Culture and values
- Vision and mission

Rules and regulations of the hospital
Organisational structure and its function

GOAL

To equip the Ophthalmic Assistant with knowledge about location, environment and set-up required for smooth functioning of a hospital and to become familiar with the mission and vision of the hospital.

OBJECTIVES

The OA will be able to

- List the needs identification to start a hospital
- Discuss selection of site, which is accessible for basic needs
- State the importance of keeping the hospital environment clean
- Understand the set-up of each department such as outpatient, inpatient, intensive care unit and speciality clinics
- List the methods of waste disposal and waste management
- Discuss and adopt the culture and values of the hospital
- Explain the vision and mission of the hospital

CHAPTER 1
Hospital Orientation

World Health Organization defines hospital as an integral part of a social and medical organization. Its function is to provide for the population complete health care both curative and preventive. Its out-patient services reach out to the family and its home environment; the hospital is also a centre for the training of health workers and biosocial research.

A good hospital would build its services on the knowledge and understanding of the community it is to serve; its success will depend upon the involvement of many professional groups, within and outside the hospital.

Hospital is an institution whose primary function is to provide in-patient services, diagnostic and therapeutic, for a variety of medical conditions both surgical and non surgical. It is meant to serve people with various diseases. It should have a pleasant ambience, the building should be planned to allow smooth patient flow, and the staff of the hospital should be trained to provide the patients high quality treatment with compassion. The hospital should also ensure safety for the patients. It has been found that 7% of the patients are admitted to hospitals with nasolacrimal infection. Hence it is important to have a planned set up which ensures an infection free environment. This chapter aims at facilitating the reader's understanding of the important factors that contribute to an ideal hospital set up.

A. Hospital setup

Need identification

Need for starting a new hospital is identified through a needs assessment survey in the community. The information which needs to be gathered from the survey includes:

- Total population in that area
- Major prevalent illnesses
- Mortality and morbidity rates
- Economic status of the people
- Presently available medical facilities
- Present accessibility of services by the people
- Areas requiring clinical services
- Availability of human resource
- Accessibility of civic amenities such as water, electricity, road and transport
- Local cultural practices

This data will help to justify the need for a hospital in that particular area

Selection of site

In the selection of site, two very important factors are the level of sub soil water and the structure of the soil. Also,

- It should be accessible to the people living around. The catchment area should be about 15-25km radius if the transport facilities are good
- The selected place should have good ground water resources and also domestic water supply for the hospital's daily use
- The hospital requires water, sewage, electricity and telephone lines. These facilities should be acquired at the earliest through the concerned public authorities
- Proper canalisation for good drainage should be made and general sanitary measures should be taken
- Both the patients and the personnel need clean air and quiet surroundings. The location should be free from noise, dust, smoke, vapors and other annoyances like atmospheric pollution coming from roads, industries, factories, and play grounds
- When planning the construction it is advisable to keep in mind plans for future expansion

- Cost is also an important factor that should be considered while selecting a hospital site. Total cost incurred to build a hospital should be calculated at the initial stage, and the budget should be planned well in order to avoid unnecessary problems in the later stage of construction

Hospital environment

Hospitals should be highly sensitive to noise and dust. It is good for the hospital to be surrounded by green trees and a garden (Fig. 1.1). If the site of the hospital does not have trees, they should be planted; the hospital must have a well maintained garden. This will prevent dust inside the hospital, help to keep the noise out, and provide a pleasant environment.

Fig. 1.1 Trees around a hospital building

Out-patient area

Out-patients are those who do not require admission to the hospital. Departments which cater to this category of patients are called Out-patient Departments (OPD). All the patients should access a hospital through the out-patient department. Good out-patient services constitute one of the most important elements of an ideal hospital. Since it is the first area of the hospital, it reflects the image of the hospital (Fig. 1.2).

- Objective of the OPD is to provide diagnostic, curative, preventive and rehabilitative services to the community. The hospital may provide a mobile service to reach out to the underserved areas.

Fig. 1.2 Out-patient area

- The patient registration counter registers the patient as an out-patient and the staff then guides them to the relevant departments for diagnosis and treatment procedures.
- The out-patient area should have proper ventilation, lighting, and sufficient space to accommodate patients and their attenders.
- Since all the patients enter through the out-patient area it is the duty of House keeping Department to ensure cleanliness.
- The out-patient area should have an aesthetic ambience which helps the patient relax.
- Health education posters in the out-patient area help create awareness in the patients and attenders on various diseases. This is also the area to put up posters educating people on basic hygiene and health.
- Sign boards and directional graphics in large hospitals helps patients to find their way around.
- Waiting areas should have the provisions of televisions, enquiry desk, touch screens and a separate play area for children.

In-patient department

A patient who is admitted to a hospital or a clinic for treatment that requires at least one night stay is called an in-patient. Areas which cater to these patients are wards or in-patient areas. In-patient areas should be located away from main roads and the OPD area. This is to ensure quiet and peace. Also, rooms which overlook the main road are a potential source of cross infection. The in-patient area should be easily

approachable from the operation theatre and supportive services. (Fig. 1.3).

- The prime objective of in-patient department is to provide accommodation for patients.
- In-patient units are grouped into general wards and special wards. In each type of ward the patients may choose the kind of accommodation based on their economic condition. Patients who are critical and need special care are put into the intensive care unit (ICU).

Fig. 1.3 In-patient area

- General wards accommodate patients who are not critically ill but need continuous care or observation and have to be in bed.
- Speciality wards cater to patients who need hospitalisation in particular specialties such as orthopedics, paediatrics, gynecology etc. This is applicable to a multi speciality hospital. In the case of eye hospitals, whether big or small the ulcer ward should be separate so there will not be cross infections. In bigger hospitals where patient flow is higher, ward can be split for each speciality like cataract, retina, pediatric, glaucoma and so on.
- **Intensive care units**: These are specially built for the patients who need close monitoring and observation. It should contain equipment like pulsoximeter, defibrillator, and oxygen supply and it should be away from the public area of the hospital.
- There should be a policy for regulating visitors and attenders which helps the hospital provide a safe and peaceful environment. Some hospitals do not restrict visiting hours. So the patients feel good if people come and see them.
- Every room of the ward should have all the facilities the hospital has assured the patient at the time of admission. There should be immediate response from housekeeping in case of any query from the patient.
- All the wards should have required staff, cleanliness and supportive facilities to ensure patient satisfaction.

Cleaning and waste management

A clean and hygienic environment has a tremendous psychological impact on the patients and visitors of the hospital. Proper and frequent cleaning of hospital floors keeps the patient free from infections. Good housekeeping is essential in a hospital to ensure cleanliness and an infection free environment.

Dust is tiny particles which carry infection, create irritation of skin and allergies, and cause damage to the instruments and equipment.

Wastes generated in the hospital should be treated and disposed of properly, to provide a safe environment for patients. If waste is not treated and disposed of properly, it is prone to spread diseases.

It may not be possible for small hospitals to maintain a separate department for hospital housekeeping. People could be appointed to maintain cleanliness and an OA could be in-charge.

Infections can be avoided by following these steps

- Dust management is an important concept that should be followed strictly in a hospital set up.
- Proper maintenance of drainage system will help keep the environment free from insects, including mosquitoes.
- Keep the environment green.

- Sprinkling water in the space around the hospital avoids airborne dust inside.
- Reduce speed of vehicles by keeping speed breakers in the roads around the hospital (with the permission of the concerned government authority).
- Keep carpets at the entrance of out-patient department and in-patient department.
- Frequent cleaning of the floors and periodic cleaning of walls with appropriate disinfectants reduce the risk of infections.
- Proper covering of equipment after use and regular maintenance of air conditioning.
- Instructing the patients and hospital personnel to follow waste management practices.
- Educate patients, attenders and hospital personnel about the importance of a clean environment with posters and pictures in various locations of the hospital.
- Follow proper waste management system in the hospital by disposing of waste as directed by the rules laid down by the pollution board.

People visit hospitals with high expectations believing that every disease is fully and quickly curable. The average health care consumer regards contemporary hospitals as the panacea to his health problems. They cannot appreciate the limitations of the hospital. Hospitals which are designed only to meet the health professionals' needs will fail to develop an environment which meets the patient's needs.

B. Culture and values

Culture is very important in a health care organisation. Culture is a way of life. Culture exists in every organisation. Culture is valuable for both the organisation and the employee. Culture is valuable for the organisation because it enhances organisational commitment of the employees. It guides employees about how things are done and what is important for them.

1. Definition of culture
2. Types of culture
3. Function of culture
4. Creating, sustaining and changing culture
5. How culture is learnt
6. Aravind Eye Care as an example. The culture and values of Aravind Eye Care System
7. Conclusion

1. Definition of culture

Organisational culture can be defined as a pervasive underlying set of beliefs, assumptions, values, shared feelings and perceptions, which influence the actions and decisions taken by the organisations. Culture is something which is created and resides in the minds of the people. Otta Klin Berg defines culture as a "way of life"

Organisational culture is marked by a number of characteristics

- **Observed behavioural regularities:** When people in the organisation interact with one another, they generally use common language, terminology, and other rituals that relate to deference and demeanor.
- **Norms:** The expected patterns of behaviour are known as norms. Norms represent an unwritten code of conduct. Standards of behaviour are set to guide the organizational members how much work to do. This, in many organisations, is expressed as "Do not do too much, do not do too little".
- **Dominant values:** Organisations advocate some major values and expect the same to be imbibed by its organisational participants. A few examples of such popular values are high product quality, regularity, and efficiency.
- **Philosophy:** Organisations set forth certain beliefs about how employees and / or customers are to be treated.

- **Rules:** There are guidelines stating how the new participants have to adapt to be accepted as full-fledged members of their group in the organisation.
- **Organisational climate:** This is an overall "feeling" that is conveyed by the physical layout, the way organisational participants interact with one another, and the manner in which organisational members behave with outside persons.

2. Types of cultures

Dominant culture and subculture

A dominant culture is marked by a set of core values shared by a majority of the organisational members. When we talk about an organisation's culture, we refer to its dominant culture. The dominant culture gives a macroview of an organisation's personality. For example, most of the employees at the Reliance Group share a concern for the value of time. This creates a dominant culture in the organisation that helps guide the day-to-day behaviour of employees.

Subculture

Subcultures expresses a set of values shared by the members of a division or department. Subcultures typically are a result of problems or experiences shared by members of a department or unit.

Strong and weak cultures

A strong culture is characterised by the organisation's core values being intensely held and widely shared. The more intensely the core values are shared, the stronger the culture. The degree of sharedness depends on two factors

Orientation and rewards

In order for people to share the same cultural values, orientation programmes are organised to tell the new comers about the organisation's philosophy and method of operation. Orientation may be done through both word of mouth and day-to-day work habits and examples. Rewards also effect sharedness. For example, promoting employees who hold the core values helps others better understand the core values. This, in turn, results in lower employee turnover. When core values are not shared with high degree of intensity, a weak culture is formed. Weak culture is usually characterised by high turnover of employees.

3. Functions of culture

Culture performs several functions in an organisation

- Culture provides shared patterns to cognitive perceptions or understanding about the values or beliefs held by the organisation. This enables the organisational members to think and behave as expected of them.
- It provides shared patterns of feelings to the organisational members showing them what they are expected to value and feel.
- It provides a boundary that creates distinctions between an organisation and others. Such boundary-defining helps identify members and non-members of the organisation.
- Culture facilitates the generation of commitment to something larger than one's individual self-interest.
- It enhances social stability by holding the organisational members together, providing them appropriate standards.
- It serves as a control mechanism that guides and shapes the attitudes and behaviour of organisational members. It helps organisational members stick to the prescribed and expected modes of behaviour.
- Culture ensures that everyone is focused in the same direction.

4. Creating, sustaining and changing a culture

Creating a culture

Beliefs and values have their base on past happenings. It implies that the ultimate source of an organisation's culture is its founders. The founders start their

organisation with a vision. The vision is imposed on all organisational members. The members imbibe the vision through interaction and their own experience.

Tata is an example that typifies this type of culture creation. His supportive-consultive role, his belief in professionalism, and assumption that only honesty and fair dealings will pay have made the vast Tata empire what it is today.

Luthans has outlined a distinct process involved in the creation of a culture. The process involves the following steps:

- A single person (founder) has an idea or vision for an enterprise.
- The founder brings in people and creates a core group that shares a common vision. All in the core group accept the idea or vision and work for it.
- The founding core group begins to act in concert to create an organisation by raising funds obtaining patents, incorporating, locating space, building and so on.

Sustaining culture

Culture once established may fade away if it is not reinforced. Once a culture is created, it must be sustained through reinforcement practices of human resource. Three such practices particularly important in sustaining a culture are selection practices, the actions of top management, and socialisation methods.

Selection

The first step involved in sustaining culture is the careful selection of entry level candidates. The basic purpose of selection process is to appoint the right people for the right jobs. For this, the trained recruiters interview candidates and attempt to screen out those whose personal styles and values do not fit with the organisation's culture. Thus, by identifying suitable candidates who can culturally match the organisational culture, selection helps to sustain culture.

Top management

Subordinates emulate their superiors. The actions of top management such as what the managers say and how they behave has a major impact on the employees working at lower levels. This filters down the entire organisation and becomes a common feature or culture of organisation. Managerial actions like a degree of freedom granted to the subordinates, prescriptions for the employee uniform, pay off in terms of raises, promotions, and other rewards also help create a common history i.e., culture in the organisation.

Socialisation

Socialisation can be conceptualised as acquisition of work skill and abilities, adoption of appropriate role behaviours and adjustment to the norms and values of the work group. In simple words, socialisation is the process of adaptation. New organisational members coming from different backgrounds may disturb the common customs and beliefs already established in the organisation. Therefore, the new employees need to be educated to the organisational culture. This adaptation process is called socialisation.

Socialisation process involves three phases

- Pre-arrival
- Encounter after induction
- Metamorphosis

Pre-arrival refers to all learning that occurs before a new member joins the organisation.

Encounter is the stage of induction which the new recruit joins the firm and is put on the job. The role playing starts here. The recruit starts comparing expectations, the image which he had formed during pre-arrival stage with reality. If expectation and reality concur, the encounter is smooth. When the two differ, stress and frustration set in. What follows is a mental process of adjustment. In this adjustment, the individual tries to replace their own values and norms with those of the organisation at least in vital

areas, if not in all. In the other extreme, the recruit simply cannot reconcile with the values and norms of the organisation, get disillusioned and quits the job.

Metamorphosis is the completion stage of changes and consolidation of changed behaviour. In this stage, the employees master the skills required for their new roles, and make the adjustment to the organisation's norms and values. This is, of course, a voluntary process and a conscious decision which enables them to become compatible with the group and organisation. This signals the completion of socialisation process.

Changes in organisational culture

As organisations do not remain the same over a period of time, so is the case with culture. Culture established in one type of environment may not remain effective in a changed environment. If so, the organisation must adapt to new conditions of environment or it may not survive. Hence, there is need for change in organisational culture.

Changing culture is important but not simple. Changing a strong culture is particularly difficult because the cultural values and assumptions have taken deep roots and employees become committed to them. It is easier to change the culture when it is weak.

Deal and Kennedy identified five situations which facilitate change in the culture.

1. When the environment is going through rapid changes, and the company has been highly value-driven.
2. When the industry is highly competitive and the environment changes quickly.
3. When the company is mediocre, or worse.
4. When the company is truly at the threshold of becoming a large corporation.
5. When the company is growing very rapidly.

A dramatic crisis

At times, there can be shocks that undermine the status quo of culture and question its relevance. Examples of such crises are a surprising financial setback, the loss of a major customer, or a dramatic technological breakthrough by a competitor which can change the market structure. For example, once the Maruti car was introduced in the Indian market, it shocked the sedate passenger car market, and forced other companies to take a more productive stance. Similarly, the economic reforms initiated during the 1990's as well as the opening of the global market forced many companies to attempt changing their cultural orientation.

Change in leadership

Changing top leadership also has major impact on organisational culture. It is correct to say that the top leadership is the personification of the culture. The top leadership sets the norms, values and formal reward systems for achieving organisational goals.

How is culture learnt?

Since the term organisational culture refers to the underlying beliefs and values that are shared by organisation members, culture can't be dictated by the top management. Organisational culture is transmitted to employees in a number of forms. The most potent ones are stories, rituals, symbols, and language.

Stories

Most stories are narratives based on true events about the organisation's founders, rule breaking, rags-to-riches successes, reductions in work force, relocation of employees, reactions to past mistakes, and organisational coping. Some stories are considered legends because the events are historic. Stories are useful because they preserve the primary values of the organisation by anchoring the present in the past.

Rituals

Rituals are a means of transmitting culture. Activities such as award ceremonies, weekly Friday prayer meetings and annual general meetings are some examples of rituals. These rituals reinforce the key values of the organisation, what goals are important, which people are important and which are expendable.

Symbols

A symbol is a representation of something else. Physical symbols in organisations are used to represent and support organisational culture. The value of symbols is that they communicate important cultural values. Symbols become more powerful facilitators of culture if they are consistent with stories narrated to the organisational members.

Languages

Language is a means of universal communication. Most organisations tend to develop their own language in the forms of jargon, phrases, acronyms, slogans, etc. By learning this language, the members attest to their acceptance of the culture and help preserve the organisational culture. Organisations use a specific slogan, metaphor, or saying to convey special meaning to employees. Slogans can be readily picked up and repeated by employees as well as customers of the company.

Values

A value is defined as a belief upon which a person acts by preference. Values guide human behaviour. As described earlier, the culture and values of an organisation are necessarily linked. Thus, the values and behaviours of employees must support the existing culture for the organisation to flourish.

When the culture and values of an organisation are in harmony and 'lived' by all employees, the organisation will prosper.

C. Vision and mission

Aravind Eye Care System - A model

"To eradicate needless blindness by providing appropriate, compassionate and high quality eye care for all."

The eye care system mission statement embodies much of the culture in the organisation – that of quality and excellence in service and products and a dedication to treating all patients without discrimination.

Together with mission statements, one of the key elements in the symbolic material of an organisation's culture is that of shared stories.

Stories about Dr.V. are commonly told and act as an ongoing reminder of his influence on the organisation. They remain a powerful way of communicating the organisation's ethics.

Spirituality

Aravind Eye Care System was founded very much on a spiritual basis. There are meditation rooms in each building. Dr. V spoke of a 'divine life in a divine body' and a higher state of consciousness. Sri Aurobindo's teachings help people develop higher levels of consciousness, away from feelings such as hate and anger.

Unity

The way in which people work together in an organisation is a key indicator of culture. This relates to how the organisation works as a group of people, how it interacts with patients and how it is regarded in the community. Employees treat other employees as members of their own family.

Community based approach

Standing in the community remains extremely important to the culture of Aravind Eye Care System. Local people (and those not so local) feel that Aravind Eye Hospital is their hospital and many

patients were able to cite examples of family and village members who had recommended the institution. Aravind Eye Care System takes pride on its close relationship with local communities and its proactive approach in providing help and awareness through camps and other programmes. In short, Aravind Eye Care System has an enviable reputation.

Patient care

Within the values of Aravind Eye Care System the most important is the emphasis put on patient centered care. Employees are taught to meet the needs of their patients, remove their fears and satisfy their reasonable needs.

Other associated traits are: warm, friendly, compassionate, humane, kind, sympathetic, peaceful, and calm.

Hardwork

The hard working culture at Aravind Eye Care System is imbibed from the leaders and management team. Initiative, drive and a willingness to take in new ideas are encouraged throughout the organisation. A high level of responsibility is given to employees who often take the work beyond the specification of the role. Excellence and quality are inherent. Other associated traits are: organised, efficient, flexible, and responsible.

Selflessness

Employees are in minimum pursuit of position and title. Service is placed before self, along with the interests of the patients and institution.

Other associated traits are: self-sacrificing, altruistic, noble, gallant.

Integrity

Aravind Eye Care System is honest and acts with integrity. Employees have good moral values, and are dedicated and loyal to the hospital. Patients are always told the truth and gifts or bribes are not accepted. Other associated traits are: humble, respectful, courteous, polite, and tolerant.

Discipline

This relates not only to behaviour of the staff (they must exercise a good level of self control and perseverance) but also their attitude towards resources and limiting wastage. Employees must be punctual and have a good attendance record. The hospitals are kept immaculately clean and staff have a high level of personal hygiene. Other associated traits are: regulation, order, restraint, control.

Team work

Employees facilitate a good working environment with consideration to other employees, team work and relationship building. No individual can be allowed to undermine the team spirit, each has respect from and to the institution. Other associated traits are: cooperation, collaboration, fellowship.

D. Rules and regulations of the hospital

Hospital provides patient care services with the help of physicians, surgeons and other paramedical staff. Despite the size of the hospital and number of patients it must have its own rules and regulations for the smooth flow of work.

Following rules and regulations

Every one should follow the rules and regulations.

Some of the rules and regulations are listed below

- OA should be a dependable person. Once work is entrusted to them, they must execute it with enthusiasm and devotion. This will make others realise their trustworthiness.
- Report to work on time. As a medical person punctuality is a must. It is not enough to report to work punctually. They must discharge their duties punctually.
- Keep absence to a minimum.

- Be loyal to the institution. Staff may be dissatisfied with a colleague or official; this should not be discussed with a patient.
- Dress code is essential to an employee because it gives them dignity.
- Respect elder people
- Remember that the patient is an important person in the hospital. As Mahatma Gandhi said the customer (patient) is never an interference but gives us an opportunity to serve him.
- Patients should be treated with respect and courtesy. The patients come from different walks of life, different economic background, and different educational backgrounds. Every one should be treated with compassion without discrimination.
- Care should be given to the patients without discrimination as to race, colour, religion, sex, national origin, value, beliefs or ability to pay
- Job description for each employee should be in file.
- Written consent from the patient should be obtained for special procedures.
- Confidentiality should be maintained by all department staff regarding patient's prognosis.
- Don't waste time.
- Don't waste supplies.
- Documentation should be true e.g., (record keeping)
- Strict visiting timing should be followed. (Depends on the general policy of the administration).
- Purchasing should be through proper channel.
- Provide proper and regular care and preventive maintenance to all equipment and instruments. All necessary instruments should be covered under annual maintenance contract and insurance policy.
- Infection control team should be in place to control infections.
- Quality management programme which includes measuring, evaluating and improving patient care.
- All services (nursing, pharmaceutical, food and dietary, imaging and therapeutic radiology, laboratory, and emergency) should be provided within the hospital premises.

E. Organisational structure and functions

- Hospital Administrator - ensures maximum patient satisfaction.
- Personnel Manager - plans and coordinates disbursement of salary, monitoring leave and attendance procedures.
- Office Manager - Attend to all administrative work and assist the administrator in the duties.
- Equipment Maintenance Manager - ensures effective purchase and maintenance of all major medical equipment.
- Finance Managers - Manage financial resources of hospitals and submit periodic reports.

Summary

Physical ambience alone is not enough to provide satisfactory services to the patient. The ophthalmic assistant (OA) plays a vital role in offering patient care. They know why and how a hospital is started and the importance of maintenance in different areas. Beyond this, they know the culture and values of the institution, mission and vision, and rules and regulations of the hospital. When they are familiar with the mission and their contribution towards it, they discharges their duties with devotion and enthusiasm. An institution must have a set of rules and regulations so that the work flow will be smooth.

Key points to remember

1. *Needs assessment survey is to be conducted in the community before starting a hospital in that area.*
2. *In the selection of site, the level of subsoil water and the structure of the soil are two important factors.*
3. *The out-patient area should have proper ventilation, lighting and sufficient space.*
4. *The in-patient area should be away from the main road.*
5. *Waste should be disposed of properly.*
6. *The culture and values of an institution guide its employees on how things are done and what is important for them.*
7. *Rules and regulations of a hospital enables a smooth flow of work.*

Student exercise

Answer the following

1. *What is the information collected in the need identification survey?*
2. *What are the important factors looked at in the selection of site?*
3. *Give a short note on placement of*
   a. *Out-patient department*
   b. *In-patient department*
   c. *Intensive care unit*
4. *What are the steps followed to avoid infections in the hospital?*
5. *Give the definition of organisational culture.*
6. *What are the characteristics of organisational culture?*
7. *Explain the functions of culture in an organisation.*
8. *How do we teach culture to trainees?*
9. *Mention some of the rules and regulations followed in the hospital.*

CHAPTER 2 PROFESSIONAL ETIQUETTE

CONTENTS

Dress code
Personal hygiene
Qualities of health professional
Medical ethics
Patient communication

GOALS

The Ophthalmic Assistant will demonstrate the etiquette to be followed in their profession

OBJECTIVES

The OA will be able to:

- State the importance of dress code
- Maintain personal hygiene
- Be familiar with the qualities of a health professional
- Understand medical ethics
- Communicate effectively with patients

CHAPTER 2
Professional Etiquette

A. Dress code

The OA is a member of a health care team. Primary nursing care is a method of patient care delivery in which the OA is responsible and accountable for the entire nursing care of the patient. The OA is to be easily identified by the patients and their attenders. Hence they are to be in uniform. Usually they wear white sari and white blouse in some of the regions in India. The hospital management can choose the colour and pattern of the uniforms. Whatever the colour and pattern, they should dress neatly and properly.

The Purposes of introducing a uniform for the OA are

- To promote a professional impression on customers and the public
- To promote employee, patient, customer safety and comfort
- To frame the professional image required for medical professionals
- To identify people by their dress

Policies

The following standards of dress and grooming are required for all categories of clinical staff providing direct patient care in clinical settings including students and physicians.

- Uniform should be clean and dressed up neatly
- Jewelry worn should be appropriate for the clinical area and present no threat of injury to the employee or patient
- Hair should be neat and tied up
- No flower is to be worn
- No finger ring is to be worn
- Nails should be cut short, clean and no polish is allowed
- Name badge should be worn
- Uniform slippers should be worn
- Always wear a wristwatch with a second hand
- Nothing should be worn related to religion e.g.. Bindi

This dress code should be maintained by all employees

B. Personal hygiene

Personal hygiene is to be performed as often as necessary to stay clean and comfortable. People who can take care of themselves practice hygiene out of habit. Other hygiene measures may be done regularly before and after meals and at bed time. Infants, children and adults who are disabled may need help with hygiene. Remember to assist a patient with personal hygiene whenever necessary. Personal hygiene is the first step to good grooming and good health. Elementary cleanliness is common knowledge. One of the most effective ways we have to protect ourselves and others from illness is good personal hygiene. In a hospital setup personal hygiene is very important. It includes

- Oral hygiene
- Bathing
- Well combed hair
- Clean face
- Washed dress
- Well clipped nails
- Clean stockings

Oral hygiene

Oral hygiene prevents illness and promotes a healthy mouth. A clean mouth and clean teeth prevent mouth odours and infections, increases comfort and make food taste better. Illness and disease may cause a bad taste in the mouth. Brush teeth regularly.

Bathing

To prevent offensive body odour, it is important to take bath regularly.

Well combed hair

Hair should be clean and styled in an attractive and simple way.

Washed dress

Uniform should fit well and be modest in length and style. Wear a clean and well pressed uniform daily.

Well clipped nails prevent microorganisms from growing and multiplying. Proper care prevents odour and infections. Feet should be washed daily and dried thoroughly between the toes.

Special hygiene measures are necessary during menstrual periods. Hand washing is necessary to prevent infections. Good health and personal hygiene practices will help you to feel well.

C. Qualities of health care professional

In a health care profession program, we expect our students to further develop the capacity for compassion and the understanding of professional integrity by testing themselves in real life experiences.

The important qualities of a health care professional are:

- The ability to communicate effectively
- An underlying compassion about others
- Unyielding integrity
- Unbending patient advocacy, pleading in support of an issue. Aim of advocacy is to generate public demand.
- Critical thinking skills
- Taking care about listening to the patient, having a sense of humor.

Communication skills

Many learning activities that utilize communication skills, both oral and written, will be provided. Frequent feedback will be provided on communication skills throughout the learning experiences using formal and informal methods.

1. Compassion for others through communication skills can be enhanced by role playing patient feedback as well as by mentoring (faculty and staff supervision of student). Important to this learning objective is the foundational knowledge of diversity, and multicultural environments in which the health professional works. Students will have lot of experiences to enhance understanding as well as skill development in translating compassionate care across cultural boundaries.
2. Patient advocacy : An effective health care professional needs the knowledge and the competence to handle the complex environment of health care. Starting with ethical reasoning they should be provided with opportunities to learn about the legal, regulatory, and practice management of the profession. Whether the patient presents with chronic diseases, issues of abuse or neglect, or mental health problems, the health care professional has the knowledge and position to support patient needs. Students will have learning opportunities in several settings to increase their understanding and competence in dealing with the health care environment. This ability to interface between the patient and the health care networks will enhance patient advocacy.
3. Critical thinking skills: Critical thinking is necessary for a health care professional because they have made a commitment to take responsibility for the life and welfare of others outside their family and friends. Health care professional plays an important role in educating patients and facilitating informed patient consent as well as by gathering data for diagnosis, testing outcomes, treatment, and understanding safe limits of practice.

D. Medical ethics in hospitals

Medical ethics is the study of moral questions pertaining to the practice of medicine and health care. Physicians' medical ethics have long been governed by the Hippocratic oath, in which physicians declare that they will do everything possible to preserve human life and to maintain high working standards. Licensing boards and national and international associations hold physicians accountable for their decisions in the practice of medicine.

Medical ethics, a branch of ethics, deals with moral validity of decisions in various aspects of medicine. The Hippocratic oath is the most enduring tradition in medicine that has been the guiding ethical code for physicians since ancient Greece, and has eventually become the basis of all medical ethics. In its most compelling portions, it emphasizes the profundity of the medical agreement, the patient dignity, the confidentiality of the transaction and the physician's responsibility to guard against abuse or corruption of his or her knowledge and art. It also exhorts the physicians to honour the rules of their profession and expose those who do not follow high standards of conduct.

Ethics address conduct and relate to what behavior is appropriate or inappropriate, as reasonably determined by the entity setting the ethical standards. An issue of ethics in ophthalmology is resolved by the determination that the best interests of patients are served.

Ophthalmologic services must be provided with compassion, respect for human dignity, honesty and integrity. An ophthalmologist must maintain competence. Competence can never be totally comprehensive, and therefore must be supplemented by other colleagues when indicated. Competence involves technical ability, cognitive knowledge, and ethical concerns for the patient. Competence includes having adequate and proper knowledge to make a professionally appropriate and acceptable decision regarding the patient's management.

Rules of ethics

Ethics are difficult to define precisely but important in any professional practice. In general these are the moral and professional values which govern the acts of practice and actions of its practitioners. Almost all professions are bound by a broad set of guidelines which collectively constitute professional ethics. The Rules of Ethics are enforceable.

1. Competence

An ophthalmologist is a physician who is educated and trained to provide medical and surgical care of the eyes and related structures. An ophthalmologist should perform only those procedures in which the ophthalmologist is competent by virtue of specific training or experience or is assisted by one who is. An ophthalmologist must not misrepresent credentials, training, experience, ability or results.

2. Informed consent

The performance of medical or surgical procedures shall be preceded by appropriate informed consent. Patients are to sign the consent letters.

3. Clinical trials and investigative procedures

Clinical trials or investigative procedures shall be approved by adequate review mechanisms. Clinical trials and investigative procedures are those conducted to develop adequate information which would form a base for prognostic or therapeutic decisions or to determine etiology or pathogenesis, in circumstances in which insufficient information exists. Appropriate informed consent for these procedures must recognize their special nature and ramifications.

4. Other opinions

The patient's request for additional opinion(s) shall be respected. Consultation(s) shall be obtained if required by the patient.

5. The impaired ophthalmologist

A physically, mentally or emotionally impaired ophthalmologist should withdraw from those aspects of practice affected by the impairment. If an impaired

ophthalmologist fails to do so, it is the duty of other ophthalmologists who know of the impairment to take action with a view to correct the situation. This may involve a wide range of remedial actions.

6. Pretreatment assessment

Treatment shall be recommended only after a careful consideration of the patient's physical, social, emotional and occupational needs. The ophthalmologist must evaluate the patient and assure that the evaluation accurately corresponds to the ophthalmic findings and the indications for treatment. Recommendation of unnecessary treatment or withholding of necessary treatment is unethical.

7. Delegation of services

Delegation is the use of auxiliary health care personnel to provide eye care services for which the ophthalmologist is responsible. An ophthalmologist must not delegate to an auxiliary those aspects of eye care within the unique competence of the ophthalmologist (that is other than those permitted by law to be performed by auxiliaries). When other aspects of eye care for which the ophthalmologist is responsible are delegated to an auxiliary, the auxiliary must be qualified and adequately supervised. An ophthalmologist may make different arrangements for the delegation of eye care in special circumstances, so long as the patient's welfare and rights are the primary considerations.

8. Postoperative care

The providing of postoperative eye care until the patient has recovered is integral to patient management. The operating ophthalmologist should provide those aspects of postoperative eye care within the unique competence of the ophthalmologist. Otherwise, the operating ophthalmologist must make arrangements before surgery for referral of the patient to another ophthalmologist, with the patient's approval and that of the other ophthalmologist. The operating ophthalmologist may make different arrangements for the provision of those aspects of postoperative eye care within the unique competence of the ophthalmologist in special circumstances, such as emergencies or when no ophthalmologist is available, so long as the patient's welfare and rights are the primary considerations. Fees should reflect postoperative eye care arrangements with advance disclosure to the patient.

9. Service with honesty

An ophthalmologist must not misrepresent the service that is performed or the charges made for that service.

10. Procedures and materials

Ophthalmologists should order only those laboratory procedures, optical devices or pharmacological agents that are in the best interest of the patient. Ordering unnecessary procedures or materials or withholding necessary procedures or materials is unethical.

11. Commercial relationships

An ophthalmologist's clinical judgment and practice must not be influenced by economic interest in, commitment to, or benefit from professionally-related commercial enterprises.

12. Communications to colleagues

Communications to colleagues must be accurate and truthful.

13. Communications to the public

Communications to the public must be accurate. They must not convey false, untrue, deceptive, or misleading information through statements, testimonials, photographs, graphics or other means. They must not omit material information without which the communications would be deceptive. Communications must not appeal to an individual's anxiety in an excessive or unfair way; and they must not create unjustified expectations of results. Communications must not misrepresent an ophthalmologist's credentials, training, experience or ability, and must not contain material claims of superiority that cannot be substantiated.

14. Interrelations between ophthalmologists

Interrelations between ophthalmologists must be conducted in a manner that advances the best interests of the patient, including the sharing of relevant information.

15. Conflict of Interest

A conflict of interest exists when professional judgment concerning the well-being of the patient has a reasonable chance of being influenced by other interests of the provider. Disclosure of a conflict of interest is required in communications to patients, the public, and colleagues.

16. Expert testimony

Expert testimony should be provided in an objective manner using medical knowledge to form expert medical opinions. Non-medical factors (such as solicitation of business from attorneys, competition with other physicians, and personal bias unrelated to professional expertise) should not bias testimony. It is unethical for a physician to accept compensation that is contingent upon the outcome of litigation. False, deceptive or misleading expert testimony is unethical.

Nature of negligence in doctor - patient relationship

Negligence in the legal sense is not only applicable to the medical practitioners but it also concerns the harm that any person may have sustained at the hands of the medical practitioner. Taking a cue from this concept it can be said that a successful action against negligence therefore requires 3 elements, and they are:-

- There should be duty of being careful. In medical parlance, it means that the doctor understands that his patient would be affected by his wrong treatment.
- The second part is breach of the above stated duty. Generally, that would imply the doctor managed the case in accordance with the accepted standards of practice at that point of time.
- The third element required to be proved is finding out whether the doctor was negligent. This is a very difficult task to establish that the act of the doctor was directly and proximately related to the harm done to the patient. Most of the time when the patient approaches the doctor he is already sick. Therefore the facts that the patient has become more sick after taking the treatment from the doctor, or the illness remained the same, and he did not get any relief, etc. become very important.

Eye camps and ophthalmic surgeons

The recommendations referred to by the said committee of the Indian Medical Council are as follows:

1. The operations in the camp should only be performed by qualified and experienced ophthalmic surgeons registered with the Indian Medical Council or any state medical council.
2. The camps should not be used as training ground for post graduate students and operative work should not be entrusted to them.
3. There should be a trained lab technician to examine urine, blood sugar etc. It is preferable to have a dentist to check teeth for sepsis and physician for general medical check up.
4. All the medicines to be used should be of standard quality duly verified by the doctor in charge of the camp.
5. Eye camps have to be organised, due care and caution has to be exercised by the organisers as per the procedure established by law.
6. The poor and rural people cannot be ignored. They should be treated with dignity. They also have a right to life and a right to good medical care.
7. Open communication with the patient is essential. Patient's confidentiality must be safeguarded within the constraints of the law.

The OA and the law

Carelessness or negligence on the part of an OA may lead to court action against the OA or the hospital, and damages could be awarded against the OA or the hospital authority. Some examples where the OA has to abide by the law are given below:-

1. Consent for operation

A patient coming into the hospital still retains his rights as a citizen and his entry only denotes his willingness to undergo any investigation or treatment of serious nature or an operation that requires anaesthesia. For the operation the written consent of the patient is a must. A patient may give his own consent if he has attained the age of 18 and is in sound state of mind. For the minor patient the signature of the parents or guardian is normally obtained. In the event of any difficulty, the OA must inform the surgeon and the senior administrative officer.

2. Correct Identity

The OA has a serious responsibility to make sure that all the patients in general ward are given bed numbers and register numbers. It is very important that the correct number is written in all the records and no mistake is made. They are checked again and again. In Operation Theatre, the "scrubbed" OA must check the number of instruments, needles, sponges, packs on the trolley frequently during operations and as operation proceeds, check each item used. They are all counted and the count of each item returned is correct.

3. Medications and drugs

There are two Acts which control the use of drugs in treatment.

1) Poisonous drug Act
2) Food and drug Act

A prescription must bear:

- The patient's name and address
- The date
- Signature of the prescriber
- Total quantity to be supplied in word or figures

4. Accidents or injury

Accidents can arise to visitors or employees of the hospital through negligence. Hospital staff should constantly be alert to the risks entailed and bring them to the notice of person concerned or the proper authority. In case of a pure accident where no negligence or incompetence is involved there is no liability at law.

5. Discharge of the patient against medical advice

Sometimes patient demands a discharge from hospital of their own will. It is the OA's duty to persuade them not to do so. But if the patient insists, the OA should inform the doctor concerned.

6. Patient's property

The department of health and social security requires all hospitals to inform the patient that the hospital cannot take responsibility for valuables or money. Where it is known that patients have an excess of money or ornaments they should be asked to hand it over against a signed receipt and it may be placed in the hospital locker.

7. Signing of legal document

Most hospitals have a rule against the OA signing the legal documents or witnessing signature during their professional duties.

8. Suspicion of theft

The OA must immediately report any theft or suspicion of theft to senior administrative officer who should look into the matter without delay.

9. Professional secrecy

The OA should not disclose any confidential information obtained because of their position regarding the patient to anyone, even to the closest relatives of the patients or friends. The details of the patient's disease should not be passed on to their employer as this may cause loss to the patient such as removal from service for which the OA may be held legally liable.

Legal responsibility of OA means the way in which they are obligated to obey the law in professional activities. The law is the final authority for regulating activities of all citizens including professional practitioners. Disobedience of the law results in punishment.

Procedures in nursing demanding special care and attention

- To have written orders from the doctor for treatment and care of the patient.
- To administer medicines-giving only as ordered, checking labels and appearance of medicines, charting accurately.
- To administer cold or hot applications to the body especially for patients unable to respond.
- To get permission slips signed for surgery or other treatment.
- To report accidents or errors.

Causes of ethical decline

In any country many factors are responsible for the deterioration of morality in the medical practice.

- A large initial investment is required to set up a clinic, a hospital or a medical institute; and it is thought appropriate to charge heavy fees to the patients as a means of recovering the cost.
- There is an increased awareness in the patient community about their legal rights. Thus doctors have fear of getting charged by consumer and other courts for criminal negligence in treating the patients. Money required to plead the cases may be substantial and hence the hospital charges are high.
- The patient approaches a doctor with mixed feelings of faith and fear, of hope and hostility. This inevitably leads to distorted doctor-patient relationship with high chances of exploitation.
- Many doctors do not (or cannot) offer the best line of treatment to the patients, some are ill trained, They are not fully aware of recent advances in the treatment and management of the disease. Additionally, poor clinical sense and lure of income from costly investigations lead the doctor to ask for unnecessary pathological and radiological tests.
- Many doctors do not have standard treatment facilities in their own clinics or hospitals. Instead of referring the patients to an institute where such facilities are available, the treating physician dose not inform about such facilities for fear of 'losing the patients'.

The basis of ethics, according to Swami Vivekananda is to become more and more selfless: "Whether men understand it or not, they are impelled by that power behind to become unselfish. That is the foundation of morality. It is the quintessence of all ethics, preached in any language, or any religion, or by any prophet in the world. "Be thou unselfish", "Not 'I', but 'thou'"- that is the background of ethical codes."

E. Patient communication

There is great development in the medical field. The discovery of new equipment and treatments are many. Only effective communication can differentiate the services rendered by the hospitals.

Ineffective patient communication is one of the indicators that creates a bad impression about a hospital. If it is not taken seriously, it may lead to closure of the unit. Good patient communication is itself one of the economic and marketing strategies on which the organisation may rely continuously for its increased market share and growth.

Various tools and methods should be taken into consideration for effective patient communication:

Meaning of "communication"

This word is derived from the Latin word "communis" which means "common".

In words of Allen " Communication is the sum of all things one person does when he wants to create understanding in the mind of another. It is a bridge of meaning. It involves a systematic and continuous process of telling, listening and understanding."

Meaning of "patient communication"

It is a process through which a hospital provides its patients the required information on the types of services, specialists and facilities available through various tools and techniques.

Methods for patient communication

Telephonic communication

This plays an important role as a proper communication tool. Through this the good image of the organisation can be protected. Receptionist / Operator or whoever attends the calls should respond in a polite manner, give clear and concise information to the person on the other side for their queries or doubts and for fixing appointments with consultants.

If the need arises the operator should involve the doctors in clarifying the doubts of the patients instead of giving wrong information about the medicine or treatment .

Doctor - patient communication

The clinician communication towards the patient is very important.

Ineffective communication between doctors and patients often reduces the accuracy of a clinician's diagnosis though time constraint is usually the main reason.

Nevertheless, numerous studies indicate that doctor-patient communication is the single most effective predictor of patient adherence to treatment plan. Hence the effective doctor-patient communication is a necessity and should not be an option.

According to the Bayer Institute for Health Care Communication, a doctor's role in communicating effectively with patients can be broken down into the following tasks:

1. Engagement
2. Empathy
3. Education
4. Enlistment

Engagement

It is a connection between the doctor and patient that continues throughout the encounter and sets the stage for partnership.

For successful engagement the doctor should show interest in the patient as a person, should use the patient's language rather than medical jargon.

Empathy

This is being sincere towards a patient by having direct eye contact and listening to the patient's information. This makes the patient feel that they are acknowledged by the doctor.

Education

It is providing increased knowledge and under standing to the patients about the disease for which they come and at the same time decrease their fears.

Enlistment

It is inviting the patient by the doctors to collaborate in decision-making regarding the problem and the treatment plan.

Counselling

Meaning

- It is a helping process
- To raise awareness about the diseases
- To facilitate patient in informed decision-making about the treatment plan
- To increase compliance to treatment that includes follow-up treatment
- To moderate patient's expectation
- To rise with increased new services

The counsellor interacts with the patients and first tries to understand their actual problems. Then

according to the type of service to be provided to them, they explain about that service in detail. For example, for cataract surgery the counselor explains the meaning of cataract, its impact on the eye, the necessity for surgery, the surgery cost, the facilities that would be available during surgery period, etc.

Thus, counseling is one of the tools for effective patient communication as it is an art to understand people's feelings and convince them to go about the required treatment plan.

The required counselling skills are

- Listening
- Giving information
- Making suggestions
- Challenging
- Supporting

Notice boards

This informs the patients of the policies, procedures, rules, events of a hospital. This is helpful for those patients who are literate.

Sign boards

This shows the route to the patients for the particular unit/department they want to go.

The signs should be clear, bold and dark enough to be easily seen by the elderly patients also.

Information boards

The information boards give basic information on various diseases like refractive error, glaucoma, cornea ulcer, cataract etc., its prevalence and incidence rates within the state and in our country, its impact over the body and curative and preventive measures to be taken by the patients.

Information machine

Touch Screen is a machine that gives the history and founder of the organisation, the organisation's culture and its values, its layout, the type of services available, the facilities, the specialists available, the charges for the various treatments, the symptoms, cause, curative and preventive measures of some diseases, the details of the courses being conducted by the hospital.

Leaflets / brochures

It gives a gist of the purpose, achievements in various fields, discoveries / research studies in different clinical subjects, the various health programmes and type of services being provided by the hospital.

Annual reports

This gives the details of any new health program or new clinical departments started, the number of surgeries performed through various camps, the training programme conducted to staff of different clinics, the welfare activities for its staff and any other social welfare activities being conducted by the hospital in that particular year.

Press releases

It includes the new activities started, any achievements through different surgeries etc. It helps not only in publicizing the activities but also in mobilizing the like minded persons for their activities in the form of volunteers, the sponsors, the consultants from both the government and NGO's.

Advertisements

This is giving ads in local newspapers, in both government and private television channels, etc. Through hoardings, illumination boards about the type of services and the facilities of a hospital, the public can be informed about the hospital activities.

Patient communication is a vital process in any hospital. It should develop and maintain a proper system for long-run purpose. This can be understood from the sayings by Mahatma Gandhiji.

"A Customer is the most important visitor on our premises.

He is not dependent on us; we are dependent on him.

We are not doing him a favor by serving him; he is doing a favor by giving us an opportunity to do so".

Internal communication

The prime responsibility of the administrator of any hospital is to get things done through people. Proper communication through proper channel should be carried on. The method of communi- cation differs from one person to another. To avoid misunderstandings, conflicts, disagreement between persons of various departments of an organisation, communication is essential.

A proper communication system of a hospital reflects its strength in achieving both the short term and long term goals of a hospital.

Though communication plays a very important role in all areas of the hospital, its importance facilitates the proper care of a patient through OA services. A lack of communication between the OA and the doctors, between the OAs themselves can lead to the death of a patient.

Hence communication is a vital management tool, a proper and careful handling of which benefits the individual and an organisation in achieving the mission of a hospital.

The types, process, methods and barriers of communication within an organisation:

Need for communication

- To coordinate the activities across various departments in a hospital
- To help in decision making process
- To maintain good relationship among people.

Process of communication

The main elements of communication process are:

Communicator

The process begins here. The communicator is one who sends the message to the receiver. In hospital the communicators may be the top managerial persons, the administrator, the department heads.

Message

It is the information which a communicator sends to the receiver.

Medium

It is the link that connects the communicator and the receiver. Example: telephones, computers etc.

Receiver

It is the person who receives the message from the sender.

Feedback

It is a process of informing the sender by the receiver the understanding of the message sent to them.

Channels of communication

Formal communication

It is established formally by the management. It is used for communicating the official messages within or outside hospital.

Informal communication

This is also "Grapevine" communication. It takes place during informal or social relations among people of various departments in a hospital. It spreads rapidly in the form of rumors and gossips.

Horizontal communication

This is transmission of information among the positions of the same level. Example-communication between the managers of different departments.

Upward communication

This is flow of information from lower-level employees to higher-level employees. Example: suggestions from staff to management.

Downward communication

This is flow of information from higher level to lower level employees.

Example: circulars, orders from medical director to OA.

Diagonal communication

Flow of messages between persons who are in positions at different levels of the hierarchy and in different departments.

Example: communication between computer technician and the storekeeper in a hospital.

Verbal communication

It is communicating the messages orally. It is easy to communicate and economic but it is dangerous as it does not have any document proof of communication.

Example: informing (over phone by the administrator) about the staff-management meeting to the staff at various levels.

Written communication

It is communication in written form. It is the best way of communication as it contains the written document as proof for future verifications.

Example: work instructions, circulars, memos etc.

Gestural communication

It is communicating through gestures. Example: nodding the head by the staff to indicate that the message told by their department in-charge has been understood.

Barriers of communication

Language

It is very important in communication. The words used by the communicator should be apt and simple to understand by the receiver.

Filtering

As the message travels through many levels of hierarchy in an organisation, it gets distorted when it actually reaches the final person.

Poor listening

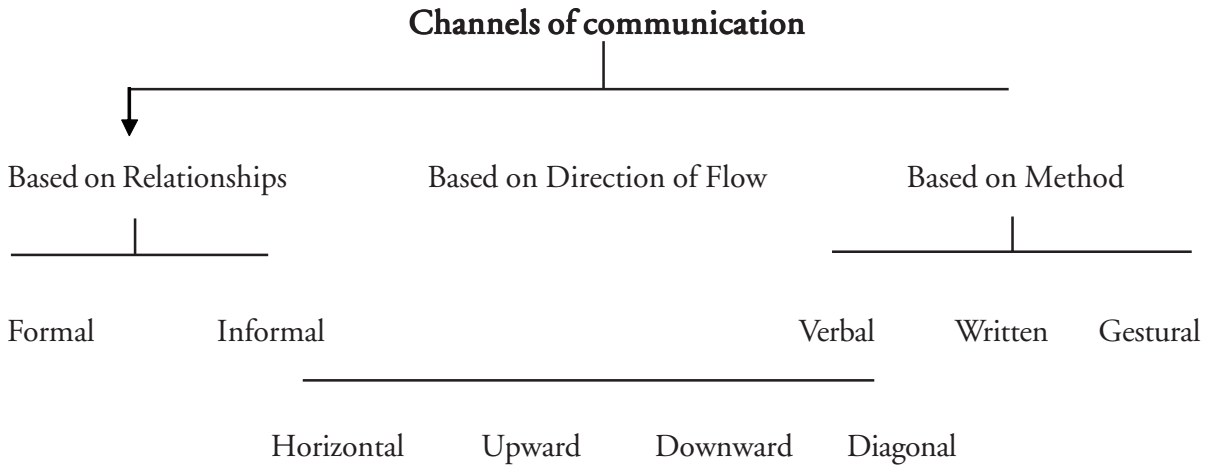
This is due to poor concentration in listening by the message receiver.

Over loading of information

This is providing more information than the capacity of the listener.

Status

This exists between manager-employee pairs. The manager should not deal with the employees with ego.



Guidelines for an effective communication

1. **Appearance** – It should be simple and smart
2. **Posture** – Should not show any signs that may indicate insincerity in communication
3. **Eye contact** – Should see the listeners by face-to-face and not seeing the floor or ceiling
4. **Facial expressions** – It should communicate the response towards the communication
5. **Voice** – It should not be in a feeble tone. It should be a majestic voice
6. **Involvement** – Communicator should involve themselves completely towards the subject matters for communication.
7. **Questions** – Asking some questions towards the listeners to check whether they have understood the message delivered.
8. **Visual Aids** – It is better to use posters, video clippings etc. to explain the discussion

Guidelines for improving organisational communication

- Share important information
- Get information out quickly
- Stress benefits
- Don't be afraid to present opposing controversial view points
- Don't overload people with information
- Bring in experts to handle subjects you are not compatible with
- Ask managers at all levels to help spread the word within the organisation
- Follow-up communication with reinforcing materials and information
- If you are uncomfortable talking in front of groups, seek training

Ten commandments for good communication developed by the American Management Association

1. Clarify before attempting to communicate
2. Examine the purpose of communication
3. Understand the physical and human environment when communicating
4. Consult with others, where appropriate to obtain their support in planning communication
5. Consider the content and overtones of the message
6. Whenever possible, communicate something that helps or is valued by the receiver
7. Follow-up your communication
8. Communicate messages that are of short-run and long-run importance
9. Be sure your actions support your communication
10. Be a good listener

The effective communication process is an on going process, upon which the efficiency of internal communication system can be analysed. Thus an effective internal communication system helps in achieving organisational goals.

Summary

The OA is to be in the prescribed uniform inside the hospital premises. This will enable the patient and the attendar to identify the OA easily and ask for any help. The OA wears a clean and well pressed uniform which will give the OA a dignified look. As a health care professional the OA should possess some important qualities. They have to practice them in day to day activities. The OA should be aware of the law that governs medical professionals and should abide by the rules. This will enable them to executive their duties effectively and bring good reputation to the hospital.

Key points to remember

1. *The OA should be in a clean and well pressed uniform.*
2. *Personal hygiene of the OA is to be impeccable.*
3. *As a health professional the OA should have compassion for the patient.*
4. *The OA should develop good communication skills.*

Student exercise

Answer the following

1. *What are the purposes of wearing uniforms in the hospital?*
2. *Write a short note about the consent form for operation.*
3. *What are the procedures in nursing care, demanding special care and attention?*
4. *Write a short note on personal hygiene.*
5. *What are the qualities of a health care professional?*
6. *What is the need for communication in the hospital?*
7. *What are the barriers of communication?*
8. *Mention the guidelines for an effective communicator.*
9. *Write the ten commandments of good communication developed by the American Management Association.*

CHAPTER 3 HUMAN ANATOMY AND PHYSIOLOGY

OUTLINE

The Cellular system
The Skeletal system
The Cardiovascular system
The Respiratory system
The Nervous system
The Sense organs
The Excretory system
The Digestive system
The Endocrine system
The Reproductive system

GOAL

The Ophthalmic Assistant will describe the various systems and functions of the human body.

OBJECTIVES

The OA will be able to

- Name the major organ systems of the body and list the various organs that make up the organ systems
- Trace the path of air through the respiratory system
- Describe the functions of blood
- Trace the path of food through the digestive system
- Identify the functions of the nervous system
- Recognize the basic difference between voluntary and involuntary muscles
- Identify the excretory organs and the waste eliminated by them

CHAPTER 3
Human Anatomy and Physiology

The basic needs of the human race are food, water and oxygen. We take in food and water through the mouth and breathe in oxygen through the nose. The food is digested in the digestive system and is made absorbable by the secretions of pancreas, liver and intestinal glands. Oxygen taken into the respiratory passage reaches the lungs and enters the blood. For the proper functioning of the vital organs like heart, brain and other parts of the body, the absorbed food and oxygen must reach them. This is done by the circulatory system. The nerves stimulate the organs to function by carrying the commands given by the brain as electrical impulses. The excretory products formed in the various organs and the carbon dioxide released after the utilization of oxygen must be carefully separated from the tissues and sent out of the body. This is done by the excretory system. The body has five special sense organs - eye, ear, nose, tongue and skin to appreciate the external environment. All these systems cooperate with one another and function in coordination.

The eye is a vital sense organ of the human body. It is related to other organ systems in many ways. Hence in addition to knowing the structure and function of the eye, the anatomy (structure) and physiology (function) of other organ systems assumes paramount importance. This helps the OA to appreciate the importance of viewing the patient as a whole and not the eye alone.

The structure and function of the body systems are discussed in detail and they are:

1. Cell
2. Skeletal system
3. Muscular system
4. Cardio vascular system
5. Respiratory system
6. Nervous system and sense organs
7. Excretory system
8. Digestive system
9. Endocrine system
10. Reproductive system

1. Cell

Cells are the smallest units of our body. They are the basic units of our body.

The structure of a cell

The human body develops from a single cell. The single cells are derived from zygote. Zygote is formed by fusion of sperm and ovum. Zygote multiplies and develops into various structural and functional types of cells. The cell consists of a plasma membrane and cytoplasm.

Inside the plasma membrane, there are number of organelles floating in a watery fluid called cytoplasm. Organelles are small structures with highly specialized functions. Organelles include

- Nucleus
- Golgi bodies
- Mitochondria
- Ribosomes
- Endoplasmic reticulum
- Lysosomes

Plasma membrane

The thin layer of protein and fat that surrounds the cell is the cell membrane or the plasma membrane. The cell membrane is semi permeable, allowing some substances to pass into the cell and blocking others.

It consists of two layers with specialised functions.

- They give the cell its immunological identity.
- They can act as specific receptors for hormones and other chemical messengers.
- The plasma membrane has several enzymes embedded on its layers.

Organelles

Nucleus

Every cell (Fig. 3.1) in the body has a nucleus with the exception of mature erythrocytes (RBCs). The nucleus has a membrane similar to plasma membrane, called nuclear membrane. It has tiny pores through which certain substances pass between nucleus and cytoplasm. The nucleus contains chromosomes. The chromosomes have the body's genetic material in the form of a large double chains of molecules of DNA (Deoxyribo Nucleic Acid). The nucleus controls the activities of a cell.

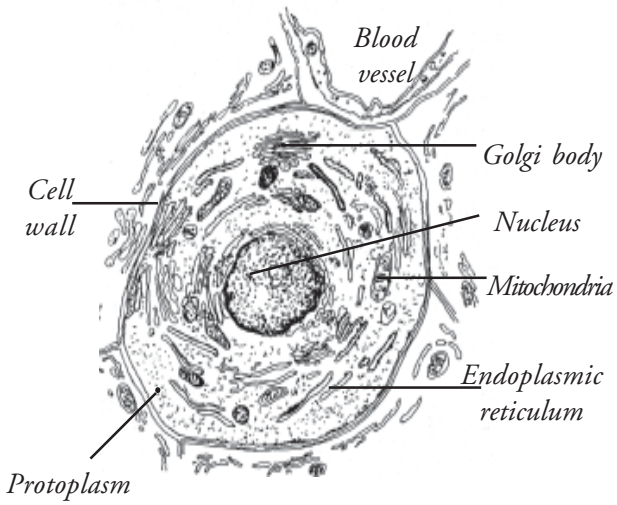


Fig. 3.1

Mitochondria

These are sausage shaped structures in the cytoplasm. They are described as the "power house" of the cell. They are involved in cellular respiration. In cellular respiration energy is generated.

Ribosomes

These are tiny granules composed of RNA (Ribo Nucleic Acid) and protein. They synthesise proteins from amino acids.

Endoplasmic reticulum

They are a series of membranous canals in the cytoplasm. These are of two types, smooth and rough.

Golgi apparatus

This consists of stacks of closely folded flattened membranous sacs. They synthesise and export proteins.

Lysosomes

These are oval or spherical membrane bound bodies produced by the golgi bodies.

Cell division

There are two types of cell division: mitosis, meiosis.

Transfer of substances across cell membranes

Some substances cross plasma membranes by passing from a higher concentration on one side to a lower concentration on the other, without the use of energy. This is called diffusion (passive transport). Other types of transport are:

- Active transport
- Bulk transport

Tissues

The tissues of the body consist of large numbers of cells. They are classified according to the size, shape and functions of these cells. There are four main types of tissues, each of which has subdivisions. They are

1. Epithelial tissue
2. Connective tissue
3. Muscle tissue
4. Nervous tissue

Epithelial tissue

This group of tissues is found covering the body and lining cavities and tubes. It is also found in glands. The structure of epithelium is closely related to its functions which include:

- Protection of underlying structures
- Secretion
- Absorption

Epithelial tissue is classified as follows

- Squamous
- Cuboidal

- Columnar
- Ciliated
- Stratified

Connective tissue

It is found in all organs supporting the specialised tissue (Fig. 3.2). The different types of cells involved include:

- Fibroblasts
- Macrophages
- Plasma cells
- Mast cells
- Fat cells

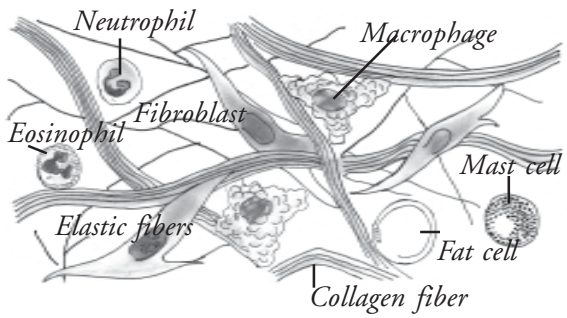


Fig . 3.2

Major functions of connective tissue are

- Binding and support
- Protection
- Transport
- Insulation

Types of connective tissue

- Areolar tissue
- Adipose tissue
- White fibrous tissue (collagen)
- Elastic tissue
- Reticular tissue
- Blood
- Lymphoid tissue
- Cartilage
- Bone

Muscle tissue

There are three types of muscle tissue:

- Striated, skeletal or voluntary muscle
- Non-striated, involuntary, visceral or smooth muscle
- Cardiac muscle

Nervous tissue

Two types of cells are found in the nervous system:

1. Excitable cells
2. Non-excitable cells

Organs

Organs are formed by a group of tissues. Each organ has its specific functions. e.g. Heart is made up of cardiac muscle which is a muscular tissue. It is the prime organ of systemic circulation.

Systems

A group of organs joins together and forms a system. We have the following systems in our body.

- Musculo-skeletal
- Circulatory
- Respiratory
- Nervous
- Endocrine
- Sense organs
- Excretory
- Reproductive

Anatomical terms

The anatomical position

This is the position assumed in all anatomical descriptions to ensure accuracy and consistency. The body is in the upright position with the head facing forward,

1. The arms at the sides
2. Palms of the hands facing forwards
3. The feet together
4. Toes directed forwards

Median plane

At anatomical position, the body is divided longitudinally into right and left halves, and this is median plane.

Medial and lateral

Any structure which is nearer to the midline is called medial. Any structure farther from the midline or at the side of the body is known as lateral.

Proximal and distal

These terms are used describing any structure that is long eg. the bones of the limbs. The proximal end of a bone is the one nearest to the point of attachment of the limb, and the distal end is farthest away.

Anterior

This indicates that the part being described is nearer the front of the body.

Posterior

This means that the part being described is nearer the back of the body.

Superior

This indicates a structure nearer the head.

Inferior

This indicates a structure farther away from the head.

Border

This is a ridge of bone which separates two surfaces.

Spine, spinous process or crest spine

This is a sharp elevation ridge or bone.

Trochanter, tuberosity and tubercle

These are roughened bony projections, usually for the attachment of muscles or ligaments. The different names are used according to the size of the projection. Trochanters are the largest and tubercles the smallest.

Fossa

This is a hollow or depression in a structure.

Foramen

This is a hole in a structure.

Bony sinus

This is a hollow cavity within a bone.

Meatus

This indicates a tube-shaped cavity within a bone.

Articulation

This is a joint between two or more bones.

Suture

This is the name given to an immovable joint, e.g. between the bones of the skull.

Articulating surface

This is the part of the bone which enters into the formation of a joint.

Septum

This is a partition separating two cavities.

Fissure or cleft

This indicates a narrow slit.

2. The skeletal system

Skeletal system deals with bones and surrounding tissue. It forms the supporting framework of human body. This section includes

- Basic structure of a bone
- Classification of the bones
- Functions of the bones
- The different bones of the body
  - Skull
  - Vertebral column
  - Thorax
  - The appendicular skeleton
- Joints and movements

Basic structure of a bone

Bones are the hardest tissue in the body and when fully developed are composed of

Water	- 20%
Organic material	- 30- 40%
Inorganic material	- 40- 50% (contains noncarbon)

There are two types of bone tissue, compact and cancellous (Fig. 3.3).

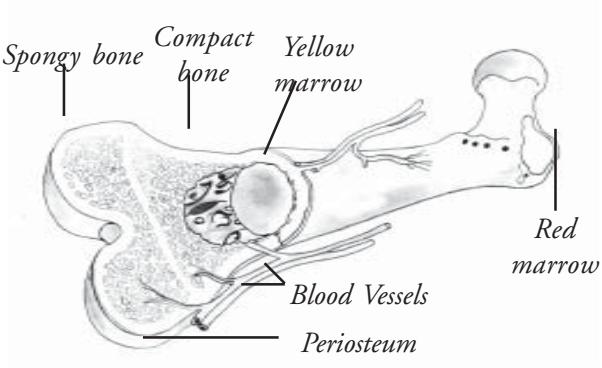


Fig . 3.3

A. Compact bone

- To the naked eye, compact bone appears to be solid
- These consist of a central canal
- This central canal is surrounded by concentric plates of bone cells, called the lamellae
- In these lamellae, there are lacunae or spaces, containing lymph and osteocytes
- These lamellae gives greater strength to the bone than a solid structure of the same size would

B. Cancellous bone

- To the naked eye, cancellous bone looks spongy
- The central canals are much larger than in compact bone
- There are fewer lamellae which gives a honey comb appearance
- Red bone marrow is always present in cancellous bone

Periosteum

- All the bones are almost completely covered by vascular fibrous membrane called "periosteum"
- This maintains the shape of the bone
- This gives attachment to muscles and tendons and protects bones from injury

Classification of bones

Bones are classified as

- Long
- Short
- Irregular
- Flat
- Sesamoid

Long bones

- They have a shaft (diaphysis) and two ends / epiphyses
- The shaft is composed of compact bone. It has a central cavity, called the medullary cavity. The medullary cavity contains "yellow bone marrow"
- The epiphyses consist of an outer covering of compact bone with cancellous bone inside

Short bones

- They are cuboidal in shape
- They have a peripheral compact bone and inner cancellous bone
- The carpal bones and tarsal bones are examples of short bones

Irregular, flat and sesamoid bones

- Irregular, flat and sesamoid bones are composed of a thin outer layer of compact bone with cancellous bone inside.
- These contains red bone marrow for example

Irregular bones form the	- Vertebrae
Flat bones form the	- Sternum, ribs
Sesamoid bones form the	- Patella

Bone cells

There are two types of bone cells which are responsible for bone formation (Fig. 3.4).

- Osteoblasts
- Osteoclasts

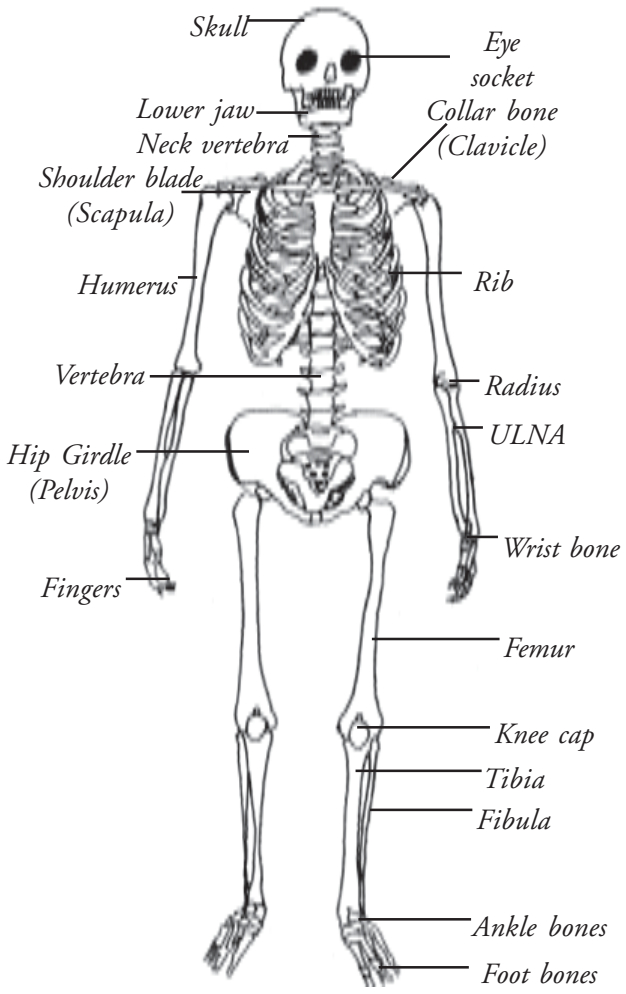


Fig. 3.4

Osteoblasts

These cells are present

- In deeper layers of periosteum
- In the immature bones.
- At the ends of diaphysis
- At the site of fracture

As the bone develops, osteoblasts become trapped in the lacunae. They stop forming new bone at this stage and are called osteocytes. Nutrient artery of the bone arises from adjacent blood vessels. They supply the bone tissues.

Osteoclasts

Their function is resorption of bone to maintain optimum shape. This takes place at bone surfaces. A fine balance of osteoblasts and osteoclasts maintains a normal bone.

Functions of bones

- They provide frame work to the body
- Give attachment to muscles and tendons
- Helps in movements of the body
- Protects the internal organs
- Contains red bone marrow from which RBCs develop
- Provide a reservoir for calcium, phosphorous and fat

Bones of the skeleton

Bones of the skeleton are divided into two groups.

- Axial skeleton
- Appendicular skeleton (Fig. 3.5)

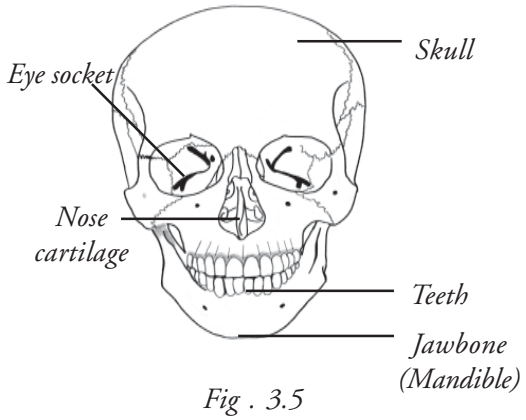


Fig . 3.5

Axial skeleton

This has the following parts

- Skull
- Vertebral column
- Thoracic cage

Skull

This rests on the upper end of vertebral column and has two parts 1. Cranium and 2. Face

Cranium

- 1 frontal bone
- 2 parietal bones

- 2 temporal bones
- 1 occipital bone
- 1 sphenoid bone
- 1 ethmoid bone

Face

- 2 zygomatic / cheek bones (Fig. 3.6)
- 2 maxilla
- 2 nasal bones
- 2 lacrimal bones
- 1 vomer
- 2 palatine bones
- 2 inferior conchae bones
- 1 mandible - (the only movable bone of the skull)

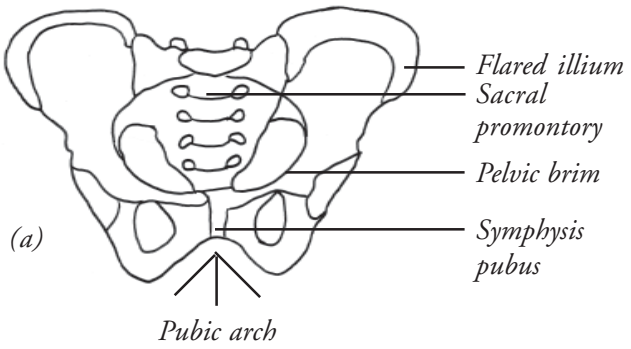


Fig. 3.6

Hyoid bone

This is an horse shoe shaped bone lying above the larynx and below the mandible

Sinuses

Sinuses are cavities present in the bone and contains air. All sinuses communicate with the nose.

Functions of sinuses

- Gives resonance to the voice
- Helps in balancing the head by lightening the skull bones

The vertebral column

The vertebral column consists of

- 7 Cervical vertebrae
- 12 Thoracic vertebrae
- 5 Lumbar vertebrae
- Sacrum (5 fused vertebrae)
- Coccyx (4 fused vertebrae)

The first cervical vertebra is called Atlas. The second cervical vertebra is called axis**.** The thoracic vertebrae are attached with the ribs. All the vertebrae are separated by intervertebral discs. When two adjacent vertebrae are viewed from the side, a foramen can be seen. Half of the wall is formed by the upper vertebra. The other half is formed by the lower vertebra.

There are inter vertebral foramen in each side, between adjacent vertebrae through which the spinal nerves emerge. The ligaments present in the vertebrae hold the vertebra together. It help to maintain the inter vertebral discs in position.

Functions of the vertebral column

- This gives a strong bony protection for the delicate spinal cord lying within it
- The intervertebral foramina act as passage for the spinal nerves, blood vessels, and the lymph vessels
- It supports the skull
- It allows a certain amount of movement.
- The intervertebral discs act as a shock absorber protecting the brain.

Thoracic cage

The bones of the thoracic cage are

- 1 sternum
- 12 pairs of ribs
- 12 thoracic vertebrae

Sternum

- It supports the thorax
- It allows a certain amount of movement

Ribs

The ribs are flat bones, anteriorly attached to the sternum, posteriorly attached to the vertebral column and forms the bony lateral walls of the thoracic cage The last two ribs have no anterior attachment. They are called "Floating ribs". During inspiration, the ribs and the sternum are lifted upwards increasing the capacity of the thoracic cavity.

Appendicular skeleton

The appendicular skeleton consists of the shoulder girdle with the upper limbs and the pelvic girdle with the lower limbs.

Shoulder girdle and upper limb

The shoulder girdle consists of

1 clavicle	-	Collar bone
1 scapula	-	Shoulder bone

Each upper extremity consists of the following bones

1 humerus	-	bone of the upper arm
1 radius	-	bone of the fore arm present in the lateral side
1 ulna	-	bone of the fore arm present in the medial side
8 carpal	-	bones of the Wrist
5 metacarpal	-	bones of the hand
14 phalanges	-	bones of the fingers

Pelvic Girdle and the lower limb

Pelvic girdle has 2 hip bones. The parts of the hip bone are: ilium, ischium, and pubis. The sacrum is formed by 5 vertebrae which are fused together.

Each lower limb has the following bones

1 femur/thigh	-	the (longest strongest) bone of the upper leg
1 tibia	-	bone of the lower leg present in the medial side
1 fibula	-	bone of the lower leg present in the lateral side
1 patella	-	a triangular bone associated with knee joint
7 tarsal bones	-	bones of the ankle
5 metatarsal bones	-	bones of the dorsal part of the foot
14 phalanges	-	bones of the toes arranged similar to the fingers

Joints

Joint is the site where two or more bones come together.

- Some joints are immovable joints, fibrous or fixed, for example : skull sutures
- Some joints are slightly movable or cartilaginous joints E.g. : symphysis pubis and the joints between the vertebrae
- Some joints are freely movable joints or synovial joints (wrist, elbow, knee, ankle)

3. Muscular system

This system is responsible for all types of movements of the body parts and its internal organs. Muscles cover the skeleton and are responsible for the shape of the body and make it firm. In this system we shall discuss

- Types of muscles
- Muscles of the face
- Muscles attached to the vertebral column
- Muscles of abdominal wall
- Muscles of trunk
- Muscles of upper limb
- Muscles of lower limb

Types of muscles

The body consists of two types of muscles

a. Voluntary muscles
b. Involuntary muscles

(a) Voluntary muscles are under our control. We can move them by our own will. They are connected to bones and move parts such as arms, legs and fingers.

(b) Involuntary muscles are not under our control. These muscles make many of the organs of the body work. The heart, stomach, urinary bladder, etc., are made up of involuntary muscles.

The proximal attachment of a muscle is called origin and its distal attachment is called either as fleshy fibers or as fibrous tendons. Depending on the arrangement of the muscle fibres with relation to the tendon, the muscles are divided into unipennate, bipennate and multipennate types. These muscles bring about movements in the joints.

Muscles of face joints

The muscles in the face producing movements of the lower jaw are called muscles of mastication. They are the masseter, temporalis and pterygoids. These muscles are attached to the mandible and are supplied by the mandibular nerve. These muscles also help in speech. Most of the muscles in the face and the scalp gain attachment to the skin and are responsible for the facial expressions. They are hence called the muscles of facial expression. Transverse wrinkles in the forehead are brought about by the occipito-frontalis muscle. The eyelids are closed by the muscle surrounding the orbit, the orbicularis oculi. The lips are moved by the orbicularis oris. The muscle that helps to blow air as in whistling is the buccinator. It is present in the region of the cheek. The angle of the mouth is elevated by the levator anguli oris and depressed by the depressor anguli oris. The dilation and compression of the nose are done by the nasalis. These muscles of facial expression are supplied by the facial nerve.

Muscles attached to vertebral column

The vertebral column is kept erect by the muscle sacrospinalis or erector spinae. The muscle is present in the posterior part of the vertebral column. It is supplied by the spinal nerves. The intercostal spaces are filled with muscles called the intercostals. They are supplied by the intercostals nerves. They help in respiration. However, the diaphragm is the most important muscles in inspiration. The muscle separates the structures in the thorax and abdomen. Contraction of the muscle results in the descent of the dome in the thoracic cavity. This leads to the expansion of the lungs and inspiration. The diaphragm is supplied by the phrenic nerve and the intercostals nerves.

Muscles of abdominal wall

The muscles of the anterior abdominal wall are arranged in three layers. They are the external oblique, internal oblique and the transverses abdominis muscles. On either side of the midline are the rectus abdominis muscles. These muscles help to bend the trunk forwards and laterally. The muscles are supplied by the intercostals nerves. The psoas major, quadratus lumborum and iliacus are the muscle of the posterior abdominal wall. They are supplied by the lumbar spinal nerves.

Muscles of trunk

The muscles trapezius, latissimus dorsi, pectoralis major and minor connect the upper limbs and the trunk. The trapezius is a muscle in the back. It extends between the occipital bone, cervical and thoracic vertebrae to the clavicle and scapula. The muscle produces movements of the clavicle and scapula. It is supplied by the spinal accessory and the cervical spinal nerves. The muscle latissimus dorsi is a broad sheet extending from the hipbone, lower ribs and thoracic vertebrae to the humerus. It is supplied by branches from the brachial plexus. The pectoral muscles are in front of the chest. The latissimus dorsi and the pectoral muscles help to adduct the upper limb.

Muscles of upper limb

The shoulder area is covered by a large multipennate muscle, the deltoid. It is an abductor of the shoulder joint. This muscle is selected to give intramuscular injections. The deltoid takes origin from the clavicle and scapula and is on the front of the arm. It has two heads of origin from the flexor of the elbow joint.

Triceps brachii is a muscle in the back of the arm. It has three heads of origin from the scapula and the humerus. It is inserted into the ulna. It is supplied by the radial nerve and is a powerful extensor of the elbow joint.

The muscles in the front of the forearm produce flexion at the wrist joints. They are called the flexors of wrist. They are supplied by branches from the median and ulnar nerves. The muscles in the back of the forearm are the extensors of the wrist joint. They are supplied by branches from the radial nerve. The delicate movements of the fingers are brought about by the intrinsic muscles of the hand. These include the thenar, hypothenar, lumbricals and interossei. These muscles are supplied by branches from the median and ulnar nerves.

Muscles of lower limb

There are three large muscles in the gluteal region. They are gluteus maximus, gluteus medius and gluteus minimus.

This muscle mass is selected to give intramuscular injections. The gluteus maximus produces extension of the hip joint and the gluteus medius and minimus produce abduction of the hip joint. They are supplied by branches from the sciatic plexus. The muscle in the front of the thigh is the quadriceps femoris. It has four heads into the patella and extends as the ligamentum patellae to the tibial tuberosity. The muscle is supplied by the femoral nerve and it helps in the extension of the knee joint. The hamstring muscles are present in the back of the thigh. They extend from the hip bone to the bones in the leg. They are supplied by the sciatic nerve. Adductor longus and adductor magnus are situated in the medial aspect of the thigh. They are supplied by the obturator nerve and produce adduction of the hip joint. The muscles in the anterior part of the leg are extensors. They produce dorsiflexion of the ankle joint. The flexors are supplied by anterior tibial nerve and the extensors are supplied by the posterior tibial nerve. The movements of the foot are brought about by the intrinsic muscles of the foot. They are the muscles of great toe, muscles of little toe, lumbricals and interossei. They are supplied by planter nerves, branches from the posterior tibial nerve.

4. The cardiovascular system

This system deals with heart, blood and blood vessels. They function effectively in nourishing all other organ systems of the body. Here we discuss

- Structure and function of heart
- Circulation of the body
- Constituents of blood and their functions
- Functions of cardiovascular system

The Heart

The heart is the pumping organ which maintains blood circulation throughout the body. Heart is a conical, hollow, muscular organ, situated between the two lungs. The heart is about the size of the owner's fist (Fig. 3.7).

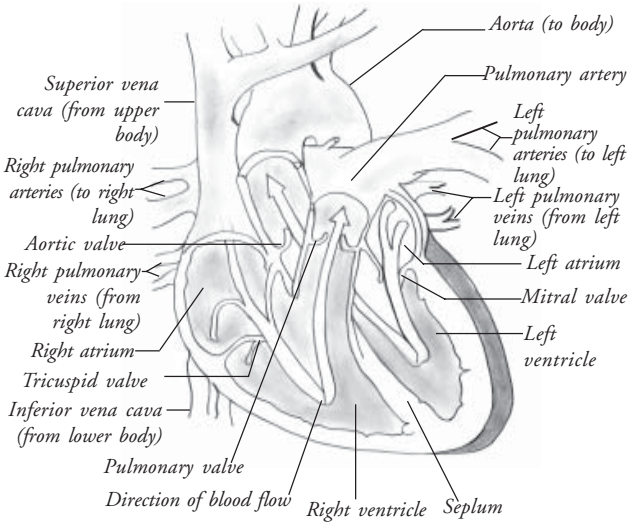


Fig. 3.7

Layers of the Heart

The heart is composed of three layers:

- Pericardium
- Myocardium
- Endocardium

Interior of the Heart

The heart is a four chambered organ. It has two atrium and two ventricles. Atria and ventricles are divided into right and left side by a continuous partition called the inter atrial septum and inter ventricular septum. Atrioventricular valves separate atrium and ventricle. These valves allow blood to flow only in one direction, i.e. from the atrium to the ventricle. Semilunar valves are present at the opening of the aorta and pulmonary artery.

Flow of blood through the Heart

The superior vena cava and the inferior vena cava empty the deoxygenated blood into the right atrium. This blood passes into the right ventricle. From there it is pumped into the pulmonary arteries (the only artery which carries de-oxygenated blood). Pulmonary arteries carry venous blood to the lungs for purification. In the lungs carbon dioxide is excreted and oxygen is absorbed. The oxygenated blood is carried to the left atrium by two pulmonary veins from each lung. It then passes through the left atrioventricular valve into the left ventricle, and from there it is pumped into the aorta. Through aorta the blood is pumped into various parts of the body.

Blood

The human body has 5-5 ½ litres of blood. It consists of plasma and blood cells.

Plasma is a straw coloured transparent fluid. It contains water, plasma proteins, minerals, nutrients from digested foods, hormones, clotting factors, antibodies, gases, and waste materials like urea.

Arteries

Blood vessels that carry oxygenated blood from the heart are called arteries (Fig. 3.8). The artery branches many times to smaller arteries and finally end as arterioles. The major blood vessels of the body are: aorta, carotid, brachial, radial and femoral.

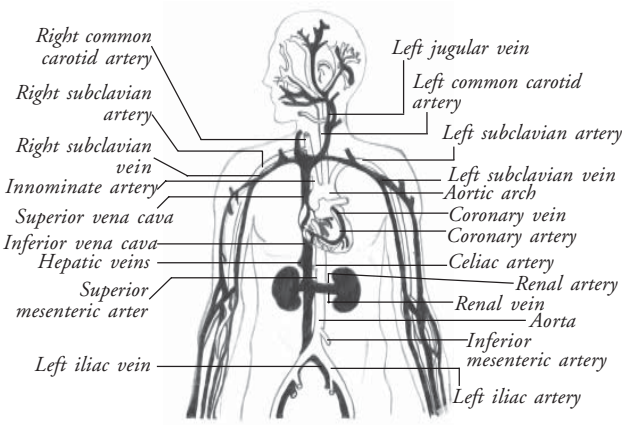


Fig. 3.8

Veins

The veins are the blood vessels that return the impure blood to the heart.

Capillaries

The smallest arterioles breakup into a number of minute vessels called capillaries. They form a network which enables the exchange of substances, i.e. gases and nutrients.

Functions of the circulatory system

- The system takes oxygen from the lungs to other parts of the body. It also takes carbon dioxide from different parts to the lungs.
- The nutrients of the digested food are taken from the intestines to the liver.
- The digested food is converted to glucose in the liver. From the liver it reaches all other organs through the blood. The energy from the liver is taken to all parts of the body.
- Waste products are taken to the kidneys.
- Hormones from the endocrine glands are taken to their place of action.
- It keeps the temperature of the body constant.
- It keeps the water content in the body constant.
- The leucocytes in the blood fight against diseases.
- The platelets in the blood play a vital role in the coagulation of blood when vessels are damaged.

Medical terminologies

Systole : Contraction of both atrium and ventricles.

Diastole : Relaxation of both atrium and ventricles.

ECG : Electrocardiogram (ECG) is done to detect the electrical activity within the heart, which can be obtained on a print out.

Blood pressure: It is defined as the force or pressure that the blood exerts on the walls of the blood vessels. The normal diastolic pressure is 120 mm of mercury. The normal diastolic pressure is 80 mm of mercury.

Pulse : Pulse is the wave of distension felt in an artery wall, when blood is pumped out of the heart. (Normal 72-80 / minute)

5. Respiratory system

All cells in the body need oxygen to carry out their activities. The respiratory system (Fig. 3.9) deals with breathing. When we breathe, the body takes in the oxygen that it needs and removes the carbon dioxide that it doesn't need . In this system we shall discuss

- Respiratory pathway
- Structure of lungs
- Mechanism of respiration

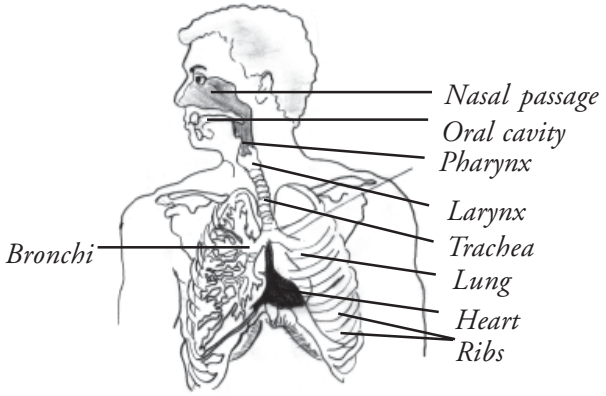


Fig. 3.9

Respiratory pathway

Anatomy of the respiratory system

Nasal cavity

Air enters the nasal cavity through two nostrils. The nose preconditions the air that enters the lungs, by cooling it or warming it and by removing dust etc.

Sinuses

Sinuses are hollow spaces in the bones of the head. Small openings connect them to the nose. The functions they serve include

1. Helping to regulate the temperature and humidity of air breathed in.
2. To lighten the bone structure of the head and to give resonance to the voice.

Pharynx

Commonly referred to as the throat. The throat is the common pathway for air and food. The air passes through the larynx into the trachea while food passes into the esophagus.

Larynx

This is the voice box and contains vocal cords in its interior. The opening of the larynx into the trachea is a narrow slit called the glottis, through which air passes into the trachea. Glottis is covered by epiglottis that keeps food out of the respiratory tract during swallowing.

Trachea / wind pipe

This is a tubular structure. It has 'C' shaped cartilage rings. They maintain the tubular structure of the trachea. The windpipe divides into the two main bronchial tubes that enter into each lung. They subdivide further for each lobe of the lungs. In the lobe they again subdivide for each lobule.

Structure of lungs

There is a pair of lungs enclosed in the thoracic cage. A double-layered membrane called pleura covers the

lungs. There is a fluid between the two membranes, called pleural fluid. It lubricates and minimizes the friction between the two membrane. The right lung is divided into three lobes or sections. Each lobe is like a balloon filled with sponge-like tissue. The left lung is divided into two lobes. The space between the two lungs is called mediastinum, where the heart is located.

The Alveoli

The alveoli are very small air sacs. They are the destination of the air we breath in.

Breathing

Breathing is the process by which oxygen in the air is taken into the lungs and brought into close contact with the blood. Blood absorbs it and carries it to all parts of the body. At the same time the blood gives up waste matter (carbon dioxide), which is taken out of the lungs when air is breathed out.

The mechanism of respiration

First the body breathes in the air which is sucked through the nose or mouth and down through the trachea, bronchus, and into the lungs. Inside the lung the air reaches the alveoli. In the walls of alveoli, tiny blood vessels allow exchange of O_2 & CO_2 in capillaries.

6. Nervous system

The nervous system detects and responds to the changes inside and outside the body. For descriptive purposes, the nervous system is divided as follows.

Central nervous system, autonomous nervous system and peripheral nervous system.

Central nervous system

The central nervous system consists of the brain and the spinal cord. The dura matter, the arachnoid matter and the pia matter are the three layers of membranes covering the brain and the spinal cord. Inside the brain there are cavities called ventricles, which contains cerebral spinal fluid (CSF). It acts as a cushion and shock absorber. It also protects the brain and spinal cord.

Brain

The brain (Fig. 3.10) constitutes about one fifth of the body weight. It lies within the cranial cavity.

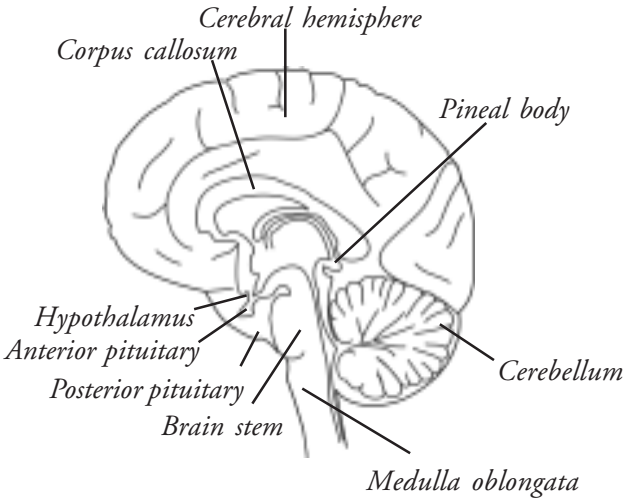


Fig. 3.10

The parts of the brain are

- Cerebrum
- Midbrain
- Pons
- Medulla oblongata
- Cerebellum

Cerebrum

Cerebrum is divided into four lobes

Frontal - Parietal
Temporal - Occipital

Functions of the cerebrum

- Memory
- Intelligence
- Thinking
- Reasoning
- Moral sense
- Learning

In the grey matter there are two areas called the hypothalamus and thalamus. They control body temperature, hunger and thirst, emotional reactions, sexual behaviour (including mating and child rearing), biological clocks (e.g. sleeping and waking cycles), secretion of some hormones.

Midbrain and pons

These two act as relay stations between the brain and the spinal cord.

Medulla oblongata

Medulla oblongata has the vital centers in its deeper structure.

The spinal nerves

These nerves leave the spinal cord through inter vertebral foramina. They are named and grouped according to the vertebrae to which they are associated.

- 8 Cervical
- 12 Thoracic
- 5 Lumbar
- 5 Sacral
- 1 Coccygeal

The lumbar, sacral and coccygeal nerves leave the spinal cord near its termination at the first lumbar vertebra and extend downwards inside the vertebral canal. This resembles a horse's tail and so is called "Cauda equina". All spinal nerves have an anterior nerve root (motor) and posterior nerve root (sensory). So they are mixed nerves .

The cranial nerves

There are 12 pairs of cranial nerves in our body. Some are sensory, some are motor and some are mixed nerves. They are:

- Olfactory
- Optic
- Oculomotor
- Trochlear
- Trigeminal
- Abducent
- Facial
- Vestibulocochlear (auditory)
- Glossopharyngeal
- Vagus
- Spinal accessory
- Hypoglossal

The autonomous nervous system

The autonomous nervous system controls the functions of the body which are carried out automatically. For example

- Rate and force of the heart beat
- Secretion of the glands
- Vasoconstriction or vasodilation
- Change in the size of the pupils of the eye.

The autonomic nervous system is divided into two parts.

- Sympathetic nervous system
- Parasympathetic nervous system

Specialised centers of the brain are

- Cardiac center - Controls the rate and force of cardiac contraction.
- Respiratory center- Controls the rate and depth of the respiration.
- Vasomotor center- Controls the diameter of the blood vessels.
- Reflex centers - Eliminate irritating substances by reflex actions of vomiting, sneezing and coughing.

Cerebellum

The cerebellum is situated behind the pons and it plays an important role in maintaining posture and balance.

Spinal cord

The brain is connected to the spinal cord. In the spinal cord, the gray matter is found in the center and white matter surrounds it. The opposite arrangement (white matter in the center and gray matter surrounding it) is found in cortex of the brain. All the messages that travel from the brain pass through the spinal cord and then to all parts of the body through the nerves. Messages from different parts of the body also pass through the spinal cord on their way to the brain. The spinal cord is protected by the vertebral column.

The peripheral nervous system

The peripheral nervous system consists of 31 pairs of spinal nerves.

Sense organs

Human beings are gifted with sense organs, which are means of communication to the external world. Human body consists of five sense organs which have special senses.

- Ear
- Eye
- Nose
- Tongue
- Skin

Ear

Anatomy of ear

There is a pair of ears in the human body. The ear (Fig. 3.11) is the organ used for sensing sounds, i.e., the organ used for hearing. The ear can be divided into three parts:

- External ear
- Middle ear
- Inner ear

Structure of ear

External ear

The external ear or the pinna is used to receive the sound waves.

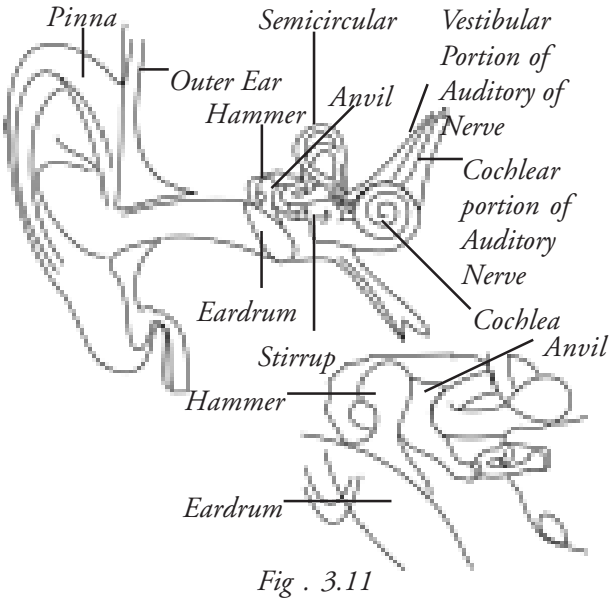


Fig . 3.11

Middle ear

The middle ear consists of the three smallest bones of our body, They are stapes, incus and malleus. The malleus is attached to the tympanic membrane. These bones transmit sound waves from the external auditory canal to the inner ear.

Inner ear

The inner ear consists of three semicircular canals, utricle, saccule, endolymphatic duct and the cochlea. The auditory nerve from the cochlea transmits the sound impulses to the brain, which identifies the sound.

Physiology of ear

Sound waves are conducted through air in the external ear. They are conducted through the bones in the middle ear. From here they pass through fluid in the inner ear. The stages involved in the transmission of sound waves are as follows:

- Sound vibrations enters the external auditory meatus / ear canal, tympanic membrane (ear drum).
- The vibrating membrane transmits the sound to the handle of malleus (hammer) which is attached to the eardrum at about its midpoint.

- Bone conduction of sound waves proceeds through the three tiny connected ear bones from malleus to incus to stapes.
- Sound is then transmitted from the footplate of the stapes through the oval window of the vestibule of the inner ear. Pressure is thus exerted by the foot plate inward into the perilymph (fluid) in the scala vestibuli of the cochlea.
- The sound ripple passes through this fluid and finally it is expanded against the round window.
- The message is gathered from here by the cochlear nerve and reaches the brain.

Nose

Man can sense smell with the help of the nose. The nose consists of 2 nostrils. The nostrils are lined with mucus membrane. The nose is bounded by cartilage and bone. The nose is lined by olfactory epithelium, which consists of supporting cells, basal cells and the olfactory receptor cells. These are highly specialised cells from which minute fibers pass to join the olfactory bulb. The olfactory bulb is the slightly enlarged portion of the olfactory tract which lies above the ethmoid bone.

The sensation of smell is stimulated by gases inhaled. The act of sniffing causes the nostril to dilate and the direction of the anterior part of the nasal respiratory chamber is altered, so that the stream of inspired air is directed towards the upper olfactory area of the cavity. Odours can be finely perceived in very minute quantities and can be finely discriminated. The sense of smell is lessened if the nasal mucous membrane is very dry, wet, or swollen as in a cold in the head. Smells are described as pleasant or unpleasant.

There is an inter-relationship between smell and taste sensations; people complain of impaired taste when they have nasal congestion.

Tongue (sense of taste)

The tongue is the organ used in identifying taste. It also assists in speech. It mixes saliva with food, it aids in chewing and swallowing. The tongue is a solid mass (Fig. 3.12) of muscle fibers.

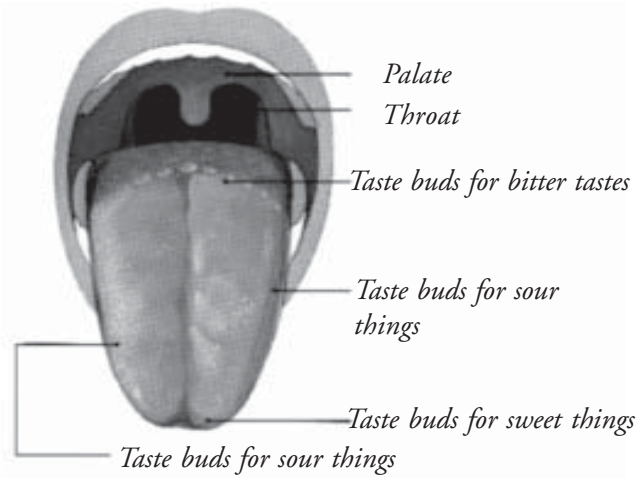


Fig . 3.12

Structure of tongue

The dorsal surface of the tongue is covered with numerous minute projections or papillae, which vary in shape. The largest are the vallate present in the root of the tongue. The most numerous are the thread like filliform papillae, and the fungiform papillae (mushroom shaped) which are present at the tip of the tongue.

The root of the tongue is supplied with lymphoid nodules called the lingual tonsil. The receptor of taste, the taste buds are distributed on the dorsal surface of the tongue. They serve to distinguish the four basic tastes – salt, sweet, sour and bitter.

When the food is chewed, it gets mixed with saliva. The juice penetrates the taste buds, and enables them to identify the taste.

The musculature of the tongue is supplied by the hypoglossal nerve (12th cranial nerve).

Skin

Skin is the outer most layer of the human body. It protects the inner organs from various external factors. The external appearance of the skin is deceptively homogeneous and simple. It consists of two layers.

The outer layer – epidermis / cuticle

The outer layer, the epidermis is made up of five or six layers of cells. They consist of a cornified layer of dead cells. Cells are shed from this layer and replaced by cells that are produced in the basal layer of the epidermis (Fig. 3.13).

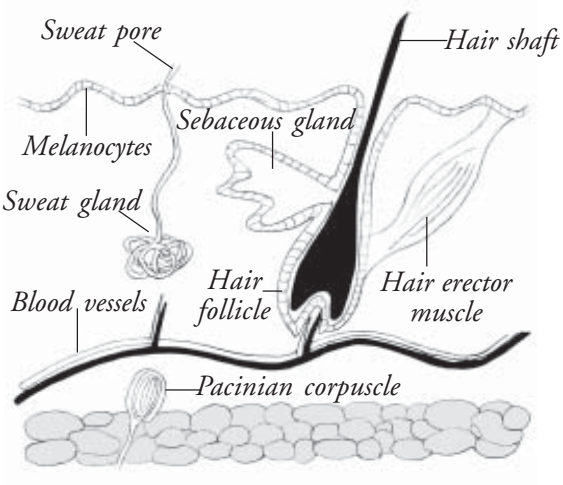


Fig. 3.13

The inner layer - dermis / corium

The dermis is composed of dense, white connective tissue. It is supportive in nature. This contains blood vessels and sensory nerve endings for pressure, touch, pain and temperature. Sweat and oil (sebaceous) glands are present in the dermis. The hair follicles arise from the dermis. The sebaceous glands are located near the hair follicle. The sweat glands open out through sweat pores, which are numerous in the epidermis.

Functions

- Skin is an organ of temperature regulation.
- Skin is a vascular organ which plays an extremely important role in temperature regulation.
- The blood vessels to the skin are organized in a way that blood may be shunted from the arteries to veins when the body needs to preserve the heat and vice versa. When a person does prolonged muscular exercise, the blood flow to the skin will increase, thereby releasing heat.
- The skin also regulates temperature by sweating.
- When the body sweats a lot, it releases heat thereby reducing the body temperature.

Melanin

The skin colouration is due to the pigment called melanin. If the melanin pigment is more, the skin appears dark.

Skin is an organ of the sense of touch, heat, cold, and pain resulting from the stimulation of the nerve endings in the skin. The sense varies with the type of nerve ending stimulated.

Skin is an organ of storage

The skin and the underlying tissue act as storage for water. The adipose tissue beneath the skin is one of the principal fat depots of the body.

7. Excretory system

The waste products from the body are eliminated through the excretory system. In this system we discuss

- The excretory substances
- The excretory organs
- The structure of kidney
- Formation of urine
- Functions of kidneys

The excretory substances

The excretory system is responsible for the elimination of wastes produced by homeostasis. Metabolism of the various chemical substances produces different waste products. They are:

- Carbondioxide
- Urea and nitrogenous waste
- Salts
- Excess water
- Undigested food
- Toxic substances
- Pathogenic organisms

Excretory organs

There are

- Sweat Glands
- Liver
- Lungs
- Kidneys

Kidneys

The principal excretory organs are kidneys. (Fig. 3.14) Every human has two kidneys, which remove urea from the blood. The kidneys are bean-shaped and dark red in color. They are situated inside the abdomen on either side of the vertebral column. The kidney is composed of two layers.

Outer layer - the cortex

Inner core - the medulla.

Formation of urine

Each kidney is composed of a number of functional units called nephrons. There are 1 million nephrons in each kidney. Nephrons are the functional units of the kidneys. The tops of the nephrons are in the cortex, while their long tubule portions are in the medulla.

The nephron consists of the glomerulus, Bowman's capsule, proximal tubule, loop of Henle, the distal tubule and the collecting ducts.

The structure and the functions of the parts of the kidneys are given below

Glomerulus : This is the tuft of capillaries through which the blood comes to nephron for filtration

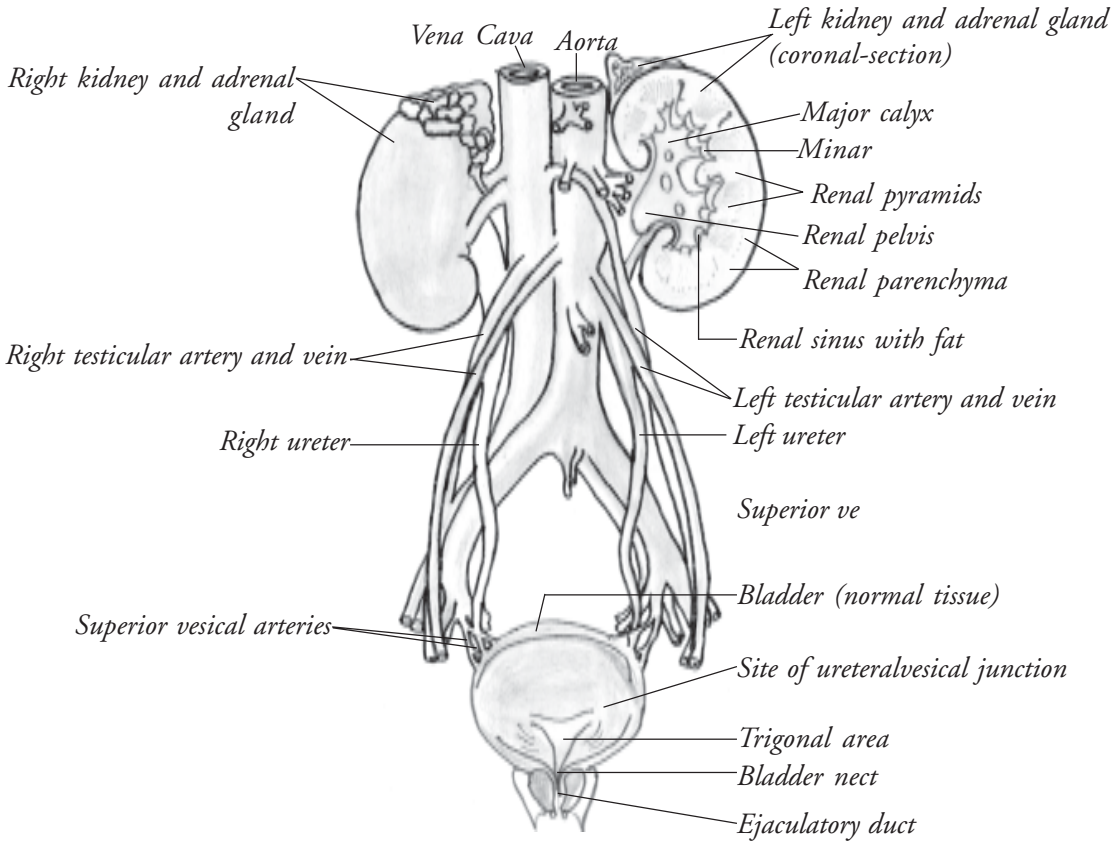


Fig. 3.14

Bowman's capsule	:	This filters the blood, which comes through glomerulus
Proximal tubule	:	Here water and some "good" molecules are absorbed back into the body, while a few other, unwanted molecules / ions are added to the urine.
Loop of Henle	:	Here more water is removed (back into the bloodstream) Some NaCl (salt) is removed from the filtrate at this point to adjust the amount of fluid which surrounds the tubule. Capillaries wind around and exchange materials with the tubule.
Distal tubule	:	Here more water and some "good" solutes are removed from the urine, while some more unwanted molecules are put in.
Collecting duct	:	Gathers urine from several nephrons. As the collecting duct goes back through the medulla, more water is removed from the urine.
Renal Pelvis	:	The collecting ducts eventually end up at the renal pelvis, which collects the urine from all of them.
The ureter	:	From the renal pelvis of each kidney the ureter conveys the urine to the urinary bladder.
Urinary bladder	:	This is a pear shaped bag where the urine is temporarily stored.
Urethra	:	This conveys urine from the bladder to outside the body.

Functions of the kidneys

- Excretes urea formed during protein metabolism.
- Excretes toxic substances.
- Regulates the loss of excess water from the body.
- Maintains the pH.
- Secretes a hormone called erythropoietin responsible for development of RBCs.
- Converts inactive vitamin D into active vitamin D.

When waste products are removed properly, the body is healthy. When the kidneys are infected, the quantity of the urea in blood will increase, endangering life.

Glucose is not normally excreted. But in the case of diabetic patients, it is excreted in urine. When diseases affect a person, the qualities of the urine change.

8. Digestive system

Food provides us with fuel to live, energy to work and play, and the raw materials to build new cells. All the different varieties of food we eat are broken down by our digestive system and transported to every part of our body by our circulatory system. In digestive system we discuss

- Organs of the digestive system
- Functions of alimentary tract
- Liver
- Large intestine
- Rectum and anus

Organs of the digestive system

The Digestive system includes the alimentary canal and the digestive glands. The alimentary tract has the following parts

- Mouth
- Pharynx
- Esophagus
- Stomach
- Small intestine
  - Duodenum

  - Jejunum
  - Ileum
- Large Intestine
  - Appendix
  - Cecum
  - Colon
  - Rectum
  - Anus

The accessory glands

- Salivary glands of the mouth
- Parotid
- Sub mandibular
- Sublingual
- Liver
  - Pancreas
  - Biliary tract

The wall of the alimentary canal (except for the mouth and the pharynx) is made up of four layers from outer to inner. They are

- Peritoneum
- The muscular layer
- The submucosa
- The mucosa

The alimentary tract

- Teeth grind the food; the tongue helps to chew food and mix it with saliva to make a soft pulp that is easy to swallow.
- The stomach secretes the following enzymes:-
  - Hydrochloric acid
  - Pepsinogen
  - Rennin
  - Gastric amylase
- The secretions of small intestine is called Succus Entericus. The small intestine is divided into duodenum, jejunum and ileum. The bile and the pancreatic juice enters the duodenum. This has lipase and amylase which digest the fat and carbohydrates respectively. The small intestine secretes intestinal juice which digests the food into nutrients that are small enough to pass through the lining of the small intestine and into the blood. They are carried away to the liver and other parts of the body to be processed, stored and distributed.

Liver

Blood from the intestines flows to the liver, carrying nutrients, vitamins and minerals, and products from digestion. The liver is like a food processing factory with more than 200 different jobs.

- It stores nutrients
- It changes absorbed nutrients from one form to another (Glucose into glycogen).
- It releases them into the blood according to the activities and needs of the body.

Large intestine

The large intestines is made up of the colon, cecum and appendix. Any useful substance in the leftovers, such as spare water and body minerals, are absorbed through the walls of the large intestine, back into the blood. The remains are formed into brown, semisolid faeces, ready to be removed from the body.

Rectum and anus

The end of the large intestine and the next part of the tract, the rectum, stores the faeces. These are finally squeezed through the anus out of the body.

9. Endocrine system

The endocrine glands or ductless glands secrete certain chemical substances called hormones. They guide and control the various metabolic activities, and the growth and differentiation of various systems. These glands do not have any ducts. As secretory glands they directly pass their secretion into the blood stream. In this system we discuss.

- General principles of hormones
- The different endocrine glands and their functions
- Gonads and reproductive system

General principles of hormones

- Hormones are secreted in response to specific stimuli.
- Hormones can be secreted independently of one another.
- Hormones are present in minute quantities in the blood.
- Hormones are believed to be catalytic in their effects.
- Hormones have a high degree of target specificity.
- All hormones are proteins in nature.
- Hormones can be extracted artificially.
- Hormones can be synthesized, isolated and purified.

Endocrine glands

- Pituitary gland
- Thyroid gland
- Parathyroid gland
- Islets of Langerhans (Pancreas)
- Adrenal glands
- Gonads
- Thymus

Pituitary gland [Hypophysis]

This is the chief center of the endocrine system. It forms an important link between the nervous and endocrine systems. It controls other endocrine glands. It is a small nut like structure situated at the base of the brain. It is divisible into two distinct portions – the anterior lobe (adenohypophysis) and the posterior lobe (neurohypophysis).

Hormones secreted in adenohypophysis

- **Growth hormone:** This hormone is responsible for growth of cells and tissues. Deficiency of this hormone results in Dwarfism. Excessive secretion results in Gigantism (Acromegaly).
- **Thyroid stimulating hormone:** It stimulates adrenal glands to synthesise and release its hormones.
- **Adrenocorticotrophic hormone (ACTH):** It stimulates adrenal glands to synthesise and release its hormones.
- **Follicle stimulating hormone:** It stimulates the growth of Graffian Follicle in the ovary in females and promotes the formation of sperm in the testes of males.
- **Luteinizing hormone:** It plays an important role in causing ovulation in females and also in development of corpus luteum. In males it stimulates the interstitial cells of the testes to secrete testosterone.
- **Prolactin:** It is associated with lactation in females.

The hormones secreted by posterior pituitary gland are:

Antidiuretic hormone (Vasopressin) : (ADH) It causes the kidneys to retain water, thus increasing the water content of the body. It plays an important role in osmoregulation / water balance of the body.

Oxytocin: It causes rhythmic contraction of the uterus at the time of childbirth for the expulsion of the fetus and the placenta. It causes the ejection of milk from the lactating mammary glands.

Thyroid gland

The gland consists of a pair of lobes. They lie one on either side of the larynx in the neck region, they are connected by a median structure called isthmus. This gland secretes a hormone called thyroxine. Iodine is essential for the production of thyroxine. Iodine deficiency leads to goiter.

Functions of thyroxine

- Stimulates the normal growth and development
- Controls the rate of cellular oxidation and basic metabolic activities.

Disorders of thyroid gland are

- Deficiency (hypothyroidism) in children leads to cretinism. In adults leads to myxedema.
- Excessive secretion results in hyperthyroidism.

Parathyroid glands

They are four small glands placed posteriorly 2 on each side of the thyroid. They secrete (1) Parathormone and (2) Calcitonin.

Functions

They control the metabolism and blood levels of calcium and phosphate.

Disorders

Hypoparathyroidism - Tetany due to fall of blood calcium level

Excessive secretion - Hyperparathyroidism

Islets of Langerhans

The islets of Langerhans are groups of epithelial cells found lying between the portions of pancreas. They contain alpha, beta and delta cells. Alpha cells produce Glucagon. Beta cells produce Insulin. Delta cells produce Somatostatin

Role of insulin

It increases the withdrawal of glucose from blood in 3 ways, or reduces the glucose level in the blood.

- Conversion of glucose into glycogen
- Oxidation of glucose in the tissues.
- Conversion of glucose into fat.

Deficiency causes hyperglycemia (increase of glucose in the blood). This disease is known as diabetes mellitus. Excess secretion lowers the blood sugar leading to hypoglycemia.

Role of glucagon

Its effects on blood glucose level are generally opposite to the effects of insulin. It increases the release of glucose from glycogen. A proper balance between insulin and glucagon production is therefore necessary to maintain proper blood glucose levels.

Adrenal glands

The two adrenal glands lie on the upper pole of the kidneys. They are also called supra renal glands.

Hormones secreted

Adrenal cortex

Aldosterone – Promotes reabsorption of sodium ions from the renal glomerular filtrate

Cortisone – Production of glucose from non-carbohydrate sources like fats and amino acids. It also acts as an anti-inflammatory agent

Adrenal medulla

- It secretes adrenaline (epinephrine), non adrenaline (non epinephrine)
- Gives instant energy,
- Stimulates constriction of blood vessels
- Increases the heart rate.
- Relaxation of the smooth muscles
- Causes goose flesh.
- Breakdown of glycogen to glucose

Gonads

They produce the sex hormones in the ovaries of females and in the testes of males.

10. Reproductive system

Reproduction is the only means by which the continuity of life is maintained. Human beings reproduce sexually. Male and female reproductive organs carry out the process of sexual reproduction which begins with fertilization of ovum by the sperm.

Female reproductive system

This consists of external genitalia - a pair of ovaries, a pair of fallopian tubes, uterus and a vagina.

Ovaries

One pair of ovaries is located in the abdominal cavity. The ova begin to develop inside the ovaries. The ovaries of the sexually matured female contain ova at

various stages of development. The final stage is a structure called the Graafian follicle, which consists of an ovum. The graffian follicle ruptures and the ovum is released.

Fallopian tubes

The terminal part of the fallopian tube is a funnel shaped structure, lying close to the ovary. It receives the ova from ovary and conveys into the uterus.

Uterus

Uterus is a muscular organ situated in the pelvic cavity.

The uterus consists of three layers

Perimetrium - Outer layer
Myometrium - Middle layer
Endometrium - Inner layer

The main function of the uterus is to prepare the endometrium for reception of fertilized ovum. The fertilized ovum is embedded in the uterine cavity where it develops and is nourished to full term. If the ovum is unfertilized, the endometrium is shed off as menses.

Vagina

This is the muscular tube lined with mucous membrane connecting the cervix at the upper end and external genitalia at the lower end. It receives sperms and serves as birth canal.

Male reproductive system

This consists of a pair of testes, seminal tracts and related glands.

Testes

There is one pair of testes inside the scrotum. The scrotum is a skin bag having two separate compartments, one for each testes. The testes form the male gametes known as spermatozoa. Each testes consists of a large number of tubules that secrete the hormone testosterone.

Epididymis

The tubules in the testes unite to form a long coiled structure called epididymis. It lies on the outside of each testis and is attached to it. This is the main storehouse of sperm. The sperm attain their motility in the epididymis.

Vas deferens

The epididymis differentiates into a muscular tube called the vas deferens. It ascends and reaches via abdominal cavity into the pelvis, opening into the urethra.

Seminal vesicles

These are paired tubular glands situated behind the neck of the urinary bladder. Each seminal vesicle's duct joins with the vas deferens of that side.

Urethra

After leaving the urinary bladder, urethra passes through the prostate gland, where it is known as the prostatic urethra. Both the vas deferences and the urethra join here.

Prostate gland

This is a gland composed of fibromuscular and glandular tissue. It is located at the lower end of the urinary bladder, it surrounds the first part of the urethra.

Penis

It is composed of spongy erectile tissue through which the urethra (penile urethra) traverse and opens to the exterior.

Practical applications

Surface Anatomy

The important surface markings related to human anatomy

1. Thyroid gland is situated in front of the neck just below the thyroid cartilage.
2. The heart lies in the chest. Surface marking: Two finger breadth from the lower most part behind the chest bone, extending to the left between 2nd and 5th ribs. The apical impulse can be felt

in the 5th left inter coastal space below the nipple.

3. To start intravenous lines, antecubital vein is commonly used. This is situated on the anterior aspect of the elbow.

The Pulse can be palpated at

Carotid Artery

The carotid arteries can be recognized in the lateral part of the neck just lateral to the larynx (voice box).

Brachial artery

The brachial artery is situated in the anterior part of the arm and can be palpated in the anterior part of the elbow.

Radial artery

The radial artery can be palpated in the forearm. Surface marking: just above the wrist on the lateral part of forearm.

Femoral artery

Femoral artery can be palpated on the upper part of the thigh

Dorsalis pedis artery

Dorsal pedis artery is situated on the anterior aspect of the foot.

Other important practical points

- Insulin is produced in the pancreas. Insulin, along with other hormones of glucagon, corticosteroids, adrenaline are important in maintaining proper blood glucose levels in the body. Lack of insulin causes diabetes.
- Excess or lack of thyroid hormone causes hyper/ hypothyroidism. Hyperthyroidism can cause manifestation in the eye (proptosis)

Summary

This unit has covered each organ in detail. All the systems of our body are interdependent and hence any dysfunction of an organ can cause serious effect to our eye. Therefore, it is very important to take the patient's history in detail when they come with any ocular ailment.

Key points to remember

1. *The organs of a living organism carry out activities that maintain life. Different organs form an organ system and carries out a particular function.*
2. *The major systems of the human body are skeletal, muscular, respiratory, circulatory, digestive, nervous, excretory, sense organs, endocrine and reproductive.*
3. *The respiratory organs are the trachea, bronchi and lungs. Respiration involves the exchange of oxygen and carbon dioxide and the oxidation of food in each cell to release energy.*
4. *The heart, blood vessels and blood make up the circulatory system. These transport nutrients, oxygen, hormones and various other substances throughout the body.*
5. *The kidneys, lungs, skin and large intestine are the excretory organs of the body.*
6. *Digestion means converting the complex food we eat into a simpler form that is easily absorbed by the body.*
7. *Food goes through numerous digestive organs like the mouth, esophagus, stomach, small intestine and large intestine. The liver and pancreas secrete certain juices that help in digestion.*
8. *The brain, spinal cord and nerves form the nervous system. It controls and coordinates all the activities of our body and the functions of other organ systems.*
9. *Nerves carry messages throughout our body. There are 31 pairs of spinal nerves and 12 pairs of cranial nerves.*
10. *Some nerves carry messages from the brain to the other parts of the body. Others carry messages from different parts of the body to the brain.*
11. *The 206 bones of the skeletal system give shape and support to the body. It also protects organs like the heart, brain and lungs.*
12. *The muscles of the muscular system cause movements of various parts of the body and internal organs.*
13. *The organs of the reproductive system are the testes in males and ovaries in females. They produce reproductive or sex cells.*
14. *Testes produces sperm and the ovaries produce ovum.*

Student exercise

A. Tick the most appropriate answer

1. *Sperms are produced in*
   a. Ovaries *b. Testes*
   c. Eggs *d. Urethra*
2. *The skeletal system consists of*
   a. Muscles *b. Bones*
   c. Muscles and bones *d. Brain*
3. *The food does not pass through these glands but they help in digestion*
   a. Liver and pancreas *b. Small intestine and pancreas*
   c. Liver and heart *d. Large intestine and stomach*
4. *In clotting the blood _____ plays an important role*
   a. Red blood cells *b. White blood cells*
   c. Thrombocytes *d. Arteries*
5. *It act as the relay station between the brain and the spinal cord*
   a. Mid brain and *b. Cerebellum & pons*
   c. Frontal and parietal *d. Occipital and temporal*

B. Fill in the blanks

1. *The artery which carries deoxygenated blood is _____*
2. *_____ part of the brain is responsible for memory.*
3. *Insulin is secreted by _____*
4. *The covering of the lungs is called _____*
5. *The basic functional unit of kidney are _____*
6. *The male reproductive system consists of _____ that produce sperms*
7. *The nervous system consists of the brain,_____ and _____*
8. *The conversion of complex food into simpler absorbable form is called _____*

C. True or False

1. *The excretory system carries oxygen to all the parts of the body.*
2. *Femur and patella are responsible for the bone formation.*
3. *In the circulatory system, the brain, spinal cord and nerves coordinate all the functions of the body.*
4. *Tissues are grouped together to form systems.*
5. *Muscular system is responsible for all types of movements of the body parts and its internal organs.*
6. *Pharynx is commonly referred to as voice box and larynx is referred to as throat.*
7. *Pituitary gland is the chief center of the endocrine system.*

D. Match the following

1. Small intestine	*- exchange of gases*
2. Artery	*- shape to the body*
3. Bones	*- situated in the pelvic cavity*
4. Urethra	*- transporting urine to the urinary bladder*
5. Respiratory system	*- digestive system*
6. Ureter	*- opening of the urinary bladder*
7. Muscular system	*- carry oxygenated blood*
8. Uterus	*- skeletal system*

E. Find the odd one out. Give reasons

1. *Oesophagus, trachea, small intestine, anus*
2. *Nostrils, lungs, bronchi, nerves*

3. *Brain, spinal cord, arteries, nerves*
4. *Kidney, stomach, ureter, urethra*
5. *Veins, capillaries, arteries, canines*

F. Rearrange the organs to show

1. *The path of the food in the body*
   Small intestine, stomach, mouth, large intestine, oesophagus
2. *The path of the oxygen rich air in the body*
   Lungs, nose, trachea, bronchi
3. *The path of blood from the heart capillaries, heart, veins, arteries*

G. Give the values of

1. *Blood volume*
2. *Pulse*
3. *Systolic Pressure*
4. *Diastolic pressure*
5. *Number of bones*
6. *Spinal nerves*
7. *Cranial nerves*
8. *Vertebrae*
9. *Nephrons in both kidney*
10. *Number of lobes in right lung*
11. *Number of lobes in left lung*

H. Explain the following

1. *Power house of cell*
2. *Floating ribs*
3. *Voice box*
4. *Throat*
5. *Wind pipe*
6. *Brain stem*
7. *Succus entericus*
8. *Graffian follicle*
9. *Axis*
10. *Atlas*

I. Differentiate the following

1. *Ureter and Urethra*
2. *Neuron and Nephron*
3. *Glucagon and Insulin*

J. State the opposites of

1. *Adduction*
2. *Depression*
3. *Spermatogenesis*
4. *Sympathetic*
5. *Osteoclast*
6. *Bicuspid valve*

K. Answer the following

1. *Describe the functions of cardio vascular system*
2. *Identify the excretory organs and the waste eliminated by them*
3. *Describe the path of food through the digestive system*
4. *Describe the functions of the nervous system.*
5. *What are the basic differences between voluntary and involuntary muscles?*

CHAPTER 4 ANATOMY AND PHYSIOLOGY OF THE EYE

OUTLINE

Orbit and lid
Conjuctiva, cornea and sclera
Uveal tract
Lens
Retina and vitreous
Extraocular muscles

GOAL

The Ophthalmic Assistant will gain knowledge of the structure of the eye, reference to its function/dysfunction in connection to environmental perception.

OBJECTIVES

The OA will be able to

- Describe the embryology of the eye
- Identify the different parts of the eye and its structures
- Analyse the various functions of parts of the eye
- Associate the structure of the eye to its function as a sensory organ
- Explain the external and internal parts of the eye

CHAPTER 4
Anatomy and Physiology of the Eye

Introduction

The eye is the most sensitive part of our body. It views the world. It is also exposed to different light of the object. The human body has a pair of eyeballs. The eyeballs are well protected in bony cavities called orbits which are situated on either side of the nose. Externally the eye is protected by the eyebrow, eyelashes and eyelids.

Development of the eye

The embryonal and fetal development of the human eye includes a series of sequential events starting with the fertilization of the ovum and ending with birth of a normal baby. Three main periods can be distinguished in the development of the eye.

The first period called embryogenesis is characterized by appearance and migration of the neural crest cells and by the formation of the primary brain vesicles known as optic vesicle and ends at the end of the 3rd week. The second period called organogenesis extends from the 4th week till the end of the 8th week. It includes the closure of the neural canal interiorly with the subsequent evagination of its lateral wall into optic vesicles, the invagination of the lower nasal wall of the optic vesicle causing the formation of the optic cup, and the development of the lens plate, retinal disk and embryonic fissure. The embryonic fissure extends into the optic stalk which connects the cavity of the optic vesicle with the cavity of the neural canal; the hyaloid artery penetrates into the optic cup through the embryonic fissure. The primary vitreous forms and the surface ectoderm overlying the lens vesicle differentiates into a primitive corneal epithelium. The third period involves the differentiation of each of the primitive organs into a fully or partially active organ and is called differentiation. The facial and orbital structures also develop at this stage.

Schedule of eye development

3.5 wks.	Optic vesicle appears, set at 180° to each other
4th wk.	Optic cup involutes and lens placode/pit forms.
5th wk.	Lens vesicle separates from epidermis; choroid fissure present in optic cup; vitreous appears.
6th wk.	Retina differentiated into neural and pigment layers; lens thickens; eyes rotate to 160°.
7th wk.	Choroid fissure closes; lens cavity obliterated; lids begin to form; axons enter optic stalk.
10th wk.	Eyelids fuse; ciliary body and iris forming.
12th wk.	Layers of retina are organising.
21st wk.	Retinal layering complete, responsive to light; eyelids open.

The orbit

The orbit is a pyramidal bony cavity containing the eyeball, extraocular muscles, fat, blood vessels and important nerves. It is formed by a roof, floor, medial wall, lateral wall, a base and an apex. The bony orbit is made up of 7 bones - frontal, sphenoid, zygomatic, maxillary, palatine, ethmoid and lacrimal. Five important cranial nerves (2,3,4, first division of 5 and 6) pass through the apex of the orbit.

External structure of the eye

Eyebrows

The eyebrows are formed by several rows of hair. They separate the upper lid from the forehead. Besides protection, they contribute to facial expression by their movement

Eye lashes

Eye lashes arise from follicles arranged in irregular rows. There are 5-6 rows in the upper lid and 3-4 rows in the lower lid.

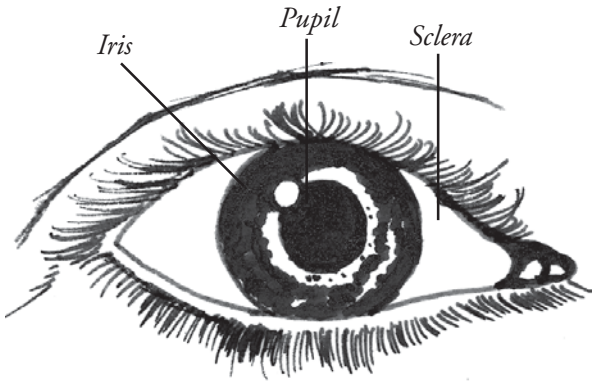


Fig . 4.2

Canthi

The site of the union of the upper and lower eyelids near the nose is known as medial canthus and the site of union towards the ear is known as lateral canthus.

Caruncle

This is a fleshy elevation situated close to the medial canthus. It has hair and sebaceous glands. It functions to trap foreign bodies.

Plica semilunaris

This is a half moon shaped movable fold of bulbar conjunctiva.

Palpebral fissure

This is the space between the eyelids. It is usually around 8-11mm in height.

Eyelids (palpebrae)

The eyelids are specialized, movable skin folds. The eyelid is composed of two parts- anterior lamina with skin and muscle (orbicularis) and the posterior lamina with tarsus and conjunctiva.

Skin of the lid

The skin of the lid is extremely thin and elastic .It is loosely attached. At the base, or lid margin, lashes or cilia are present. The base of each cilia has sweat glands known as glands of Moll and sebaceous glands known as glands of Zeis. The suppurative inflammation of these glands results in styes (hordeolum).

Muscles of the eyelid

There are two types of muscles in the lid- the retractors (which open the lid) and the protractors (which close the lid) (Fig. 4.3).

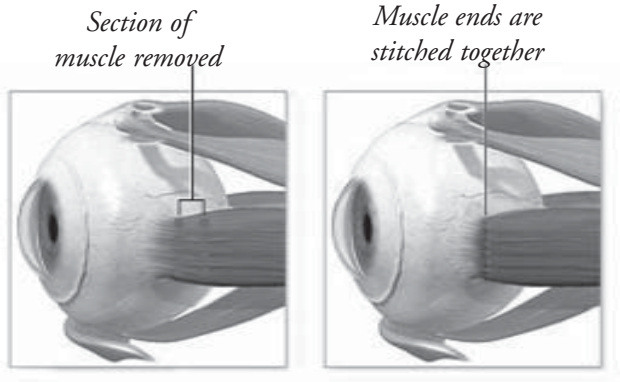


Fig. 4.3

The main retractor of the lid is the elevator palpebrae superiors. It originates near the apex of the orbit and is inserted anteriorly into the skin of the upper lid forming the lid crease. This muscle is supplied by the 3rd cranial nerve.

The protractor of the eyelid is the orbicularis oculi. This muscle is situated beneath the skin of the eyelid. This is supplied by the 7th cranial nerve. Orbicularis oculi muscle helps in blinking.

Normally the upper eyelid covers the upper 2mm of the limbus. Malposition of upper lid downwards is known as ptosis.

As we close our eyes, the eyes move up. This reflex is known as Bell's phenomenon.

Orbital septum

The orbital septum is a diaphragm between the orbit and the eyelid. It lies posterior to the orbicularis muscle but anterior to the orbital fat. It functions as

a barrier and prevents the spread of infection and haemorrhage from either passing anteriorly or posteriorly.

Tarsal plates

Tarsal plates are composed of rigid fibrous tissue. They are attached to the bony orbit through medial and lateral canthal ligaments. They contain sebaceous glands known as Meibomian glands. These glands run perpendicular to the lid margin. Clogging of the lid margins, with inflammation results in a condition clinically known as chalazion.

The eyelids receive blood supply from terminal branches of the ophthalmic artery which anastomose with angular artery.

The eyelids receive nerve supply from the terminal branches of 5th nerve.

Functions of the eyelid

- Protects the delicate eyeball from injury and foreign body.
- Keeps cornea clean, transparent and moist by blinking.
- Helps in maintenance of tear film.

Eye ball

The adult eyeball or globe measures approximately one inch or 25mm in diameter.

The eyeball is composed of three separate layers/ coats.

- The outer protective layer (sclera and cornea)
- The middle vascular layer (uvea)
- The inner receptor layer (retina)

The outer protective layer

This consists of the sclera and the cornea. The sclera is what we commonly regard as 'white of the eye'. It forms the posterior portion of the globe. It is perforated posteriorly by the optic nerve.

Cornea

Cornea is the anterior portion of the eyeball. It forms the anterior transparent 1/6th of the eyeball and looks like the glass cover of a circular wristwatch. It is about 1mm thick and has a diameter of 10-11mm. It gets its energy and nutrition from the aqueous and oxygen from the air. The transparency and curvature of the cornea accounts for visual acuity and refractive state of the eye. Cornea is the most important focusing structure of the eye (Fig. 4.4).

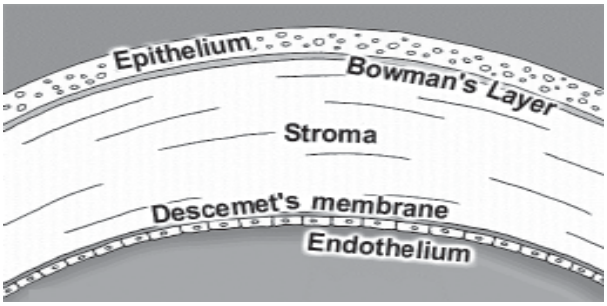


Fig. 4.4

Anatomically the cornea has five layers

- Epithelium
- Bowman's membrane
- Stroma (forms the bulk of corneal tissue)
- Descemet's membrane
- Endothelium

The cornea is avascular and has no lymphatics. Nerve supply to the cornea is from the branches of the trigeminal nerve.

The junction of the cornea and the sclera is called the limbus. Important angle structures lie here.

The middle vascular layer

It is also called the uvea. This vascular layer supplies nourishment to the eyeball. It is composed of the iris, the ciliary body and the choroid. The uveal tract contains melanin- a pigment which determines the color of the eye.

Iris

It is the most anterior portion of the uvea. It represents the pigmented moving diaphragm of he eye. It controls the amount of light entering the eye and is comparable to the aperture of the camera. The hole in the centre of the iris is the pupil. Pupil constricts in the light and dilates in the dark. Two muscles- the dilator and constrictor control this action. Constrictor muscles are innervated by parasympathetic fibers of the 3rd cranial nerve and the dilator muscles are innervated by sympathetic fibers from the superior cervical ganglion.

Ciliary body

It lies between the iris and choroid. It contains the ciliary muscle and ciliary processes. The ciliary muscle takes part in accommodation. With accommodation we change our focus at different distances. This is possible because of the simultaneous changes in the shape of the lens as the ciliary muscle contracts and relaxes.

The ciliary processes produce aqueous humor. Aqueous is a transparent fluid which nourishes ocular structures.

Aqueous humor

The aqueous humor is a clear, watery fluid, formed by the ultra filtration and secretion through the capillary process in the posterior chamber of the eye.

Circulation of aqueous

Pathway of aqueous humor drainage

Ciliary processes - posterior chamber - pupil - anterior chamber - trabecular meshwork - canal of Schlemm - collector channel - episcleral veins.

Note: Structures seen with a gonioscope while viewing angle structures - Schwab's line (end of Descemet's membrane), trabecular meshwork, scleral spur, ciliary body band, root of iris.

Choroid

It lies on the inner scleral surface. It nourishes the retina.

The receptor layer (retina)

This is the innermost layer of the eyeball. It is extremely thin (0.5mm) and transparent. It contains highly specialized visual receptors which help us see. It is comparable to the film of a camera. The retinal neurons transmit the picture through the optic nerve fibers to the brain for perception. The retina has ten layers:

- Retinal pigment epithelium
- Layer of rods and cones
- External limiting membrane
- Outer nuclear layer
- Outer plexiform layer
- Inner nuclear layer
- Inner plexiform layer
- Ganglion cell layer
- Nerve fiber layer
- Internal limiting membrane

The retinal receptors are divided into two main populations-the rods and the cones. The rods function best in dim light; the cones function best under daylight conditions. The cones are far fewer in number than the rods, numbering 6 million, whereas the rods number 125 million. Cones enable us to see small visual details with great acuity. Vision with rods is relatively poor. Color vision is totally dependent on the integrity of the cones. The cones form a concentrated area in the retina known as the fovea, which lies in the center of the Macula Lutea.

The junction of the periphery of the retina and the ciliary body is called the ora serrata.

Optic nerve

The optic nerve is the second cranial nerve situated in the posterior part of the globe. It transmits visual impulses from the retina to the brain. The head of the optic nerve is called the optic disc and is seen during ophthalmoscopic examination.

Visual pathway

As the retinal fibers leave the optic nerves, half of them cross to the opposite side. This structure of mutual crossing is known as the optic chiasm. From the optic chiasm the crossed nasal fibers mix with the uncrossed temporal sector to form the optic tract. The optic tract continues towards a cell station in the brain called the lateral geniculate body. It is a relay station. From here fibers spread out in a fan shaped manner to reach their final destination the visual cortex (Fig. 4.5).

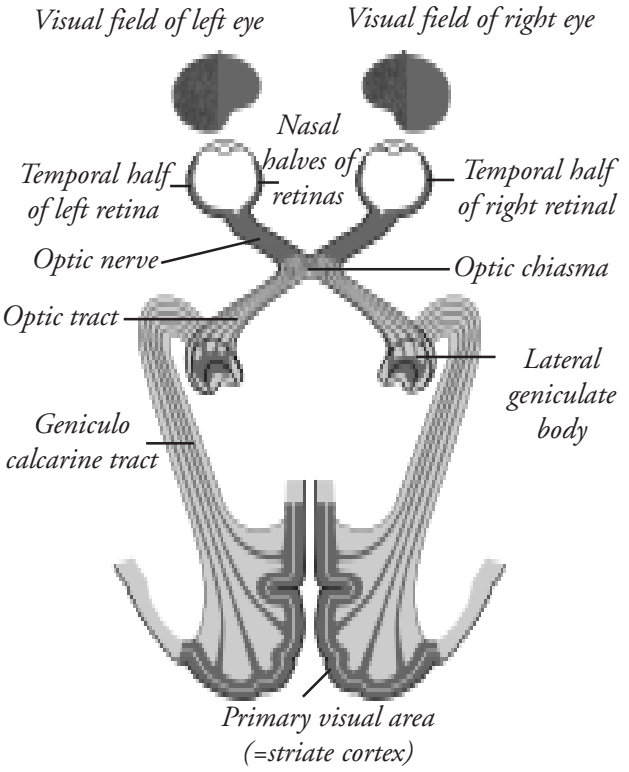


Fig. 4.5

The lens

Lens which is proteinaceous and crystalline lens is a biconvex transparent structure. It lies behind the iris and in front of the vitreous. It is attached to ciliary muscles of the ciliary body by ligaments or fine threads, termed the zonules. Contraction of the ciliary muscle allows the zonules to relax. This in turn causes the lens to relax and become more convex. Thus it helps in accommodation.

The lens has an elastic envelope known as the capsule. The central portion of the lens is known as the nucleus. The nucleus is covered by cortex. The main function of the lens is to bend/refract light and to help in accommodation.

The Vitreous

The posterior segment of the eye. It prevents the eye from collapsing and provides support to the eye.

Extra ocular muscles

Each eyeball is controlled by six extra ocular muscles. There are four recti and two oblique muscles for each eye.

Note: The muscles are about 40mm long and about 10mm wide. They become tendinous 4-6mm from insertion.

Lacrimal system

Lacrimal system consists of

- Secretory portion
- Excretory portion

The main function of the lacrimal system is to produce tears for the lubrication and nourishment of the external eye. It also removes waste products (Fig. 4.6).

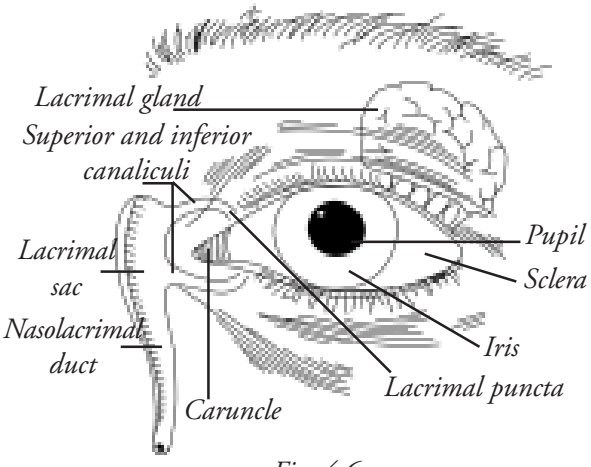


Fig: 4.6

Secretory portion

The secretory portion consists of the main and accessory lacrimal glands. These glands produce the aqueous part of tears to keep the eye moist.

The main gland lies in the lacrimal fossa which is located at the anterio-lateral portion of the roof of the orbit. It opens by several ducts which pour tears into the superior fornix. This is responsible for reflex secretions.

The accessory glands of Krause and Wolf ring are located in the superior tarsal conjunctiva.

Excretory portion

This consists of

- Punctum
- Canaliculus
- Common canaliculus
- Lacrimal sac
- Naso lacrimal duct

Punctum

There are 2 puncta in each eye-the upper and the lower situated on the upper and lower eyelid margins about 5mm from medial canthus. Each punctum is situated on a lacrimal papilla.

Canaliculus

Each canaliculus has a 2mm vertical portion and an 8mm horizontal portion. The canaliculi are directed medially and meet to form a common canaliculus.

Lacrimal sac

The lacrimal sac is situated medially in the lacrimal fossa. The medial palpabral ligament lies anterior to it. It measures about 8-10mm.

Nasolacrimal duct

The nasolacrimal duct continues downward outward and laterally to end into the inferior meatus of the nose.

Tear film

The tear film resting on the corneal surface has three layers**:**

- Lipid or oil layer,
- Lacrimal or aqueous layer, and
- Mucous or mucin layer

Functions of the tear film are to

- Carry bacteria-fighting compounds to the eye
- Carry nutrients to and waste products away from the eye
- Keep the eye moist
- Provide a smooth refracting surface
- Remove debris from the eye

Composition of tears

Tears contain almost 98% water. They are slightly alkaline due to the presence of chlorides and bicarbonates of sodium, potassium and calcium. They contain other constituents like urea, proteins, glucose, vitamin C and an antibacterial enzyme called lysozyme.

Functions of tears

The main functions of tears are:

- To keep the corneal and conjunctival surface moist and clean by mechanical flushing system.
- To provide nutrition to the cornea.
- To inhibit the growth of microorganisms
- To provide a regular corneal surface by filling interspaces between the epithelial cells.

Circulation of tears

Normally the amount of tear secretion is just sufficient to moisten the conjunctiva cul-de-sac. Almost 50% of the tear secretions are lost through evaporation. The rest are drained through the superior and inferior puncta medially by the blinking movements of the lids.

It is then sucked into the lacrimal sac and forced through the nasolacrimal duct into the nose during the act of blinking the eyes. During reflex irritation or emotional stimuli, excess of tears are secreted.

The amount of tear secretion can be measured by Schirmer's test. A strip of filter paper (5 by 35mm) is placed into the lower fornix for 5 minutes. At least 15mm of wetting indicates normal production.

Practical tips

- Basal cell carcinoma, squamous cell carcinoma, melanoma and meibomian gland carcinoma may arise from the eyelids. These have to be recognized early and treated.
- An extra row of eyelashes arising from the meibomian gland orifices is called dystichiasis. Misdirection of eyelashes which rub against the cornea is called trichiasis. In these conditions the eyelashes have to be removed (epilation).
- Inward turning of the eyelid is called entropion.
- Outward turning of the eyelid is called ectropion.
- Loss of transparency of the lens or its capsule is called cataract and is seen commonly in middle - old age.
- Obstruction of the lacrimal drainage system causes epiphora while increased tear secretion is called lacrimation.
- Paralysis of the extra ocular muscle causes double vision (diplopia). This is commonly seen in 3rd, 4th, and 6th nerve palsies.

The visual system of the eye

The two eyes are the most important sensory organs of our body.

The human eye functions almost like a camera. It needs a transparent pathway of light from the outside world to be focused upon the retina (the innermost sensory layer of the eyeball – which acts like the film of a camera) to see images.

Parallel rays of light from a distant light source enter the eye through the clear pathway of cornea, aqueous humor, lens and the vitreous to form a sharp image upon the fovea in the retina. When the light falls upon the retinal receptors the rods and cones produce visual sensations due to photochemical changes in the pigment contents of the rods and cones, giving rise to electrical variations of charges, which are transmitted through the bipolar cells to the ganglion cells and ultimately via the visual pathway to the brain.

The visual cycle / Wald's cycle: When the retinal photoreceptors are exposed to light they undergo changes which can be transmitted to the brain. These chemical changes constitute the visual cycle.

Rods are made up of rhodopsin. (retinine + opsin = rhodopsin). This pigment, on exposure to light, gets bleached. This is the basic step of visual cycle.

The impulses from the retina travel along the visual pathway; that is: the optic nerve, optic chiasma, optic tract, lateral geniculate body, optic radiation and to the visual cortex of the brain. These impulses produce different sensations :

- **Light sense:** The rods are more sensitive to dim illumination, while the cones are sensitive to bright, day illumination
- **Form sense:** enables a person to perceive the shape of an object i.e., the visual acuity.
- **Color sense:** helps to distinguish different colors of different wavelengths of light.

In human beings the two eyes work together as if they were one and a single mental image is perceived. This is known as binocular singe vision.

Binocular vision is a unique feature of mammals and helps in specialized visual function.

It has three components

- Simultaneous perception
- Fusion
- Stereopsis

Simultaneous perception

Under normal conditions, the image of any object falls on the macula of each eye. There is simultaneous macular perception i.e. both the macula have the same image on them at one given time on looking in one direction.

Fusion

This is the ability to see two similar incomplete images simultaneously and interpret it as a single complete image

Stereopsis: depth perception

When binocular single vision is disturbed we see double. This is known as diplopia. By 6 months of age most of the binocular reflexes are well developed.

Pupillary reactions

When light is thrown on the eye, the pupils constrict. This is mediated by the afferent impulses traveling through the optic nerve and the efferent responses through the 3rd nerve.

These afferent responses bring about contraction of both the pupils due to the decussating of optic nerve fibres at the chiasma.

When the light stimulus constricts the pupil it is called a direct light response. The other pupil constricting is called consensual reflex.

Near response

When an object is brought close to the eyes, in order to focus it clearly on the retina, the eyes:

- Converge
- Accommodate
- The pupils constrict

This is called the near response

Summary

This unit has covered the development of the eye and different parts of the eye. The functions of all the parts of the eye is clearly described.

Key points to remember

- *The eyeball is made up of three coats-the outer protective sclera, middle vascular choroids, inner neuronal retinal coat*
- *The transparent cornea is made up of 5 layers. Transparency of the cornea is maintained by its relative hydration. Cornea is the most important refracting media in the eye.*
- *The angle structures are important for drainage of aqueous humor and are important in the pathology of glaucoma*
- *The retina consists of 10 layers. The rods and cones are photoreceptors in the retina. Rods help in dim light and night vision and the cones for color vision and fine seeing.*
- *Lens is an important focusing mechanism of the eye. Ciliary muscle contraction relaxes the zonules resulting in increased refracting power of the lens. Thus the eye can see nearby objects.*

Student exercise

A. Draw the diagram of eye and

- *Describe the parts of the eye*
- *List the layers of the eyelid*

B. True / False

- *The cornea is the main refractive media of the eye. (True / False)*
- *The aqueous humour leaves the eye by filtering through the trabecular meshwork. (True / False)*
- *The rods are responsible for vision in dim light. (True / False)*
- *Loss of transparency of the lens is called cataract. (True / False)*
- *The accessory lacrimal glands are responsible for reflex tear secretion. (True / False)*
- *Relative afferent pupillary defect (RAPD) is tested by the swinging flashlight test. (True / False)*
- *Rods are responsible for colour vision (True / False)*

C. Choose the correct answer

The orbicularis oculi is the muscle that

- *Dilates the pupil*
- *Affects accommodation*
- *Closes the eyelids*
- *Constricts the pupil*

The average size of the adult eyeball is

- *15mm*
- *25mm*
- *40mm*
- *30mm*

The meibomian gland is contained in

- *Conjunctiva*
- *Muscle*
- *Tarsal plate*
- *Lacrimal system*

Elevator muscle is supplied by (cranial nerve)

- *3*
- *4*
- *5*
- *6*

The aqueous is produced by

- *Salivary gland*
- *Tarsal gland*
- *Lacrimal gland*
- *Ciliary body*

All statements about tears are correct except

- *Tears have a role in maintaining IOP*
- *Tears have bactericidal function*
- *Tears have cleansing function*
- *Tears have nutritional function*

Answer the following

1. *Name the coats of the eyeball*
2. *Which is the primary (most powerful) focusing structure of the eye?*
3. *Name the parts of the vascular coat of the eye and the source of its dark color*
4. *How does the pupil control the amount of light entering the eye?*
5. *Trace the flow of aqueous in the eye*
6. *Name the structures seen in the angle of the eye*
7. *Name the receptors in the retina and their function*
8. *List the extra ocular muscles, their origin, insertion, action and nerve supply*
9. *What is accommodation? Name the structures that are needed for the eye to see nearby things clearly*
10. *What is aqueous humor? Describe its functions.*
11. *Name the layers of the tear film and the functions of tears*
12. *Name the pupillary reactions. Describe the method to test direct and consensual pupillary reflex*

Practical skill students exercise / activity

1. *Label the various parts of the eye in the charts provided.*
2. *Collect information on the mechanism of aqueous humor production and drainage in detail and prepare a chart for the same.*
3. *Enumerate various refractive media of the eye. Name the most important one and its refractive index.*
4. *Describe the pupillary pathway with well illustrated diagrams.*

CHAPTER 5 MICROBIOLOGY

UNIT OUTLINE

Basic microbiology
Sterilisation
Hand washing

GOAL

The Ophthalmic Assistant will understand the basic microbiology concepts, the importance of sterilisation, and perform relevant microbiological, sterilisation and hand washing techniques

OBJECTIVES

The OA will be able to

- Describe the basis of microbiology
- Analyse common ocular micro organisms and the ocular diseases caused by them
- Practice the right method of collecting specimen
- Prepare a smear, staining technique and culturing in a medium
- Practice all the basic sterilisation techniques
- Describe the purpose of washing the hands
- Practice the correct steps in hand washing

CHAPTER 5
Microbiology

Microbiology is the study of microorganisms, which includes bacteria, viruses, fungi and parasites. These living organisms are so small that they are invisible to the human eye and can be seen only with aid of microscopes.

Infection is a term which refers to invasion and multiplication of harmful microorganisms in body tissues. Though human beings live surrounded by a sea of microorganisms, only some of these are harmful. Disease caused by harmful microorganisms is termed infectious diseases. It can affect any part of the body including the eye.

The role of OA in dealing with infectious diseases of the eye is to know about various micro organism causing infections, the types of infections caused by them and methods to prevent spread of infection.

This chapter on basic microbiology gives information about the various microorganisms causing infection and the types of infection caused by them. The topic on infection control covers sterilisation and disinfection procedures used in the operation theatre and in the ward. It also covers hand-washing procedures, which help to prevent transmission of disease causing microorganisms from one person to the other.

Basic microbiology

Microbiology is a study of microorganisms, living things which can be seen only with the aid of a microscope. It studies the causative agents of infectious diseases and the methods of protection against such diseases. There are many different species of microorganisms, only a fraction of these cause disease in humans. Disease - causing micro-organisms are called pathogens. These include bacteria, viruses, fungi and parasites.

Bacteria

These are unicellular organisms; i.e. they are composed of one cell only. Reproduction occurs by simple binary fission. This means that each cell divides to form two, both of which divide in turn and so on. In order to multiply, bacteria require a favorable environment. Pathogenic bacteria survive best in the sort of environment that the human body provides. This includes a temperature of 37° C, moisture, supply of food and slight alkalinity. Some bacteria require a supply of oxygen, these are known as aerobes. Others can only survive in the absence of oxygen. These are called anaerobes. Some bacteria have the ability to change into a form, which is extremely resistant to adverse conditions. This resistant form is known as a spore.

Products of the bacteria cause much of the effect of bacterial infection on the body. These harmful products are called toxins; when released they circulate in the blood stream. In a severe infection they cause serious symptoms, collectively referred to as toxemia.

Classification of bacteria

The importance of classification lies in the need to be able to identify bacteria so that the most effective methods can be used to prevent spreading and to treat infections. Shape of bacteria is the most elementary method of classification (Fig. 5.1).

a. **Cocci**: These are spherical or oval shaped bacteria.
b. **Bacilli:** These bacteria are rod shaped.
c. **Spirochetes:** These are corkscrew shaped or spiral bacteria. The coils of the spiral may be either tight or loose.
d. **Vibrio:** Comma shaped or curved rods.
e. **Actinomyces**: Branching filamentous bacteria.

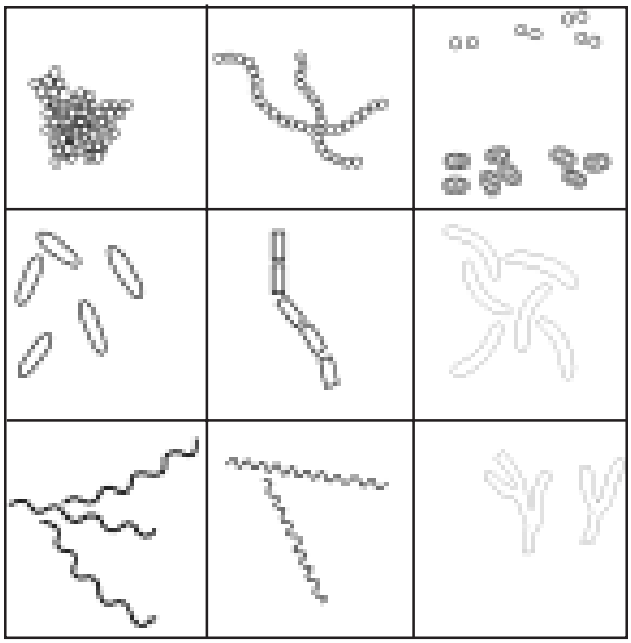


Fig. 5.1

Another simple method of classifying bacteria is by Gram's staining, which divides them into Gram positive and Gram negative bacteria.

Culture media

Bacteria and fungi have to be grown (cultured) to be identified. For growing this bacteria and fungi, we use a special preparation called media.

Different media are:

1. Blood agar (BA) - For growing various bacteria
2. Chocolate agar (CA) - For growing various bacteria
3. Sabourad's Dextrose Agar (SDA) - For growing fungus

Gram positive cocci

1. Staphylococcus aureus

Gram positive cocci occur in grape like clusters. They are the most common cause of suppurative infections in humans. They commonly colonize on the skin, in glands, and mucous membranes of humans and animals. Staphylococci are common in hospital environment and cause infections like boils, wound infections, food poisoning, pneumonia, septic arthritis, corneal ulcer and endophthalmitis.

2. Streptococcus pyogenes

Gram positive cocci arranged in chains or pairs normally present in the human upper respiratory tract – throat, nasopharynx or nose of patients and carriers. Crowding is an important factor in the transmission of infection. Transmission of infection is either by direct contact or through airborne droplets, contaminated dust or fomites. Infections caused are tonsilitis, otitis media and rheumatic fever.

3. Streptococcus viridans

This bacterium is normally found in the mouth (commensal) where it does no harm. It enters the blood stream after dental extraction. Infections caused are dental abscess and subacute bacterial endocarditis where heart valves have previously been damaged.

4. Streptococcus pneumoniae

Pneumococci are Gram-positive diplococci, which are normal inhabitants of the respiratory tract. They are transmitted from one to another by inhalation of contaminated dust droplets or droplet nuclei. Spreading is facilitated by crowding of people. Pneumococcus is one of the most common organisms causing ocular infections like endophthalmitis, dacryocystitis and corneal ulcer. They also cause otitis media, meningitis and pneumonia

Gram-negative cocci

Neisseria (Meningococcus and Gonococcus)

Gram negative diplococci: Transmission is essentially by airborne droplets. They cause serious infections in children and adults. In ophthalmology, conjunctivitis (ophthalmia neonatorum) in newborns is a severe infection caused by gonococcus. They also cause keratitis and endophthalmitis.

Gram positive bacilli

1. Cornyebacterium species

Commonly known as diphtheroids. They are normal commensals living mainly on skin and mucous membranes. Diphtheria is a serious infection caused by them. They also cause membranous conjunctivitis.

2. Bacillus species

This organism produces highly heat resistant spores and is aerobic. They are present in soil, dust, water and air and are common contaminants. Bacillus anthracis causes the deadly disease anthrax. It also causes anthrax of the lid and conjunctivitis.

3. Clostridium species

They produce spores and are anaerobic. This bacterium is found in both animal and human faeces and in soil and dust. Spread is by direct contact of wounds with soil, dust and faeces. Clostridium tetani causes tetanus, clostridium Welchi causes gas gangrene and food poisoning.

Gram negative bacilli

Some bacteria are

- Escherichia coli
- Klebsiella
- Proteus
- Pseudomonas
- Salmonella species
- Shigella

Most of these bacteria are responsible for diarrhea, dysentery, food poisoning, typhoid and wound infections.

Pseudomonas is important in ocular infections because it causes keratitis and endophthalmitis which is difficult to treat. These bacteria are found in human intestines, soil and water. It survives in disinfectant bottles, respirators and humidifiers. It is spread by direct and indirect contact. Infections caused are wound and burn infections, urinary tract infections and septicemia. It is resistant to many antibiotics and is a problem in many hospitals.

Nocardia asteroids

They are usually saprophytes in soil and live freely in nature. Infection is acquired mainly by soil contamination following injury. Common ocular infections caused are conjunctivitis, corneal ulcers and endophthalmitis.

Mycobacterium tuberculosis

Mycobacterium tuberculosis is the causative agent for the disease tuberculosis, which is spread by droplet transmissions (coughing). The disease can be diagnosed by seeing the bacilli in sputum stained by Zeihl Neilson acid fast stain. It appears as pink rods and normally treated with multiple drugs (4 drugs) for 6 -12 months. Because of increase in HIV infection, tuberculosis is also increasing.

Fungi

Fungi have been recognized as causative agents of human disease from very early times. Fungal infections are very common and some of them cause very serious and even fatal diseases. Most fungi are present in the soil as saprophytes and human infections are mainly opportunistic. It is very difficult to treat fungal infections. We have to use antifungal drugs for a very long time.

The different diseases caused by various fungi

1. Infections of hair skin and nails known as tineas. It is caused by dermatophytes.
2. Candida albicans is common in diabetic patients and patients taking antibiotics or corticosteroid treatment over a long period as it suppresses the normal flora. In ophthalmology, candida causes corneal ulcers and endophthalmitis. It also causes oral thrush, vaginitis and other systemic infections.
3. Many other fungi like aspergillus, fusarium, and penicillium are very common especially in ocular diseases like corneal ulcers and endophthalmitis.

Viruses

Viruses are smaller than bacteria and can be seen only by an electron microscope. There are numerous types

of viruses which commonly cause infections in humans: poxvirus, herpes virus, adeno virus, hepatitis virus, polio, mumps, measles and rubella virus, HIV virus and rabies virus. All these viruses cause a variety of symptoms ranging from the common cold, and influenza to the fatal diseases such as AIDS, yellow fever, rabies. In ophthalmology, adeno virus and entero virus commonly cause conjunctivitis. Herpes viruses and HIV are important agents of diseases, causing conjunctivitis, keratitis and retinitis. Viruses can enter the human body by the respiratory tract (inhalation), ingestion and inoculation. Viral multiplication is complex and takes place inside living cells. Viruses are very delicate organisms and can be readily killed by simple measures like washing with soap and water, boiling and common disinfections. Special antiviral drugs are needed to control the infections caused by viruses. Many vaccines are also available to prevent viral infections. e.g., polio vaccine, MMR vaccine, hepatitis vaccine.

Parasites

Parasites are not microorganisms but are organisms, which are much bigger than bacteria and fungi. They can be seen with the naked eye. Parasitic infections are very common in developing countries. These infections are caused mostly by eating or drinking food and water contaminated by people's faeces which contain the ova (eggs) of these parasites. Infection can also be acquired by walking barefoot. Some infections like malaria and filaria are caused by mosquito bites.

Some common parasites are

1. Entamoeba histolytica - dysentery (amoebiasis)
2. Malarial parasites - Malaria
3. Filarial parasites - Filariasis (elephant legs)
4. Hook worms - Anaemia

In ophthalmology also they cause a variety of diseases like keratitis (caused by Acanthamoeba).

Treatment of bacteria, fungi, virus and parasite

Some of the commonly used medicines to treat the infection caused by the microorganisms are

1. Antibiotic for bacterial infections e.g., ciprofloxacin, ampicillin, gentamycin
2. Antifungal treatment for disease caused by fungus e.g., amphotericin B, natamycin
3. Antiviral treatment for diseases caused by viruses e.g., acyclovir, gancyclovir
4. Antiparasitic agent for treatment of diseases caused by parasite e.g., albendazole

Practical skills

Smear preparation

- Collect the things required: spirit lamp, glass slides, Kimura's spatula, and topical drops
- Identify the patient and the case sheet
- Ask the patient to lie down and prepare the eyes for scrapping after explaining to the patient about any discomfort encountered
- Assist the doctor by heating the spatula and instilling a local anesthesia before scraping
- Label the slides with the medical record number of the patient
- Fill in the requisition form with all the required details and send the slides to the laboratory for identification immediately after collection

Gram staining procedure

1. Materials from the eye are smeared on a glass slide. They are fixed to the slide by heating.
2. A primary stain called Gram's crystal violet is added. After a minute it is washed in water.
3. Then, Gram's iodine is added for a minute and washed with water.
4. Then the smear is decolourised with a decolouriser, which is a combination of acetone and alcohol.

5. This process is immediate and then a counter stain called dilute carbol fuchsin is added for 30 seconds, washed and dried.
6. The smear is air-dried; a drop of oil is placed and seen through the microscope. Bacteria with violet colour are Gram positive and those which are red / pink are Gram negative.

Processing in the lab

- The OA receives the sample and checks the requisition form if all details have been duly filled in.
- Enter the details in the register and assign a number to all the samples of a particular patient.
- Incubate the media and prepare the slides for staining.
- In case of preoperative cultures, the OA first cleans the eye to avoid contamination and then collects the sample from conjunctiva and streaks on to a sterile blood agar plate.
- Assigns a number to each patient and enters duly all the details in register.
- Instructs the patient about the need of culture collection and tells them about the consequences of a positive bacterial growth.

Definitions

Sterilisation

Sterilisation is defined as the process by which the surface of an article or medium is freed of all microorganisms either in the vegetative or spore state.

Disinfection

Disinfection means the destruction of all pathogenic organisms or organisms capable of giving rise to infection.

Antisepsis

This is used to indicate the prevention of infection by inhibiting the growth of bacteria. Chemical disinfectants, which are applied to skin and mucous membrane to prevent infection, are called antiseptics.

Principles of aseptic technique are most often used when carrying out a surgical dressing but are equally important in any procedure which is likely to permit the entry of microorganisms into the tissues. i.e. intravenous infusion, catheterization.

Various agents of sterilisation can be classified as physical agents and chemical agents.

Physical agents

- Dry heat: flaming, incineration, and hot air oven.
- Moist heat: pasteurization, boiling, steam under normal pressure, steam under high pressure (autoclave)
- Gas sterilisation

Dry heat

Hot air oven

This method destroys microorganisms by denaturizing of proteins, and increase in the electrolyte contents in the cell. The time period of sterilisation is 1 hour and the temperature attained is 160°-180° c. This method is used to sterilise metal instruments. This is highly effective for ophthalmic instruments. Instrument should be thoroughly cleaned with distilled water and soap before placing in hot air oven.

Practical skill

Method of loading

Allow space between items and the chamber to ensure free circulation of hot air.

Advantage

It is a safe method for glass articles. Dry heat does not blunt the edges of sharp instruments. It is particularly suitable for sterilising eye instruments. Instruments do not become corroded as with repeated autoclaving / boiling.

Moist heat

Boiling

Boiling helps in high-level disinfection. All pathogenic organisms are killed within 10 minutes of boiling at 90-100 degree C. It is not an effective method of destruction of spores, which are highly heat resistant. The instruments should be cleaned properly before immersing in boiling water, as blood, pus, etc. prevents the organism from being killed. Protect the tips of delicate instruments with a rubber tube.

Practical skill

Precaution

Instrument should not be dropped inside the boiler. Place them gently using a Cheatell's forceps. Care should be taken to use only distilled water or clean tap water.

Autoclave

The mechanism is steam under pressure

The principle is that water boils when the vapour pressure of it is equal to its surrounding air. Hence, if pressure inside the vessel increases the temperature at which the water boils also increases. Autoclaving is done at 121 degree C at 15 pounds pressure.

This is a safe method of sterilisation. The steam must penetrate every part and fiber of the item to be sterilised for a specified time at the required temperature. Steam kills organisms by the coagulation of the cell protein. The steam will condense when it meets the cooler surface of the items in the autoclave and the latent heat released on condensation will penetrate and kill the organisms. Materials which may be sterilised by autoclave, include: linen, instruments, rubber, liquids etc. The timing of the autoclave will depend upon the type of materials being autoclaved (Fig.5.2).

Fig. 5.2

Example

- 15 pounds pressure 120 degree centigrade 30 minutes for linen instruments, dressings etc.
- 15 pounds pressure 120 degree centigrade 10 minutes for rubber items i.e., gloves.
- 15 pounds pressure 110 degree centigrade 30 minutes for liquids.

Flash autoclave is a high speed autoclave with a temperature of 180 degree c for 15 minutes. It may be used for cataract instruments in between surgeries.

Practical skill

Autoclaving

Bowie dick test

To check whether the autoclave is functioning correctly a special test run is done which is a shortened cycle. The test is to check the efficiency of air removal from the chamber during the pre-vacuum cycle. About 30 towels are arranged in a pile. Autoclave tape should be placed on the top, middle and bottom towels. The towels are made into a tight pack and the test run performed. The autoclave tape should change colour on all the three towels if it is functioning properly.

Packing of bins for autoclaving

Instruments should be thoroughly cleaned by washing in warm water. A toothbrush can be used to clean delicate instruments. An ultrasonic cleaner can also

be used to clean delicate instrument, it is especially useful for removing the block from cannulaes. Care should be taken when drying the instruments not to damage the tips. Rubber tubing should be used to protect the delicate tips of instruments. Separate each instrument and place them in trays. Place the trays inside the bin after spreading a towel inside (Fig. 5.3). Place one towel with autoclave tape in the bottom, middle and top of the bin. Close the bin and keep the holes open so that the steam can penetrate inside the bin. Linen gowns are folded and packed in such a way that the inside part faces outside to enable surgeons and nurses to put them on without touching the outside. Towels are folded so that the holes of the towel are visible. These items are placed in the bin or in a separate pack with autoclave tape placed as before. Avoid packing items too tightly, to enable penetration of the steam in each and every layer of the items.

Fig. 5.3

Loading an autoclave

Check whether the holes of the bins are open. Do not overload the autoclave, as the steam cannot penetrate easily. Do not load liquids with instruments because the sterilisation time is different. Set the correct pressure and timing. Close the door of the autoclave and switch on.

Unloading

Once the cycle is over, switch off and allow the pressure to come down. Open the door slowly. Close the holes of the bins immediately to prevent microorganisms entering and avoid any contact with unsterile area. Take out the bins, using a clean cloth to prevent burning of your hands. Store the sterile items in their designated place.

Gas sterilisation

Ethylene oxide is effective gas for sterilising instruments and other materials which would otherwise be damaged by heat and chemical disinfectants. For example: vitrectomy probes, cryoprobes, fiber optic light, lens. Sterilisation time is 100 minutes at a temperature of 55 degree centigrade. Complete cycle takes 3 hours.

Practical skill

Preparation for gas sterilisation

Any lubricant should be removed from instruments, as the gas cannot penetrate. All items should be cleaned and dried and any detachable parts taken apart. Make sure items are dried thoroughly before packing as water and ethylene oxide form a harmful gas.

Packing

Double thickness paper (Dennison wrapper) is used for packing. Items can also be packed in a polythene bag. Check that the bag or paper is not damaged before using. Before sealing the items in the bag, make sure there is no air in it to avoid rupture when the vacuum forms in the steriliser.

Loading the steriliser

Items should be loaded in the steriliser carefully to allow free circulation and penetration of gas. Avoid overloading – air space should be provided between the chamber ceiling and the top package. Items should not touch the wall of the steriliser. Then the sterilised articles are kept outside for 24 hours or 8 hours in an

aerator. This will remove the irritating quantity of Ethylene oxide.

Chemical agents

Chemical agents cause death of the microorganisms by protein coagulation and breaking of cell membrane.

- Alcohol
- Formaldehyde (Formalin)
- Glutaraldehyde (Cidex)
- Iodine & Chlorine
- Carbolic acid & Lysol
- Ethylene oxide
- Potassium permanganate
- Bleaching powder

Qualities of good antiseptic

- Should kill all microorganisms
- Have speedy action
- Be stable
- Safe and easy to use
- Must not cause irritation
- Must not corrode metals

Chemical sterilisation

This method is used for sharp instruments as boiling can blunt the sharp cutting edges. This should be avoided if heat sterilisation is available.

Dettol, savlon, cidex etc., are the chemicals used for sterilisation of sharp instrument.

1) Glutaraldehyde (CIDEX)

It is used in places where heat sterilization or other methods are unavailable. It kills all microorganisms including spores. The microorganism is destroyed within 3-6 hours of immersion. This method is not recommended because CIDEX is a highly corrosive chemical and inhalation of vapors causes irritation. Further, protective gloves and goggles should be worn while using CIDEX (Fig. 5.4).

Fig. 5.4

2) Formalin

This is used for fumigation of operation theatres. It destroys all microorganisms. It is available in tablets and liquids. Apart from fumigation it is used for sterilisation for metal instruments and glass. The sterilisation time is 12 to 48 hours and the doors should be sealed and left unopened. The main disadvantage is that formalin is an irritant to eyes and skin and it is carcinogenic. Eye protective equipment should be worn.

3) Alcohol

Ethanol and iso-propanol are commonly used. They destroy microorganisms by protein denaturation, but have no action on spores. 60 - 70% alcohol is generally preferred. It is used for hand washing, disinfection of thermometers, indirect ophthalmoscopy and metal instruments. Iso-propanol is preferred as it is more bactericidal. The time period of sterilisation is 10 minutes, it is an advantage to use alcohol because it is highly inflammable, and evaporates quickly. Methanol is highly effective against fungus but is toxic and flammable.

4) Sodium hypochlorite

It is used for destruction of bacteria, spores and viruses. Sodium hypochlorite is used as a disinfectant

in the concentration of 0.4%. The items must be immersed in a container for 10 minutes and washed with sterile water before use. It is used for disinfecting indirect ophthalmoscopy lenses, but the disadvantage is that it is highly volatile and corrosive. It acts as bleach.

5) Povidone Iodine

This is mainly used for surface sterilisation. 10% solution is used for soaking surgical instruments, and facial skin preparation .This is the most popular and easily available disinfectant. It is less expensive and does not have side effects. It is sold as Betadine. A 5% solution is used for hand scrubbing and 0.5% solution is used for eye drops. It destroys bacteria, spores, and fungi. It is used on all metal instruments and for disinfecting sutures. The time period of disinfection is 10 minutes. Povidone Iodine drops are used as an antiseptic before surgery. It is instilled into the conjunctiva to decrease infection. The disadvantage is that it stains dresses, surfaces, and instruments and makes gloves sticky and evaporates if the bottle is not closed tight.

6) Dettol

It is used at 2 to 5% concentration as a hand wash. It destroys microorganism by causing cell lysis. A few drops of dettol mixed with water is used for cleaning rooms.

7) Lysol

This is a mixture of carbolic acid and soap solution. It is active against a wide range of organisms. They are good general disinfectants but are toxic to man. Sharp instruments like needle knife are disinfected for four hours.

Guidelines for OA in relation to asepsis

Outpatients

1. Viral conjunctivitis is caused by virus. As patients with conjunctivitis spread the disease, they must not be kept in the waiting room. They must be attended to and sent to the doctor immediately
2. After testing infected patients, the nurses must wash their hands well and also the instruments
3. Handle sterilised apparatus carefully. Keep sterilised swabs and bandages closed
4. Use new disposable syringes
5. Keep tonometer clean

Operation theatre

The work of the OA in the operation theatre is very important.

- They must see that patients and assistants follow the rules of the theatre and caution them accordingly.
- They must keep sterilised articles properly labeled and stored away from any contamination.
- They should avoid unnecessary movement and conversation in the operation theatre to keep the risk of infection to a minimum.
- The OA must never be afraid of accepting mistakes or mishap, and must be ready to reveal it to the superiors. This honesty will save the sight of the patient. For example, when a sterilised apparatus falls on the floor by mistake, it must be taken away with the permission of the surgeon. If, on the other hand, it is not reported to the surgeon for fear of reprimand, it will affect the sight of a patient.
- If a OA has a wound, or is suffering from infectious diseases like fever or cold, she must avoid working in the theatre.

The duties of a ward OA

- The OA must supervise whether house- keeping staff cleans the patients' rooms
- Keep the bed sheets clean
- All waste materials must be immediately removed from the ward
- Keep patients with infectious diseases and those who have undergone surgery in separate rooms

Hand washing

Steps in hand washing

- Wet hands with sufficient water
- Rub the palms together vigorously using soap
- Rub particularly between fingers and finger tips and use nailbrush if possible
- Join hands together so that thumbs and wrists touch each other
- Avoid splashing and wash thoroughly
- Dry on a clean towel, which must be changed daily

Importance / purpose of hand washing

- To prevent cross contamination
- To prevent the spread of microorganisms while having contacts with patients

Materials necessary for hand washing

- Alcohol based hand rub
- Antimicrobial soap
- Antiseptic agents such as chlorhexidene, iodine, chlorine
- Detergents etc.,

Duration of hand washing

- Before handling the patients - two minutes scrub
- In between patient handling - 30 secs
- After handling highly infectious patient-60 seconds

Situation for hand washing

Hands should be washed

- Before any clinical procedure
- Before and after handling infectious patients, food items
- When entering and leaving sterile areas

Procedure 1

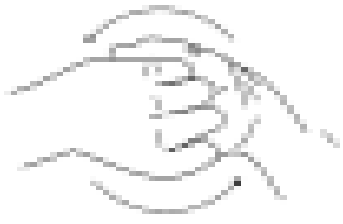
Wet hand and wrists. Apply soap

Procedure 2

Right palm over left, left over right

Procedure 3

Palm to over, fingers interlaced



Procedure 4

Back fingers to opposing fingers interlocked

Procedure 5

Rotational rubbing of right thumb claspec in left palm and vice versa

Procedure 6

Rotational rubbing backwards and forwards with tops of fingers and thumb of right hand in left and vice versa

Note: Repeat procedures 1-6 until the hands are clean. Rinse hands and pat dry

Fig. 5.5

- Practical demonstration of hand washing and hand scrubbing
- Communication skill

Attitude

- Awareness of infection
- Vigilance against cross contamination
- Honesty

The most important principles of asepsis are

1. Hands must be washed at the beginning of the procedure and at any time during it when an unsterile article is touched.
2. OAs with infected skin lesions or throat lesion should not carry out any procedure involving aseptic technique.
3. Dressing trolleys should be cleaned in the prescribed manner.
4. OAs must always have their hair tied up so that it doesn't fall on the sterile field.
5. Soiled dressing must be removed carefully from the wound, to prevent scattering of organisms into the air.
6. Used dressings should be put straight into a bag provided for the purpose and later incinerated (burnt).
7. Neither the wound nor any part of a sterile item which will come into contact with it should be touched by hand. A strict no touch technique should be adhered to. If any sterile item is contaminated by touching an unsterile area, it should be immediately discarded.
8. Unnecessary talking and movement should be avoided.
9. Minimum exposure to wounds and minimum disturbances to clothing and linen also minimise infection.
10. As most of the infections are caused by droplet spread, one must cough with mouth closed or cover the mouth.

Summary

This unit covers the basic elements of microbiology, sterilisation and essentials of hand washing. Hospital is a place that attracts bacteria, virus and fungi. This section insists on an infection free zone. It is important that they should know the connection of micro organisms and infection control in an eye hospital. The OAs are responsible for providing good sanitation, and preventing the transmission of disease causing micro organisms from patient to patient or from patient to doctors and paramedical personnel. The OA should realise that the infections could happen due to the contaminated, unsterile, disinfected needles and linen if they are not properly disposed of. They should be very careful to wear sterile gloves especially at the time of collecting samples like blood, staining, so that the paramedical personnel / doctor may not get infected through body fluids or contaminated objects. The paramedics and the doctors must be very careful in handling patients with HIV / AIDS and Hepatitis - B patients.

The medical personnel should note that the sterile techniques apply even to opening and closing of eye drops / ointments. Special precautions must be taken by the paramedical personnel in case they have common cold or fever so that they do not infect the patient. To ensure safety of medical personnel and patients, hand washing becomes the base in disinfection procedures.

Key points to remember

1. *Pneumococci and pseudomonas are common bacteria which cause serious eye infection*
2. *All bacteria can be identified by gram staining procedure and culture. This helps in the treatment of the patients*
3. *Viruses like adeno virus, herpes virus, fungi like aspergillus and parasites also cause many eye infections*
4. *Always use clean water for hand washing*
5. *Dry hands thoroughly to prevent bacterial contamination*
6. *Give importance to finger tips, nails and the space between the fingers*
7. *Do not bring the hands below hip after washing because there may be risk for contamination*
8. *Be careful not to touch anywhere after washing hands*

Student exercise

A. Fill in the blanks

1. *Some common parasites are _____, _____ and _____*
2. *Diseases caused by S.pneumoniae are_____ , _____*
3. *_____ and _____ causes gas gangrene and food poisoning.*
4. *In ophthalmology _____ and _____ commonly cause conjunctivitis.*
5. *Some bacteria require oxygen for growth, these are known as _____*
6. *The temperature of sterilsation in hot air oven is _____*
7. *_____ , _____ can be sterilised by autoclave*
8. *The principle of autoclave is _____*
9. *_____ is the most common chemical agent used for sterilisation*
10. *Hot air oven is used to sterilise_____*
11. *The test used to check whether autoclave is functioning properly is called _____*
12. *The only gas-sterilising agent commonly used is _____*

B. Choose the correct answer

1. *SDA culture medium is used to grow*
   a. Bacteria *b. Viruses*
   c. Fungi *d. Chlamydia*
2. *Of the following, which is not a microorganism?*
   a. Hook worm *b. Viruses*
   c. Fungi *d. Bacteria*
3. *Common fungal infection in diabetic patient is caused by*
   a. Candida albicans *b. Pseudomonas*
   c. Aspergillus *d. Fusarium*
4. *Bacteria is*
   a. Unicellular *b. Multicellular*
   c. Bicellular
5. *Operation theatre sterilsation with formalin needs:*
   a. 24 hrs *b. 48 hrs*
   c. 72 hrs *d. 84 hrs*
6. *Which is best to get rid of infection?*
   a. Cleaning *b. Drying*
   c. Sterilsation *d. High level disinfection.*
7. *The temperature and pressure for sterilising rubber item is*
   a. 15 lbs at 120° (30m); b.15 lbs at 120°(10m)
   c. 15 lbs at 110° (30min)

C. Match the following

1. *Streptococcus* - *Dysentery*
2. *Ciprofloxacin* - *Adeno virus*
3. *Entamoeba* - *Gram-positive bacilli*
4. *Conjunctivitis* - *Antibiotic*
5. *Antiseptic* - *Making micro organisms free*
6. *Contamination* - *Ensuring microorganisms free condition*

7. Sterilisation - *Introduction of microorganisms into sterilsation material*
8. Asepsis - *Kills microorganisms*

D. Answer the following

1. *What are the different types of pathogens?*
2. *What is the procedure for gram stain?*
3. *How do bacteria cause the infection on the human body?*
4. *What are the diseases caused by bacteria, virus, fungus and parasite?*
5. *Name the gram positive and gram-negative bacteria?*
6. *List the various chemical sterilising agents?*
7. *Specify the temperature of each method of sterilisation along with the time period required.*
8. *Which is the best method to get rid of any infection in case of any emergency? Explain in detail?*
9. *What type of disinfectant will be used based on the type of contaminant?*
10. *Write the advantages and disadvantages of each method of sterilisation?*
11. *What are the materials necessary for hand washing?*
12. *What are the purposes of hand washing?*
13. *List the steps of hand washing?*
14. *Define hand asepsis and hand hygiene?*

Practical skill

1. *Discuss different organisms and the diseases caused by them.*
2. *Demonstrate the technique of collecting specimen.*
3. *Carry out the procedures of packing of instruments.*
4. *Carry out the methods of asepsis.*
5. *Individual class demonstration of loading the autoclave.*
6. *Know the exact method of sterilisation for each of the instruments.*
7. *Demonstration of handling the instruments.*
8. *Preparation of the instruments before sterilisation.*

CHAPTER 6 BASIC LABORATORY TESTS

OUTLINE

Basic Biochemistry
Specimen collection

GOAL

To enhance the Ophthalmic Assistant (OA) skills to perform the Urine Analysis, blood sugar and Albumin test.

OBJECTIVES

The OA will

- Describe the method, principle and the application of the tests
- Demonstrate the procedure of performing the test
- Describe way of collecting the urine and blood samples
- Discuss the ways of storage and transport of the samples
- Perform the test in proper steps to give accurate results
- State the normal limits of the performed biochemical tests and be able to Interpret the results

CHAPTER 6
Basic Laboratory Tests

The chapter will give an understanding of the blood and urine tests, method of performing the tests and enable them to interpret the test results. It also educates them on the proper method for collection, handling, storage, transport of samples. Learning the method of performing the tests is essential for obtaining correct result. This helps the physician in making diagnosis of the disease and treatment of an ailment.

Basic laboratory is used to identify the diseases in patient. The disease conditions in the body are the result of some changes in chemical composition and functioning of tissue. The changes can be picked up with various biochemical tests.

In case of emergencies it is very critical to have basic knowledge of some of the commonly performed tests in the laboratory so that the diagnosis of the patient can be confirmed, and appropriate treatment could be started.

Urine analysis

Routine urine analysis is done for 2 purposes.

- To find out metabolic or endocrine disturbances of the body
- To determine intrinsic conditions that may affect urinary tract or the kidneys

The first part of urine analysis is direct visual observation or physical examination of urine, and the second is the chemical examination. Normal urine has the following properties.

Volume : 60 - 2500 ml / 24 hrs
Specific gravity : 1.003 - 1.030
Reaction : Acidic

Physical examination

- The various aspects include
- Volume
- Colour
- Appearance
- Sediment formation
- Odour
- Reaction in pH
- Specific Gravity

Colour

Normal urine varies from pale yellow to dark amber, depending on the concentration of urochrome. The pH of urine also influences color. Very pale urine can result from high fluid composition diuretic drugs, etc. Dark yellow urine indicates symptoms of jaundice. It can be detected in urine by urine bile salt and bile pigment. A red or red-brown (abnormal) color could be from a food dye, eating fresh beets, a drug, or the presence of either hemoglobin or myoglobin. If the sample contained many red blood cells, it would be cloudy as well as red.

Appearance

Normal urine is usually clear. The appearance may be cloudy if amorphous phosphates are present; they form a white precipitate, which dissolves when acid is added. Urine may also appear cloudy or turbid due to leukocytes, or epithelial cells.

Sediment formation

If urine has amorphous phosphates, or urates then on standing for sometime, sediment formation occurs at the bottom.

Odour

The presence of ketone bodies gives a sweet smell to urine. Contaminated urine with bacteria usually gives a pungent smell.

Reaction and pH

Fresh urine is slightly acidic. A high protein intake or urinary tract infections also produce acidic urine. Urinary tract infections by Proteus and Pseudomonas may cause alkaline urine formation.

Specific gravity

It is the ratios of weight of volume of urine to the weight of same volume of distilled water. It is used to measure the concentration and diluting capacity of the kidneys. It varies from 1.003 to 1.030.

Chemical examination

The routine chemical analysis includes the estimation of protein and glucose, both of which are qualitative tests.

Determination of urine protein

Normally only a small amount of low molecular weight protein is filtered at the glomerulus. Renal tubules secrete a mucoprotein called Tam-Horsfull protein. This is normally excreted in urine. The presence of protein in urine is the first sign of a serious problem.

Determination of urine glucose

Only a small amount of glucose (2 – 20 mg/dl) may be present in fasting urine, which is not detectable by chemical methods. The presence of chemically detectable amount of glucose in urine is called glycosuria. This may be an indicator of diabetic mellitus and the blood sugar has to be treated. The quantity of glucose is dependent on:

1. Blood glucose level
2. Rate of filtration
3. Rate of tubular reabsorption

Normal renal threshold level for Glucose is 150 – 170 mg/dl. When this level is exceeded renal glycosuria occurs.

Practical skill

Testing for urine albumin (Protein)

It is easy to identify the function of the kidneys and to identify the presence or absence of salt. For this test early morning sample is suitable.

The normal urine has protein less than 50 mg per 24 h. The level deviates in certain undesirable conditions such as in irregular reabsorption.

Testing for albumin (Protein)

Method : Qualitative test

Principle : The test is based on the principle of precipitation of protein by chemical agents (acids) or coagulation by heat.

Application : This test is used in the determination of glomerular proteinuria, glomerulonephritis, hypertension etc.

Sampling instructions

- Collect urine in clean container (need not be sterile)
- Reagents / Consumables
- Reagent I: Acetic acid (glacial) 3% Sulphosalicylic acid

Procedure

- Transfer 3-4ml of urine in to a small test tube.
- Add 2-3 drops of sulphosalicylic acid on the top of the specimen.
- Observe for turbidity after 5 min.

Interpretation

- No formation of turbidity at the upper portion of urine-protein absent
- Formation of turbidity – protein present
- If protein are present grade the result according to the degree of turbidity as +, ++, +++,+++++.

Testing for urine glucose:

This test is used to identify presence or absence of glucose in urine. Glucose present in urine is called glycosuria. This is an easy test to identify the diabetic patient.

1. Method
   - Benedict's qualitative test
2. Principle
   - Benedict's reagent (5 ml) is heated with 8 drops of urine (0.5 ml). Glucose present in urine reduces cupric ions present in the reagent to cuprousions. The blue color of the reagent changes to green, orange, yellow or red according to the concentration of glucose present in urine.
3. Application
   - This test is used in the determination of glycosuria and diabetes mellitus and also in cases of endocrine hyperactivities. Non-pathological cases of hyperglycemia can occur as in pregnancy, stress and anxiety.
4. Sampling instructions
   - Collect urine in clean container
5. Reagents / Consumables
   - Reagent I: Benedict's reagent
6. Procedure
   - Pipette 5.0ml of Benedict's reagent in the test tube.
   - By using a Pasteur pipette add 8 drops of urine.
   - Heat carefully on the flame of a gas burner or spirit lamp for 5-10 min.
   - Cool under tap water.
7. Reference range
   - Blue +, Green ++, Yellow +++, Red ++++

Blood hemoglobin (Hb) Sahli's method

The routine hematological test include Hb concentration, total RBC, total WBC etc. The hematological values are affected by various factors in individuals apparently in normal health. They include:

- Sex, age, weight, height and environment.
- Physiological conditions under which specimens are obtained.
- The technique and timing of specimen collection, transport and storage.

A decrease in haemoglobin below the normal range is an indication of anemia, whereas an increase usually occurs in haemoconcentration due to loss of body fluids in severe diarrhoea and vomiting. High values are also observed in congenital heart diseases.

Practical skill

This test is used to identify whether patient is anaemic or polycythemic. Haemoglobin decrease is known as anaemia. Increase in haemoglobin known as polycythemia.

Method : Sahli's method

Principle : When blood is added to 0.1 N HCL, haemoglobin is converted to brown colored acid hematin. The resulting colour after dilution is compared with a standard brown glass reference blocks of Sahli's haemoglobinometer.

Application: This test is useful in the diagnosis of anemia, polycythemia.

Limitations: The method gives an error up to 1g/dl and estimation of haemoglobin is not useful in diagnosing the cause of anemia.

Equipment

- Sahli heamoglobinometer
- Hb pipette
- A graduated tube

Consumables

- 0.1 N Hcl
- Distilled water
- Pasteur pipettes

Procedure

- Using a Pasteur pipette add 0.1 N Hcl in the tube up to lowest mark (20% mark)
- Draw blood up to 20ml mark in Hb pipette. Adjust the blood column carefully without bubbles
- Wipe off excess blood on the sides of the pipette by using a piece of dry cotton
- Transfer blood to the acid in the graduated tube
- Rinse the pipette well, mix the reaction mixture and allow the tube to stand for at least 10 minutes
- Dilute the solution with distilled water by adding few drops at a time carefully and by mixing the reaction mixture until colour matches the glass plate in the comparator
- The matching should be done only in natural light

Sampling instructions

- Use whole blood as sample
- Collect 1-2 ml of venous blood in a Lavender topped EDTA vacutainer tube
- When capillary blood is used, collect 20 µ/dl of blood directly in to Hb pipette without adding any anticoagulant or preservative

Sampling, handling instruction & storage

- Process all samples for haemoglobin estimation within 1 hour
- Do not store any sample for more than 1 hour
- Care should be taken as all samples are potentially infectious
- Wear gloves while collecting and processing specimens

Precautions

- Immediately after use, rinse the Hb pipette by using tap water in a beaker
- Ensure sample is at room temperature in case of stored specimens

Reference range

Men : 12 – 15 g/dl

Women : 11 – 15 g/dl attitude

1. Communicate the necessary information to the patient before testing
2. Perform tests with utmost care to avoid any false positive result
3. Communicate the necessary information immediately to the ophthalmologist in case of any abnormal results

Summary

The OAs are perform many clinical procedures. It is important that they know the fundamental concepts of biochemistry in connection with ocular problems. It is also important that they have a good understanding of the best method of taking samples and interpretation of the lab results. They should counsel the patient while taking samples and make them aware about their body conditions. In the case of disabled, mentally ill or old patients, they should help them get in wheelchairs and help the patient cooperate while taking samples. They should be intelligent and active in the laboratory. They must be clear about what tests need to be done for the patient. They should not change the samples and interpret wrong results in the laboratory. They should also be tactful in the time of emergencies due to hyper / hypoglycemia in a patient. The role of the OA in the biochemistry lab is crucial, requiring intelligence and good attitude.

Key points to remember

- *The container used for collection should be clean, dry. Bottles need not be sterile.*
- *For qualitative tests, morning urine is best.*
- *Always perform urine analysis on fresh samples In case of time delay, it should be stored at 2-8 degree centigrade*
- *Do not reuse containers; dispose of them in a bin of sodium hypochlorite.*
- *Venous blood is preferred for most hematology examination.*
- *Capillary blood should be used only when it is not possible to collect venous blood as it may give erroneous results.*

Student exercise

A. Answer the following

1) *What is meant by glycosuria?*
2. *What test is used to find bilirubin in urine?*
3. *Which method is used to find whether urine is acidic or alkaline?*
4. *Which value is renal threshold level?*
5. *Which test is used to find out salt in urine?*

B. Choose the correct answer

1. *In which condition will haemoglobin decrease?*
   a) Anaemic
   b) Polycythemic
   c) Diabetes mellitus
   d) Kidney failure
2) *In which condition will haemoglobin increase?*
   a) Anaemic
   b) Polycythemic
   c) Diabetes mellitus
   d) Kidney failure
3) *Which test is used to evaluate the function of kidney?*
   a) Urine glucose
   b) Urine albumin
   c) Urine bile salt
   d) Urine bile pigment
4) *Which test is used to find jaundice?*
   a) Urine glucose
   b) Urine albumin
   c) Urine bile salt & urine bile pigment
   d) Urine pH

C. Fill in the blanks

1. *Normal value of haemoglobin for man is*_____
2. *Renal threshold level is* _____
3. *Dark yellow urine indicates the presence of* _____
4. *Name of method to identify the hemoglobin is* _____
5. *Name of the method to identify the presence of glucose in urine is* _____

Practical skill

1. *Preparation of patient before blood collection*
2. *Interpretation of the reaction from the Sahli's scale*
3. *Maintenance of Sahli pipette*
4. *Demonstration of blood collection procedure before performing the test*

CHAPTER 7 PHARMACOLOGY

OUTLINE

General pharmacology
Ocular pharmocology

GOALS

To enhance the OAs knowledge of basic pharmacology and the routes of administration of drugs to help their doctors render effective care to the patients

OBJECTIVES

The Ophthalmic Assistant will be able to

- Define pharmacology, drugs, actions and reactions of different drugs
- Modes of administering pharmacological agents (drugs)
- Discuss read the drugs in the prescription written by ophthalmologists
- Administer the prescribed drugs to the patients in the ward
- Aiscuss the drug actions, patients reactions to drugs and general types and uses of common drugs
- Ascertain when and how to administer drugs
- Recognise the symptoms of allergic reaction as well as, when such reactions require treatment, and how to summon help

CHAPTER 7
Pharmacology

General pharmacology

Pharmacology is the study of the action and uses of medicinal drugs. To properly assist a doctor, it is essential for the beginning ophthalmic assistant to know about the basic principles of using different medication, whether it is a systemic medication or an ocular medication. They should be able to administer the drug in the proper dosage and through proper route. They should be able to identify the adverse effects of commonly used drugs and should summon help in such an occasion. This particular section deals with the various drugs used for diagnosing and treating diseases, their effects and side effects. It also gives the precautions the ophthalmic assistants should keep in mind while administering the drugs. Only when the assistants have an overview of these aspects of medications can they appropriately assist the ophthalmologist and be of great help in day to day practice.

Definition - pharmacology

The study of drugs is called pharmacology. The drugs are prepared naturally from plants, from animals and from minerals. Some medicines are prepared as gases e.g., oxygen, carbon dioxide, nitrous oxide. Some drugs are prepared artificially from other sources (synthetic drugs).

Trade name

This is the name given by the manufacturer.

Chemical name/generic name

The name of the chemicals constituting the medicine.

Uses of drugs

- To treat a disease - (therapeutic drugs)
- To prevent a disease - (prophylactic drug)
- To diagnose a disease - (diagnostic agents)
- To alleviate the signs and symptoms of a disease - (e.g., analgesics)

Types of medicines

Antibiotics

Antibiotics prevent the growth of microorganisms and cure infections. There are many types of antibiotics. After identifying the organism causing the disease, the doctor prescribes appropriate antibiotics. Precautions to be followed before starting the drug.

1. Always ask the patients if they have any allergy to any specific drug. Most commonly allergic reactions are seen for penicillin (e.g., penicillin injection, ampicillin) and sulpha e.g., (Cotrimoxazole) Test dose should be given before starting any parentral (intramuscular or intravenous) injections of such drugs.
2. Patient should report immediately if they develop blisters on their body or oral cavity or conjunctiva which may be the first sign of allergy to drug (called Stevens Johnson syndrome). The patient should be vigilant to look for these signs.
3. If starting the patient on any oral treatment, they must be correctly instructed to report immediately if they develop rash / itching or any systemic complaints immediately after starting the drug.
4. Patient should be instructed to take the antibiotic in the scheduled dose for the scheduled time which is important to avoid emergence of bacterial resistance to the antibiotic (i.e., that particular bacteria does not respond to that antibiotic during a subsequent infection).

Analgesic

Analgesics are painkillers. There are two types of analgesics

- Corticosteroids (potent drugs)
- Non steroidal anti inflammatory drugs (NSAID) (less potent drugs)

Analgesic can be given with or without sleeping doses

Non steroidal anti Inflammatory drugs NSAIDS

E.g. aspirin, paracetamol, ibuprofen (brufen). Precautions to be followed before starting the drug

- Ask for drug allergy
- H/O acid peptic diseases
- Advise patients to take the drug after food
- Patient with acid peptic disease - avoid aspirin, ibuprofen. Milder drugs like paracetamol can be used with care
- Report any allergic manifestations

Corticosteroids

Precautions to be followed before starting the drug

- These are drugs started with caution; the patients have to be monitored continuously
- If given continuously it may cause side effects which have to be checked, ex: weight gain, hypertension, thinning of long bones (can fracture with trivial trauma), depression etc.
- Steroids must not be stopped abruptly. They have to be tapered and stopped under a doctors' guidance
- If stopped abruptly patients may present with a variety of systemic problems due to the dependency on the steroids administered

We have to rule out infections like tuberculosis (with chest x-ray and sputum examination) and diabetes, which may be aggravated by steroid treatment.

Anti hypertensives

Anti hypertensives control hypertension. When the blood pressure is high, anti hypertensives are given. Nifedipine is an example.

Precautions to be followed before starting the drug

- Rule out history of asthma: atenolol and similar drugs (beta blockers) to be avoided
- Kidney diseases: If both kidneys are involved avoid enalapril
- Some drugs may cause sudden drop of blood pressure and cause giddiness / fainting attacks. Hence, start at low dose and gradually increase. Always monitor the patient for end organ diseases, involvement of kidney, eye, heart and brain.

Gastro-intestinal medicines

Diseases of the stomach and intestine are controlled by medicines.

a. Ulcer- Antacids e.g., digene, gelucil

b. Diarrhoea - Antibiotics, anti diarrhoeals and oral rehydration solutions

Diarrhoea: Anti diarrhoeal drugs are better avoided because they may cause further problems if diarrhoea is of an infective cause. Patient should be instructed about how to prepare and take oral rehydration solution (ORS).

c. Constipation- Bulk forming drugs like isphagula

Oral hypoglycemic agents

These medicines reduce the blood sugar level. These are drugs given in diabetes mellitus. The commonly used drugs are:

- Glyciphage
- Daonil

Insulin

Injectable hypoglycemic agent. Insulin is of three types. They react:

a.	Immediately and short durations	- Short acting e.g., Regular insulin (Human actrapid/H4)
b.	At a moderate rate	- Intermediate actions e.g., NPH, Linte (Human monotaed)
c.	Slowly	- Long acting e.g., (Ultra lenti)
d.	Premixed insulin	- Short acting + inter mediate acting e.g.,(Mixtard)

Insulin

Acute infections and other situations may require change to insulin

- Insulin should be taken half (½) an hour before food
- Avoid skipping meals
- Report if any allergy develops
- Immunosuppressives

Oral hypoglycemic drugs

- Should be given before food
- Diet should be on proper time and proper quantity as instructed by the physician
- Avoid skipping meals
- Instruct the patient about hypoglycemia and its symptoms which may develop if they skip meals. e.g. sweating, giddiness
- Advise the patient to keep some sweets with him/ her which will be useful in situations of hypoglycemia

Routes of drug administration

Oral - Tablet and syrup

Local applications - Topical drops, ointments;

Injections

Systemic

- Intra muscular (I.M)
- Intra venous (I.V)
- Subcutaneous

In eye

- Intravitreal
- Retrobulbar, peribulbar
- Sub - conjunctival
- Sub - tenon's
- Intracameral

The forms of medicines

Drugs are available in solid, liquid, powder and gaseous forms. Drugs are stored in bottles, boxes and the gases in cylinders.

The Law for keeping and selling drugs

- The drugs can be issued to a patient only on issue of prescription
- The drugs that can induce habit formation should be kept under lock and key
- No drugs should be prescribed to a client without the order of the doctor
- The prescription should be written and signed by a doctor only

Drug safety

- Drugs should be checked and kept secure
- The names should be written legibly
- They should be covered tightly
- If the colour has changed or if the expiry date is over it should not be used. The drugs which need to be clear should not have any turbidity
- The drugs needs to be stored at appropriate temperature
- The drugs should be kept away from the reach of children
- The dangerous drugs should be kept under lock and key

Rules for administering medications

- You should know the reasons for administering that particular medicine and the measurement.
- Administer the medicine correctly by following the doctor's orders

Common drugs & example

Types of drugs	Examples of drugs	Usage
Analgesics and antipyretics	Paracetamol	Fever and headache
Anaesthetic agents	Ether, Nitrous oxide Lignocaine	Produces general and local anesthesia
Anti hypertensives	Nifedipine, Diltiazem	Reduces blood pressure
Anti Ulcer drugs	Gelucil, Digene Ranitidine, Omeprazole	Used to treat gastritis and ulcer
Hypoglycemic agents	Daonil, Glyciphage, Insulin	Used in diabetic patients to reduce blood glucose levels
Bronchodilators	Deriphylline, Salbutmol Aminophylline	Used in asthma patients to reduce wheezing
Antihistamines	Avil, cetrizine	Used in cold, allergic reactions to drugs or any other allergy
Antibiotics Anti helmenthics	Penicillin, ampicillin Nemocid, mebendazole	Used to treat bacterial infections Used to treat worm infestation
Cardiac drugs	Digoxin, sorbitrate, monotrate	Used in myocardial infarction and ischemic heart disease
Anti fungal agents	Nystatin, Whitfield's ointment, Gentian violet, Amphotericin	Used to treat infection caused by fungi
Narcotic sedatives	Fortwin, Morphine, Pethidine, Narcotic analgesics	Used in severe pain (post-operative), to induce sleep and in pulmonary edema
Antidotes	Atropine	Used in insecticide poisoning
Psychiatric medicines	Largactil, reserpine	Used in patients with psychiatric disorders
Anti anxiety drugs	Alprazolam, Diazepam	Used in convulsions and in patients with anxiety disorder.
Corticosteroids	Dexamethasone, Hydrocortisone	Used in inflammatory disorders
Diuretics	Lasix, furosemide	Used in pulmonary edema and renal failure
Emergency drugs	Adrenaline Atropine Sodium bicarbonate Dopamine Calcium Gluconate Oxygen Sorbitrate	Used in cardio pulmonary arrest To stimulate heart function Acidosis Hypo tension Used in cardio pulmonary arrest Cardiac and respiratory diseases Chest pain in myocardial infarction

- The five rights to be followed while administering medications
  - Right drug
  - Right time
  - Right dosage
  - Right patient*
  - Right route

(*The right patient involves positively identifying the patient. Special care must be taken when there are two / more people with the same name, in the same room or unit.)

- Check the label of the drug / eye drops before administering
- Always check the expiry date
- Do not use any medicines if it is not labeled
- Do not use if there is any damage in the bottle / if the nozzle cap is lost
- Follow the instructions carefully to mix medicine
- The drugs should be given to the patient and not to anyone else
- Do not use if the color has changed / if there is any turbidity in an eye drop / IV Solution
- If the patient refuses to have eye drops instilled or use a drug, or it is omitted for any reason it should be recorded in the patient's case sheet along with the reason
- Record the date, time, route of medicine- only after instilling the drops / after the patient swallows the tablet or syrup / or after giving an injection
- You should be aware of the drug's side effects before administering the medicine
- It is possible for errors to happen. As soon as it is realized, check the patient's eye and immediately notify the doctor

Giving drugs to children

1. The quantity of the medicine must be carefully measured
2. Medicines in liquid form must have a syrup base, or it must be mixed with honey or sugar
3. Tablets must be powdered to enable the child to swallow easily. Do not mix the drugs in milk or food; the child may start avoiding food itself
4. Keep the child in sitting position while administering the drug. If the child takes the drug happily, appreciate it. Don't force the medicine down the throat. It is better if the child sips it. Encourage the child to drink it on his own; or encourage the child to keep his fingers on the spoon
5. Inform the doctor when a child refuses to take a particular medicine or vomits

Expansion of abbreviations

QD	-	Once in a Day
BD	-	Twice a Day
Tid / Tds	-	Thrice a Day
Qid	-	Four times a day
Sos	-	Whenever Necessary
Stat	-	Immediately
Q6H	-	Every Six Hour
A.C	-	Anti Cebum (before meals)
P.C.	-	Post Cebum (after meals)
P.O	-	Per Oral
H.S.	-	At bed time
IV	-	Intra venous
IM	-	Intramuscularly
S.C	-	Subcutaneous
One hourly	-	12 Times a day (Every 1 hour)
Two hourly	-	6 Times a day (Every 2 hour)
Fourth hourly	-	3 Times a day
Six hourly	-	2 Times a day
G	-	Drops
OC	-	Ointments
↑↑	-	High (increase)
↓↓	-	Low (decrease)
One Teaspoon	-	5 ML
One Table Spoon	-	15 ML
One Ounce	-	30 ML
One Pound	-	450 ML
One Pint	-	600 ML

Ocular pharmacology

What are eye drops?

Ophthalmic medical assistants commonly assist the ophthalmologist by instilling eye drops in patients' eyes. Eye drops are drugs in liquid form that are applied to the surface of the eye (topically). Diagnostic types of eye drops are used during certain eye tests; therapeutic eye drops are used to treat ocular conditions or diseases.

Forms of ocular medicines

Ocular medications are formulated in three forms as solutions, suspension and ointments.

Solutions

These are in liquid forms and usually they are instilled into the eye. In a solution, the active drug is completely dissolved in an inactive, transparent liquid.

Suspensions

In a suspension, particles of the drug are visibly suspended in a liquid. The fluid is cloudy or milky, unlike a solution, which is clear. Shake the suspension well before use.

Ointment

Ointment contains a drug added to an oil base. The ointment melts on the warm skin and is absorbed into the tissues.

Classification, uses, action and adverse effects

Drugs for use in the eye are classified according to their action as follows:

- Mydriatics and cycloplegics
- Miotics
- Antibiotics
- Anti-inflammatory drugs
- Anti-viral drugs
- Local anaesthetics
- Tear substitutes
- Diagnostic stains
- Immunosuppressives

Mydriatics and cycloplegics

Mydriatics drugs dilate the pupil by affecting the dilatory and contracting muscles of the iris; cycloplegics paralyse the ciliary muscles to prevent the process of accommodation of the lens.

Uses of mydriatics

- Examination of the fundus
- The treatment of inflammatory eye disease like iridocyclitis. The effect of the drug is to relax the smooth muscles of the iris and ciliary body, thereby resting the eye
- Preoperative dilatation of the pupil
- Refraction
- Postoperatively to prevent formation of synechiae (adhesions)

The commonly used mydriatics

- Atropine Sulphate
- Homatropine
- Tropicamide
- Cyclopentolate
- Phenylephrine

Atropine 1%

This is both a mydriatic and cycloplegic drug. Its effect may last for up to 10 days following instillation. Excessive use of atropine can cause systemic side effects - drying of the mouth and tachycardia by absorption through the conjunctiva.

Homatropine 2- 5%

This is a derivative of atropine with a weaker and shorter action, wearing off after two days.

Cyclopentolate (Mydrilate 0.5 – 1%)

This drug is a mydriatic and cycloplegic. It dilates with 15 minutes and wears off by 8 hours; it is therefore often used for examination in the clinic.

Tropicamide (0.5 – 1%)

This is effective within 15 minutes and wears off in 6 hours.

Phenylephrine (Drosyn 2.5, 5 and 10%)

This drug is a mydriatic only. It does not cause cycloplegia. It dilates within 15 minutes and wears off in a few hours.

Instilling dilating drops

Basic policies to be followed prior to using mydriatics and cycloplegics

- Check for shallow AC with torchlight and inform doctor if angle is shallow - get permission to dilate
- Patient should be told the nature of the drug and its action and of blurred vision
- Confirm that the patient has not come driving any vehicle or he has somebody along with him
- Explain that they cannot read for the specified duration of action of that drug
- Rule out any previous H/O allergy to the drug
- Do not use combination of phenyl epheneprine for cardiac and hypertensives as it may cause increase in blood pressure by absorption through conjunctiva

Miotics - (Constrictors)

Miotics causes contraction of the iris sphincter muscles, resulting in constriction of pupil size and decreases the elevated IOP by opening up the angle of the anterior chamber. This helps to relieve angle closure glaucoma. By increasing the flow of aqueous through the trabecular mesh work it lowers the intra ocular pressure in open angle glaucoma.

Uses of miotics

- Used in primary open angle glaucoma.
- For emergency relief of angle closure glaucoma to control IOP
- Chronic open angle glaucoma
- Ocular hypertension

Commonly used miotics

- Pilocarpine 1%- 4%
- Pilocarpine Hydrochloride
- Pilocarpine Nitrate

Pilocarpine

Used in primary open angle glaucoma. The effect of pilocarpine lasts for about 8 hours. It is also used to reverse the actions of a mydriatic after a clinical examination.

The patient should be told about transient stinging and burning on installation. Also the patient may experience watering, congestion, peri-or supra-orbital headache.

Pilocarpine should not be used in patients with asthma / hypertension.

Pilocarpine Nitrate 1%, 2%, 4% (Carporen, Pilocar, Pilagan) cause.

a) Miosis
b) Increase in accommodation
c) Decrease IOP due to increase outflow

Onset: 1 hour.

Effect: 6 Hours

Uses: All POAG, PACG, before ALT NAD Laser PI procedure

Side effect of pilocarpine

- Blurring vision, head ache, cataract, iris cyst,
- Lacrimation, (due to irritation and punctal occlusion)

Contraindication

Retinal detachment, high myopia

Anti glaucoma drugs

In addition to miotics, there are other drugs that reduce intraocular pressure in glaucoma. These are

- Beta-blockers
- Osmotic agents

Beta-Blockers

These drugs lower the intraocular pressure by decreasing the production of aqueous fluid and by increasing the outflow of the aqueous humor.

- Ask for history of asthma
- Beta blockers should not be given in asthma
- Should be avoided in cardiac patient as cardiac failure can be precipitated

Commonly used beta-blockers

- Timolol 0.25 – 0.5%
- Betaxolol 0.5%
- Levobunalol

They can be used twice daily and have very few side effects in the eye. However, they may cause the following adverse effects

- Ocular irritation including conjunctivitis, keratitis, blepharitis
- Decreased corneal sensitivity in long term use
- Asthmatic attacks in patients with history of asthma
- Visual disturbances including refractive changes

Diamox (acetazolamide)

This drug inhibits an enzyme called carbonic anhydrase which acts in the production of aqueous fluid. It reduces the production of aqueous from the ciliary body, thus lowering the intraocular pressure.

Diamox is usually taken as 250 mg tablets once every 6 hours. It is also available as a slow release capsule of 500 mg. The following side effects may be experienced.

- Transient myopia
- Perioral numbness
- Electrolyte imbalance
- Gastrointestinal discomfort
- Prolonged use may cause kidney stones.
- It can cause hypokalemia (instruct patient to take fruits)

Osmotic agents

They absorb fluid from ocular tissue and lower the intraocular pressure. They used to treat acute angle closure glaucoma. The common side effects are nausea, vomiting, increased urine output and heart failure.

The commonly used osmotic agents

- Oral glycerol
- Inj.mannitol

Glycerol

This is a liquid given orally. Usually a dose of 1 to 1.5 ml per kilogram of body weight is given. It may be mixed with fruit juice to make it taste better.

Mannitol 5 – 20%

A dose of 2 gram per kilogram of body weight is given by rapid intravenous infusion. Check blood pressure before administering as it may cause further BP fall.

Mechanism	:	Water transfer from the eye to blood
Dose	:	(1mg/1kg) per kg body weight max 60 drops per minute (IV).
Action	:	30 Minutes
Effect	:	6 hours
Contraindication	:	Cardiac patient (pulmonary edema) more urine production. After mannitol, patient should be still for 4 hrs (intra cranial pressure will reduce) Herniation of brain stem in erect position. So heart lungs function will get reduced

Antibiotics

Antibiotics are used to prevent and treat bacterial infections of the eye.

Uses of antibiotics

- Prophylactically given after cataract surgery to prevent infection
- Conjunctival and corneal infections – topical antibiotics
- Infections caused by penetrating injuries and bacterial corneal ulcers
- Subconjunctival antibiotic injections
- For infections inside the eye (endophthalmitis) very small amounts of certain antibiotics may be injected directly into the vitreous body by the doctor

Commonly used antibiotics

1. Chloramphenicol 0.5%: Vanmycetin, Chlormet, Dexoren, Chlorocol
2. Gentamycin 0.3%: Genticyn, Garamycin, Bactigen, Genoptic
3. Ciprofloxacin 0.3%: Ciplox, Quinobact, Ocuflox, Milflox, Ciprozen, Ciprolen
4. Norfloxacin 0.3% : Norflox, Floxiren, Norzen
5. Ofloxacin 0.3% :Exocin, Ocucin, Ofloren, Oflacin, Zo
6. Tobramycin 0.3% Toba; Tobaren; Eyebrex

Penicillin Group of antibiotics

Benzyl penicillin - used in ophthalmia neonaturum

Aminoglycocides

- Gentamicin
- Tobramycin
- Amikacin
- Fortified Gentamicin (Supergara - Inj. Gentamicin 80mg is added to gentamicin eye drops)
- Neomycin
- Spiramycin

Broad spectrum antibiotics

- Ofloxacin

Fluoroquinolones

- Ciprofloxacin
- Ofloxacin
- Gatefloxacin
- Sparfloxacin
- Lomefloxacin

Cephalosporins

- Cefazolin

Sulphonamides

- Sulphacetamide (Locula)

Antibiotic drops and ointments can cause local burning, discomfort, itching, conjunctival hyperemia and impairment of taste.

Anti - viral drugs

These act by inhibiting the growth of viruses. These drugs are used in the treatment of herpetic corneal ulcers (dendritic ulcers).

Commonly used antiviral drugs

- Idox uridine (I.D.U.) – available in drop and ointment form
- Acyclovir is available as eye ointment .It can also be given systemically

Anti - fungal drugs

These drugs are used in the treatment of fungal corneal ulcers and fungal keratitis.

- Natamycin
- Fluconazole
- Nystatin
- Amphotericin B

The Adverse effects

- Burning, pruiritis, stinging,
- Erythema
- Headache, nervousness, nausea, vomiting

Anti - inflammatory drugs

There are two types of anti inflammatory drugs

1. Corticosteroids

The most powerful anti-inflammatory drugs are the corticosteroids. They can be combined with antibiotics. Chloramphenicol with Dexamethasone, Prednisolone acetate, Prednisolone sodium phosphate, Prednisolone and betamethasone, Flurometha lone, Betnesol N, tobramycin with dexamethasone.

2. Non steroidal anti inflammatory drugs

These are less powerful than corticosteroids. Examples

- Diclofenac sodium (Voveran ophtha eye drops)
- Ketoralac (Ketlur eye drops)
- Flurbiprofen (Flur eye Drops)

Uses of anti inflammatory drugs

- Local and systemic treatment of uveitis
- Scleritis
- Allergic types of conjunctivitis and keratitis.

Most of the anti-inflammatory drugs are steroids. Prolonged use of steroids may result in increased intra ocular pressure, corneal ulceration, cataract.

Local anaesthetics

Local anesthetics drops are used to anaesthetise the cornea or conjunctiva.

Uses of local anesthetics

Used in short corneal and conjunctival procedures such as.

- Tonometry
- Lacrimal duct patency
- Gonioscopy
- Removal of foreign bodies
- Suture removal
- Corneal & conjunctival scrapings for diagnostic purposes
- Paracentesis of anterior chamber

The commonly used local anaesthetics include

- Lignocaine HCl
- Proparacaine HCl

Allergic reaction in some patients is noted. Initial irritation, stinging, burning may occur after instillation.

Tear substitutes / artificial tears

Tear substitutes are viscous substances that help to maintain a thin film of fluid over the corneal surface.

Uses of tear substitute

- Used in lacrimal secretion deficiency, dry eye syndrome
- Used to treat burning, irritation, and dryness of the eye
- Soothing, lubricating and moisturizing of corneal tissues
- Bonding Gonioscopic prisms to the eye (Viscosity around 40 cps)
- Used in corneal staining

Artificial tears drops

1. Polyvinyl Alcohol + Povidone - Tears Plus, Dudrop, I-Lube, Irisol plus
2. Hydroxypropyl methyl cellulose - Moisol
3. Carboxymethyl cellulose sodium 0.5% - Refresh tears

Diagnostic stains

Corneal damages either from an ulcer or following trauma may be demonstrated by the use of stains.

The most common stains are

Fluorescein 2% - Stains live tissue

Rose Bengal 1%- Stains dead tissue

Uses of fluorescein

- For evaluating contact lens fitting, whether it is ideal, loose or tight
- Help in preliminary diagnosis of corneal ulcer and conjunctival problems (stippling, abrasions, ulcerations, foreign bodies etc.)
- Applanation tonometry
- Ophthalmic angiography – IV Fluorescein is used
- Advocated for visualization of choroidal vessels with infrared absorption – ICG

Fluorescein when diluted shows up green and using light from a cobalt-blue filter intensifies the fluorescent effect.

Fluorescein is excreted in breast milk. Use caution when administering to a nursing woman. Urticarial reactions have also occurred in patients without history of allergy to iodides. Also while applying fluorescein drops to the eye, be cautious not to spill the dye, which will stain clothing.

Uses of rose Bengal 1%

Rose Bengal stains diseased cells as in herpes simplex keratitis, corneal ulceration and dry eye syndrome.

Immunosuppressive drugs

These are drugs used for lowering the immune status of the body. In certain diseases the immune mechanism of the body increases the inflammation and affects the vision. Medications developed to suppress the body's normal production of antibodies that fight foreign substances such as transplants, bacteria and infections are known as immunosuppressive. In order to keep the inflammation under control, immunosuppressive drugs are given. It is also given in malignancies. Examples of immunosuppressive: Cyclophospharmide, Azathioprine, Methotrexate, Cyclosporine).

Side effects of commonly used immunosuppressive drugs

- Nausea and vomiting - It is quite common
- Bone marrow depression - Recognised by reduced RBC and WBC count in blood. Hence the importance of periodically testing blood counts
- Liver toxicity - Jaundice may be seen. investigations like SGOT, SCPT, platelet count need to be done
- Renal toxicity - decreased imbalances for investigation
- Hair loss - needs reassurance
- Infections - Due to reduced immunity of the body
- Pregnant women – causes fetal malformations
- Malignancies – can also develop (different from the one being treated)
- Sterility – inability to conceive

These points should be kept in mind while dealing with a patient on immunosuppressives. The treating doctor should be appropriately informed on noticing these side effects. The OA can create awareness about these complications so that the patient and relatives are not alarmed.

Patients on immunosuppressive drugs should follow certain precautions

- They should come for regular follow up visits as advised by the doctor
- They should not change the dose or stop the drug on their own and should not restart the drug on their own
- If they develop side effects listed above they should contact the doctor immediately
- They should avoid contact with people having infections to prevent acquiring infections

Summary

Pharmacology, both general and ocular, is explained in simple language to aid OA to monitor and administer commonly used drugs with a scientific basis and help them to recognize the common problems encountered in the day to day medical practice. In this way they are a great help for the ophthalmologist. Some of the drugs might give allergic reaction. Therefore, the OA should clarify with the patient whether the patient is allergic to any drug. The OA should inform the patient about certain anesthetic drugs that might cause a glare. The effect of the drugs must be known so the patient need not be agitated while they come across any mild symptoms. In case of high risk patient they should be very careful in administering drugs that could bring down BP, cause depressions, dizziness, nausea or any other side effects. The OA should verify the patient case sheets before administering the drugs.

Classification	Action	Uses	Side Effect	Contra Indication
Mydriatics& cycloplegics - Atropine - Homatropine - Cycloentolate - Tropicamide - Phenyl ephrine	Dilate the pupil	- Fundus exam - Refraction - Treatment of iridocyclitis	- Irritability - Ocular congestion - Photophobia	- Shallow anterior chamber
Miotics / Pilocarpine	Constrict the pupil, hypertension	Glaucoma	- Watering - Congestion - Supra orbital head ache	- Asthma - Hypertension
Other drugs used in glaucoma				
Beta blockers	Decrease the production of aqueous	Glaucoma	Ocular Irritation	- Asthma - Hypertension
Diamox	Decrease the production of aqueous	Glaucoma	Transient myopia, Kidney Stones	- Kidney Stones
Osmotic agents Glycerol & Mannitol	Absorb the fluid from Ocular Tissue	Acute Glaucoma	Cardiac failure and electrolyte imbalance	- Cardiac Patients
Antibiotics & Antivirals	Destroys the bacteria or virus causing infection	Prevents and treats the infection	Local burning impairement of taste and conjun -ctival hyeremia	- Avoid in patient with histroy of hypersensitive reaction
Anti inflammatory	Destroys the inflammatory reaction by decreasing the infiltration of WBCs at the site of inflammation	Used separetely / in combination with antibiotics to prevent and treat any ocular inflammatory condition	Increase intra ocular pressure. Corneal ulceration Glaucoma and cataract with excessive long term use.	

Key points to remember

- *Drugs are used to treat a disease, to prevent a disease, to diagnose a disease and to alleviate the signs and symptoms of a disease*
- *The common systemic drugs related to the field of ophthalmology are antibiotics, analgesic, anti hypertensives, gastrointestinal drugs and oral hypoglycemic agents*
- *The prescription should be given by a doctor only*
- *It is important to keep the drugs safely, the dangerous drugs under lock and key*
- *Follow the rules while administering any drug*
- *Follow the five rights:*

  Right drug, Right time, Right dosage, Right patient and the Right route
- *Ocular medicines are available in the form of drops, suspensions and ointment*

Common drug names

Steroids

Dexamethasone - Decadran

Betamethasone - Betnesol

Hydrocortisone - Wycort

Predinisolone - Predforte / Predmet

Loteprednol - Lotepred 0.5%

Antibiotics with steroids

Betnesol-N - Betamethasone with Neomycin

Chloromet-DM - Chloramphenicol with Dexamethasone

Genticyn-B - Gentamycin with Betamethasone

Toba-DM - Tobramycin with Dexamethasone.

Sofracort - Soframycin with cortisone

Dexoren-S - Chloramphenicol with dexamethasone

Anti Bacterial

- *Ciprofloxacin 0.3%*
- *Cefazoline drops*
- *Ofloxacin 0.3%*

Gram Positive Ulcer	Gram Negative Ulcer
Ciplox	*Gentamycin*
Cefazoline	*Tobramycin*
Chloramphenicol	*Vancomycin*

Anti viral

- *Ridinox eye drops*
- *Acyclovir 3% oint (Acivir oint / Ocuvir oint / Herperax oint)*
- *Ocuvir Applicaps*
- *Vira - A Ointment*

Anti fungal

- *Natamycin 5% (Natamet, Elmycin)*
- *Ketaconazole 2%*
- *Fluconazole*
- *Itraconazole 1% (Itral drops and Oint)*
- *Nystin Ointment*

Dilators - (Mydriatic + Cycloplegic)

- *Mydriatic – Dilatation only*
- *Cycloplegic – Ciliary Muscle Paralysis*

Pupil size

Normal - 3 to 5mm

Mydriasis - More than 5mm

Miosis - Less than 3mm

Mydriatic

- *Phenylephrine 5%, 10% (Drosyn)*
- *Tropicamide Plus,*
- *Tropicamide 1%*

Cycloplegic

- *Cyclopentolate 1%*
- *Atropine 1%*
- *Homatropine 2%*

Uses

1. Corneal ulcer

2. Iritis

Action of cycloplegics

1. *Gives rest to ciliary body (cycloplegic effect)*
2. *Relieves pain*
3. *Relieves photophobia*
4. *Decreases congestion*
5. *Increases blood supply*
6. *Local anaesthetic effect*

Phenylephrine 5%, 10% (Drosyn)

Mydriatic only. On set - 30 minutes (Action)

Duration - 4 hours (Effect)

Tropicamide Plus (Tropicamide with phenylephrine)

Fast acting Mydriatic on set - 15 minutes

Duration - 2 hours

Used in Refraction, Fundus examination

Cyclopentolate - Cyclogic 1%

Mydriatic + Cycloplegic. on set - 20 – 45 minutes

Duration - 12 – 24 hours

Homatropine 1% - Mydriatic + cycloplegic

Onset: 30-45mts

Effect: 12-36hrs

Atropine – Atropine Sulphate 1%

Mydriatic + Cycloplegic

Duration of action 15 days

The commonly used beta blockers are Timolol, Betaxalol and Levobunalol. Ask for drug allergy before starting a drug.

Student exercise

A. Fill in the blanks

1. *The drugs that dilate the pupil are_____ and _____*
2. *The drugs that constrict a pupil are _____*
3. *_____ is an example of beta blockers*
4. *The other name of Diamox is _____*
5. *The commonly used osmotic agents are _____ and_____*

B. Choose the most appropriate answer

1. *Which of the following drugs is not an antibiotic?*
   - *a) Chloramphenicol b) Ciprofloxacin*
   - *c) Diamox d) Tobramycin*
2. *Which of the following is an antiviral drug?*
   - *a) Acyclovir b) Atropine*
   - *c) Betaxolol d) Neomycin*
3. *The drug that is used in asthma patients*
   - *a) Salbutamol b) Avil*
   - *c) Digoxin d) Ranitidine*
4. *An anti fungal drug*
   - *a) Fortwin b) Omez*
   - *c) Nemocid d) Amphotericin*
5. *Dexamethasone is*
   - *a) Antibiotic b) Corticosteroid*
   - *c) Anti allergic d) Cardiac drug*

C. Match the following

1. *Blurred vision - Beta blocker*
2. *Lignocaine - Artificial tears*

3. *Polyvinyl Alcohol* - *Local Anesthetic*
4. *Fluroscein* - *Mydriatic*
5. *Timolol* - *Staining*

D. Write the uses of the following drugs

1. *Paracetamol*
2. *Oral Rehydration Solution*
3. *Glyciphage*
4. *Cap. Nifedipine*
5. *Sorbitrate*

E. Expand the following

1. *Tds*
2. *SOS*
3. *H.S*
4. *Stat*
5. Qid

F. Answer the following

1. *List the rules to be followed while administering medication*
2. *Differentiate mydriatics and miotics*
3. *What are antibiotics?*
4. *What are anti hypertensives?*
5. *What are analgesics?*
6. *Explain briefly about antibiotics used in ophthalmology.*
7. *List the different modes of drug delivery*
8. *Differentiate topical and systemic medications*
9. *Differentiate trade name and chemical name*
10. *What are analgesics?*
11. *What are immunosuppressive drugs?*
12. *Name 2 immunosuppressive drugs*
13. *Place the following in proper order*
    a. *Check the doctor's instructions or prescriptions*
    b. *Expose palpebral conjunctiva*
    c. *Wash hands and dry*
    d. *Instruct the patient to open the eyes and look up*
    e. *Inspect the patient's lids to determine the need for cleaning*

Practical skills

- *Discuss the use and dispensing of drugs with your doctors.*
- *Learn from your doctor the ways to manage drug allergies and adverse reactions which have to be treated immediately.*
- *Collect the printed package, inserts of different drugs (most commonly used) from your hospital practice or from your pharmacy and read through it.*
- *Learn the technique of giving proper intra deltoid, intragluteal, intravenous and subcutaneous injections.*

CHAPTER 8 OCULAR DISEASES

OUTLINE

Diseases of the Eye lids
Diseases of the lacrimal system
Dry eyes
Diseases of the conjunctiva
Diseases of the cornea
Diseases of the lens
Glaucoma
Refractive errors
Squint
External eye diseases
Retinal diseases-diabetic retinopathy, retinal detachments
Diseases of the orbit
Diseases of the optic nerve
Diseases of uveal tract
Malnutritional eye diseases
Headache

GOALS

To identify various eye diseases and conditions to prevent, detect, diagnose and manage conditions that can interfere with one of our most precious senses : sight.

OBJECTIVES

The Ophthalmic Assistant will be able to

- Recognise the medical terms used in common eye diseases.
- Explain the common diseases of the eye and their presentations
- Demonstrate the diagnostic procedures of various diseases
- Discuss the treatment procedures in eye diseases
- Identify and report the complications

CHAPTER 8
Ocular Diseases

Diseases of the eyelid

Eyelids are movable curtains in front of the eyes. They protect the eyes from strong wind and injurious agents. Each eye has an upper and lower eyelid. The upper eyelid has a fibrous tarsal plate. Small glands are present on the lid, which open along the lid margins. The secretion of the glands lubricates the eye and facilitates smooth movement of eyelids. At the margins of each lid are 2 to 3 rows of hairs which form the eyelashes. The inner surface of the eyelids and eyeball are covered by a thin mucous secreting membrane called conjunctiva. The lower lid remains static in position while the upper eyelid moves with each blink. Lids are kept mobile by LPS (Levator Palpebrae Superiors) and circular muscles. Lids protect eyes from perspiration, FB (Foreign Body) particulate matter from strong light and wind. Eyelids distribute tear film uniformly by constant blinking and this keeps the eye moist and clean. Tears also keep the eye free from infection.

Congenital anomalies of the eyelids

- Crypto blepharon: Rare condition resulting in failure to differentiate into lid structures. Skin passes uninterrupted from forehead over the eyes to cheek
- Coloboma of lid: Small notch to absence of entire length of eyelid especially upper eyelid. This has to be corrected by plastic surgery
- Distichiasis: Two or more rows of eyelashes
- Epicanthus: Crescentic fold of skin running vertically between lids at inner canthus (nasally)
- Telecanthus: Normal interpalpable distance but wide intercanthal distance
- Palpable fissure slants: Upwards and downwards slants of palpable fissure as in Down's syndrome.
- Ankyloblepharon: Fusion of the lid margins
- Congenital Entropion inward rotation of the eyelid
- Congenital Ectropion outward rotation of the eyelid

Anomalies of the eyelid

I. Congenital (defects present at birth)
- Coloboma
- Epicanthus
- Blepharophimosis

II. Anomalies of position of lashes and lid margin
- Entropion
- Ectropion
- Ptosis
- Lagophthalmos

III. Inflammatory disorders
- Blepharitis
- Chalazion
- Hordeolum internum
- Hordeolum externum

IV. Lid Tumors
- Benign
- Malignant

V. Lid Injuries
- Lacerations
- Penetrating injuries
- Chemical burns

Trichiasis

Definition: The direction of eye lashes are changed causing irritation, watering and corneal abrasions.

Cause

- Chronic Blepharitis
- Herpes Zoster infection
- Trachoma

Treatment

Epilation or removing eyelash with forceps.

Phthiriasis Palpebrarum

Definition : Small louse and nits seen in root of eye lashes

Cause : Poor hygienic condition

Symptoms : Itching and irritation

Treatment

- Eye lash clipping
- Removal of nits by forceps
- Delousing the patients

Blepharitis

Definition : It is inflammation of the eyelid margins. (Fig. 8.1)

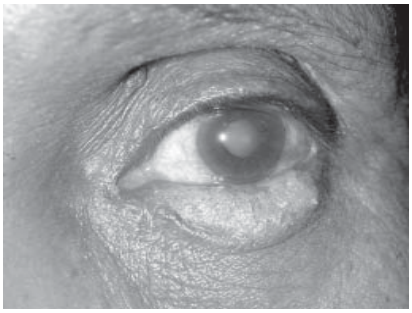


Fig. 8.1

Causes

- Seborrhea (dandruff)
- Staphylococcal infection
- Poor hygienic conditions
- Uncorrected refractive errors
- Diabetes

Types

Features	Squamous	Ulcerative
1. Scales	White	Yellow
2. On removal of scales	No bleeding	Bleeding due to scales underlying ulceration
3. Caused by	Exfoliation	Staphylococci

Symptoms

- Itching
- Watering (lacrimation)
- Photophobia

Treatment

- Improvement of general health
- Treatment of dandruff
- Lid hygiene
- Antibiotic eye ointment
- Correction of refractive error
- Screening for diabetes in adults and treating if present

External hordeolum (Stye)

Definition

Inflammation of follicle of the eyelash including the gland of Zeis.

Causative organism

Staphylococcus (a bacterial infection)

Risk factors

- Children and young adults
- Diabetes
- Very sick patients
- Uncorrected refractive errors

Symptoms and signs

- Pain and swelling of the lid margin
- Edema of lids
- Tenderness

Treatment

- Hot fomentation
- Antibiotic eye ointment
- Analgesic
- Treatment of refractive errors, blepharitis, diabetes

Hordeolum Internum

Definition

Acute inflammation of the meibomian gland.

Causative organism

Staphylococcus

Risk factors

Same as hordeolum externum

Symptoms

Same as hordeolum externum but more severe

Signs

- Point of maximum tenderness is away from lid margin
- Pus points on the tarsal conjunctiva

Treatment

Same as hordeolum externum

Chalazion

Definition

Chronic inflammation of the meibomian gland

(Fig. 8.2 & Fig. 8.3)

Fig. 8.2

Fig. 8.3

Causes

- Blepharitis
- Chronic conjunctivitis
- Diabetes in adults
- Errors of refraction

Symptoms

Painless nodular swelling in the eye lid

Signs

- Well defined swelling
- Firm and non tender
- Eversion of the lid shows purplish discolouration of conjunctiva

Treatment

1. Hot fomentation
2. Antibiotic eye ointment
3. Incision and curettage

Ectropion

Definition

Rolling in out of the margin of the eye lid.

(Fig. 8.4 & Fig. 8.5)

Fig. 8.4

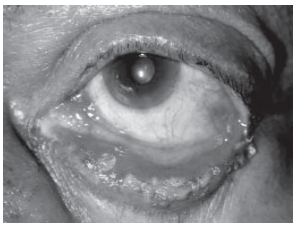


Fig. 8.5

Type

- Senile	Old age
- Paralytic	Paralysis of orbicularis seen in facial palsy
- Congenital	Present since birth
- Mechanical	due to weight of swelling in the lower lid
- Cicatrical	Chemical burns

Symptoms

- Epiphora : Because punctum is not apposed to the globe.
- Excoriation of skin around the lid

Treatment

Temporary

- Antibiotic ointment
- Adhesive tape to close the lid at night

Permanent

- Surgical corrections

Entropion

Definition

Rolling in of the lid margin with its lashes
(Fig. 8.6 & Fig. 8.7)

Fig. 8.6

Fig. 8.7

Type

- Senile — old age
- Spastic — excessive contraction of orbicularis oculi
- Cicatrical — due to scarring (trachoma, chemical burns)
- Congenital — present since birth
- Mechanical — due to weight of the swellings in the lid

Symptoms

- Foreign body sensation
- Pain
- Lacrimation

Complications

- Corneal ulceration
- Corneal opacities

Treatment

Temporary procedures

- Adhesive tape : pulling the skin out with strip of plaster
- Cautery : over skin below lashes
- Soft contact lenses

Permanent procedures: Surgical

Lagophthalmos

Definition

Inadequate closure of eyelids when an attempt is made to close them.

Causes

- Facial nerve palsy
- Proptosis
- Patient in coma
- Deformity of upper lid

Complications

- Dryness of conjunctiva and cornea
- Exposure keratitis

Treatment

Temporary

- Artificial tear drops at day time
- Antibiotic ointment at night time
- Closure of lids with adhesive tape
- Soft contact lenses to prevent corneal damage

Permanent

Surgery: Tarsorrhaphy

Ptosis

Definition

Drooping of the upper eye lid (Fig. 8.8)

Fig . 8.8

Causes

- Old age
- Abnormalities in the development of muscles
- Malfunctioning of the nerves
- Injury or trauma in the eye
- Inflammation, diabetic, stroke, tumors, cancers, zaneurysms
- Mechanical

Congenital

Present from birth

Acquired

- Due to nerve damage	3rd nerve palsy
- Muscle disease	Myasthenia gravis
- Mechanical	Tumors, chalazion etc. pulling the lid down
- Traumatic	Following injury

Treatment

- Neostigmine tablets are given for myasthenia disease
- Surgical correction is done in most cases

Tumors of the Eyelids

Benign

- Papilloma
- Molluscum contagiosum
- Naevus
- Xanthelesma
- Warts
- Hemangioma
- Neurofibroma

Malignant

- Rhodent ulcer (Basal cell carcinoma)
- Squamous cell carcinoma
- Meibomian gland carcinoma

Diseases of the lacrimal system

Tears are secreted by the lacrimal gland and reach the conjunctival sac through tubes. Tears keep the cornea clean, wet and shining. There is a germicide called lysozyme in it. This protects the eye by killing microorganisms. The tears secreted evaporate to a great extent and the rest get collected in a small space near the nose. From there they reach the lacrimal sac, through two holes called lacrimal puncta and two tubes called canaliculi found in the eyelids near the nose. The lacrimal sac is placed in bony lacrimal fossa (a space in the nose near the eye).

When we cry or when we become emotional or when dust or smoke affects the eye, more tears are secreted. The excess tears reach the lacrimal sac and from there come out through the nose. That is why there is watering in the nose.

If there is obstruction in the canaliculi there will be watering in the eyes. Most importantly, the tears will collect in the lacrimal sac if there is obstruction in the tube connecting the lacrimal sac and the nose. This obstruction may be due to many reasons. If we press with a finger at the site of lacrimal sac the tears collected there will be driven back through the eye. In course of time, it will get infected and tears will turn into pus. This will result in chronic dacryocystitis. Middle aged people are generally affected. Women are more likely to be affected than men. Sometimes, lacrimal abscess will form in the lacrimal sac. There will be swelling and pain in the place where it is located. The abscess will burst and the pus will drain through a fistula. The abscess will heal or may become a lacrimal fistula.

The symptoms of lacrimal sac inflammation are watering of eyes, pus formation, small swelling at the place where the lacrimal sac is located. When it is pressed, the pus will be discharged. As pus with organisms is present near the eye, such patients run the risk of endangering the eye. Even when there is a small scratch injury to the eye, the pus in the sac will infect the cornea causing ulcer. In such conditions there is a possibility of losing eye sight permanently. In such patients sac must be removed first. The immediate danger to the eye is thus eliminated. But, as the path through which excess tears are removed is cut off, watering in the eye will continue. However, this will not affect the eye in any way. Another procedure is to make an ostium in the nose at the place where the sac is situated, and to create a passage between the surface of the nose and the sac so that the tears can flow to the nose. This offers near complete cure. In infants this defect is congenital, due to lack to development of the passage. From birth, they will have excess tearing with discharge. Most cases can be cured by

administering antibiotic drops and giving massage at the lacrimal sac. If this does not offer remedy, the block or obstruction is removed by inserting a thin wire through the lacrimal sac and the tube connecting it to the nose (probing of the nasolacrimal duct), after giving anaesthesia. This procedure is called probing. If this fails in some children surgery becomes mandatory. If there is watering in the eye with discharge,an ophthalmologist must be approached to ascertain whether the problem is due to lacrimal sac.

Reasons for excess tearing

It is important to know the different reasons for tearing in the eye. With proper treatment excessive tearing can be stopped.

Let us first see the obstruction in the lacrimal sac. There are two main reasons for tear secretion. It may be due to (a) excess secretion (b) inadequate drainage.

The tears in the eye go to the sac and from there reach the nose through a tube like structure. If there is obstruction in the sac, tears cannot reach the nose. So, it returns back to the eye and there is watering. If this defect is not corrected germs will collect there, multiply, and discharge will occur. There are two types of surgical procedures to correct this. One is Dacryocystorhinostomy - DCR. As elderly people cannot endure this, the second procedure is done without breaking the nose. Here the sac is removed. This is called Dacryocystectomy (DCT). This will destroy the place where germs collect. There will be no discharge but there will be tearing in the eyes.

This is seen in a few newborn infants too. The discharge must be cleared by massaging the lacrimal sac. This massage must be continued up to one year. Surgical procedure may be adopted later if management fails.

Other causes of tearing in the eye

The cornea is very thin and even a small injury to it or a speck of dust on it will result in redness, irritation and excess tearing. There are other reasons also. They are

- Foreign bodies like speck of dust, sand, and iron sticking onto the corneal surface
- Dust in upper eyelids will cause friction during lid movements (causing injury to the cornea)
- The eye lashes grow inward (Trichiasis)
- Elderly people will have a growth called concretion in the upper eyelid. This also will rub on the cornea and cause tearing.
- Abscess in the inner side of the lids
- Lagophthalmos
- Corneal ulcer
- Rise in intraocular pressure
- Conjunctivitis
- Defective vision. In-patients who do not wear glasses and strain themselves, there will be tearing. Some will have difficulty when the muscles do not function properly while reading. This can be corrected by simple exercises
- Pterygium and pinguecula may grow causing tearing
- Postoperatively sutures may cause irritation
- (Dry eye) tearing will be less. But such patients have a feeling of tearing

Lacrimal apparatus diseases are divided into 2 groups

Diseases of Lacrimal Gland

Infection : Acute dacryoadenitis

Tumors : Adenoma carcinoma, adenoma

Diseases of Lacrimal sac

Infection - Dacryocystitis

Tumors - Very rare e.g.: papilloma

Dacryocystitis

Definition

Acute or chronic inflammation of lacrimal sac.

(Fig. 8.9 & Fig. 8.10)

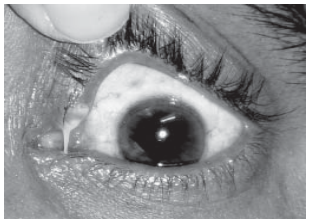


Fig. 8.9

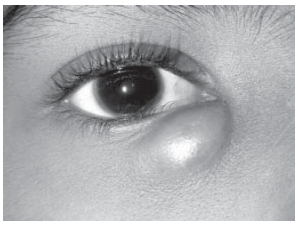


Fig. 8.10

Causative organisms

- Pneumococcus (most common)
- Streptococcus
- Staphylococcus
- Mycobacterium etc.

Causes

- Congenital deformation of the lacrimal drainage system
- Diseases of nose : deviated nasal septum
- Nasal polyps
- Infection spreading from naso-pharynx
- Trauma causing distortion of anatomy and stagnation of tears

Sequence of events

Obstruction at the junction of the lower end of lacrimal sac and the upper end of naso-lacrimal duct

↓

Stagnation of tears in the sac

↓

Predisposing to infection

Dacryocystitis

Types

- Acute dacryocystitis
- Chronic dacryocystitis
- Congenital dacryocystitis

Symptoms

Acute

- Sudden onset of pain, redness and swelling in the sac area
- Watering of the eyes
- Sometimes redness of the eyes
- Congenital – watering of one or both eyes since birth

Chronic

- Watering of the eyes
- Sometimes discharge
- Pus like material coming from lacrimal puncta when pressing over the sac area.

Diagnosis

- ***Acute*** : Syringing contraindicated
- ***Chronic*** : On syringing, fluid will regurgitate through the same punctum or upper punctum, Mucus or pus may also be seen in the regurgitant fluid.
- ***Congenital***: 1-2 drops of 2% fluorescent dye instilled in the eye and after some time, a cotton swab is introduced in the nostril to see whether the dye has drained into the nose.

Complications

- Chronic conjunctivitis
- Can lead to infection within the eye after surgery in the eye
- Promote bacterial corneal ulcers
- Acute dacryocystitis may progress to orbital cellulitis, lacrimal fistula [skin opening in sac area].

Treatment

I. Acute Dacryocystitis

- Hot compresses: 3-4 times / day
- Broad spectrum systemic antibiotics
- Topical antibiotics: 4–6 times / day
- DCT (dacryocystectomy) or dacryocysto - rhinostomy (DCR) done after inflammation subsides.

II. Chronic dacryocystitis

- In younger age DCR is done
- In old age DCT is done

III. Congenital dacryocystitis

- Massaging and antibiotic drop instillation
- Probing : probe is passed down naso-lacrimal duct
- DCR if the above procedures fail to open lacrimal passages after 3 years

Dry Eye

It is one of the most common problems treated by ophthalmologist.

Definition

There is decreased secretion of tears or deficiency in the composition of tears.

Causes

- Aging
- Hot, dry or windy climates
- High altitude
- Air conditioning
- Cigarette smoking
- Working on computer for long time
- Contact lens wearers

Symptoms

- Itching
- Burning
- Irritation
- Redness
- Blurred vision that improves with blinking
- Excessive tearing
- Increased discomfort after reading, watching TV, or working on a computer
- F.B sensation

Diagnosis

Schirmer test is done

Treatment

No permanent cure, can only relieve symptoms

I. Preservation of existing tears

- Reduction of room temperature
- Humidifiers
- Punctual occlusion

II. Supplementation of tears

1. Drops - Methyl Cellulose
   - Hydroxy ethyl cellulose
   - Hyper mellose
2. Ointments - HPMC gel at bed time

Diseases of the conjunctiva

The most common conjunctival disease is conjunctivitis which is infective. Others being pterygium, pinguecula and subconjunctival haemorrhage.

Conjunctivitis

Definition

Infection of the conjunctiva

Classification

Infections

Bacterial

- Staphylococus aureus
- Haemophillus
- Gonococcal (Ophthalmic Neonatorum)
- Mycobacterium

Viral

- Adenovirus
- Varicella
- Herpes Zoster
- Mumps
- Influenza

Chalamydial (Trachoma)

- Chlamydia trachomatis

Table: 1

	Conjunctival congestion	Ciliary congestion
i. Site	Fornices	Limbus
ii. Color	Bright red	Violet
iii. Depth	Vessels superficial	Vessels deep
iv. Branching	Dichotomously	Radially
v. 1.1000 epinephrine test	Whitens conjunctiva	No effect
vi. Disease	Conjunctivits	Iridocystitis, Glaucoma

Allergic

- Simple allergic conjunctivitis
- Vernal catarrh

Trauma

Infective conjunctivitis

Symptoms

- Discomfort and foreign body sensations due to engorgement of blood vessels
- Sticking together of eye lashes due to discharge
- Photophobia and watering of the eye
- Defective vision due to thin layer of discharge on the cornea
- Haloes around light due to thin layer of discharge on the corneal surface.

Signs

- **Discharge :** causes sticking together of eyelashes especially when waking up in the morning
- **Congestion :** should be differentiated from other causes of congestion (redness) (Table:1).
- **Subconjunctival hemorrhage:** more common in viral conjunctivitis. Rupture of tiny conjunctival vessel.
- **Follicles:** Round swellings (0.5 – 2 mm) surrounded by tiny blood vessel in the tarsal conjunctiva, more commonly seen in viral conjunctivitis and allergic conjunctivitis.
- **Papillae :** Round swelling with blood vessels in the centre over the tarsal conjunctiva more commonly seen in vernal conjunctivitis.
- **Pre Auricular Lymphadenopathy:** Seen in viral, chlamydial infection

Treatment

- Frequent wash with luke warm saline solution to clear crusting and discharge
- Use dark glasses to prevent photophobia
- Broad spectrum antibiotic drops are used
  - E.g.,: ciprofloxacin dosage hourly to 4 times depending on severity.
  - Ointment: Tetracycline / gentamycin/ Chloramphenicol at bed time

To prevent contamination

- Patient must keep his hands clean and avoid touching around the eye.
- Personal belongings of the patient like towel, handkerchief, and pillow should be kept separately.
- Other family members if infected should be treated simultaneously.

Simple allergic conjunctivitis

Definition

Allergic reaction due to large amount of allergens reaching the conjunctiva

Causes

- Pollen grains
- Certain topical drugs e.g.. Neomycin
- Contact with pet animals
- Dust, cosmetics, chemicals

Treatment

- Removal of allergen
- Antihistamine tablets & drops
- Topical 2% Sodium chromoglycolate to prevent recurrence
- Corticosteroid drops in severe cases

Vernal conjunctivitis

Definition

Hypersensitivity reaction of conjunctiva to exogenous allergens

Causes

Age	- 6-20 yrs, usually males
Seasonal variation	- Prevalent in summer
Exciting factors	- Dust, dry heat, pollens

Symptoms

- Intense itching
- Discharge
- Photophobia, burning and foreign body sensation

Signs

- Cobble stone appearance due to papillary hypertrophy in the palpaberal conjunctiva
- Multiple small nodules around the limbus
- Trantas spots superficial white spots scattered around the limbus.

Treatment

- Cold compresses
- Disodium chromoglycolate 4 times / day reduces itching
- Topical steroids like dexamethasone 4 times daily and tapering dose depending on the severity. Long term use of steroids can cause cataract and glaucoma.

Ophthalmia neonatorum

Definition

Bilateral purulent conjunctivitis occurring in new born within first 3 weeks of life.

Causative organisms

- Gonococcus (Most common)
- Chlamydia

Mode of Infection

- Before birth - very rare
- During birth - face presentation is the most common
- After birth - from soiled linen

Clinical picture

Watering, redness & discharge.

Treatment

1) Prophylaxis

- Proper antenatal care of mother. Any vaginal discharge should be treated meticulously.
- Crede's prophylaxis: 1% silver nitrate is instilled into the baby's eyes immediately after birth.

2) Curative

Swab taken for culture and sensitivity

Gonococcal - Ciprofloxacin hourly for 3-5 days

Chlamydial - 1% tetracycline 2 times/day

Pterygium

Definition

It is a triangular growth on the conjunctiva encroaching on the cornea in the horizontal meridian, in the palpaberal fissure, either from the nasal or temporal side of bulbar conjunctiva or from both sides.

Cause

- U-V radiations
- Exposure to hot, sandy and dusty weather

Parts of pterygium

Head - Apex of triangular fleshy growth

Neck - Constricted portion at the limbus

Body - Remaining bulky part

Symptoms

- Appearance of lesion on nasal or temporal side
- Dimness of vision due to obstruction of visual axis
- Redness and burning sensation.

Signs

1. Decreased visual acuity
2. Triangular fold of conjunctival fleshy growth encroaching upon the cornea

Treatment

- Stationary pterygium - no treatment (If inflamed - NSAIDS or steroids eye drops)
- Progressive pterygium - excision
- Recurrent pterygium - mitomycin C, Beta radiation
- Pterygium in the pupillary area - Excision of pterygium and keratoplasty

Subconjunctival Haemorrhage

Definition

Spontaneous rupture of conjunctival blood vessels

Clinical picture

Sectoral red patch under the conjunctiva where blood collects.

Causes

- Trauma
- Diabetic and hypertensives
- Sneezing
- Coughing
- Straining
- Lifting heavy weight
- Vomiting

Treatment: None

Reassurance to the patient

Diseases of the cornea

Cornea forms one fifth of the front part of the eyeball. It is a clear membrane, like colorless glass. It is circular with slight convexity and inner concavity. It has a diameter of 11mm with a thickness of 0.65mm at the periphery and 0.54mm in the centre. It has five layers. They are:

- Epithelium
- Bowman's layer
- Stroma
- Descemet's membrane
- Endothelium

Endothelium is made up of a layer of hexagonal cells. It has contact with aqueous humour. Through it cornea gets nutrients and oxygen. Only when it is healthy the refractory nature of the cornea will be maintained.

Cornea is like a window to the eye. The rays of light enroute to the retina pass through it. If the cornea is not clear, the light rays cannot pass through, and vision will be affected.

It is important for us to know the diseases affecting the cornea. When it is affected, scars will be formed and eyesight will get diminished, leading to loss of vision. Even if all the other parts of the eye are healthy, a disease to the cornea will affect vision.

A) Corneal ulcers
   Bacterial ulcer
   Fungal ulcer
   Viral ulcer
   Parasitic ulcer
B) Degenerative Conditions
   Arcus Senelis
   Band Shaped Keratoplasty
C) Dystrophies
   Granular
   Macular
   Lattice

A) Corneal ulcers

Definition

It is defined as a break in the corneal epithelium with added infection

Route of Spread

Exogenous route	- From outside source
Secondary route	- From adjacent structures like conjunctiva, sclera, uvea
Endogenous route	- Systemic sources

Causative organisms

Bacteria	Fungal	Parasitic	Virus
1.Staphylococcus aureus	Candida Albicans	Acanthamoeba	Herpes simplex
2.Pseudomonas	Aspergillus		Herpes zoster
3. Streptococcus	Fusarium		
4. E.Coli			
5. Klebsciella			

Symptoms	Signs
Lacrimation (watering)	Edema of lids and blepharospasm
Photophobia	Circum ciliary congestion Localised area of necrosis
Pain	Vascularisation of cornea
Defective vision	Hypopyon may be present

Investigations

Corneal Scraping

Done under local anesthesia. The material obtained is used for the following investigations.

- Gram and Giemsa stains for bacteria
- 10% KOH wet preparation for fungus
- Culture on blood agar for aerobic organisms
- Culture on Sabouraud's dextrose agar for fungus

Check the diabetic status of the patient

Complications

- Perforation - (Hole in cornea)
- Corneal opacities
- Endophthalmitis or panophthalmitis
- Secondary glaucoma

Treatment

a. Control of infections
   - Antibiotics are used until the ulcer heals - e.g., fortified gentamycin, Cefazolin, Ciprofloxacin
   - Antifungal - e.g.,: Natamycin, Nystatin etc.

b. Rest to the eye
   - Cycloplegics: atropine 1% eye ointment 2 times / day gives rest to eye by paralysing the ciliary muscle
   - Dark glasses: protect the eye from irritating effect of strong light

Features	Bacterial ulcer	Fungal ulcer
i. History of Injury	Non specific	With Vegetable matter
ii. Predisposing factors	Non specific	Immunocompromised, steroids
iii. Course	Rapid	Slow
iv. Symptoms and signs	Proportionate	Sign out of proportion to symptoms
v. Satellite lesions	Absent	Present
vi. Margins	Well defined	Feathery
vii. Hypopyon	Usually not seen	Usually seen

c. Relief of pain
   - Hot compresses
   - Oral pain killers

d. Removal of any septic focus in the neighbourhood
   - If sac is infected, it is to be removed without delay

e. Improve general health condition
   - By control of diabetes and improving nutrition.

Don'ts in a case of corneal ulcer

- No Bandage
- No Steroid drop
- No Schiotz Tonometer

Viral ulcer (Dendritic ulcer)

Definition

Ulcer with a branched appearance caused by herpes simplex virus (Fig. 8.11).

Symptoms

Pain, watering and photophobia

Clinical signs

- The ulcer appears as star shaped or branched pattern
- Absent corneal sensation
- Enlarged and tender pre auricular lymph nodes

Treatment

- Antiviral drops or ointment (e.g.,: acyclovir eye ointment 3%)

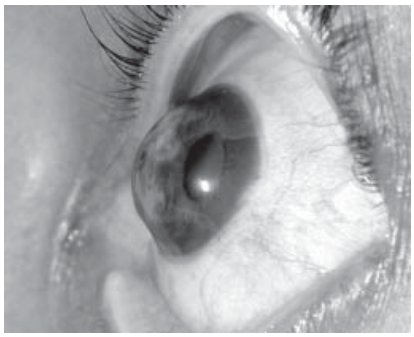


Fig. 8.11

- Steroids to suppress the host response
- Antibiotic eye drops to prevent secondary infection

B. Degenerative conditions

Keratoconus

Definition

Bilateral conical protrusion of central part of the cornea due to thinning

Symptoms

Defective vision due to irregular myopic astigmatism and watering due to rupture of hydrops

Signs

1. Munson's sign: bulging of the lower lid when patient looks down.
2. Retinoscopy: scissoring reflex
3. Ophthalmoscopy: oil drop sign
4. Slit lamp:
   - Thinning of cornea at the centre
   - Prominent corneal nerves
   - Fleischer's ring–iron deposits at the base of cone
5. Keratometry ('K' reading) showing high astigmatism

Complications

Acute hydrops: rupture of Descemet's membrane and seepage of aqueous in the corneal stroma and epithelium

Treatment

- Hard contact lens
- Penetrating keratoplasty

Arcus senilis

Normally seen at peripheral cornea

- Corneal degeneration
- Lesion: starts as crescent grey line around 12° clock and 6 ° clock. Finally it becomes circular
- Site: periphery of cornea parallel to limbus. There is clear space seen between the lesion and the limbus
- Does not affect vision or vitality of cornea

C. Corneal dystrophies

Definition: condition in which cornea loses its clarity due to deposition of materials in various layers of the cornea

Features

1) Usually inherited
2) Not caused by outside factors like injury or diet
3) Progresses gradually
4) Occurs in otherwise healthy people

Symptoms

- Some detected on routine examination
- Some cause visual impairment
- Some cause repeated episodes of pain without visual loss

Types

1) Epithelial dystrophy – Map-dot finger print dystrophy
2) Stromal dystrophy – granular dystrophy, macular dystrophy and lattice dystrophy
3) Endothelial dystrophy – Fuch's dystrophy

Diseases of the lens

Cataract is a term applied when the human lens loses its transparency and becomes opacified. Hence light cannot pass through the lens in required levels and fall on the retina to produce an image.

1) Cataract
   - Congenital
   - Acquired
2) Dislocation of Lens
   - Hereditary dislocation
   - Traumatic dislocation
3) Congenital anomalies of lens
   - Ectopia lentis
   - Coloboma of lens
   - Lenticonus
4) Secondary Glaucoma
   - Phacomorphic
   - Phacolytic

Cataract

Definition: Opacity of lens (Fig. 8.12)

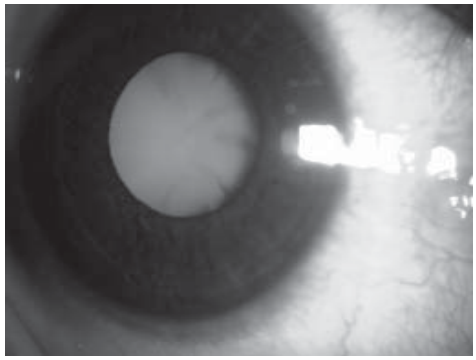


Fig . 8.12

Classification

A. Congenital cataract / developmental cataract
B. Acquired cataract
   - Senile cataract
   - Traumatic cataract
   - Complicated cataract: Due to some ocular diseases like anterior uveitis, retinal detachment
   - Secondary cataract: Due to systemic diseases e.g. diabetes mellitus
   - Toxic cataract: Due to drugs e.g. miotics (pilocarpine, steroids)

Congenital cataract

Cause

- Maternal malnutrition
- Maternal infection by virus as in rubella
- Deficient oxygenation due to placental hemorrhage

Symptoms

Mother complaints that infant has:

- White reflex from pupil
- Inability to see properly in bright light
- Abnormal movements of eye as in squint or nystagmus

Differential diagnosis

Congenital cataract should be differentiated from retinoblastoma which is a malignant condition producing white reflex at the pupil.

Treatment

1. Lens aspiration
2. Lensectomy

B. Senile cataract

Definition: Cataract related to ageing process.

Symptoms

- Painless progressive decrease in vision
- Misty / foggy vision
- Fixed dark spots before the eye
- Uniocular double or distorted images of objects
- Coloured haloes

Signs

- White pupil in the severely affected eye

Types

- Cortical
- Nuclear
- Posterior subcapsular

Cortical cataract

Also called soft cataract.

Stages of development

i. Immature cataract : few areas of opaque lens is present
ii. Mature cataract : entire lens becomes opaque
iii. Hypermature or Morgagnian cataract: the cortex becomes a milky fluid and the nucleus is shrunken and yellow. Sinks to the bottom of lens capsule

Nuclear cataract

- The opacity starts at the nucleus and gets intensified while cortex remains clear. Later stages opacity extends to the cortex also
- Initially tinted dark brown, becomes black.
- Colour is due to deposit of melanin in the nucleus
- Index myopia**:** Myopia due to increased refractive index of nucleus leads to gradual decrease in distant vision.
- Second sight: Myopia due to cataract neutralises the "plus power" of presbyopia. So a patient using presbyopic glasses for reading is able to read without any glasses when nuclear cataract sets in.

Posterior sub capsular cataract (PSCC)

- Opacity formed in front of posterior capsule at the centre and progress towards the periphery.
- Vision much affected during day time or in bright light (Fig. 8.13).
- Surgery indicated at a relatively early stage.

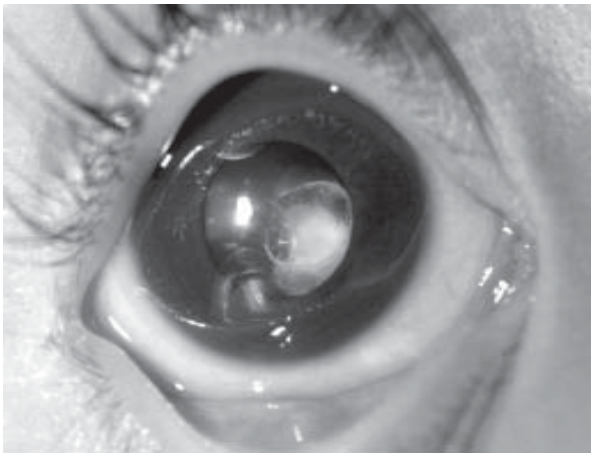


Fig. 8.13

Treatment

1) Extra capsular cataract extraction
   a) Anterior capsule is removed
   b) Nucleus is extracted
   c) Cortical matter is aspirated
   d) Sutures are applied to close the wound
2) Phacoemulsification
   a) Anterior capsule is removed
   b) Cataractous lens is broken into pieces by ultrasonic vibrating instrument and aspirated within the eye itself.
   c) Scleral tunnel is made so no sutures are used.

3) Intraocular lens implantation (IOL)
   a) Artificial lens made of PMMA (polymethyl metha acrylate) is inserted,
   b) Site of implantation
      i) Posterior chamber in the capsular bag
      ii) When posterior capsule is not intact - sulcus
      iii) Anterior chamber - posterior capsule is deficient

Subluxation / dislocation of the lens

Definition

- Subluxation - displacement of the lens side ways but remains behind the pupil
- Dislocation - displacement of the lens either
  - Forward - into the anterior chamber
  - Backward - into the vitreous
- Ectopia lentis - congenital bilateral, subluxation or dislocation of the lens

Causes

- Congenital (ectopia lentis)
- Acquired
  - Excessive stretching of zonules - trauma
  - Degeneration of zonules - pseudo exfoliation

Clinical features

Mono ocular diplopia

- Unequal depth of AC
- Iridodonesis
- Phacodonesis

4. Lens induced glaucoma

Phacolytic glaucoma

Hypermature cataract

Leakage of lens material

Macrophages engulf lens material

Obstruct trabecular meshwork

Secondary open angle glaucoma

Phacomorphic glaucoma

- Intumescent (swollen)
- Shallow anterior chamber
- Secondary angle closure glaucoma
- Fixed dilated pupil

Note: (Pupil should never be dilated)

Glaucoma

The vision lost due to glaucoma cannot be restored. Vision once lost is permanently lost. Glaucoma must be diagnosed early and treated. It is a condition which causes an abnormal increase in pressure within the eye. The front part of the eye between cornea and lens can be divided into two chambers. The chamber between iris and cornea is anterior chamber. It is filled with a colourless, clear liquid called aqueous humour. Aqueous humour supplies nutrients and oxygen to cornea and lens. This liquid flows out through the filters in the anterior chamber angle. The liquid again fills up the chamber. This filling in and draining go on continuously and uniformly. In glaucoma if the outflow is blocked then the intraocular pressure increases. We call this state glaucoma. The pressure is normally between 11mm to 20mm of Hg. If it goes above the limit that is if the pressure increases it affects the optic nerve and gradually causes loss of vision.

Types of glaucoma

- The most common is chronic simple glaucoma or open angle glaucoma. The angle between the iris and the cornea is normal but the drainage filters get clogged from inside. In this type the patient loses his vision slowly without his knowledge. As the loss of vision takes place silently without symptoms, it is called silent thief of sight. First, the peripheral field of vision is lost. In course of time central vision is also affected. Such patients go to the ophthalmologist at an advanced stage.
- The second type is angle closure glaucoma. This disease causes headache, pain, watering and redness of the eye and loss of sight suddenly. The patients will see rainbow like circles, halos, around

lamps. They will at once approach the doctor. In chronic cases such symptoms are not observed.

- In addition to these two, there are other types of glaucoma. In congenital types, the infants at birth will have big eyes like those of a calf. This is called Buphthalmos. The cornea will be big. Photophobia, redness and watering of the eye will be observed and the child will keep the face buried in the pillow. Other occasions are when there is trauma, there is inflammation or when the cataract is about to burst.

How is glaucoma diagnosed?

The following tests are conducted

- Slit lamp examination
- Tonometry
- Fundus examination
- Testing visual fields. The latest computerised equipment called computer field analysis is available and it will give accurate diagnosis.
- Gonioscopy
- Visual Acuity

Symptoms of glaucoma

- Frequent headaches in the mornings
- Frequent change of glasses
- Blurred, cloudy, vision
- After watching TV or cinema pain around the eyes
- Rainbow like halos (rings) around lamps
- Gradual loss of field of vision
- Defective night vision

However, one may have glaucoma without any of these symptoms.

Who will get glaucoma?

- At any age; generally above 40
- If some one in the family or any blood relation has glaucoma
- Diabetic patients
- African heritage
- People who change glasses frequently due to myopia

Treatment

There are three treatments available

- Medical treatment: Some patients suffering from glaucoma may be treated with eye drops and tablets. Depending on the severity of the intraocular pressure, one or two types of eye drops are used. Some may require tablets also. It is important that the treatment is continued according to the physician's directions.
- Laser treatment: They are called laser trabeculoplasty and Laser Iridotomy. Patients need not stay long in the hospital but can take up their work the next day.
- Surgery: If the medical and laser treatments are not effective, surgery is the only alternative.

Note the following

- Glaucoma is not a form of cancer.
- Trachoma and glaucoma are two different diseases.
- There is no connection between hypertension and glaucoma.
- There is no connection between glaucoma and block in lacrimal sac.
- Glaucoma is not an infectious disease.
- All people above 40 must get their eyes examined once in two years.

Glaucoma patients should be advised to

Follow instructions of the ophthalmologist.

- Eye drops must be used without fail
- Eye drops must be applied to the eye
- Must not stop treatment without doctor's advice
- People in the family and relatives must get themselves examined
- Must inform about it to other doctors when consulted
- It is not possible to cure glaucoma completely. But it is possible to control it and keep the vision by continuous treatment

Laser treatment for glaucoma

As already explained, when the intraocular pressure increases beyond normal limits, the eye is affected by glaucoma. The aqueous humour fills the anterior chamber. The aqueous humour is the clear fluid that flows through the inside of the eye, nourishing the lens, the iris and the inside of the cornea. This fluid is not the same as tears, which bathes the outside of the eye. When aqueous humour secretes more or when the passage draining it is blocked, intraocular pressure will increase. In Schiotz scale normal pressure should be between 15mm and 20mm Hg.

Glaucoma affects the optic nerve connecting the eye and the brain. The symptoms, as already indicated, are pain in the eye, headache and seeing rainbow - like halos around lamps.

In laser treatment, a hole is made through the iris with a laser. This enables the liquid to flow from the chamber behind the iris to the front chamber. Normally this treatment takes just 5 minutes. It is painless and needs no injections. The patient needs no hospitalisation. Only after microscopic examination of the post treated, one could decide whether more laser treatment is necessary. This treatment is called laser iridotomy.

Laser trabeculoplasty

The liquid in the front chamber passes through minute sieve-like structures and reaches the canal and then onto the blood vessels. Due to ageing, changes take place in the eye and some solid particles get deposited on the sieve like structure. This causes blockage. Because of this, pressure gradually increases. This is the cause for open angle glaucoma. The side vision of the patient will be slowly lost without his/her knowledge. Some patients will have headache, and need to change glasses because of myopia. There are possibilities of one getting open angle glaucoma if there is a family history of diabetes.

In the laser treatment for open angle glaucoma, some parts of the sieve like structure are burnt by directing laser beams. The basic principle is to shrink the muscles by directing laser beams on them. The parts around the burnt out place will open up, allowing the liquid to pass through. In the first treatment usually half of the affected portion is subjected to laser treatment. So two separate treatments are possible for each eye.

When surgery does not help in certain glaucoma cases to reduce pressure, laser treatment helps to open up the closed tubes.

When high pressure cannot be controlled by eye drops or surgery, the liquid secreting part is subjected to laser cyclo photocoagulation. Immediately after laser treatment, some eye drops are applied, pressure is reduced and the eye is kept without movement. The patient must wait for an hour. Then the pressure is measured. After ascertaining the pressure is stable, the patient is sent home.

An additional dose of eye drops will be given on the day of the treatment and it must be applied thrice a day for a week to the eye which has undergone treatment. The medicines already given must be continued. There must be an interval of 10 minutes between applying two medicines.

Refractive errors

Optics of the eye

Emmetropia (No refractive error)

When light rays coming from a distant object are focused on the retina.

Ametropia (Refractive error)

When light rays coming from a distant object are not focused on the retina.

Types of refractive error

- Myopia (near sighted)
- Hypermetropia (far sighted)
- Astigmatism

Myopia

Definition

When light rays coming from a distant object are focused in front of the retina.

Types

• Depending on the mechanism
  - Axial myopia : anterior-posterior length of eye ball is more than normal (long eye ball)
  - Curvature myopia : Curvature of cornea / lens is more than normal
  - Index myopia : Refractive index of nucleus is more than Normal (as in nuclear cataract)

• Clinical
  - Congenital myopia: Present at birth
  - Developmental Myopia: common. The power increases during adolescence and then remains steady. (< 6D)
  - Pathological myopia: The power rapidly progresses and requires frequent change of glass. (> 6D)

Symptoms

- Defective vision for distance
- Discomfort after near work
- Black spots seen floating before eye
- Flashes of light

Signs

- Eyes are prominent
- Retinoscopy error is myopic
- Ophthalmoscopy
  - Large disc
  - Crescent around the disc
  - Tiggroid fundus

Treatment

- Concave lens (as spectacles)
- Contact lens
- Radial keratotomy
- LASIK with excimer laser

Hypermetropia

Definition

Rays coming from a distant object are focussed behind the retina.

Types

Depending on mechanism

- Axial hypermetropia : Anterior posterior length of eye ball is less (short eye ball)
- Curvature hypermetropia: Curvature of cornea / lens or both flatter than normal.
- Index hypermetropia: Refractive index of various media are less than normal.

Depending upon power of accommodation

- Latent hypermetropia : Hypermetropia which is corrected due to tone of the ciliary muscles.
- Manifest hypermetropia : Hypermetropia which is not corrected by tone of the ciliary muscles.
  - Facultative Hypermetropia : Hypermetropia which is corrected by contraction of ciliary muscle (act of accommodation)
  - Absolute hypermetropia : Hypermetropia which cannot be corrected by contraction of ciliary muscle (act of accommodation)

Symptoms

- Eye strain after near work
- Headache after near work
- Feeling of blurring and dryness in the eye.

Signs

- Apparent divergent squint
- Anterior chamber is shallow
- Fundus:
  - Disc is small
  - Vessels tortuous

Treatment

- Convex lenses
- Contact lenses

Astigmatism

Definition

When light rays from distant objects cannot converge at a point on the retina due to unequal refractive power in different meridians.

Types

1. Regular astigmatism: Refractive error changes uniformly from one meridian to the other. It is further divided into

- Simple astigmatism: one focus falls on the retina and the other focus falls in front or behind the retina.
  - Simple myopic astigmatism: when other focus falls in front of retina
  - Simple hypermetropic astigmatism: when other focus falls behind the retina.
- Compound astigmatism: when both focal lines fall
  - in front of retina – compound myopic astigmatism
  - behind the retina - compound hypermetropic astigmatism
  - Mixed astigmatism: when one focus falls in front of the retina & other focus falls behind the retina.

2. Irregular astigmatism: Refractive error changes differently in different meridians.

Treatment

Regular astigmatism - Glasses and contact lenses.

Irregular astigmatism - Contact lenses

Presbyopia

Definition

Loss of accommodation power due to aging.

Causes

- Lens matter becomes less elastic
- Weakening of ciliary muscles.

Symptoms

- Difficulty in reading small prints especially in dim light or evenings
- Inability to perform near work. E.g.) threading a needle etc.
- Fatigue or headache while doing near work.

Treatment

Convex spherical lenses are prescribed or added to existing glasses in the following manner.

Squint

Squint is not a sign of luck. It is a state which affects appearance and eyesight.

What is squint? How does it happen?

When we see an object with both eyes at the same time, they work together. Though two images fall on the retina, the sense of sight is transmitted by the optic nerve to the brain where both images are superimposed. We see one object in its dimension and colour. The six ocular muscles connected to the eyeballs are responsible for their movement. This enables one to move the eyeball up or down and sideways. Only if the movements are simultaneous, we can see objects like this. All the 12 muscles must coordinate in this action. If the eyes are not straight, the sensation of the brain will be different between the two eyes. The brain will take the message from the powerful eye and reject that of the other eye. If this is not rectified one will have double vision. And the eye whose image is ignored will have sight slowly deteriorated.

In short, in certain abnormal conditions when one eye fixates at the object and the other eye turns in a different direction, this is called the crossing of the eyes or 'squint'. The squinting eye is often referred to as the lazy eye or the crooked eye. The scientific name for squint is strabismus.

The squint eye may turn in any direction, in, out, up or down. The infant's eyes are not developed

enough to see clearly and to work together as a team and therefore, they wander about giving at times the appearance of crossing. This should disappear as child grows. If it continues after 6 months, the child needs the attention of an eye specialist. It must be noted that squint in the infant may be an early symptom of retinoblastoma.

Parents must watch their children from infancy to find whether they move the eyes together, or whether there is extraordinary movement. Some children may keep their eyes on one side. The cornea of one eye will appear slightly deflected when the child is tired, or sick and in bright light. The habit of closing one eye, rubbing the eyes often, keeping the objects close to the eyes are other symptoms. Such children must be taken to the eye specialist immediately. 5 percent of the children between 3 and 5 years have one eye defect or another. In India it is estimated that one crore children have eye defects.

Squint affects the sight, personal appearance and personality of the children. A squint child's playmates ridicule him/her and he/she becomes shy and withdrawn.

Plan of treatment

- Glasses to correct the fault
- Patching of the good eye
- Applying eye drops or ointments
- Special types of exercises
- Operation

Patching of one eye

To induce the lazy eye to function properly, the good eye is patched for a few week or even months. This is one kind of treatment. This will help in the correction of double vision. Even when glasses are prescribed for defective vision, they can be worn along with the eye patches. Children must be encouraged by parents and teachers to follow this strictly. They must consult eye specialists often to examine the eye to estimate the progress. For this treatment to be effective it must be started before 3 years. But it can be undertaken at least before 10 years.

Instead of patching an eye, eye drops can be applied to the good eye. Dilate the pupil, reduce its sight and induce the lazy eye. But this is usually not desirable.

Out of the six muscles that control the movement of the eye, one of the pair may be strong and another weak. In such cases the eye will be pulled to the strong side. This also causes squint. Squint can be corrected by surgery.

Classification

Squint

Latent Squint (Heterophoria)	Manifest Squint (Heterotropia)
Non paralytic (Concomitant)	Paralytic (Non-concomitant)
Convergent (Esotropia)	Divergent (Exotropia)

Heterophoria

In this condition the eyes look apparently straight. But when one eye is covered, the covered eye deviates. On removing the cover the eye becomes straight.

Types

Esophoria : Eye deviates inwards
Exophoria : Eye deviates outwards
Hyperphoria : Eye deviates upwards
Hypophoria : Eye deviates downwards

Under normal conditions the 2 eyes are kept in check by power of fusion.

Heterotropia

The eyes are deviated in primary position. Depending on the direction of deviation they are of following types.

1. Exotropia : Deviated outwards
2. Esotropia : Deviated inwards
3. Hypotropia : Deviated downwards
4. Hypertropia : Deviated upwards

Clinical investigations

- Hirschberg test
- Cover test
- Prism vergence test
- Maddox rod test
- Worth four dot test
- Hess charting
- Diplopia charting
- Synoptophore

Goals of treatment

1. Good visual improvement in both eyes
2. Straight eyes (cosmetic)
3. Eyes working together for binocular vision (functional)

Treatment : 4 O'S

1. Optical: Best corrected glasses are prescribed
2. Orthoptic exercises
3. Occlusion therapy : Strabismus associated with amblyopia is treated by occlusion
4. Operation : Most common and successful method done for cosmetic and functional purpose

Amblyopia (Lazy eye)

Definition: Decrease in visual acuity without any diseases in the eye.

Features

- Usually unilateral
- Develops between 6 months to 6 years of life

Types

- **Strabismic amblyopia:** Amblyopia present in the squinted eye, as it is not used for seeing objects.
- **Anisometropic Amblyopia:** Where there is difference in refractive power between both eyes. The eye with very blurred image is not used and this leads to amblyopia.
- **Ametropic Amblyopia:** In this condition both eyes suffer from high refractive error. This results in blurred image. If it is not corrected in early childhood amblyopia results.
- **Amblyopia Exanopsia:** Amblyopia develops because the light does not reach the retina during first few months or years of life, as in congenital ptosis or cataract

Treatment

- Removal of any opacity in the media
- Full correction of refractive errors

Occlusion therapy: The normal eye is occluded and child is forced to see with the amblyopic eye. When vision is equalized, surgical correction is done to put the eyes straight.

Diseases of the Retina and Vitreous

Retina is an important part of the eye and it is made of minute structures. It is the inner most layer of the three-layers of the eye. The retina is made of nerve fibres, which end in the optic nerve. There are photosensitive rods (cylindrical cells) and a layer of nerve fibres under it. At the back there is the yellow spot which is very sensitive. For the object to be seen clearly the rays must converge on it. Rods help to perceive the intensity of light and the cone cells help to identify the colour of the object. Rod cells help in night vision and cone cells in day vision. The concavity inside the retina is filled with colourless clear jelly called vitreous which helps to keep the three layers apposed to each other.

When the retina is affected by congenital defects, injury to the eye, other physical ailment or old age, the patient may lose vision (Fig. 8.14).

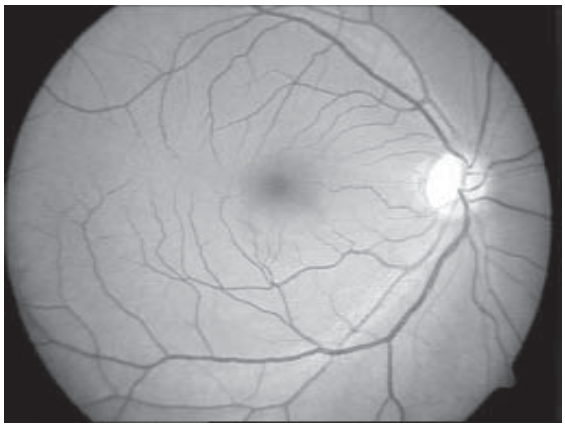


Fig. 8.14 - Normal Retina

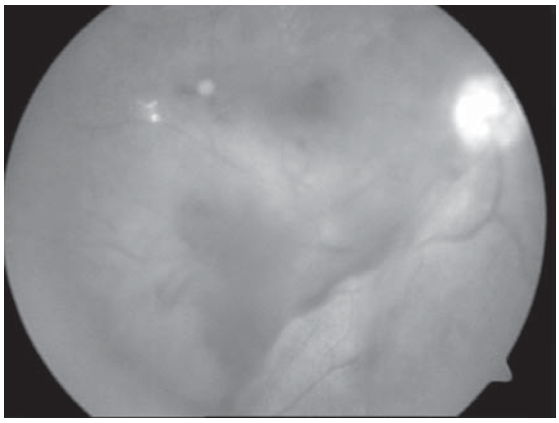


Fig. 8.15

Diseases of vitreous

Some common problems of the vitreous are

1. Floaters
2. Vitreous hemorrhage

1. Floaters

They are various kinds of opacities moving in front of the eye. They are due to presence of opacities in the vitreous which cast a shadow on the retina. They are a common complaint and are usually harmless.

Causes

- Blood in vitreous
  - Diabetic retinopathy
  - Vein occlusion
  - Trauma
- Degeneration of the vitreous
  - High myopia
  - Aging
- Inflammatory exudates
  - Retinitis
  - Uveitis
  - Optic neuritis
- Synchysis scintillans- cholesterol crystals in the vitreous

Management

Treatment is that of the cause in most cases.

Vitreous hemorrhage

Definition: bleeding into the vitreous (Fig. 8.15)

Source of hemorrhage: blood vessels in the retina

Causes

- Trauma to the eye
- Diseases of the blood vessels
- Diabetic retinopathy
- Retinal vein occlusions
- Inflammation of the retinal veins
- Diseases of retina
- Retinal tears
- Retinal detachment

Management

- Blood usually gets absorbed over a few months, hence observation initially.
- Vitrectomy: surgical method of removing vitreous if blood does not get absorbed.

Diseases of the retina

Some of the common and important diseases are;

1. Diabetic retinopathy
2. Hypertensive retinopathy
3. Retinal vein occlusions
4. Retinitis pigmentosa
5 Retinal detachment
6 Central serous retinopathy (CSR)
7 Retinoblastoma

1. Diabetic retinopathy

It is one of the most important ocular manifestations of diabetes. It is now a major cause of blindness in developed countries and is rapidly becoming an important cause of preventable blindness in developing countries.

Definition

It is a change seen in the retina of patients suffering from diabetes mellitus. Control of blood sugar level decreases the risk of developing severe diabetic retinopathy.

Classification

1. Non proliferative diabetic retinopathy
   Ophthalmoscopic features (Fig. 8.16)
   - Micro aneurysms
   - Hemorrhages
   - Hard exudates
   - Retinal oedema
2. Proliferative diabetic retinopathy
   ophthalmoscopic features (Fig. 8.17)
   - New vessels at the disc (NVD)
   - Fibrovascular bands
   - Vitreous detachment
   - Vitreous hemorrhage

Investigation

- Urine and blood sugar examination
- FFA (fundus flourescein angiography)

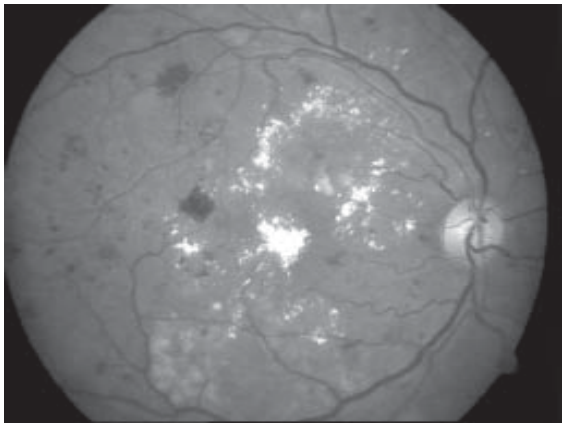


Fig. 8.16

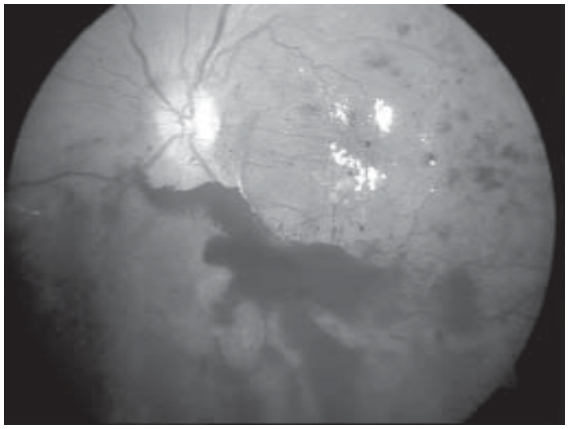


Fig. 8.17

Management

- **Medical treatment**: good diabetic control,
- **Laser treatment:** photocoagulation- to stop leaking from retinal vessels and bleeding from new vessels
- **Surgical treatment:** vitrectomy is done in case of vitreous hemorrhage, traction retinal detachment

2. Hypertensive retinopathy

vascular changes in the retina associated with systemic hypertension

Clinical features

Grade I - mild generalised narrowing of arterioles, particularly of small branches

Grade II - marked generalized narrowing associated with focal narrowing of arterioles

Grade III - grade II changes and also hemorrhages, cotton-wool spots and hard exudates

Grade IV – all changes of grade III plus papilloedema

Management

No special management is required for the retinopathy as most of the changes are reversible with adequate control of blood pressure.

3. Retinal vein eclosion

More common than the artery occlusions, it affects elderly patients in sixth or seventh decades of life.

Risk factors

- Hypertension
- Diabetes
- Arteriosclerosis

Clinical features

- Sudden loss of vision
- Oedema and hemorrhages all over the fundus including the macula

Complications

- Neovascular glaucoma: occurs in 50% of cases within three months (so called 90 days glaucoma)
- Vitreous hemorrhage
- Proliferative retinopathy

Treatment

- Proper control of diseases like hypertension, diabetes etc.
- Laser photocoagulation: for macular oedema and new vessels

Retinitis pigmentosa

Definition: It is a hereditary condition of the retina affecting the rods (Fig. 8.18).

Clinical features

- Night blindness (nyctalopia)
- Tubular vision: advanced cases

Fundus changes

- Waxy pallor of disc
- Narrowed vessels
- Bony spicule pigmentation

Treatment

- No permanent cure at present
- Supportive treatment
  - Vitamin A
  - Low vision aids - night vision devices, field expanders etc.
  - Visual rehabilitation
  - Genetic counselling- no consanguineous marriage (marriage among relatives)
  - Affected individuals discouraged to have kids

4. Retinal Detachment

Definition: separation of the retina from the retinal pigment epithelial layer (Fig. 8.19).

Risk factors

- Myopia
- Retinal degeneration
- Trauma

Symptoms

- Floaters
- Flashes of light (due to excitement of retina by vitreous movements)
- Early stages - field defects
- Sudden painless loss of vision - (in large and central detachments)

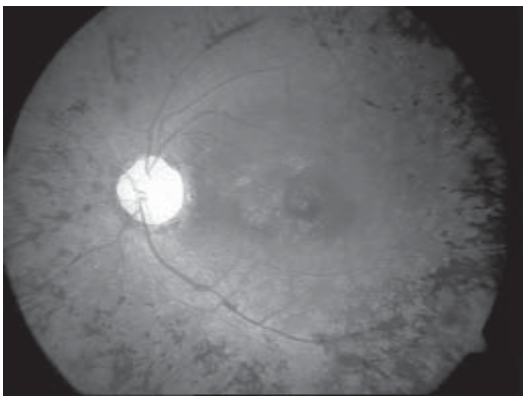


Fig. 8.18

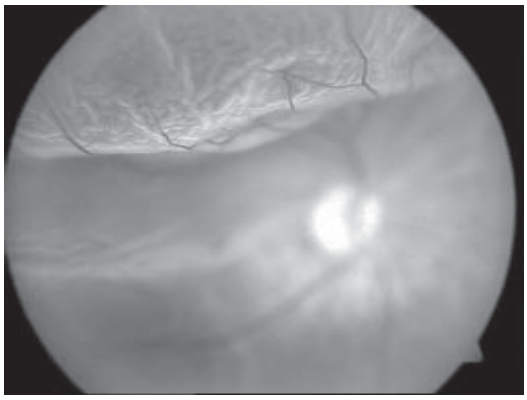


Fig. 8.19

Signs

- direct ophthalmoscopy: shows grey reflex instead of normal pink reflex
- indirect ophthalmoscopy: detached retina is grey, wavy and moves with eye movements -retinal break is seen

Treatment

Surgery: scleral buckling procedure

Central serous retinopathy (CSR)

Definition: It is due to detachment of retina in the macular region due to accumulation of fluid resulting in defective vision (Fig. 8.20).

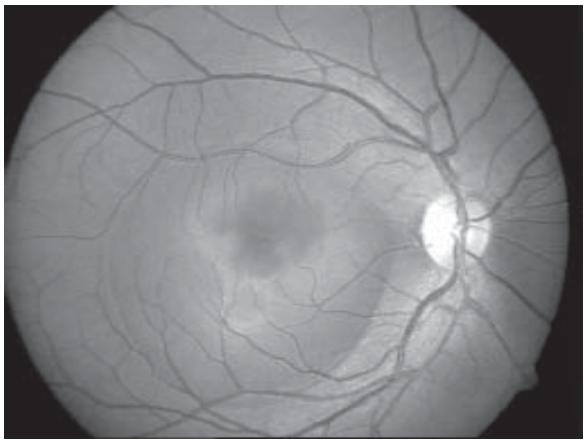


Fig. 8.20

Causes: not known

Symptoms

- Sudden onset of painless loss of vision
- Central scotoma (dark area)
- Micropsia (objects appears small)
- Metamorphopsia (irregularity of the objects)

Signs

- Ophthalmoscopy
  - Mild elevation of macular area
  - Foveal reflex is absent

Treatment

- Reassurance to the patient (usually resolves spontaneously without any treatment)
- Long standing cases (more than 4 months) : laser photocoagulation

7. Retinoblastoma

Definition: it is a malignant tumour of the retina occurring in children under 5 years. It is the most common intraocular malignant tumour of childhood. (Fig. 8.21)

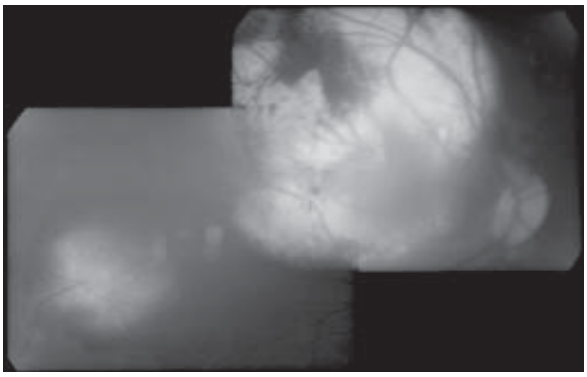


Fig. 8.21

Symptoms

- White reflex over the pupil (leukocoria)
- Squint

Signs

Indirect ophthalmoscopy: elevated fungating mass with satellite lesions seen in the retina.

Treatment

- Radiation therapy, chemotherapy
- Photocoagulation
- Cryotherapy
- Enucleation / excentration

Eale's disease

Eale's disease is one in which young people have haemorrhage in the retina. Eale's disease is generally found among young persons of 20 to 30 years. 70 percent of them are men. About 70 to 85 percent have both eyes affected.

Diseases of Orbit

The eye along with its surrounding structures like connective tissue, nerves, blood vessels, fat, muscles and glands have the potential to give rise to virtually any known neoplasm anywhere in the body. Certain

types of tumors are more common and specific to this organ. A brief discussion of the more important tumors follows.

Common orbital diseases of children

- Orbital cellulitis
- Rhabdomyosarcoma
- Capillary hemangioma
- Dermoid and epidermoid cysts
- Leukemia
- Lymphangioma
- Psueudotumor
- Optic nerve glioma
- Metastatic neuroblastoma
- Neuro fibroma

Common orbital diseases of adults

- Thyroid related ophthalmopathy
- Pseudo tumour
- Cavernous haemangioma
- Lacrimal gland tumour
- Lymphoma
- Lymphangioma
- Meningioma

Proptosis

Definition: forward protrusion of the eyeball beyond the orbital margin.

Causes

- Inflammatory
  - Acute - orbital cellulitis
  - Chronic - pseudotumor
- Neoplastic
  - Benign - dermoid
  - Malignant - rhabdomyosarcoma
- Parasitic
  - Cysticercosis
  - Hydatid cyst
- Vascular- retrobulbar haemorrhage
  - Orbital varices
  - Aneurysm
- Systemic diseases
  - Thyroid ophthalmopathy
  - Leukaemic deposits

Measurement of proptosis: Exophthalmometry

Investigations

- Thyroid function test
- X-ray orbit
- USG
- CT and MRI
- Biopsy

Treatment

- Medical – for orbital cellulitis, thyroid disease.
- Radiotherapy- for secondary deposits and malignant tumours
- Surgical a. tarsorrhaphy: to protect the exposed cornea, b. orbitotomy to remove the tumour

Thyroid ophthalmopathy

It is the most common cause of both unilateral and bilateral proptosis in adults.

Ocular manifestations

- Retraction of eyelids
- Lid lag
- Lagophthalmos – incomplete closure of eye lids
- Infrequent blinking
- Increased lid pigmentation
- Extra ocular muscle palsies

Investigations

- Thyroid function test: T3 and T4 levels
- USG: shows enlargement of extra ocular muscles
- CT scan: enlargement of muscles
- Optic nerve compression can be demonstrated.

Orbital cellulitis

Definition: infection of the fat and cellular tissues of the orbit.

Causes

- Sinus infection
- Penetrating orbital injury
- Thrombophlebitis
- Post operative: following enucleation of the globe
- Dental or naso-pharyngeal infection. Causative organism: streptococcus, staphylococcus, haemophilus

Types

a. Preseptal
b. Orbital

Symptoms

- Pain and swelling of the lids
- Lacrimation and photophobia
- Diplopia due to limitation of movements
- Impairment of vision at later stages
- Frequently associated with fever

Signs

- Lid oedema and tenderness
- Conjunctival congestion
- Proptosis
- Limitation of ocular movements
- Ophthalmoscopy: features of optic neuritis in severe cases

  Complications: cavernous sinus thrombosis

Treatment

- Admit the patient
- Broad spectrum antibiotics systemically

Neuro ophthalmology

Some of the common and important diseases in neuro ophthalmology are

1) Optic neuritis
2) Papilloedema
3) Optic atrophy
4) Cranial nerve palsies

Optic neuritis

Definition: Inflammation of the optic nerve

Causes

- Idiopathic
- Childhood infection (e.g.,: measles, mumps)
- Viral infection (e.g.,: encephalitis, herpes zoster)
- Systemic diseases (e.g.,: syphilis, tuberculosis)
- Local inflammations (e.g,: sinusitis, meningitis, orbit)
- Intraocular inflammation

Symptoms

- Uniocular sudden loss of vision
- Pain behind the eye ball particularly while moving

Signs

- Visual acuity may be 6/60 or less
- Pupil: relative afferent pupillary defect
- Colour vision: defective
- Field defect: central, centrocaecal scotoma

Fundus

a) Hyperemia of the disc
b) Oedema of the disc
c) Small hemorrhages on the disc

Treatment: systemic and oral steroids

Papilloedema

Definition: non-inflammatory swelling of the optic disc produced by raised intracranial pressure.

Causes

- Congenital: e.g.,: aqueductal stenosis
- Space occupying intracranial lesions
- Head injury
- Infection: meningitis and encephalitis
- Malignant hypertension

Symptoms

a. General symptoms:
   1. Headache
   2. Vomiting

b. Ocular symptoms
   1. Visual acuity normal
   2. Transient blackout of vision for few seconds
   3. Fields: enlargement of blind spot

Signs

a) Blurring of disc margin

b) Disc hyperemia

c) Dilated vessels

d) Hemorrhages on disc

Treatment: Given according to the cause of the disease.

Optic atrophy

Definition: death of the optic nerve fibres characterized by pallor of the disc.

Causes

- Glaucoma
- Trauma
- Retinitis pigmentosa
- Central retinal artery occlusion
- Papilloedema
- Optic neuritis

Symptoms

- Sudden or gradual loss of vision
- Defective color vision

Signs

- Visual acuity impaired
- Relative afferent pupillary defect (RAPD)

Fundus

- Pallor of disc
- Narrowing of blood vessels

Treatment: The specific cause should be treated before the onset of optic atrophy. The damaged part of optic nerve cannot be recovered.

Cranial nerve lesions

Third nerve palsy

- Ptosis (falling down of upper eyelid) - levator muscle paralysis
- Restriction of adduction- medial rectus paralysis
- Restriction of elevation- superior rectus paralysis
- Restriction of depression - inferior rectus paralysis

Fourth nerve palsy

- Double vision on looking down
- Paralysis of superior oblique muscle

Sixth nerve palsy

- Double vision on looking to the side of lesion
- Paralysis of lateral rectus muscle

Diseases of the uvea

Uveitis

Definition: inflammation of the uvea (iris, ciliary body and choroid)

Inflammation of iris - Iritis

Inflammation of ciliary body - Cyclitis

Inflammation of choroid - Choroiditis

Classification

- Anterior uveitis (irido-cyclitis) : inflammation of the iris and the ciliary body.
- Intermediate uveitits - inflammation of ciliary body.
- Posterior uveitis: inflammation of the choroid with or without cyclitis.
- Pan uveitis : iritis + cyclitis + choroiditis

Anterior uveitis

Causes

- Bacteria – tuberculosis, leprosy
- Virus – herpes simplex, herpes zoster

- Fungus – histoplasmosis
- Parasite - toxoplasmosis, toxocariasis
- Systemic diseases- joint diseases
- Trauma

Symptoms

- Pain
- Redness
- Defective vision
- Photophobia
- Watering

Signs

- Vision diminished
- Conjunctiva – circumciliary congestion
- Cornea – oedema keratitic
  - Keratitic precipitates (KP's): cells that stick to the back surface of cornea (endothelium)
- Anterior chamber
  - Cells : inflammatory cells
  - Flare : due to increased protein content of the aqueous
  - Hypopyon: large accumulation of inflammatory cells in the lower part of anterior chamber.
- Pupil – small and irregular (sluggish pupillary reaction)
- Synechiae
  - Sticking of iris to the lens capsule (posterior synechiae)

Treatment

Mydriatics: e.g., Atropine eye drop or ointment (1%)

Steroids

- Topical : dexamethosone - 1 drop hourly to 4 times per day - eye ointment at bed time
- Subconjunctival - 0.5 ml per day dexamethasone
- Oral - 1mg prednisolone per kg per day and tapered as condition improves, Painkillers - paracetamol or ibuprofen

Complications

- Band keratopathy
- Complicated cataract
- Retinal detachment
- Optic neuritis

Posterior Uveitis (choroiditis)

Symptoms

- Defective vision
- Floaters - seeing black dots
- If central area is involved
  - Metamorphopsia (distortion)
  - Micropsia (objects appear smaller)
  - Macropsia (objects appear larger)
- Photopsia (flashes of light)

Signs

Requires indirect ophthalmoscopy to detect the various abnormalities in the retina and choroid.

Treatment

It depends upon the cause. It is better to refer the case for investigation and treatment in a well equipped eye center.

Loss of sight due to malnutrition

The eye specialists of countries like India, Srilanka, Bangladesh, Nepal, Indonesia and Thailand encounter many children with nutritional blindness. Many countries in Africa and South America also have large incidence of such cases. The deficiency of vitamins affects the eye, and it is estimated that about half a million children become blind every year as a result of this deficiency.

Reasons for children losing eye sight

a. Vitamin A deficiency
b. Infection in the mother's vagina during child birth
c. Injury due to hits from sticks, crackers

Children below five years are affected by vitamin A deficiency. The effects are seen in the eye in the

form of dryness, is called Xerophthalmia which means 'dry eye'. Night blindness or inability to see in dim light is one of the early manifestations of the disease. There are structural changes in the eye. Conjunctiva becomes dry and wrinkled. Pearly grey, elevated patches called Bitot's spots may be seen. In severe deficiency the cornea is also involved resulting in complete loss of vision.

Night blindness is recorded as early as 1600 B.C and the liver of the sheep was given to treat it. Now we know that liver has Vitamin A. Jacques Gilmo described the condition in 1585. A Dutch man at the same time wrote a poem about night blindness and liver given as cure.

Inadequate diet, diarrhoea, measles and diseases of lungs aggravate Vitamin A deficiency. Vitamin A deficiency is noticed in most economically backward families.

Causes for Vitamin A deficiency

Poverty, ignorance and faulty food habits are responsible for vitamin A deficiency. Inadequate intake of food rich in vitamin A is the main reason. When pregnant women have the deficiency, their children have less vitamin A in their liver. It must be noted that 95 percent of Vitamin A is stored in the liver. When the child is breast fed, the child gets poor supply of Vitamin A from mother's milk. Again the deficiency occurs when supplementary food is delayed after four months. When the infant has diarrhoea, measles and other infections of lungs, Vitamin A in the body gets depleted. Further protein-energy deficiency and other infections affect absorption and storage of Vitamin A in the body leading to deficiency.

Signs of Vitamin A deficiency

Night blindness

The first manifestation of Vitamin A deficiency is night blindness. This is caused by damage to the cylindrical light sensitive rod cells in the retina. Patients with this defect cannot see in dim light, and at night. The disease can be noticed when the child falters in the dim light or when he is not able to eat properly. They must be given treatment at once.

Bitot spots

This symptom was first noticed and explained by the French doctor Bitot in 1863. Conjunctiva becomes dry and wrinkled. Pearly grey elevated patches are seen. The number of children below age five affected by this is less; it is high in school age children.

Dry conjunctiva

The conjunctival epithelium becomes dry due to lack of tears. When the disease becomes acute, cornea loses its brightness and will be bluish white.

Corneal ulcer

There are other reasons for corneal ulcers. But if it is due to the dryness of cornea, the layer of the cornea will be partly or fully damaged. This results in lesions, making cure difficult.

The cornea becomes soft and dissolves. The liquid inside will come out as the eye ball shrinks.

Lesions or scars appear in the cornea when there is injury or infection. Children with Vitamin A and protein deficiency are more susceptible.

These signs and symptoms need not take place in that order. If it is accompanied by infection like measles, cornea becomes ulcerated.

Treatment

As soon as Vitamin A deficiency is noticed in children between 1 and 6 years, Vitamin A of 200,000 IU must be orally administered. It must be repeated next day and after one month.

For children below 1 year or weighing below 8 kilo, the same treatment is given with a reduced dose of 100,000 IU.

Prevention of Vitamin A deficiency

Vitamin A is a fat-soluble vitamin and is present in animal foods such as butter, eggs and liver. It is stored in the liver and used by the body whenever required.

When the child has an attack of diarrhoea, measles etc., administering 2 lakhs IU of Vitamin A will prevent deficiency. Likewise breast feeding mothers must be given a similar dose of Vitamin A. The children will get it. Mothers must be given Vitamin A within a month of child birth. When the child finds it difficult to see sunlight, it must be given vitamin A supplement. The breast milk immediately after child birth is rich in vitamin A and it must be given to infants. Breast feeding for 6 months ensures a good supply of it. Vitamin A is found in green leafy vegetables, drumstick leaves, carrots, curry leaves, mint and coriander leaves, yellow pumpkin, papaya, radish, tomatoes and mangoes, milk, eggs, fish, liver, fish liver oil etc. Papaya is rich in Vitamin A. There are false beliefs about eating it. Children and mothers can eat it without fear. Children below five years must be given one glass of milk a day.

50 grams of leaves will give enough Vitamin A for adults. Children below six get enough Vitamin A if they are given 50 grams of any leaves cooked in any form liked by them. After cooking it will fill a tablespoon. It can be mixed with other items of food. Small children can be given papaya and mangoes rich in carotenes or milk, egg and liver rich in retinol.

Vitamin A is fat soluble. For Vitamin A to be absorbed a small quantity of fat is required. Some oil or fatty food must be added to the diet daily.

Headache

Headache is a common symptom, the cause of which can be as simple and harmless as a muscle tension headache or as serious and dangerous as haemorrhage or tumour in the brain. In clinical practice psychological 'tension' headache is seen most frequently.

Pain sensitive structures in the head

Within the cranial cavity the membranes covering the brain, arteries and veins are sensitive to pain. The brain is not sensitive to pain! Pain in the head is felt through the 5th, 9th and 10th cranial nerves. All the layers of the scalp are pain sensitive and headache arising from the muscles or blood vessels are very common.

Diagnostic approach

History

Most information is derived from determining

- The first attack or previous attacks
- Whether onset is acute or gradual (days or weeks)
- Whether attacks have recurred for many years (chronic)
- Site of headache
- Accompanying symptoms
- Precipitating factors

Headache in children

All the causes of adult headache (except retrobulbar neuritis, glaucoma, temporal arteritis and cervical spondylosis) may cause headache in children. In this age group, the most common type of headache is that accompanying any febrile illness or infection of the nasal passages and sinuses.

The complaint of headache by a child should not be taken lightly: the younger the child, the more likely the presence of an underlying organic disease. Fever may not only represent a mild 'constitutional' upset, but may also result from meningitis, encephalitis, brain abscess or tuberculoma. The presence of neck stiffness and / or impaired conscious level indicates the need for urgent medical care.

Although intracranial tumours are uncommon in children, when they occur they tend to lie in the midline (e.g., medulloblastoma, pineal region tumours). As a result, obstructive hydro-cephalus often develops acutely with headache as a prominent initial symptom.

In a child with unexplained headache, CT scan should be performed

- if the presentation is acute
- if the severity progressively increases
- if the school performance declines or other symptoms such as a sudden change in personality.

- if the head circumference increases
- if the child is under 5 years of age

Headache : Specific causes

A. Tension type headache

This is the most common form of headache experienced by 70% of males and 90% of females at some time in their lives.

Characteristics

Diffuse, dull, aching, band-like headache, worse on touching the scalp and aggravated by noise; associated with tension but not with other physical symptoms.

Duration

Many hours – days

Frequency

Infrequent or daily; worse towards the end of the day. May persist over many years.

Mechanism

Muscular, due to persistent contraction, e.g., clenching teeth, head posture, furrowing of brow.

Treatment

Reassurance
Attempt to reduce psychological stress
Anxiolytics
Anti-depressants

B. Migraine

Migraine is a common, often familial disorder characterised by unilateral throbbing headache.

Onset

Childhood or early adult life

Incidence

Affects 5-10% of the population

Female male ratio

The female / male ratio is 2:1

Family history

Positive in 70% of all sufferers

Two recognisable forms exist:

1. Migraine with aura (Classic migraine)

An aura or warning of visual, sensory or motor type followed by headache throbbing, unilateral, worsened by bright light, relieved by sleep, associated with nausea, and occasionally vomiting.

2. Migraine without aura (Common migraine)

The aura is absent. The headache has similar features but it is often poorly localised and its description may merge with that of tension headache.

The aura of migraine may take many forms. The visual forms comprise flashing lights, zig-zags (fortifications), scintillating scotoma and may precede visual field defects. Such auras are of visual (occipital) cortex origin.

The headache is paroxysmal, lasting from 2 to 48 hours and rarely occurring more frequently than twice weekly.

Mechanism

Whether migraine is primarily a vascular or neuronal disorder remains controversial. Chemical neuro transmitters, 5 hydroxytryptamine (5 HT) synonym: serotonin and noradrenaline seem responsible for controlling the diameter of extra-and intracranial blood vessels.

Specific types of migraine with aura

Basilar

It is characterised by bilateral visual symptoms, unsteadiness, dysarthria, vertigo, limb paraesthesia, even quadriparesis. Loss of consciousness may ensue and precede the onset of headache. This form of migraine affects young women.

Hemiplegic

Characterised by an aura of hemoplegia which unusually persists for some days after the headache

has subsided. Often misdiagnosed as a stroke. Recovery is the rule.

Ophthalmoplegic: characterised by extraocular nerve palsies, usually the 3rd, rarely the 6th. These may result from dilatation of the internal carotid artery with stretching of the 3rd or 6th cranial nerve within the cavernous sinus.

Precipitating factors in migraine

- Dietary: alcohol, chocolate and cheese (contain tyramine)
- Hormonal: often premenstrual or related to oral contraceptive (fluctuation in oestrogen)
- Stress, physical fatigue, exercise, sleep deprivation and minor head injury

Diagnosis

Clinical history with

- Occasional positive family history
- Travel sickness or migraine variants (abdominal pains) in childhood
- Onset in childhood, adolescence, early adult life or menopause.

Differential diagnosis

- Partial (focal) epilepsy (in hemiplegic or hemisensory migraine)
- Aneurysm compressing 3rd cranial nerve
- Transient is chaemic attack (in hemiplegic or hemisensory migraine)
- Arteriovenous malformation- give rise to well-localised but chronic headache
- Hypoglycemia

Management

- Identification and avoidance of precipitating factors
- Prophylaxis: - pizotifen (5HT2 receptor blocker)
  - Propranolol (beta adrenergic receptor blocker)
  - Methysergide (5 HT 2 receptor blocker)
- Treatment of acute attack
  - Simple analgesics (eg. aspirin)
  - Sumatriptan (a selective 5HT1 agonist)
  - Ergotamine

C. Cluster headache (Histamine cephalogia)

Cluster headaches occur less frequently than migraine, and more often in men than women, with onset in middle age.

Characteristics

Severe unilateral pain around one eye, associated with conjunctival injection, lacrimation, rhinorrhoea and occasionally a transient Horner's syndrome.

Duration

10 minutes to 2 hours

Frequency

Once to many times per day, often wakening from sleep at night. Clusters of attacks separated by weeks or even many months. Alcohol may precipitate the attacks.

Mechanism

Serum histamine levels rise during the attacks, hence 'histamine cephalgia'.

Treatment

Antihistamines give disappointing results. Ergotamine and sumatriptan may give relief. In some cases prednisolone is used.

D. Giant cell (Temporal) arteritis

Giant cell arteritis, an autoimmune disease of unknown cause, presents with headache in the elderly. This is severe and throbbing in nature and overlies the involved blood vessel, usually the superficial temporal artery, although the condition may affect any extra - or intracranial vessel.

Palpation reveals a thickened, tender but non-pulsatile artery.

Neurological symptoms

Strokes, hearing loss, myelopathy and neuropathy may result.

Jaw claudication

Pain when chewing or talking due to ischaemia of the masseter muscles is pathognomomic and occurs in a high proportion of patients.

Visual symptoms are common, with blindness (transient or permanent) or diplopia.

Associated systemic symptoms: weight loss, generalised muscle aches, polymyalgia rheumatica in one-fifth of cases.

Duration

The headache is intractable lasting until treatment is started.

Mechanism

Large and medium-sized arteries undergo intense giant cell formation, with fragmentation of the laminae and narrowing of the lumen, resulting in distal ischaemia as well as stimulating pain sensitive fibres. Occlusion of important end arteries eg. the ophthalmic artery, may result in blindness; occlusion of the basilar artery may cause brain stem or bilateral occipital infarction.

Diagnosis

The ESR is usually high. Blood film shows anaemia or thrombocytosis. C-reactive protein and hepatic alkaline phosphatase are elevated. Biopsy of 1 cm length of temporal artery is often diagnostic.

Treatment

Urgent treatment, prednisolone 60mg daily, prevents visual loss or brain stem stroke, as well as relieving the headache. If complications have already occurred eg. blindness, high dose parenteral steroids are given.

E. Headache from raised intracranial pressure

Characteristics

- Generalised
- Aggravated by bending or coughing
- Worse in the morning on awakening; may awaken the patient from sleep
- The severity of the headache gradually progresses

Associated features

- Vomiting in later stages
- Transient loss of vision (obscuration) with sudden change in posture
- Eventual impairment of conscious level

Management

Further investigations like CT scan, MRI scan of the brain are essential.

F. Headache due to intracranial Haemmorhage

Characteristics

- Instantaneous onset
- Severe pain, spreading over the vertex to the occiput; or described as a "sudden blow to the back of the head"
- Patient may drop to knees or lose consciousness

Associated features

- Usually accompanied by vomiting
- Focal neurological signs suggest a haematoma

Management

Further investigations like CT scan and lumbar puncture are essential.

G. Non-neurological causes of headache

Local causes

Sinuses

Well localised. Worse in morning. Affected by posture, eg. bending. On X ray are sinuses opacified.

Treatment

Decongestants or drainage.

Ocular

Refractive errors may result in muscle contraction headaches; they resolve when corrected with glasses. Glaucoma does not produce headache without other

symptoms, e.g., misting of vision, haloes. Cupping is seen on fundoscopy.

Dental disease

Discomfort localised to teeth. Check for malocclusion. Check temporo mandibular joints.

Systemic causes

Headache may accompany any febrile illness or may be the presenting feature of accelerated hypertension or metabolic disorders, e.g., hypoglycaemia, hypercalcaemia.

Many drugs produce headache

- Through vasodilatation e.g., bronchodilators, antihistamines
- On withdrawal e.g., amphetamines, benzo-diazepines, caffeine.

Key points to remember

1. *Inflammed condition of the eyelids should be treated by hot fomentation.*
2. *In all abnormal conditions of the eye lid corneal damage may occur.*
3. *In corneal ulcers the condition of the sac and diabetic status of patient should be assessed.*
4. *No bandage should be applied in corneal ulcer or conjunctivitis.*
5. *In allergic conjunctivitis and post-operative follow-up cases, patient should be given proper advice if steroids are used, as they can get glaucoma if used long term.*
6. *While dispensing spectacles for refractive errors, the pupillary center and the optical center must be aligned correctly.*
7. *Amblyopia should be identified and treated before 8 years after which there will be not much improvement*
8. *All diabetic retinopathy patients should come for regular follow up.*
9. *Optic neuritis has good visual recovery if treated appropriately with steroids.*
10. *Thyroid ophthalmopathy is the most common cause of proptosis in adults.*
11. *Schiotz tonometry should not be done in active corneal lesions and conjunctivitis.*
12. *Dilating drops should not be applied in shallow anterior chamber and phacomorphic glaucoma.*

Choose the correct answer

1. *Rolling in of the eye lid is*
   a. Trichiasis *b. Entropion*
   c. Ectropion *d. Ptosis*
2. *Lacrimal probing is indicated in*
   a. Congenital dacryocystitis
   b. Acute dacryocystitis
   c. Chronic dacryocystitis *d. Lacrimal fistula*
3. *Ophthalmia Neonatorum is caused by*
   a. Toxocara *b. Gonococcus*
   c. Endogenous protein *d. Toxoplasma*
4. *Dentrite (branched) appearance is seen in*
   a. Fungal ulcer *b. Bacterial ulcer*
   c. Nutritional ulcer *d. Viral corneal ulcer.*
5. *Presbyopia commonly occurs at*
   a. 30 yrs of age *b. 40 yrs of age*
   c. 50 yrs of age *d. 60 yrs of age.*
6. *Synechia denotes*
   a. Cells *b. Flare*
   c. Keratie precipitates *d. Adhesion*
7. *Retinal detachment is common in*
   a. Emmetropia *b. Hypermetropia*
   c. Myopia *d. Presbyopia*
8. *Ptosis is caused by paralysis of*
   a. Optic nerve *b. Occulomotor nerve*
   c. Facial nerve *d. Trochlear nerve*
9. *Proptosis is*
   a. Dropping of upper lid
   b. Forward protrusion of the eye
   c. Inward displacement of the eye
   d. retraction of upper lid
10. *Which is the most common surgical procedure in cataract extraction*
    a. Intracapsular *b. Extracapsular*
    c. Phacoemulsification *d. Couching*

11. *Which of the following anti-glaucoma medicines constricts pupil?*
    a. Timolol *b. Acetazolamide*
    c. Pilocarpine *d. Mannitol*

B. Fill in the blanks

1. *Cataract is treated by ————————*
2. *10% KOH wet preparation is done to detect ——————————in corneal ulcer.*
3. *The condition of eye with refractive error is known as ————————————*
4. *Decrease in visual acuity without any disease in the eye is ————————*
5. *————is inflammation of the choroid, ciliary body and iris.*
6. *————————is the most important ocular manifestation of diabetes.*
7. *Retinal detachment is separation of ———— form the ——— layer.*
8. *Papilledema is swelling of the optic disc due to ——————*
9. *———— is the most common cause of both unilateral and bilateral proptosis in adults.*

Change one or more words to make them true

1. *Measurement of proptosis is done by tonometry.*
2. *Antibiotics are used in the treatment of optic neuritis.*
3. *Retinoblastoma is benign tumor of the retina.*
4. *Flare in uveitis is due to increased cholesterol content in the aqueous.*
5. *Strabismus amblyopia is difference in refractive power between both eyes.*
6. *Keratoconus is thickening of central part of cornea.*
7. *Ciliary congestion is seen in conjunctivitis.*
8. *For chronic dacryocystitis in younger age DCT is done.*
9. *Inadequate closure of eye lid is called ptosis.*
10. *Acute inflammation of meibomian gland is called chalazion.*

Match the following

1.	*External hordeolum*	*- Concave lens*
2.	*Vernal Catarrh*	*- Reassurance to patient*
3.	*Subconjunctival hemorrhage*	*- Cold compresses*
4.	*Myopia*	*- Hot compresses*
5.	*Presbyopia*	*- Convex lens*
6.	*Squint*	*- Cover test*
7.	*Anterior Uveitis*	*- Hard contact lens*
8.	*Retinitis pigmentosa*	*- Occlusion Therapy*
9.	*Amblyopia*	*- Low vision aids*
10.	*Keratoconus*	*- Mydriatics*

Find the odd man out

1. *Entropion, ectropion, ptosis, chalazion*
2. *Pterygium, pinguecula, keratoconus*
3. *Myopia, hypermetropia, presbyopia*
4. *Esotropia, exotropia, amblyopia*
5. *Diabetic retinopathy, hypertensive retinopathy, retinal vein occlusion, retinoblastoma.*

Give reasons for the following

1. *Lagophthalmos in facial nerve palsy.*
2. *Discharge from the eyes in dacryocystitis.*
3. *Foreign body sensation in conjunctivitis.*
4. *Night blindness in retinitis pigmentosa.*
5. *Flashes of the light in retinal detachment.*

Answer these Questions

1. *What is the difference between ciliary congestion and conjunctival congestion?*
2. *What are the 2 things you should not do in a case of corneal ulcer?*
3. *What are the precautions you take in care of conjunctivitis to prevent its spread?*
4. *What are the stages of cataract?*

CHAPTER 9 FUNDAMENTALS OF OPHTHALMIC INSTRUMENTS AND THEIR MAINTENANCE

OUTLINE

Torch
Direct ophthalmoscope
Indirect ophthalmoscope
Schiotz tonometer
Applanation tonometer
Slit lamp
Gonio lens
Keratometer

GOALS

The Ophthalmic Assistant will know the instruments used in the out-patient department, their functions and care.

OBJECTIVES

The OA will be able to

- Identify various types of instruments
- Discuss the purpose of each instrument
- Demonstrate use of the instruments
- Describe the maintanance of instruments

CHAPTER 9

Fundamentals of Ophthalmic Instruments and their Maintenance

This chapter on introduction to instrumentation and maintenance contains valuable information about the instruments used in an outpatient department on a daily basis. As an ophthalmic assistant it is essential to identify instruments, the purpose it is used for and how to maintain the instruments. Good maintenance of the instruments prolongs its life and helps in obtaining accurate data from patients.

Different types of instruments

- Torch light
- Binocular loups
- Slit lamp
- Direct ophthalmoscope
- Indirect ophthalmoscope
- Schiotz tonometer
- Applanation tonometer
- Non-contact tonometer
- Fundus viewing lens
- Gonio lens
- Trial frame and test lenses
- Retinoscope
- Keratometer
- Neuro tray for neurological examination

Torch light (flash light)

A torch light is an instrument used by an ophthalmologist to examine the eye of a patient. A good torch light should give a circular patch of light of nearly uniform brightness

Description

The front glass cover, the bulb, the concave reflector, the switch, the cells and the barrel are the main parts of the torch. Since it is very expensive to replace the batteries frequently, a 500m A step down transformer can be used.

Care

- Keep the torch light off when not in use.
- Remove the cells when it is not to be used for more than a day, or else there will be leakage which will cause corrosion of the barrel and switch contacts.
- Torch light should be kept on the table with a support or else it will roll off the desk

Maintenance

- Wipe the dust on the barrel of the torch light and on the front glass every day.
- When the illumination is not sufficient, replace the cells with fresh cells.
- When the bulb is fused out, replace it with the same type of bulb.

Quality control

The torch light should give a bright spot light of uniform illumination when the light is aimed at a wall from a distance of about ½ a meter in the day light.

Spare parts

- A spare bulb
- A pair of fresh cells

Ophthalmoscope

Direct ophthalmoscope

Light from a bulb is reflected at right angles and projected at a spot. This spot of light is used to view the fundus through the pupil of the eye (Fig. 9.1).

Fig. 9.1 - Direct ophthalmoscope

- Electrical system
  - Dry cells or rechargeable batteries
  - Dwitch with a rheostat that controls the current flow through the bulb for changing its brightness
- Optical system (the head)
  - This is fitted on the handle with the spring loaded lock
  - It consists of
    - System of condensing & focusing lens
    - Reflector to produce the spot of light.
    - The viewing system
  - Consist of a wheel with lenses of different powers ranging from -20 to +20D
  - The power of the lens used for viewing is indicated on the disc and can be seen through a window in the head
- There is a provision in the head for changing the spot size or for obtaining a semi-circular spot or for reducing it to a streak
- There is a provision in the head for obtaining red free light by inducing filter in the path of light

Do's and Don'ts

- The cells have to be replaced when the battery is low
- Both the cells should be replaced
- When fresh cells are loaded the voltage could go upto 3.1v (usually 2.5 v or 2.8 v). It should not be turned to maximum brightness
- In case of rechargeable batteries, the batteries should be recharged periodically
- Sudden jerks or impact to the instrument on the table should be avoided to prevent the bulb from getting fused
- Store the instrument with the viewing lenses set at zero

Maintenance

- Remove the dust and stain on the outside of the instrument
- When not in the use keep the instrument in the box / pouch provided for it
- During rounds it should always be carried in the box / pouch provided for it
- Reverse the cell at the end of the day

Spare parts

1. A spare bulb
2. A pair of fresh cells

Indirect ophthalmoscope

The modern indirect ophthalmoscope helps to view the fundus with the help of a hand held high positive aspheric lens (20D) (Fig. 9.2).

Description

- **An illuminating system:** consists of tungsten filament lamp or halogen lamp, a front silvered concave reflector, two condensing lens and provision for introducing filters.

Fig. 9.2 - Indirect ophthalmoscope

- **An electric system:** consists of step down transformer provided with switch, a rheostat, a fuse and a sufficiently long connecting cable.
- **Stereoscopic viewing system(vision box):** Has two eye pieces which can be moved laterally according to the user's interpupillary distance (IPD). The vision box is attached to the illuminating system. The light from the image of 20D lens is divided into two beams by mirrors in the vision box before reaching doctor's eye through eye piece.
- **A headband that supports the illumination system:** the illuminating system and the attached vision box are attached to the head band which the ophthalmologist wears. The cable for the lamp is also attached to the head band.

Care

- Use the bulb in a low illumination setting. When there is a need to increase it to a high illumination use it only for brief periods.
- The instrument should be hung using its head band only, it should not be hung on a hook by its electrical cord, since it may cause electrical failure.
- When not in use switch it off.

Maintenance

- Remove the dust and stain on the instrument daily with a clean dry cloth
- When not in use, keep the instrument in its box and keep the box closed
- The head band may get oily and may also become wet with the sweat of the ophthalmologist. The instrument must be wiped clean to remove the oil and the sweat
- When the bulb is fused out, take it to the ophthalmic instrument service station or to the dealer to get the bulb changed

Spare parts

- A spare bulb
- A spare fuse

Difference between direct and indirect ophthalmoscopes

	Direct ophthalmoscope	Indirect ophthalmoscope
Pupil	Undilated	Fully dilated
Image	Not inverted	Vertically and horizontally inverted
Field of view	Small(6°)	Wider(25°)
Magnification	Large (15)	Small (x3 in 20D lens) (x5 in13D lens)
Binocularity	Absent	Present
Effects of patients' refraction error on the image	More	Less

Advantages of the instrument

- Stereoscopic view
- Wider field of view
- Increased illumination
- Reduced distortion
- Ophthalmologist works from a distance

Slit lamp

Slit lamp is an instrument used to study the anterior segment of the eye under magnification (Fig. 9.3).

Fig. 9.3- Slit lamp

Purpose

- The slit lamp microscope enables the observer to view binocularly eyelids, lashes, conjunctiva, sclera, cornea, anter- ior chamber, iris, lens and the anterior portion of vitreous and permits the detection of the disease in these areas.
- It permits the examination of the angle structures, using gonio lens
- It helps to view the fundus using either 90 D, or 78 D lens
- The attachment of an applanation tonometer permits the measurement of intra ocular pressure
- It is used to deliver laser treatment to any required place in the eye

Description of the instrument

It consists of three major components

1. An illuminating system consists of light source, mirrors and prisms
2. Magnification system consists of the biomicroscope
3. Mechanical system consists of
   a) Chin rest mounted on a vertical stand for placing the patient's chin in correct position. A head rest with a head band is available for securing the patients head to the stand if necessary. The height of the chin rest is adjusted manually to bring the chin rest to the level of the patient's chin
   b) The table is provided with castor wheels for ease in moving the equipment from one place to an other. The castor wheels have a locking mechanism to fix the equipment in place
   c) A joystick is provided to move the illuminating system and the microscope together up or down, left or right, forward or backward as needed during observation

The bulbs used in the illuminating system are of low voltage and a suitable transformer is provided with the slit lamp. It is always advisable to use the transformer in its lowest setting for most of the observation and to use a higher setting for a brief period for a detailed examination.

Care

- The slit lamp should to be located in a place easily accessible to the ophthalmologist in the examination room.
- An electrical plug point should be available near the equipment
- The connecting wire should not be in the path of the patients or staff.
- Remove the dust and clean the slit lamp daily
- When not in use keep the equipment covered with the dust cover
- When the ophthalmologist examines an infected case such as a corneal ulcer or conjunctivitis, clean the head band and the parts touched by the ophthalmologist and patient in the slit lamp with a clean cloth using spirit

Maintenance

1. The optical paths of the microscope may get growth of fungi if the instrument is not properly cared for. Proper maintenance is required.
2 The knob or the wheel is spring loaded and the adjustment of the load is such that the motions of the knob or wheel is not too tight or too lose. Lubricating the movable parts makes the adjustments easier to manipulate.

The instruments used in measurement of intra ocular pressure are;

1. Schiotz tonometry
2. Applanation tonometry
3. Non contact tonometer

Schiotz Tonometry

Simple, portable, inexpensive instrument used in the measurement of IOP (Fig. 9.4).

Fig. 9.4 - Schiotz Tonometer

Principle

Schiotz indentation tonometry relies on the principle of indentation in which a plunger with a preset weight indents the cornea.

Parts of the Schiotz tonometer

It consists of the following

- Handle for holding the instrument in vertical position on the cornea
- Foot plate which rests on the cornea
- Plunger which move freely within the shaft in the foot plate
- A bent lever whose short arm rests on the upper end of the plunger and a long arm acts as a pointer needle.
- Scale
- Weights 5.5 gm is fixed to the plunger. Extra weights 7.5 and 10 gms are also with the instrument.

Measurement -The weight rests on the plunger, and attached to it is a pointer needle and scale for measurement. The tonometer is placed on the cornea, a reading is taken from the scale. The number is converted to millimeters of mercury (mm Hg) by using a conversion card.

Care

- The instrument should be kept meticulously clean.
- Calibration should be tested before using - A test block is provided with each tonometer. The tonometer is held perpendicular to the test block, and when placed on the block the needle should align at zero position. There is a nut screw on tonometer that can be loosened so that needle can be set back to zero.
- Never bend the needle to scale the instrument at zero.
- Adding or subtracting from the reading to allow for needle misalignment is incorrect.

Maintenance and Sterlisation of Schiotz tonometer

- Keep the instrument covered within the case while not in use
- After measurement, remove the weights and unscrew the plunger to clean thoroughly
- The plunger must move freely with in the footplate. It must be clean without particles
- The plunger is removed from the barrel and cleaned with alcohol
- A pipe cleaner is used to clean the inside of the barrel
- Sterilise the part of the instrument that will come in contact with the patient's eye with an antiseptic solution
- Allow three minutes for the alchol (sterilising agent) to dry to prevent alcohol keratitis
- The foot plate of the Schiotz tonometer may also be sterilised by flame sterilisation

Applanation Tonometer

The Goldmann Applanation tonometry is another instrument used in measurement of intraocular pressure (Fig. 9.5).

Fig. 9.5 - Applanation tonometer

Principle

- The tonometer is used in conjunction with a slit lamp and a cobalt blue filter.
- A drop of topical anesthetic and fluorescein dye is instilled before measurement of the intra ocular pressure

- The tonometer tip couches the eye and the force is increased by turning the adjustment knob until a circle of cornea of 3.06 mm in diameter is flattened
- The end point is when the inner edge of the two semicircles just touches each other
- Measure the force that is required to flatten the cornea and multiply it by 10 to express the intraocular pressure in millimeters of mercury

Parts of the Applanation tonometer

It consists of

- Double prism head (tonometer tip) attached by a rod to a housing that delivers the measured force, controlled by an adjustment knob.

Care

- Clean the tonometer in between patients.
- Calibrate the instrument on a regular basis using the controlled weight supplied with the instrument.
- Place the applanation head in a suitable container after use.

Maintenance

- To clean the tonometer, wipe the entire tonometer tip carefully and thoroughly with a spirit sponge and allow it to air dry for one to two minutes before use.
- Be sure to get rid of the disinfectant and allow for thorough air drying. If the patient's eye comes in contact with the disinfectant solution, corneal damage, pain and discomfort could result.

Gonio lens

It is used to visualize the angle structures in the eye. There are two types of gonio lens

- Direct gonio lenses: provides direct view of the angle and can be used for both diagnostic and surgical purposes. It does not require the use of a slit lamp and is used with the patient lying in supine position.
- Indirect gonio lenses: provides a mirror image of the opposite angle and can be used only in conjunction with a slit lamp for diagnostic purposes. This is the most commonly used gonio lens in an ophthalmic department.

Parts of the Gonio lens

- Highly polished truncated silver surfaced pyramid with a plain anterior viewing surface
- There are different types of gonio lens which are single mirror, three mirror and four mirror.
- The lens is used with a forty five degree angle so that the entire 360^0 of the anterior chamber can be observed.

Care

- The lens has to be replaced in the lens case provided for it.
- The lens has to be held only at the pyramid side and plain mirror surface should not be touched.

Care and maintenance

- Clean the instrument after each use with clean cloth
- Remove the dust that cannot be cleaned with liquid, by blowing it off with dry empty bulb syringe.
- Remove finger prints or oil from the lens after use.
- Be sure that all the cleaning agents are completely removed from the lens surface.
- Check the ocular surface of the pyramid looking for any breaks that could damage the cornea while using the instruments.

Fundus viewing contact lenses

It is a device used to examine the posterior vitreous and the posterior pole of the fundus and its periphery. The most commonly used lens are 90 D, 78 D and 20D.

90 D and 78 D

- It is a non contact lens
- These are high power condensing lenses which can be used only with the slit lamp.

- Used to shorten the light path and bring the retinal image within the focal range of the slit lamp.
- 90-D lens, which is the most commonly used, gives a wider field of view but less magnification.
- This can be used with the patient's head positioned in a slit lamp and the ophthalmologist holding the lens in front of the examining eye and viewing through the slit lamp (Fig. 9.6).

Fig. 9.6

20 D

It is also known as pan retinal viewing lens. It is a hand held non-contact biconvex lens used along with indirect ophthalmoscope. The image formed in the lens is a real inverted image. It helps to detect common retinal conditions like diabetic retinopathy,intraocular foreign body and retinal detachment and view the periphery of retina to look for degenerative changes in high myopia (Fig. 9.7).

Fig. 9.7

Care

- Remove the dust from the lens after use.
- Do not handle the lens by touching the lens surface.
- Replace it back in its case after each use.

Maintenance

- Clean the lens regularly with solution to remove dust and oily fingerprints.
- Do not clean the lens with a dry cloth, this will promote dust to build up
- Do not rub the lens too hard, as this can remove the antireflective coating.
- Never autoclave or boil the lens.

Trial frame and test lenses

A Trial frame is used to carry the test lenses during retinoscopy. (Duke Elder – Refraction book Fig: 21.15).

Neuro tray

It contains all the essential equipment for a complete neurological examination

1. Torch light
2. Container with strong smelling substance like asfoetida / camphor
3. A red colour target with handle
4. A roll of cotton
5. Tuning fork of 512 & 256 Hz
6. Containers with sugar, salt
7. Knee hammer
8. Bell pins
9. Inch tape
10. Scale
11. Ischihara pseudo isochromatic colour vision book
12. Stethoscope

Description of trial frame

1. It should be light, readily adaptable, allowing adjustments for each eye separately
2. Anterior and posterior adjustment, lateral and vertical adjustment must be possible
3. Each side can be filled with at least three cells
   a. One situated next to eye for spherical lens
   b. One in middle for a cylindrical lens, capable of smooth and accurate rotation so that there

is no trouble in arriving at correct direction of the axis

c. One farther from the eye for a prism, Maddox rod, etc

Trial case with Test Lenses

A typical trial set of test lenses will have spherical lenses from every quarter of a diopter up to 4D and every half up to 6D, every diopter up to 14D, every two diopter up to 20D and cylinders every quarter up to 2D, every half up to 6 D.

- Prisms up to 10 prism diopter with additional two of 15 and 20 prism diopters
- Plano lenses, opaque discs, pin hole and stenopaeic discs, Maddox rods, red and green glasses are also included

Care

- Care should be taken not to drop the trial frame
- The frame can go out of alignment if dropped
- The trial lenses should be kept in a case to help keep them clean

Maintenance

- Trial frame is wiped with a soft cloth to keep it free from dust and should be wiped between patients
- The trial lenses can be cleaned with a glass cleaner and a soft cotton cloth

Streak retinoscope

The streak retinoscope is a hand held instrument used to determine the refractive power of the eye objectively.

Description

- The instrument is similar to that of a direct ophthalmoscope.
- The light emitted from the instrument can be rotated 360 degree.
- There is no lens disc in retinoscope.

Care

- It should be turned off immediately after use.
- Bulbs should be changed when it gets fused.

Maintenance

Same as for an direct ophthalmoscope.

Non contact tonometer

It is an instrument used to measure intra ocular pressure.

Advantages

- It doesn't touch the eye.
- No anesthesia required.

Procedure

- It has a video monitor to observe the eye and set up proper alignment.
- The instrument can be table mount / hand held.
- The readings are taken when a soft gentle puff of air is directed at patients eye.
- The pressure is displayed on the radio monitor.

ContraIndication

NCT can be used on almost all patient but is contra indicated in instances of edematous or ulcerated cornea, following a keratoplasty or penetrating trauma.

Principle

By measuring time necessary for a given force of air to flatten a given area of the cornea, the IOP is calculated.

Maintenance

1. The dust cover keeps the instrument dust free
2. At the start of the day check the air nozzle by firing an air pulse without the patient in place
3. A clean dry cotton swab or a soft cloth can be used to clean the fixation area.

Keratometer

The keratometer is an instrument used to measure the anterior curvature of the cornea. The measurements are commonly referred to ask-readings.

Purpose

These measurements are important in

- Contact lens fitting
- Determination of corneal astigmatism and
- Calculation of intraocular lens powers

Description

- Telescope like part
- Knobs – four knobs for reading angular position
- Circular scale for reading angular position
- Two nobs for making adjustments on either side of instrument

Care

- Keep the instrument covered and turned off when not in use.
- Calibration of the keratometer should be checked to assure accuracy of the readings.
- Do not attempt to adjust the drum scales.

Maintenance

- Remove the dust and stain on the equipment on daily basis.
- If bulb gets fused it has to be replaced.

Summary

In this unit we have seen the different equipment used in an eye hospital. The uses of equipment, how they are handled and how to maintain them is also clearly explained. The equipment is to be regularly checked and the defects should be rectified without delay.

Key points to remember

- *Handle all the instruments with care*
- *If you find any fault in any of these instruments please take it to the service station*
- *Maintain the instruments with proper sterilisation method.*

Student exercise

Fill in blanks

1. *The instruments used to measure the intraocular pressure are _____ and _____.*
2. *The image of an indirect ophthalmoscope is _____.*
3. *The handy instrument to examine the fundus is _____.*
4. *The instrument used to measure the anterior curvature of cornea is _____.*
5. *The instrument used to test refraction objectively is _____.*

Tick the most appropriate answer

1. *The first choice of an instrument by an ophthalmologist is*

   a. Slitlamp *b. Gonio lens*

   c. Torch light *d. Direct ophthalmoscope*

2. *Which of the following is not a fundus viewing device*

   a. 90D *b. 20D*

   c. Direct ophthal moscopy *d. Applanation tonometer*

3. *The device used in the measurement in the intraocular pressure*

   a. Schiotz tonometer *b. Torch light*

   c. 90D *d. 78D*

4. *The neuro tray consist of all the instruments except*

   a. Asafoetida *b. Salt*

   c. Cotton *d. Slit lamp*

5. *20D lens is used to diagnose all except*
   a. *Retinal detachment*
   b. *Diabetic retinopathy*
   c. *Intraocular foreign body*
   d. *Increased intra ocular pressure*

True or false

1. *Torch light is not an instrument used by an ophthalmologist - True / False*
2. *90 D is an instrument used in the measurement of intra ocular pressure - True / False*
3. *Applanation tonometer has to be mounted on a slit lamp to measure the IOP - True / False*
4. *All lenses should be autoclaved - True / False*
5. *Gonio lens is an instrument used to view the angle of the anterior chamber - True / False*

Match the following

1. *90 D*	-	*Angle structures*
2. *20 D*	-	*Ischihara pseudo iso chromatic colour vision chart*
3. *Slit lamp*	-	*Non contact lens*
4. *Gonio lens*	-	*High myopic fundus*
5. *Neuro tray*	-	*Joy stick*

Answer the following

1. *Name 5 instruments used in ophthalmology*
2. *Name the non-contact lenses used in the examination of the eye*
3. *Name the instruments used in the measurement of intraocular pressure*
4. *What are the differences between direct and indirect ophthalmoscopy?*
5. *What is the equipment in a neuro tray?*
6. *Write about maintenance and care of an instrument of your choice*
7. *Draw and label the parts of a slit lamp*

Assignments

1. *Collect information about the instruments used in the operation theatre*
2. *Research methods of sterilizing surgical instruments in ophthalmology*
3. *Make a poster of do's and don't in handling the lens*
4. *Find out the procedures done in an outpatient department*
5. *Collect information about all the equipment taken to an eye camp*
6. *Collect data of the companies supplying the instruments*
7. *Prepare a ray diagram of a indirect ophthalmoscope*
8. *Collect information about other sterilisation procedures*

CHAPTER 10 BASIC OPHTHALMIC ASSISTING PROCEDURES

OUTLINE

History taking
Vision testing
Instillation of eye drops
Measuring intraocular pressure
Dressing preparation
Bandage tying and untying

GOALS

The Ophthalmic Assistant will be able to collect information from the patient to help the ophthalmologist in evaluating and diagnosing the patient's condition. The OA will help the ophthalmologist in treatment procedures for the diseases in the eye.

OBJECTIVES

To OA will be able to

- State the purpose of history taking
- Discuss the importance of developing a good rapport with the patient
- List the components in history taking
- Elicit the details regarding demographic data,past history,family history and medical history
- Collect history in proper sequence
- Record the details in the case sheet
- Discuss the importance of medical ethics in collecting history
- List the different visual acuity tests
- Demonstrate the pouch technique to instil eye drops
- Measure intraocular measure
- Tie and untie the bandage

CHAPTER 10
Basic Ophthalmic Assisting Procedures

In any health care facility, for a doctor to make a diagnosis/ diagnoses, a detailed and accurate history must be elicited. History taking is recording the story of the patient's medical disorder. History taking is a series of specific questions linked in an orderly sequence. The patient's history collection will be relevant to the condition of the patient and the requirements of the institution.

Two types of patients are seen in the Eye hospitals:

- The patient who desires a routine ocular examination combined with a refraction.
- The patient with the symptoms of ocular disorders.

The OA should find out to which category, the patient belongs. While collecting the data OA should know what is relevant and what is not relevant to the case. They should develop a good rapport with the patient and collect the necessary information .They should be precise and pertinent in acquiring patient's history. Some patients may have the habit of visiting the ophthalmologist several times. Sometimes the patient with multiple systemic disorders may say that they enjoy excellent health but when questioned may answer that they are taking pills for hypertension, iron tablets for anemia, injections for diabetes. The patient may not connect a general systemic disorder with an ocular problem. The systemic diseases may have serious or minor complications in the eye.

First the OA should make the patient feel comfortable, then the patients will share their complaints. The should not refrain from asking a particular question because it appears to be too private or embarrassing. If the history is conducted in a frank and professional manner and the questions are posed with tact and good taste, the patient will reveal even the most private matters, just as he or she would remove a shirt for chest examination. Some patients may refuse to speak to anyone except the physician about any eye problems. This is the patient's privilege. These patients should be treated more carefully and tactfully. They should not attempt to interpret a statement made by the patient. This will waste valuable time of the ophthalmologist.

History taking

There may be four types of history collection

- Problem focused
- Expanded problem focused
- Detailed
- Comprehensive

It is very important to note that the history has to be simple, clear and accurate. Each type of history may include some or all of the following elements.

- Patient's present illness / chief complaint
- Present ocular history
- Past ocular history
- Present medical history
- Family ocular and medical history
- Occupational history
- Treatment history

Chief complaint / present ocular history

This is the reason the patient is seeking help from an ophthalmologist, except in those patients who come for the periodic evaluation or a follow up check. The patient may describe symptom and this is usually stated in the patient's words. To define the chief complaint they can ask the following questions to the patients.

1. What are your symptoms?
2. When did the symptoms start?
3. Does the symptom seem to be getting worse?

Depending on the patient's answer they can ask for a chronological description of the development of the patient's present illness. It may include the following elements;

- Status of vision
- Onset of the symptom
- Description of the present symptom
- Treatment

To derive at these elements they can ask the following questions;

- Any change in vision? Decrease in distance or near vision? Has the vision been affected in one eye or both eyes?
- Did the symptom start all of a sudden or gradually?
- Is it stationary or progressive?
- Where exactly is the problem?
- Are symptoms constant or just occasional? If it is occasional, how long does it last? how often
- When does it occur? What is the severity of the problem? For example, if the problem is pain, ask whether the pain is sharp or dull ache?
- Does it get worse with other activity? Do the symptoms interfere with your work or other activities?

Ocular history

- Any previous eye injuries - what type?
- Any previous surgery - what type, when?
- Glasses / contact lenses
- Is there a past history of eye problems? What type, when?
- Do you follow any prescription - Drops/ medicines for your eyes? What type, Dosage, frequency?

Medical history

- Are you suffering from
  Diabetes, High B.P, Heart disease, asthma, etc
- What are all the medicines you are taking?

Family history

Headache diseases that run in the family

- Document in the chart family history of diabetes, type and onset.
- High blood pressure, heart disease, strabismus?

Allergies

Can cause eye problems

- Possible causes of allergies – oral or topical drugs, environment (pollen, dust etc.)
- Medicines
- Over the counter drops

Patient complains of red eye

- How long has the eye been red-example 1day or 1month
- Any trauma to eye
- Foreign substance in eye (shampoo, dirt)
- Allergies

Questions to be asked to the patient suffering from red eye

- Pain and duration
- Irritation –F B sensation
- Itching
- Sensitivity to light (photophobia)
- Discharge present or absent
- Colour of the discharge - clear, white or yellow white
- Decrease in vision
- Any treatment taken
- Headache, vomiting
- Application of any medicene

Diagnosis to consider

- Conjunctivitis
- Iritis
- Angle closure glaucoma
- Contact lens over wear – sleeping in DWSCTL
- Dry eyes

- Post-op iritis
- Pingecula
- Pterygium
- Subconjunctival hemorrhage
- Penetrating foreign body or injury – if patient is carpenter or lathe worker
- Blepharitis
- Trichiasis
- Foreign body in eye - dust or stone particles, flying iron dust

Patient complains of decreased vision - Questions to be asked

- Duration of blurred vision
- Gradual or sudden loss of vision
- Defective vision -distance, near or both
- Is it during the day or night time
- Stationary/progressive
- Whether painful/painless

Diagnosis to consider

- Cataract
- Onset of presbyopia
- Optic neuritis
- Retinal detachment
- Diabetic retinopathy with CSME
- Vitreous haemorrhage
- Hx of diabetes - is BS under control?

Tips to win confidence of the patient

- Appearance
- Cleanliness and neatness
- Lab coat if possible
- Handling of patients
- Attentiveness to the patient's complaints without contradicting

1. Show concern by observing the following:
   a) Introduce yourself (My name is ....., I will be working with you for a few minutes to record your ocular problem).
   b) Explain: in order to get the best care and treatment from your doctor, I need to record a few important facts regarding your eye problem.
   c) Attitude toward patient: be friendly, be sensitive, and smile. Treat them cordially, so that they feel you are interested in them as a total person and not just in their eye problem.
2. Why is this important?
   - By having a good relationship with your patient, you are more likely to be successful in winning your patient's trust.
   - Therefore he/she will have confidence in you and will feel comfortable in sharing his/her history with you, thus saving the doctor some valuable time.
3. Why there is a need for an accurate record of the history?
   - Story (with systemic ramifications) regarding insulin / penicillin. Technician asked patient if she had any allergic reactions to medications. Patient replied," Yes, penicillin" Technician recorded in the patient's chart as "Insulin". After surgery the patient developed an infection and penicillin was prescribed by the doctor. He was not aware of her allergy because of the incorrect history record. The patient almost lost her life due to this error. Her relatives wanted to know why the doctor had not observed her allergy and they checked the record and found out that insulin had been mistakenly recorded.
   - Story (with ocular ramifications) regarding Diamox / Diuril. Technician asked patient, "What medication are you now taking?" The patient was taking Diamox for a severe glaucoma condition. But the technician recorded Diuril in the chart (which is also a diuretic, but it does not lower intraocular pressure like Diamox). After surgery the doctor ordered the patient to continue with her regular medications. When she looked at

the chart, she noted Diuril (not Diamox) and followed the doctor's orders. The patient's intraocular eye pressure increased over a period of several days causing some glaucomatous damage (to the optic nerve and thus causing the vision to decrease). Finally the error of the OA's history taking was discovered and appropriate medication was given, but damage to the optic nerve resulted from this mistake was irreversible.

- History taking must be concise and to the point by observing the following suggestions.

What can be learnt from these two examples?

- Listen carefully to your patient.
  - Repeat the patient's answer to your question so he/she can clarify the answer, if you heard it wrong or mistakenly put down a similar sounding medication. We are dealing with people's quality of life as well as their very life and so it is important to get it right in their record.
  - Take notes on paper as the patient tells you about his/her problem. Look them in the eye to let them know that you are interested and concerned about their problem. Then organize the information in chronological order (arranged in order of occurence). The doctor will appreciate this very much.
  - Write down the pertinent facts on the medical form in order of occurrence. Leave out all the unimportant information that the patient may tell you. Some times the patients will go into great detail and much of this does not apply to the chief complaint. Sometimes the patient needs to get someone's listening ear, therefore, be polite but guide the patient back to the chief complaint. The doctor will be appreciative if you let the patient unwind with you and not take his valuable time.
  - Put the following facts in the patient's record:

1. Chief complaint: brief description of the problem; indicate which eye(s).
2. Present ocular illness: When did it start (over a period of time)?
3. Duration: Complaints can change, such as light flashes, then floaters, then half of the vision is gone and the patient only sees a black shadow in half of his visual field. Start with the distant time: for example 1-1/2 years, and work toward the present time- 9 months, 6 months, 3 weeks, yesterday, today, etc.

Past history

- Diseases: Diabetes, tuberculosis, high blood pressure, etc., and dates when they were first diagnosed should be noted in the chart (duration in months/years)
- Operations: Cancer, appendectomy, Caesarian-section, retinal reattachment, trabeculectomy for glaucoma, laser for diabetic retinopathy, etc., plus approximate dates.
- Medications: Insulin, Digitalis, Eltroxin, Diuretics, Aspirin, etc.). Sometimes they will not know the name of the medication; but they may describe the color and the size of the pill or capsule and how often they take it and for what problem (breathing, heart, arthritis, etc.,). Do not assume the name of the medicine and come to your conclusion. If the patient is not in a position to tell the name of the medicine, right the same in the record.
- Allergies to drugs and foods.
- Family history: (Blood relatives living or dead who have had blindness or any eye disease).

Emergencies : (which, what, when, where, how, and duration of symptoms?)

- Which eye?
- What happened? (Chemical or foreign body in eye, etc.)
- When did it happen?
- Where did it happen? (On job or at home)
- How did it happen?
- How has the injury affected your eye(s)? (can't see, pain, blurred vision, double vision, etc.)

- Duration of symptoms? (One hour-emergency/ conjunctivitis for three weeks-take the whole history)
- Needs to see the doctor immediately, soon, later today?

Assignment

"24 HOURS" – Choose someone you love and respect (mother, father, a sister, a brother, a cousin, a very good friend) to be your constant companion. Pretend that person hears what you say to others, sees and hears how you react to other's treatment of you (either good or bad) and see if this makes a difference in your daily behavior towards other people. If you take this assignment to heart, it will change your attitude and you will become a more sensitive and positive thinking person with whom people will enjoy associating. It will also make a difference in how you treat your patients.

Key points to remember

A systematic order should be followed in taking an adequate history. Here are some of the tips in history taking:

- *Identify the chief reason the patient has sought an eye examination*
- *Identify any secondary problems the patient has that are referable to the eye*
- *Identify any systemic or general illness the patient presently has and any medication being taken*
- *List past ocular disorders or operations*
- *Determine if the patient is wearing contact lenses or spectacles, and if so, how old they are and when the last eye examination occurred*
- *Be brief but also go into detail with any specific ocular problems that arise. General questions regarding any abnormality may be important, such as time and duration, family involvement, and so on*
- *Record any previous therapy and the response*
- *Never talk ill about any treatment taken outside or about the doctor who has treated the patient*

Medical terminology

VA	-	*visual acuity*
RX/CTL	-	*treatment/contact lens*
B.P	-	*blood pressure*
FB	-	*foreign body*
DWSCTL	-	*daily wear soft contact lens*
CSME	-	*cystoid macular edima*

Student exercise

Say true or false

1. *History taking is a confidential experience with the patient and the OA who is involved (True / False)*
2. *The most significant question is what medication are you taking?" (True / False)*
3. *The patient should be allowed to speak freely of all their problems (True / False)*

Answer the following question

List and describe the essential elements of a complete problem oriented medical case history.

Visual acuity

Vision testing

Definition

Acuity of vision is defined as the smallest object or letter that can be clearly seen and distinguished at specified distances.

Types of visual acuity

- Distant visual acuity
- Near visual acuity
- Pinhole visual acuity

a) Visual acuity distance

Definition: The ability of a person to distinguish an object or letter whose rays are parallel and where no accommodation is required.

For all practical purposes 6 meters or 20 feet is used for distance visual acuity testing as the rays are considered parallel and no accommodative efforts are required

Various distant visual acuity charts are

In adults

- Snellen chart
- Log MAR chart

In illiterates

- E –chart (Fig. 10.1)
- Landolt's broken rings chart (Fig. 10.2)
- Multiple pictures chart

In children

- Cake decorations
- Sheridon-Gardinel testing
- Keeler's preferential looking tests
- Cardiff charts

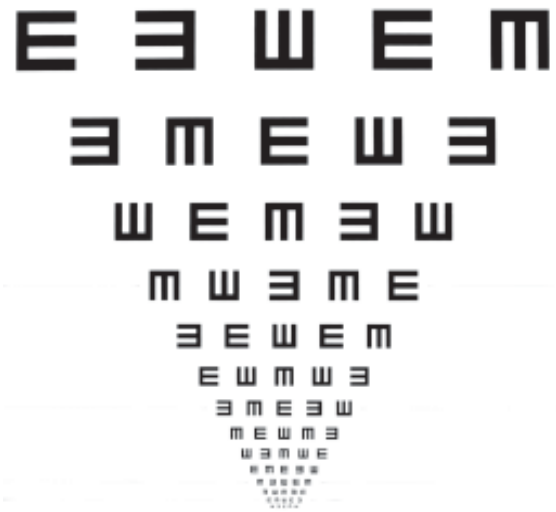


Fig. 10.1

b) Near visual acuity

Definition: The smallest objects or letter that can be distinguished clearly at a normal reading distance. For practical considerations the normal reading distance is considered to be 40cms (Fig. 10.3).

Snellen near acuity charts are used; near vision is graded from N_5 to N_{48} (Fig. 10.4).

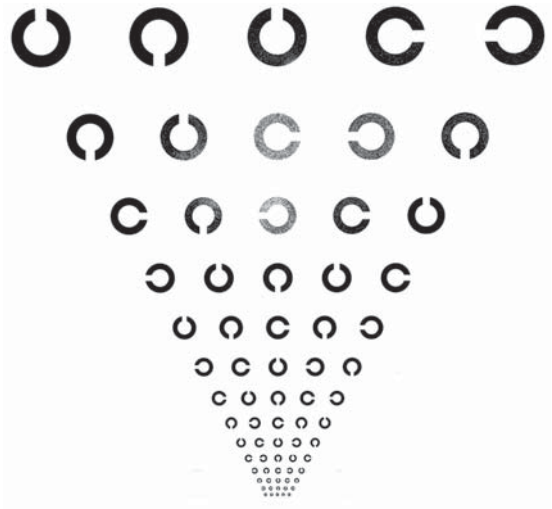


Fig. 10.2

Fig. 10.3 - Cake decoration

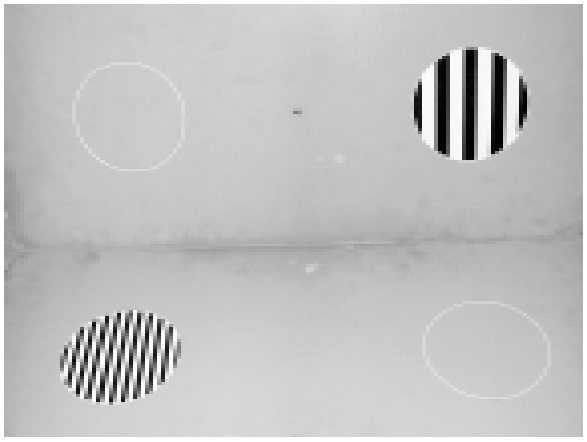


Fig. 10.4 - Snellen's near acuity chart

Pinhole visual acuity

To be done for all patients with less than 6/6 vision.

- Reduces the peripheral rays and allows the central rays alone to reach the retina.
- Increases the contrast of vision

- Helps in attaining 6/6 vision following vision loss due to refractive error.
- Helps in differentiating visual loss correctable by spectacles and other disorders

Practical considerations

Distant visual acuity testing

The Snellen chart

Principle: This procedure measures the patient's distant vision by testing his/her ability to read a character at a standard distance from a specified chart. The size of the letter is standardized so that the letter in each row should be clearly legible at a graded distance to a person with normal vision.

Equipment necessary

- Snellen distant visual acuity chart with a good illuminating source
- Trial frame (Fig. 10.5)
- Occluder (Fig. 10.6)
- Pin hole

Fig. 10.5 - Trial frame

Fig. 10.6 - Occluder

Procedure

- Explain the procedure and its importance to the patient and try to win their confidence
- The patient is seated comfortably at 6 metres distance
- The chart should be at the eye level of the patient
- Check the visual acuity of the patient without glasses first followed by with the present glasses if any.
- Occlude one eye and test the visual acuity individually (separately)
- Instruct the patient to read from left to right each line and observe
- Encourage the patient as this may give more accurate results
- Test for visual acuity with pinhole if vision is less than 6/6
- Interpret the visual acuity and record it in the case sheet for each eye separately

Interpretation of visual acuity

1. Visual acuity is recorded as a fraction. The numerator indicate distance in meters at which the patient can read clearly the smallest possible letters/characters in the chart. The denominator indicates the distance in meters at which a normal person can see the same letters/characters in the chart.
2. Normal visual acuity is 6/6.
3. If the patient is unable to read 2 letters of last line it should be indicated as $6/6^{-2}$
4. If the patient is unable to read last line at 6 meters but reads the previous lines then visual acuity is 6/9
   - If they are unable to read last two lines but able to read others visual acuity is 6/12
   - If unable to read last 3 lines then visual acuity is 6/18
   - If unable to read last 4 lines then visual acuity is 6/24
   - If the patient can read only the first 2 lines the visual acuity is 6/36
   - If they can read only the first line visual acuity is 6/60
5. If the patient is unable to read the first line the visual acuity is less than 6/60
   - Then patient may be asked to go forward to read the first line. The distance from the chart from which the patient can read clearly the first line of the chart is considered the numerator e.g., 4/60, 3/60 etc.,
   - Instead the OA may ask the patient to count fingers and the farthest distance at

which the patient can count fingers is taken as numerator. E.g. 4/60,3/60 ½ meters / 60, etc.

6. If the patient is not able to appreciate counting fingers, then patient may be tested whether they appreciate movements of hand close to face. If the patient can appreciate then the visual acuity is HM or hand movements
7. If patient cannot appreciate HM then a strong source of light may be shined from different directions. If patients can perceive light and can accurately point out directions projection with perception of light (PL+ and PR accurate) may be recorded.
8. If the patient perceives light but is unable to point out to the direction of the light then the visual acuity is perception with inaccurate projection (PL + PR inaccurate)
9. If the patient is unable to appreciate light then the visual acuity is no perception of light or No PL
    - The OA should create a good rapport with the patient so that they feel comfortable, particularly the uncooperative patients.
    - The OA should be humble and explain the procedure to the patient in a proper way in patient's own language.
    - They should identify the appropriate chart for each patient. E.g. E-chart, picture chart etc.
    - They should be responsible to arrange the necessary equipment to carry out the procedure.

Do's and don'ts

- Each eye should be tested separately
- Test with and without glasses separately
- Observe whether the patient misses letters on particular side, like temporal half or nasal half
- Don't irritate the patient if they are uncooperative, instead try to gain their confidence.
- Observe whether the illumination is adequate.
- Never allow the patient to open/close the eye partially or squinting of eyes, which may alter the visual acuity.

Key points to remember

- *Test each eye separately*
- *Make sure illumination is adequate and patient is seated comfortably at 6m distance from the chart.*
- *Test pinhole acuity in all patients with vision less than 6/6 with correction*

Student exercise

Fill in the blanks

1. *Normal visual acuity is _____*
2. *Near visual acuity is tested at a distance of _____cms*
3. *If the patient is able to read only the first two lines then their visual acuity is_____*
4. *Visual acuity charts used in children are _____ and _____*

True or False

1. *Sherdran – gardinel chart is used to test visual acuity in adults.*
2. *Distant visual acuity using Snellen chart is done at a distance of 8m*
3. *Pin hole visual acuity helps in differentiating visual loss corrected by spectacles and others which cannot be corrected by spectacles.*

Answer the following

1. *What is visual acuity? What are its types?*
2. *What is the use of testing pinhole visual acuity?*

Instillation of eye drops

What are eye drops?

OAs commonly assist the ophthalmologist by instilling eye drops in patients' eyes. Eye drops are drugs in liquid form that are applied in the eye (topically). Diagnostic types of eye drops are used during certain eye tests; therapeutic eye drops are used to treat ocular conditions or diseases.

Forms of ocular topical medicines

Ocular medications are formulated in three forms: as solutions, suspension, and ointments.

Solutions

These are in liquid form and usually they are instilled into the eye. In a solution, the active drug is completely dissolved in an inactive, transparent vehicle. The solutions are clear.

Suspensions

In a suspension, particles of the drug are visibly suspended in a liquid. The fluid is cloudy or milky, unlike a solution, which is clear. Shake the suspension well before use.

Ointment

Contains a drug added to an oil base. The ointment melts and is absorbed into the tissues.

Types of doctors order

- Written order – are the accepted type of order
- Verbal orders – are accepted in an emergency situation but are to be written as soon as the emergency is over.
- Telephone orders – are accepted in many institutions. Whoever speaks with the doctor over the telephone writes it in the appropriate place along with the name of the doctor and the signature of the person receiving the order. The telephone order must be read back to the doctor for confirmation. It must be signed by the doctor when he/she comes to the unit.
- Standing orders - they are to be carried out whenever a certain condition exists. For eg. Pre-operative eye drops for cataract.
- Stat orders - one that is given immediately and only once.
- PRN orders - It may be given as and when necessary.

Safety in administring eye drops

- Eye drops should be kept away from the reach of children.
- Follow the "5 Rights" in administering eye drops. The "5 Rights" are:
  - The Right eye drop
  - The Right dose
  - The Right route
  - The Right time
  - The Right patient

The right patient involves positively identifying the patient. Special care must be taken when there are two or more people with the same name, in the same room or unit.

- Always check the expiry date of the eye drops before use.
- Check the label before administering and after administering the eye drops.
- Do not use if the colour has changed or if there is any turbidity in an eye drop.
- If the patient refuses to have eye drops instilled or it is omitted for any reason, it should be recorded in the patients case sheet along with the reason.
- Do not use if there is any damage to the bottle or if the nozzle cap is lost.
- It is possible for errors to happen. As soon as it is realised, check the patient's eye and immediately notify the doctor.

Common abbreviations used

Q.d.	- Once a day
b.d.	- Two times a day
t.i.d/t.d.s	- Three times day
q.i.d	- Four times a day
prn	- Whenever necessary
Stat	- Immediately, once
Q_6H	- Every six hours

A.C. - Before meals
P.C. - After meals
H.S. - At bed time
E/D - Eye drops
Oint - Ointment

Practical

Steps and techniques in administering eye drops /ointment

- Collect the necessary equipment to administer eye drops

  A clean tray containing
  - bottle with sterile forceps
  - Necessary eye drops / ointment
  - Jar with cotton wipers
  - Kidney tray
  - Sterile pads and bandages.
- Identify the patient by comparing the information in the case sheet
- Explain the procedure to the patient and explain if any discomfort is to be expected
- Bring the prepared tray to the patient's bedside.
- Wash hands thoroughly and dry with a clean towel
- Place the patient in a sitting position with his head tilted back or in a supine position with neck extended back over a pillow. Ask the patient to look up. Give them a cotton wiper to hold
- If the patient has crusts or exudates around the eye, clean the eye with sterile wiper, then apply drops / ointment
- Open the eye drop container. Hold the container with the nozzle pointing downwards.
- The pouch technique (Fig. 10.7)
  - Make a pouch in the lower fornix by pulling the lower lid away from the globe. Instill one or two drops / ointment directly into the pouch. Instruct the patients to close their eyes gently. Give the patient the cotton wiper to hold and remove excess medication and tears.
- Replace nozzle cap properly.
- Wash hands
- Record eye drops in the case sheet.
- Do not apply more drops / ointment as it may increase systemic absorption and toxicity and drug wastage

Fig. 10.7

Exercises

Key points to remember

1. *Always check the doctors order before administering any eye drop*
2. *Follow the five rights in administering eye drops.*
3. *The tip of the bottle should not touch the eye or elsewhere.*
4. *Always remember to check the expiry date of the eye drop.*

Student exercise

Say True / False

1. *Mydriatics could be given to patients with acute angle closure glaucoma.*
2. *Anaesthetics: do not use in patient with history of hyper sensitivity to the drug.*
3. *Do not use if there is any damage to the bottle or if the nozzle cap is lost.*
4. *Always check the expiry date of the eye drops before use.*
5. *Steriods: do not use in patients with acute infections.*

Classification of Drops	Uses	Action	Adverse Effects	Points to Remember
Mydriatics & Cycloplegics Eg:Atropine, Homatropine, Tropicamide, Cyclopentolate	- Used in patients undergoing examination of the fundus - Used in refraction examinations that require the absence of accommodation (changing the curvature of lens to focus images of near objects). - They act as pain relieving agents in some patients by preventing spasm of the ciliary muscles e.g.- eye injuries - corneal ulcers - uveitis	Mydriatics usually dilate the pupil by stimulating the iris dilator muscles or inhibiting the constrictor pupillae. - A temporary paralysis of the ciliary muscles is caused by cycloplegics	- Irritability, ocular congestion with long-term use. - Photophobia	Do not uses in patients with acute Angle closure glaucoma.
Anaesthetics Eg: Xylocaine Lignocaine	Used to anasthetise during diagnostic procedures Ex: tonometry, gonioscopy, and any other examination that involves touching the surface of the eye.	It produces local anesthesia in the eye instilled instillation. It anaesthtises the eye in which it is instilled	Burning sensation for 30 seconds after initial Allergy develops with repeated use.	Do not use in patient with history of hyper-sensitivity to the drug. Warn patient not to touch or rub the eye after instillation, since this may cause corneal abrasion.
Antibiotics Eg: Chloram phenicol Gentamicin, Tobramycin, Natamycin	Used to prevent and treat ocular infections	Bactericida (kills the bacteria) or Bacteriostatic. (prevents multipli- - cation of bacteria)	Local burning, discomfort, itching, conjunctival hyperemia, bad taste.	Avoid in patients with history of hypersensitive reactions to antibiotics.

Classification of Drops	Uses	Action	Adverse Effects	Points to Remember
Steriods Eg: dexa - methasone, prednisolone	Used separately or in combination with antibiotics to prevent and treat any ocular inflammatory conditions. of inflammation.	Decreases the inflammatory reaction by decreasing the infiltration of WBCs at the site -secondary infections.	- Corneal ulceration, increased intraocular pressure.(glaucoma) and cataract with excessive long term use.	- Shake the suspensions well before use. - Do not use in patients with acute infections.

Further study

1. Collect and read the package literature of eye drops commonly used in your hospital.
2. Write an assignment about the different groups of eye drugs, actions and side effects.
3. Demonstrate the procedure of administering drop on classmates and correct each other.

Measurement of intraocular pressure using the Schiotz tonometer

Definition of intraocular pressure (IOP)

- Intraocular pressure refers to the pressure exerted by the intraocular contents on the coats of the eyeball.
- It is maintained by the equilibrium between the aqueous humour formation, its outflow and the episcleral venous pressure.

Normal IOP values

- Ranges between 10.5 and 20.5mm of Hg
- Mean IOP = 15.5 $\pm$ 2.5mm of Hg
- Increase in IOP more than normal values is glaucoma

Measurement of IOP

1. Direct measurement (Manometry)

- Here a needle is introduced into the anterior chamber and is connected to a suitable mercury manometer.
- Disadvantage: Not a practical method for routine IOP measurement.

2. Tonometry or Indirect method:

- It is an indirect method of measuring IOP with instruments called tonometers.
- Types of Tonometer:
  i. Indentation or Impression tonometers (eg: Schiotz)
  ii. Applanation Tonometers (eg: Gold-mannn Applanation tonometer)

We shall confine ourselves to Schiotz tonometry.

Schiotz tonometry devised in the year 1905.

Principle

Schiotz indentation tonometer works on the fundamental fact that the plunger will indent a soft eye more than a hard eye.

Parts of a schiotz tonometer

Schiotz tonometer consists of the following

a) Handle for holding the instrument in vertical position on the cornea.
b) Foot plate which rests on the cornea.
c) Plunger which moves freely within a shaft in the foot plate.
d) A bent lever whose short arm rests on the upper end of the plunger and a long arm which acts as a pointer needle. The degree of indentation is shown by the movement of this pointer over a scale.

e) Scale.

f) Weight of 5.5gm is fixed to plunger. Extra weights 7.5gm and 10gm are included.

Chart provided for IOP calculation by Schiotz tonometer (Friednwalds chart)

Schiotz scale reading	IOP in mm of Hg with different plunger body weights			
	5.5gm	7.5gm	10gm	15gm
3.0	24.4	35.8	50.6	81.8
3.5	22.4	33.0	46.9	76.2
4.0	20.6	30.4	43.4	71.0
4.5	18.9	28.0	40.2	66.2
5.0	17.3	25.8	37.2	61.8
5.5	15.9	23.8	34.4	57.6
6.0	14.6	21.9	31.8	53.6
6.5	13.4	20.1	29.4	49.9
7.0	12.2	18.5	27.2	46.5
7.5	11.2	17.0	25.1	43.2
8.0	10.2	15.6	23.1	40.2
8.5	9.4	14.3	21.3	38.1
9.0	8.5	13.1	19.6	34.6
9.5	7.8	12.0	18.0	32.0
10.0	7.1	10.9	16.5	29.6

Practical usage of Schiotz tonometer

1. Always check the instrument before usage and calibrate
2. Wash and dry your hands before working with the instrument.
3. Explain to the patients that you will be touching eye with an instrument but they will not feel any pain.
4. Administer one drop of lignocaine eye drop to the eye(s) to be tested.
5. Allow 2 to 5 minutes for the local anesthetic to act.
6. Patient should lie supine.
7. Rest your fingers only on the bony orbital rim and not over the eye ball.
8. Gently separate the lids.
9. Ask the patient to hold their hand up and look at the thumb or a finger to give them a point of fixation.
10. With the tonometer having no added weights (the instrument weighs 5.5gm) rest the foot plate on the centre of the cornea.
11. Look at the scale of the tonometer to find out the degree of indentation. If it indicates 3 or less, put the next heavier weight on the plunger. When the scale reading is $\geq$ 4 it is an ideal indentation.
12. Use the provided Friedenwalds conversion table for estimation of IOP'S.
13. Record the readings for each eye separately in the patient's chart.

Maintanence and sterilisation of Schiotz tonometer

1. Keep the instrument covered within the case while not in use.
2. Ensure proper functioning of the instrument before each IOP recordings and calibrate.
3. Calibration: Place the foot plate on the model cornea provided in each case. Scale reading of zero ensures proper calibration.
4. Always sterlize with an antiseptic solution the part of the instrument that will come in contact with the patient's eye.
5. Allow three minutes for the alchol (sterlizing agent) to dry to prevent alcohol keratitis.
6. After the measurement remove the weights and unscrew the plunger to clean thoroughly.
7. The foot plate of the Schiotz tonometer may also be sterlized by flame sterlization.

Attitude

1. Communicate well with the patient to reduce anxiety.
2. Clear the doubts of the patient by answering all their questions.

3. Assist the patient to maintain a comfortable position throughout the procedure
4. Handle the equipment with care.
5. Communicate the necessary information to the ophthalmologist

Key points to remember

Do's in measuring IOP by Schiotz

- *Explain the procedure and its importance to the patient in their own language in a gentle way.*
- *Always wash and dry your hands before working.*
- *Be gentle while separating the eyelids*
- *Take two to three readings when you find the values are abnormally low or high.*
- *Special care is required in eyes which are swollen from surgery or injury. In patients who are unable to open their eyes voluntarily or when the patient is uncooperative, reassure the patient and resume work gently.*

Dont's in measuring IOP by Schiotz

- *Do not rest your fingers over the globe.*
- *Do not do indentation tonometry in a red and inflammed eye or eyes with conjunctivitis, corneal pathology, foreign body or in dry eye*

Advantages of Schiotz tonometry

1. *Simplicity of the instrument*
2. *Good reliability*
3. *Low price*
4. *Reasonable accuracy*
5. *Easy usage*
6. *Easy transportability*

Disadvantages of Schiotz tonometry

1. *Patient has to lie supine*
2. *Operater variability*
3. *Cannot be done in patients with corneal pathology or infections or changes in ocular rigidity.*
4. *Errors in recording IOP*

Sources of errors in performing IOP by Schiotz tonometer

1. *Contraction of extraocular muscles.*
2. *Accomodation*
3. *Ocular rigidity*
4. *Variaitons in corneal curvature and thickness*
5. *Scale reading and faulty technique*

Self evaluation

1. *Prepare a patient for schiotz tonometry.*
2. *Interpret schiotz scale using friednwalds chart*
3. *Sterlize a schiotz tonometer.*
4. *State the advantages and disadvantages of schiotz tonometer.*

Student exercise

I. Fill in the blanks

1. *The normal IOP ranges from..... to .....*
2. *Goldmann tonometer is an example of ..... tonometer*
3. *Extra weights are added to Schitoz tonometer when the scale reading is less than .....*

II. True or False

1. *Schiotiz tonometer is a type of indendation tonometer.*
2. *Acetone is used to sterlize schiotz tonometer*
3. *Ocular rigidity can cause false high reading with Schitoz tonometer.*

III. Match the following

1. Monometry	*-*	*Indendation*
2. Schiotz tonometer	*-*	*Applanation*
3. Goldmann tonometer	*-*	*Direct method of measuring IOP*

Answer the following

1. *What is the normal IOP value ?*
2. *What is schiotz tonometer? What are its parts?*

3. *How will you measure IOP using schiotz tonometer?*
4. *How will you sterlise Schotiz tonometer?*
5. *What are the advantages and disadvantages of Schiotz tonometer?*

Dressing preparation

Dressing is done post operative for the patient to avoid dust, infection and prevent injury.

Materials required for preparing wiper

1. Clean round basin
2. Distilled water
3. Clean cotton.

Practical

Dressing tips

- Before preparing the bandage look around and see whether the place is neat and tidy.
- They should clip the nails before the preparation of bandage.
- Wash the hands thoroughly with soap and wipe on a clean towel.
- Spread a clean bed cover and sit on it comfortably

I. Wiper preparation method

- Pour the distilled water in a basin.
- Immerse the clean pieces of cotton into the water
- Take a small round ball (marble size) of cotton from the water.
- Roll the cotton into a square shape.
- Take some more cotton and keep it on the square cotton and roll it gently in a length wise direction so that a clean wiper is prepared.

II. Cotton bandage preparation method

- Spread a mat in a clean room
- Take the gauze piece from the packet and spread it on the mat.
- Cut the gauze into nine pieces
- Take the cotton roll and keep it in the right hand. Place the cotton into the gauze piece and wrap it tightly.
- Cut the cotton wrapped gauze into 4 rectangular pieces (measurement can be the length of your pointer finger).
  - The other wasted cotton pieces should be utilized to prepare small balls of cotton used for wiping the patient's eye at the time of instilling drops.
  - From 1 roll of cotton 120 cotton bands could be prepared.

III. Bandage tying cloth- preparing method

Materials required for preparing bandage strips

- Clean Mat
- Scissors
- Bandage cloth roll packet

Method

- Spread a mat in a clean room
- Take a roll of bandage and fold it into two at forearm measurement
- Trim the ends of the bandage.
- Keep one end long and the other end short and cut to the size of the ear.

Note: We can prepare 8 strips of bandage from one bandage roll.

Points to remember in preparation of wiper, bandage strip and bands

- Right place (where there is less pollution, no people walking here and there)
- Right size / measurement
- Right method

Points to Remember

1. All the procedures and methods involved in dressing preparation technique must be followed carefully.

Bandage tying

Bandaging of the eye

A bandage is applied to prevent movement of the eyelids, to assist in healing of corneal abrasions and after operations.

Method

Ask the patient to close both eyes gently and place eye pad and shield over the affected eye. Standing in front of the patient, start with a turn round the cheek on the affected side and take the bandage one turn round the head, placing the patients ear through the hole in the bandage continue with turns round the cheek. Finish with one turn round the head and tie the bandage securely on the forehead. Ask the patient if the bandage feels comfortable before leaving him.

Take two pads

- Fold the first pad in half. Then place it over the eye with one hand and hold it in place.
- With the free hand, apply the second pad over the first.
- Place the plastic shield over the two cotton pads. Apply a single piece of tape at an oblique angle just above the brow of the opposite eye.
- Firmly press the tape against the skin medial to lateral so that 6 to 7 centimeters of tape contact the skin above the cheekbone and forehead.
- A long piece of bandage cloth measuring 1m x 10 cm can be tied over it.
- It should be tied just tight enough to secure the pad properly. The knot should come on the forehead and it should be neatly trimmed. (Knot on the side interferes with the sleeping posture of the patient).

Do's

- Explain the procedure and gain the co-operation from the patient.
- Handwashing should be done prior and after applying a bandage.
- Apply the bandage with gentleness

Don't

- Don't apply wet bandage
- Don't apply bandage on wrong eye
- Don't use unsterile dressing
- Don't apply too tight or too loose
- Don't cover other eye with the bandage

Student exercise

I. Fill in the blanks

1. *One can cut _____ pieces in a bandage roll*
2. *One can prepare _____ number of cotton strips from a cotton roll*

II. Say True / False

1. *When you spread a gauze piece it can be cut into 3 pieces*
2. *Cotton wipers must be prepared from cotton dipped in distilled water*
3. *From a roll or cotton 5 cotton bands could be prepared*

III. Answer the Question

1. *What are the materials required in the preparation of cotton wiper, cotton band and gauze stripe?*

CHAPTER 11 VITAL SIGNS

OUTLINE

Temperature
Pulse
Respiration
Blood pressure

GOALS

The OA will describe vital signs, and demonstrate measuring the parameters accurately

OBJECTIVES

To Ophthalmic Assistant will

- Define temperature, pulse and respiration
- Explain normal body temperature
- List the different types of fever
- List the factors affecting temperature, pulse, respiration and blood pressure
- Explain the methods of checking temperature, pulse, respiration and blood pressure
- Check vital signs following the steps
- Locate various sites of peripheral pulses
- Check blood pressure of patients

CHAPTER 11
Vital Signs

A person's health status is measured by his/her vital signs which consist of four elements.

Body temperature indicates the status of body metabolism regulated by higher centers in brain.

Pulse indicates the condition of heart and blood vessels in periphery.

Respiratory sounds and rates indicate the condition of respiratory system.

Blood Pressure indicates the status of circulatory system.

Vital signs

Definition

Vital signs are physical findings that indicate an individual is alive, such as heart beat, breathing rate, temperature and blood pressure. These signs can be observed, measured, and monitored to assess an individual's level of physical functioning. Normal vital signs change with age, sex, weight exercise, and tolerance condition.

Normal ranges for the average healthy adult:

1. Temperature - 98.6 F
2. Respiration - 16-18 per minute
3. Pulse - 60-90 per minute
4. Blood pressure - 120/80 mm Hg

Body temperature

Body temperature is the degree of heat maintained by the body or the balance between the heat produced and lost in the body. The heat regulating centre is the hypothalamus, situated in the brain.

Heat is produced in the body in the following ways

- Oxidation of food
- Exercise
- Strong emotions
- Hormonal effect
- Changes in the environment or atmospheric conditions
- Disease conditions

Heat is lost from the body through organs such as skin, lungs, kidneys and bowels.

Factors affecting body temperature

- Time and climate
- Age and body condition
- Emotion and exercise

A body temperature of 98.6 F is considered to be normal.

Temperature measurement

Definition

Taking a person's temperature assesses whether it is within a normal range. A high temperature is fever.

How the test is performed?

A clinical thermometer is used to measure the temperature of the body.

Electronic thermometers display the temperature on a digital read out.

Plastic strip thermometer

It changes colour to indicate the temperature. Place the strip on the forehead and read it after 1 minute. Read it while the strip is in place.

Clinical thermometer

It consists of two different parts. One is the bulb containing Mercury and other is a stem with measuring scales showing the lowest degree of the temperature being 35°C or 95° F and the highest being 43.3°C or 110° F.

Types of clinical Thermometer

1. Oral thermometer (Long and slender bulbs)
2. Rectal thermometer (Short and fat bulbs)

Conversion of Celsius and Farenheit scale

To convert Farenheit scale to Celsius scale, follow the below mentioned method: If the Farenheit is 104 it can be converted to a

- C= (F-32) x 5/9
- C= (104-32) x 5/9
- C= 72 x 5/9 = 40°C

To convert Celsius to Farenheit scale

If Celsius is 37°C

- F= C x 9/5 + 32
- F = 37 x 9/5 + 32
- F = 66.6 + 32 = 98.6° F

Common sites of taking body temperature

- Mouth
- Axilla
- Groin
- Rectum

How to prepare for the test?

Wait for 20 to 30 minutes after smoking, eating or drinking.

Why is the test performed?

The measurement of body temperature determines whether a person has fever. It may be helpful in monitoring to see if a person is ill or whether a treatment is working, especially antibiotic treatment of infections.

What does abnormal results mean?

If the reading on the thermometer is more than 1 to 1.5 degrees above the patient's normal temperature the patient has a fever. Most fever is a sign of infection and occurs with other symptoms. Abnormally high or low temperatures can be serious and patient should consult a health care provider.

A tray containing the following things are needed

S.No	Article	Purpose
1.	Two thermometers in a jar containing Dettol lotion 1:40 with some cotton at the bottom of the jar.	Disinfection of the used thermo meter. cotton at bottom of the jar prevents the bulb of the thermo meters from breaking.
2.	One jar with clean water	To rinse the thermometer.
3.	Clean cotton swabs in a container	To wipe the thermometer.
4.	Kidney tray	To discard the soiled swabs.
5.	Watch with second hand, pen, chart	To record the TPR as soon as the procedure is completed.

Contraindication

Patients who are extremely nervous, delerious, unconscious, hysterical, or mentally confused or those who can not follow instructions.

In mouth breathers, patients with injuries, inflammations or operations of the mouth, extremely weak persons who are not able to hold the thermometers under the tongue.

The Axilla or Groin

Advantages

- Taking temperature by axilla cause less discomfort for the patient.
- In children and other patients who are not able to hold the thermometer in the mouth, this method may be used since the nurse will be able to keep it in position without difficulty.
- Taking hot or cold drinks will not affect the temperature reading.

Steps of procedure

S.No	Article	Purpose
1.	Wash hands	To prevent cross infection
2.	Remove the thermometer from the antiseptic lotion and rinse it in cold water	To remove the disinfectant lotion
3.	Wipe the thermometer from the bulb upwards with a rotating movement using a clean cotton swab. Discard the swab	To maintain the asepsis of the bulb end
4.	Shake the thermometers if the mercury level is below 35° C. Shake it with the quick moments of the wrist	To record the temperature correctly the level of the mercury should be well below the actual temperature of the patient
5.	Ask the patient to open his mouth and place the thermometer under the tongue and ask him to hold the thermometer in place by closing lips and not by biting on the thermometer	To record the temperature accurately Biting on the thermometer can break the thermometer. Danger !
6.	Have the thermometer in place for one or two minutes	To allow enough time to register the body temperature
7.	Remove the thermometer and wipe from the stem to the bulb with a clean cotton swab Discard the swab	Wipe from the area of fast contamination to that of greatest contamination
8.	Read the level of mercury and record immediately	
9.	Reset the tray	

- The patient does not get the ill taste of the disinfectiants.
- There is no fear of biting the thermometer.

Disadvantages

- The axilla is moist from perspiration. Presence of moisture can give false reading
- If the thermometer is not placed correctly,it may go beyond the axilla and remain in the air or in contact with the clothing and give a false reading
- For the above reasons the axillary method is least reliable

Temperature by axilla

Before placing the thermometer in the axilla, see that the axilla is completely dry. Keep the thermometer in position by placing the arm over the chest. Leave the thermometer in position for five minutes. Axillary and groin temperature are usually about 1°F lower than that of the mouth.

Taking temperature by rectum

Requirements

All the articles as described in the oral method. Instead of oral thermometer, a rectal thermometer is used (Fig. 11.1).

1. Vaseline
2. Swabs

Procedure

1. Provide privacy
2. Place the patient in side lying position (lateral)

Fig. 11.1

3. Lubricate the bulb of the thermometer with Vaseline and insert the thermometer about 1.5 inches into the rectum. Keep it in position for 3 minutes
4. Remove the thermometers from the rectum and wipe it with clean cotton swabs
5. Read the level of the mercury
6. Keep the patient comfortable
7. Rectum temperature is usually about 1°F higher than that of the mouth

Fever

1. Relapsing fever

Relapsing fever is one in which there are brief febrile periods followed by one or more days of normal temperature (e.g., Malaria, relapsing fever).

2. Remittent fever

Remittent fever is characterized by variations of more than two degrees between morning and evening but does not reach normal (e.g., tuberculosis).

3. Intermittent or quotidian fever

The temperature rises from normal or subnormal to high fever and back at regular intervals. The interval may vary from few hours to three days. Usually the fever is higher in the evening than in the morning.

Pyrexia

In low pyrexia the fever does not rise above 99° to 100°F or 37.2 to 37.8°C.

Moderate pyrexia

The body temperature remains between 100° to 103°F or 37.8 to 39.4°C.

Hyper pyrexia

The temperature goes above 105°F

The Pulse

Definition

Pulse is an alternate expansion (rise) and recoil (fall) of an artery as the wave of blood is forced through during the contraction of the left ventricle (Fig. 11.2).

Fig. 11.2

Why is the test performed?

Measuring the pulse can give very important information about the health of a person. Any deviation from normal heart rate can indicate a medical condition. Fast pulse may signal the presence of an infection, dehydration or thyroid problem.

Normal values

1.	New borns, infants	- 140 - 160 beats / min
2.	Children 1 to10 yrs	- 70 - 120 beats / min
3.	Children over 10 yrs	- 60 - 100 beats / min
4.	Adult	- 60 - 90 beats / min
5.	Well trained athletes	- 40 - 60 per min

Important sites of palpation of pulse

- Temporal artery over the temporal bone
- The carotid artery can be recognized in the lateral part of the neck, just lateral to the larynx
- The brachial artery is situated in the anterior part of the forearm and can be palpated in the anterior part of the elbow
- Radial artery in front of the wrist
- Femoral artery can be palpated on the upper part of the thigh
- Popliteal artery (back of the knee)
- Posterior tibial artery
- Dorsalis pedis artery in situated on the anterior aspect of the foot

Characteristics of pulse

1. Rate - Number of pulse beats in a minute
2. Rhythm - Regularity of beats
3. Volume - Fullness of artery
4. Tension - Degree of compressibility

Respiration

A respiration consists of both inspiration and expiration and a pause. The respiration is controlled by the respiratory centre in the brain called medulla oblongata. Average rates of respiration at rest.

Infants	-	30 to 40 per minute
First year	-	26 to 30 per minute
Second year	-	20 to 26 per minute
Adolescence	-	20 per minutes
Adults	-	16 to 18 per minute
Old age	-	10 to 24 per minute

Respiration method

1. Never make the patient conscious that you are counting his respiration. For this, place the patients hand over the chest before taking the pulse. After counting the pulse, keep the hand in place and count the respirations also
2. Count the inspirations only (inspiration, expirations together make a respiration)
3. Note the characteristics of the respirations
4. Never count the respirations when the patient is in a state of tension

Blood pressure

Definition

Blood pressure is a measurement of the force applied to the walls of the arteries as the heart pumps blood through the body. The pressure is determined by the force and amount of blood pumped and the size and flexibility of the arteries.

Blood pressure has two components systolic and diastolic pressure. Systolic pressure is the highest pressure recorded in arteries during heart contractions. Diastolic pressure is the lowest pressure recorded during relaxation of the heart. Blood pressure is the difference between systolic and diastolic pressure. Usually while recording the pressure, systolic pressure is written as the top recording, diastolic pressure is written below systolic pressure. (e.g.,) 120/80 mmHg (systolic / diastolic). Normal blood pressure varies according to the age of the individual.

	Systolic	Diastolic
Infants	70 -90	50
Children	80 – 100	60
Adolescents	90 – 110	60
Adults	110 – 120	70 -80
Elderly	130 – 150	80 -90

Hypertension is a condition of abnormal high blood pressure. Hypotension is a condition of abnormal low blood pressure. The instrument used in measuring blood pressure is called a sphygmo – manometer.

Preparation of articles

1. Sphygmomanometer
2. Stethescope
3. Chart

Fig. 11.3

Procedure

1. Explain the procedure to the patient to gain their confidence and cooperation. Place the patient in a comfortable position either lying down with the arm resting on the bed or sitting with the arm supported on the table at heart level to ensure accurate reading. Patient should be resting at least 5 to 10 minutes prior to taking blood pressure.
2. The upper arm should be bare with sleeve comfortably rolled up.
3. Cuff should be well tied around patient's arm with its lower edge about 3 finger breath above bend of the elbow. Centre of cuff should lie over brachial artery.
4. Monometer should be at the same level as the cuff.
5. Feel for the radial pulse or brachial pulse.
6. Valve is tightened with fingers of one hand and cuff is inflated till pulse is impalpable. Note the pressure on the manometer. This is a rough estimate of systolic pressure detected by palpation (palpatory method) Release the pressure in the cuff).
7. Now inflate to another30 mmHg and apply diaphragm of stethoscope over brachial artery (Auscultatory method).
8. Deflate slowly the cuff until the sounds can be heard through stethoscope. This is recorded as the systolic pressure.
9. Continue to deflate the cuff slowly about 5 mmHg per second. The sounds muffle and then disappear. The point of disappearance is recorded as diastolic blood pressure.
10. Remove the cuff and place it neatly in the box and record in the chart immediately.
11. If any sudden change in blood pressure is detected while recording, the senior MLOP or ward doctor should be notified.

To summarize it can be said that checking the vital signs plays an important role in treating patients. They are to be well versed with these procedures. When the patients come for an eye test, she can perform these tests and notify the doctor about the results. While taking down the history of the patient she is to ask them whether they have BP and other systemic problems. Knowledge about vital signs will help her in the operation theatre also.

Key points to remember

1. *Normal vital signs change with age, sex, weight, exercise tolerance and condition.*
2. *The heat regulating centre is the hypothalamus situated in the brain.*
3. *Clinical thermometer consists of two different parts. One is the bulb containing mercury and the other is a stem with measuring scales showing the lowest temperature being 35° C or 95° F and the highest being 43.3° C or 110° F.*
4. *Fast pulse may signal the presence of an infection or dehydration.*
5. *Blood pressure is a measurement of the force applied to the walls of the arteries as the heart pumps blood through the body.*

Student exercise

Say True/False

1. *A body temperature of 98.6° F is considered to be normal*
2. *The measurement of body temperature determines whether a person has fever*
3. *In low pyrexia the fever does not rise above 99° to 100°F or 37.2° to 37.8°C*
4. *Pulse rate of new borns, infants will be 140 – 160 beats / min*
5. *No need to worry about irregular pulse*

Answer the questions

1. *What is the definition of vital signs?*
2. *What are the factors affecting body temperature?*
3. *Write the formula to convert farenheit scale to celsius scale.*
4. *Explain the steps to be followed to check the temperature of a patient.*
5. *Why do we check the pulse?*
6. *What is the method used to count respirations?*
7. *Describe the blood pressure checking procedure.*

CHAPTER 12 SYSTEMIC DISEASES

OUTLINE

Diabetes mellitus
Hypertension
Bronchial asthma

GOALS

The Ophthalmic Assistant will be able to describe the systemic diseases, the etiological factors, clinical manifestations and their management.

OBJECTIVES

To OA will be able to

- Describe diabetes mellitus and glucose metabolism
- Differentiate type I and type II diabetes and list diagnostic tests done
- Explain the management of diabetes and its complications
- Define hypertension, possible causes and treatment
- Discuss bronchial asthma, its diagnosis and treatment

CHAPTER 12
Systemic Diseases

Diabetes mellitus

Introduction

Diabetes mellitus is a chronic metabolic disease. Diabetes is increasing at an alarming rate all over the world and particularly in India. Body cells require glucose which produces energy required for daily activities. The food we eat turns into glucose after digestion. Glucose enters the blood stream and reaches different body cells. Insulin is like a key which opens the body cell doors to allow glucose to enter. In the absence of enough insulin glucose cannot enter the cells. Glucose remains in the blood stream in high amounts resulting in hyperglycemia. This abnormal blood glucose level is called diabetes mellitus.

It is not a single disease, but a group of diseases, characterized by chronic hyperglycemia (elevated levels of glucose in the blood) from various reasons, mainly due to impaired glucose metabolism.

Long term hyperglycemia leads to disorders like myocardial infarction, stroke, kidney diseases and diabetic retinopathy. Diabetic retinopathy affects the vision and may even leads to blindness. The OA is likely to encounter patients with diabetes. Patients with diabetes may have cataracts or glaucoma. Learning about diabetes will help the OA provide proper care and comfort to these patients.

Overview of physiology

The beta cells of the islets of langerhans produce a hormone, insulin. The islets of langerhans are situated in the pancreas, a yellowish gray gland situated behind the stomach.

The pancreas has many functions in addition to insulin production. The pancreas also produces digestive enzymes and other hormones .

Classification

- Type I diabetes
- Type II diabetes
- Gestational Diabetes
- Juvenille Diabetes

Etiology and risk factors

Type I diabetes mellitus

Genetic factors: This is genetically linked with (Human Leucocyte Antigen) HLA on chromosome 6. It is speculated that these HLA molecules provide antigens to produce auto- antibodies specific to islets of langerhans.

Immunologic factors: auto antibodies against the islets of langerhans destroy the beta cells affecting insulin production.

Environmental factors: It has been proposed that some virus or toxins may cause the beta cell destruction.

Type II Diabetes mellitus

Ages	:	Insulin resistance tends to increase with age over 40 years
Obesity	:	The insulin secreted is not sufficient for the cells
Family History	:	If the father or mother has diabetes, the chances of the child getting diabetes are increased
Lack of physical	:	This leads to impaired glucose
Activities	:	Metabolism

Pathophysiology

Type I Diabetes

- This generally occurs in young, lean patients.
- It is characterized by the marked inability of the pancreas to secrete insulin
- These patients are dependent on exogenous insulin to sustain their lives

Type II diabetes

In type II diabetes the body cells are resistant to insulin and there may be insulin deficiency

- This group of patients develops diabetes at an older age, after 40 years
- These patients are usually over weight
- The treatment modalities are diet control, weight reduction, oral anti diabetic drugs and insulin injection if necessary

Flow chart-pathophysiology of diabetes

- Deficiency of insulin
- Cells cannot access the calories contained in the glucose without insulin
- Liver releases glucose
- Glucose concentration in blood exceeds capacity of renal tubules to reabsorb
- Loss of water and minerals
- Thirst - polydipsia

Symptoms of diabetes

Symptoms of diabetes occur because body tissues are not able to utilise glucose. The classical symptoms include polyphagia, polydipsia and polyuria.

1. Polyphagia

Patients have increased appetite, and eat more than usual. This is because cells are starved of glucose since glucose is not able to enter cells. Although a diabetic eats more, the cells do not get enough glucose.

2. Polyuria

Patient passes large volumes of urine. Normal urine does not contain glucose. In the diabetics, kidneys are unable to reabsorb the excess glucose, so it appears in the urine. When glucose appears in urine, it drains a lot of water with it causing excessive urination.

3. Polydipsia

It is excessive thirst due to loss of water from the body. Other symptoms may include

4. Fatigue and weight loss in diabetes

In order to obtain energy, cells start using body fat and protein for energy instead of glucose. This leads to weight loss and tiredness.

Some people may not have any symptoms. DM is accidentally discovered in some persons during routine examination of urine and blood.

Diagnosis

- Blood glucose –the presence of abnormally high blood glucose levels is the criteria by which the diagnosis of diabetes should be made.
- Benedict's test to determine urine glucose
- Glucose tolerance test

The Result of the Oral Glucose Tolence Test can be evaluated as follows (using plasma to sample)			
	Normal	Impaired Glucose Tolerance	Diabetes
Fasting Value	< 5.5 mmol/L	5.5 - 7.7 mmol/L	>= 7.8 mmol/L
2-hour Value	< 7.8 mmol/L	7.8 - 11.0 mmol/L	>= 11.1 mmol/L

Oral glucose tolerance test

Performing an oral glucose tolerance test is necessary only when random or fasting blood glucose values do not establish the diagnosis.

Method

- Instruct the patient not to restrict diet during the 3 days preceding the test.
- The patient should fast for 12 hours immediately before testing.
- The test is usually scheduled in the morning.
- A fasting blood sample to determine plasma glucose level is taken. (If the plasma glucose level is =/> 7.8 mmol/L, no need for further testing)
- 75g of glucose, diluted in 250 ml of water, is given by mouth, within 5 minutes
- After 2 hours, a second blood sample is taken, and the plasma glucose level is determined

Diagnostic criteria – as defined by the world health organisation

Any patient on at least two occasions has

- Fasting plasma glucose levels of 140 mg/dl
- PPS > 200mgms
- GTT-2 hours sample with 200mg or greater will be considered as diabetic

Treatment of diabetes consist of three main components

The main goal of treatment is to normalize the blood sugar level in an attempt to reduce the development of complications

There are five components in the treatment of diabetes.

a. Diet
b. Exercise
c. Drugs - oral hypoglycemic agents, insulin injection
d. Monitoring
e. Education

Diet and exercise are the corner stone of diabetic management.

Diet

Balanced food within permitted calorie limits as prescribed by the doctor is taken. Sugar containing items have to be avoided. High fiber diet is encouraged.

Exercise

Exercise helps in glucose utilization and maintenance of weight.

Drugs

Oral hypoglycemic drugs

- Daonil
- Glyciphage
- Pioshitezovie

Injectable Insulin

Used in Type I diabetes life long and in Type II diabetics when blood sugar is not well controlled with oral agents.

Types of insulin

- Short acting - Duration of action is from 2 hours to 8 hrs
- Intermediate acting - In this type of insulin action starts after 4 hours effective for 24 hours
- Long acting - Effective for 24-36 hrs

Complications of diabetes: Acute complications

- Diabetic ketoacidosis
- Hypoglycemic attack

Chronic complications

- Ischemic heart disease, heart attack (silent, common)
- Renal failure
- Stroke
- Tingling of fingers and toes, foot ulcers due to neuropathy
- Nephropathy and renal failure
- Diabetic retinopathy
- Urinary tract infections

The diabetic patient who comes to an ophthalmic unit may develop hypoglycemia or ketoacidosis. The difference between hypoglycemia and hyperglycemia is given below.

Points to differentiate between hypoglycemia and hyperglycemia

Clinical features	Hyper glycemia	Hypo glycemia
Onset	Gradual	Sudden
Skin	Dry and cold	Warm & moist
Pulse	Faint and fast	Normal or high
Blood pressure	Low	Normal
Breathing pattern	Deep & sighing	Normal
Breath smell	Fruit odour	Normal
Blood sugar	High	Low
Treatment	I.V. fluids, insulin	I.V. glucose (25%dextrose)

Treatment of acute complication

1. Hypoglycemia
   - Occurs when blood sugar is < 60mgms

Treatment

- Sugar containing foods in conscious patient.
- Unconscious patient – 50ml of 25% dextrose followed by 10% dextrose drip for 12-24 hours.

2. Diabetic ketoacidosis
   - Occurs due to infection, stress, or stopping drugs. It is an acute complication.
   - Diabetic ketoacidosis can be life threatening if untreated.

Treatment

- Rapid correction of dehydration by IV fluids – normal saline or ringers lactate.
- Hourly intravenous insulin.

Student exercise

1. Fill in the blanks

a. Drugs that reduce blood sugar are called _____

b. Type II diabetes is called _____

c. Daonil is _____ drug

2. Choose the correct answer

a. Symptoms of diabetes mellitus include all except
   - *Polyphagler*
   - *Polymiar*
   - *Polydipsia*
   - *All the above*

b. Chronic complications of diabetes include
   - *Ischemic heart disease*
   - *Nephropathy*
   - *Diabetic retinopathy*
   - *All by the above*

c. Treatment of hypoglycemia
   - *25% in dextrose*
   - *injection insulin*
   - *Tab. Daonil*

3. Match the following

a. Hypoglycemia	*PPBS>200mg*
b. Hyperglycemia	*Blood sugar <60mg*
c. Type I D.M	*NIDDM*
d. Type II DM	*IDDM*

4. Choose the correct

a. Daonil is an
   - *Oral hypoglycemic drug*
   - *Oral hyperglymic drug*
   - *Antihypertensive drug*
   - *Analgesic*

Hypertension

Introduction

Hypertension is a very common disorder affecting 25% of the population. It is a major risk factor for coronary heart disease, cerebral, renal and peripheral vascular disease. It is called the silent killer because people with hypertension are often symptom free.

Definition - hypertension

Hypertension is defined as a systolic blood pressure greater than or equal to 140mmHg and/or a diastolic

blood pressure greater than or equal to 90 mm hg occurring in a patient on at least three separate occasions.

Classification of hypertension

Hypertension can be divided into 2 groups

- Primary hypertension
- Secondary hypertension.

Primary hypertension

Primary hypertension is the most common - 95% of patients with raised blood pressure are in this category.

This is also called essential hypertension. There is no known cause, we only know the effects.

At times people show a rapid rise in blood pressure with a risk of death within a year or two - this is known as malignant hypertension.

Secondary hypertension

Of the remaining 5% who have secondary hypertension, most are a result of renal disease, endocrine diseases, vascular disease, or neurogenic disorders.

Most of the people are affected with benign hypertension, in other words, stable. It is compatible with a long life. In this chapter the emphasis is given to primary hypertension and it will be explained in detail.

No one's blood pressure is constant. Exercise, a sudden burst of anger, all of these can raise our normal blood pressure readings. But generally, they don't raise our blood pressure to dangerous levels for long periods of time. In the absence of high blood pressure symptoms, hypertension is diagnosed based on several blood pressure readings taken over a period of time.

Etiology & predisposing factors of primary hypertension

As described earlier the etiology for primary hypertension is not known. Predisposing factors are

- Stress
- Obesity
- Diets high in cholesterol
- Smoking
- Heavy alcohol intake
- Lack of physical activity
- Over stimulation with coffee,tobacco
- Familial tendency

Etiology - secondary hypertension

Renal disease

- Acute glomerulonephritis
- Chronic renal disease
- Renal artery stenosis
- Renal vasculitis
- Renin-producing tumours

Endocrine disease

- Adrenocortical hyperfunction (Cushing's sydrome)
- Pheochromocytoma
- Acromegaly
- Myxodema
- Thyrotoxicosis

Vascular diseases

- Coarction of aorta
- Polyarteritis nodosa
- Aortic insufficiency

Neurogenic disorders

- Brain tumors and increased cranial pressure
- Polyneuritis, bulbar poliomyelitis

Miscellaneous causes

- Pregnancy
- Burns

Pathophysiology

The systemic arterial pressure is a result of

- Cardiac output - Cardiac output is determined by stroke volume and heart rate.
- Peripheral vascular resistance - Control of peripheral resistance is maintained by autonomic nervous system and circulating hormones.
- Any factor producing an alteration in peripheral resistance, heart rate, or stroke volume affects the systemic arterial pressure.

Structural and functional changes in the peripheral blood vessels

Loss of elasticity due to atherosclerosis

Loss of ability of the vessels to distend & recoil

Less ability to accommodate the blood pumped out

Decrease in cardiac output

Increase in peripheral resistance

Increase in blood pressure

The stabilising mechanism regulating blood pressure

The baro receptors

They are found in the carotid sinus, aorta and in the walls of the left ventricle. They monitor the level of pressure in the arteries. When the blood pressure lowers, this tries to raise the blood pressure or lowers the blood pressure when it is high. The exact reason why this control fails in hypertension is unknown.

Body fluid volume

Changes in fluid volume affect the blood pressure. If the body has excess salt and water, the blood pressure rises. This happens when there is alteration in kidney function of excreting water and salt.

Renin angiotensin system

Renin is an enzyme secreted by the kidney when the blood pressure decreases. The following flow chart explains how the blood pressure raises due to the action of renin and angiotensin.

Category	Systolic BP (mmHg)	Diastolic P(mmHg)
Normal	Less than 130	Less than 85
High normal	130-139	85-89
Stage 1 Hypertension	140-159	90-99
Stage 2 Hypertension	160-179	100-109
Stage 3 Hypertension	180 & above	110 & above

Blood pressure decreases

Kidney secretes renin

Angiotensin I

Angiotensin II → Vaso constriction

Raised blood pressure

Stimulates aldosteron secretion

Increased retention of sodium and water

Elevated blood pressure levels

Also when there is inappropriate renin secretion there is increased peripheral vascular resistance which causes essential hypertension.

Vascular auto regulation

Vascular auto regulation is the capacity of blood vessels to alter their resistance according to the blood flow. This means it should decrease the vascular resistance when the blood flow is decreased and increase the vascular resistance when the blood flow is increased. In hypertension this mechanism fails which results in increased sodium and water retention. This increases the blood pressure.

Clinical manifestations

- Headache
- Giddiness
- Palpitation
- Chest pain
- Nocturia
- Nose bleeds
- Vision changes

There may not be any symptoms and patient's hypertension may be detected only in routine examinations.

Complications

- Coronary heart disease
- Cerebro vascular accident
- Peripheral vascular disease
- Hypertensive retinopathy
- Renal disorders

Diagnosis of hypertension

History

- BP readings – high on 3 separate occasions
- Evidence of endovsan olamase - eye, cardiac or renal involvement

Physical assessment and Investigations

- Blood pressure measurement
- Fundus examination of the eyes to observe any vascular changes.
- Assessment to rule out systemic diseases.
- Route urine examination which will include protein, red blood cells, pus cells and casts -The presence of these may indicate the presence of renal disease.
- Chest x-ray to rule out left ventricular enlargement that results from hypertension.
- ECG to determine the degree of cardiac involvement.
- Assessment for psycho social factors that aggrevate the clients hypertension.

Management

Life style modifications

- Diet
  - Low fat, low carbohydrate diet
  - High fiber diet
- Weight reduction
- Stop smoking
- Relaxation
- Exercise
- Reducing alcohol consumption.

Mild hypertensive patients can be managed by diet control and weight reduction initially. If there is no response then drugs can be used for management.

Anti - hypertensive Drugs

Principal drugs used in treatment are

Beta -blockers

- Propranolol
- Atenolol
- Metoprolol

Calcium blockers

- Nifidepine
- Amlodipine
- Diltiazem
- Verapamil

ACE inhibitors

- Enalapril
- Lisinopril
- Captopril

Diuretics

- Thiazides

Eye and hypertension

Uncontrolled high blood pressure speeds up the normal aging of blood vessels in the eye. The constant force of the high blood pressure can make them weak and lose their elasticity. Uncontrolled hypertension can result in arterio venous compression, hemorrhages, exudates, and papill- edema of optic fundus (edema of the optic nerve at its point of entrance into the eye ball). The appearance of retina has been found to be a reliable index of the severity and prognosis of hypertension.

Symptoms and signs of hypertensive retinopathy

Hemorrhages around retinal vessels are signs hypertension is affecting the eyes and a person's vision. Vitreous hemorrhage is common in hypertensive patients.

Early changes

- Narrowing of arteries
- Arterio-venous (AV) junction changes.

Late changes

- Deposits of lipids (fats) in the eye.
- Cotton - wool spots (CWS-micro infarctions).
- Bleeding into the eye and complications like scarring, and pull on the retina leading to retinal detachment.
- Vein occlusions leading to sudden loss of vision and can cause growth of new vessels in the eye.
- In severe cases swelling of optic disc called papilledema occurs.

What can be done?

- Regular eye exams
- Good control of blood pressure
- Laser may be done in certain cases

Bronchial Asthma

Between 100 and 150 million people around the globe suffer from asthma. Asthma attacks all age groups but often starts in childhood. It is a disease characterized by recurrent attacks of breathlessness and wheezing, which vary in severity and frequency from person to person. In an individual, they may occur from hour to hour or day to day. Asthma cannot be cured, but can be controlled. Asthma is on the increase due to rapid urbanisation.

Definition

Asthma is an intermittent, inflammatous, reversible, obstructive airway disease in which trachea, & bronchi react in a hyperactive way to certain stimuli.

Types of asthma

Allergic asthma

Caused by known allergens such as dust, pollens, animals, food, etc.

Idiopathic non allergic asthma

This is not related to specific allergens. Factors such as common cold, respiratory tract infections, exercise, and stress may be responsible.

Mixed asthma

This has both the charecteristics of allergic and non allergic.This is the most common type of asthma.

Pathophysiology

Initial exposure to allergen

Antibodies are attached to mast cells (Mast cells are normally found in the body tissue. when stimulated they release histamine that causes allergic signs)

Re-exposure to allergen

Antigen and antibody binds

Release of mast cell products- histamine and other factors

Obstruction / narrowing of airway due to

- Contraction of smooth muscles around the bronchi
- Swelling of mucous membrane that line the bronchi
- Excessive mucus production within the bronchi

Clinical manifestations

Frequently the asthmatic attack occurs at night.

When a person has an asthmatic attack, usually they have

- Cough with tightening of the chest
- Difficulty in breathing, especially expiration. It is more prolonged than inspiration
- The patient uses accessory muscles of respiration
- Later cyanosis may occur
- Wheezing

The asthmatic attack may last from 30 minutes to several hours and may subside spontaneously. Occasionally it may last longer, which may be life threatening. This condition is referred to as status asthmaticus.

Diagnosis

- History will disclose factors which precipitate asthmatic attacks
- X-ray during acute attacks may reveal hyperinflation and flat diaphragm
- Sputum clear, white, foamy
- Arterial blood gas reveals hypoxia. The PCO_2 level will be high

Treatment

Asthma treatment is of utmost importance. Asthma can be controlled but not cured. It is not usually fatal, but it can become life-threatening if it is not treated or controlled. Asthma can produce respiratory failure Treatments:

- Broncho dilators - Inj, and tablets salbutamol, deriphylline, aminophylline, terbutalin
- Corticosteroids - efcorlin, solumedvol, decadron
- Oxygen
- Saltrulamol (tablets, inhaler, syrup)
- Deriphyclone (given in injection and tablets)
- Aminophyllin

Emergency care

- The two goals of emergency care for an acute asthmatic attack are
  - Improve oxygenation and ventilation
  - Relieve bronchospasm,
- New early asthma treatment can prevent fatalities
  - Observe the respiration and check pulse
  - Establish an airway and assist ventilations if necessary (mouth-to-mouth breathing if the patient is not breathing)
  - Enquire if the patient uses any medication for asthmatic treatment. Shake the inhaler and spray once in the air. Have the victim breathe in and out once. Then insert the inhaler and assist with three applications of the medication
  - Inform the physician
  - Stay calm and keep the patient as calm as possible; stress, cold and emotional intensity worsen the asthma
  - Keep the victim in a position of comfort, usually seated
  - If they don't have an inhaler, Asthalin nebuliser, inj. deriphylline (IV) and steroid

can be given as per doctor's order. Oxygen may be started

- If you do not anticipate aspiration, give the patient warm fluid by mouth

Prevention

- Identification of stimuli and avoid contact with that stimuli
- Prevention and proper management of common cold.

Inhalers

The most common way of taking treatment is with an inhaler – or "puffer" which delivers a precisely measured dose of a medicine in aerosol or fine powder form. The two main types of medicines used in inhalers are relievers and preventers.

Reliever

Medicine helps to open up the airways and works rapidly. It is used at the beginning of an asthmatic attach. Common reliever medicines include salbutamol (Ventolin), terbutaline and ipratropium. Inhalers containing these medicines are coloured blue.

Preventer drugs

These can be used together with relievers, and are for preventing symptoms. Most preventers are inhaled corticosteroids, usually referred to simply as steroids. They reduce the inflammation in the airways.

Tablets

If asthma is quite severe or unpredictable, it may be necessary to take a course of steroids in tablet form. These work in the same way as inhaled preventers, by reducing inflammation.

Nebulisers

Nebulisers make a mist of water and asthma medicine that is breathed in. They can deliver more of the drug to exactly where it's needed than conventional inhalers can. This is particularly critical in the event of a serious asthma attack.

Spacers

A spacer is a long tube that clips on to the inhaler. At the other end of the tube is a mouthpiece or mask that the patients breathes in and out of.

I. Fill in the blanks

1. *Saltrulamol is a* _____
2. *Asthma is an inflammatory* _____ *obstructive airway disease.*

II. Choose the correct answer

1. *Inj. aminophyline given in case of*
   a. *Status asthmaticus (acute asthmatic attack)*
   b. *Heart block*
   c. *Ischemic heart disease*
2. *Emergency care for an acute attack includes*
   a. *Improve oxygenation and ventilation*
   b. *Relieve bronchospasm*
   c. *Back rest*
   d. *All of the above*

III. Match the following

1. *Broncho dilaters*	-	*Efeorlins*
2. *Corticosteroids*	-	*Respiratory tract infection*
3. *Allergic asthma*	-	*Salbutamol*
4. *Non allergic asthma*	-	*Dust, pollution*

CHAPTER 13 OCULAR EMERGENCIES

OUTLINE

Chemical injuries
Corneal emergencies
Postop emergencies
Retina emergencies
Neuro - ophthalmic emergencies

GOALS

The Ophthalmic Assistant will learn basic knowledge of ocular emergencies, their treatment and management and to distinguish emergency situations from non - emergencyconditions.

OBJECTIVES

The OA will be able to

- Screen emergency conditions by asking a specific series of questions
- Determine the urgency of conditions and handle them appropriately
- Perform necessary procedures in the management of ocular emergencies
- Analyze the ethical and legal concerns regarding ocular emergencies.
- Demonstrate practical aspects of eye irrigation.

CHAPTER 13
Ocular Emergencies

Ocular emergencies may be broadly classified as

1. True emergencies, must be attended to within minutes
- Chemical injuries of eye
- Central retinal artery occlusion (CRAO)

2. Other emergent conditions
   - CRVO
   - Corneal FB
   - Corneal abrasion
   - Corneal ulcer
   - Perforating injuries
   - Blunt injuries

1. True emergencies

Chemical injuries

These may be an acid, alkali, or organic solvent.

- Alkali injuries are more dangerous because of easy and deep penetration into the eyes. Common causes of alkali injuries are limewater injury as found in plaster cement or white wash solution, and laboratory accidents (Fig. 13.1).

Fig. 13.1

- Acid injuries may follow laboratory accidents, attempted crimes, battery blast injuries.
- Organic solvents - household items like alcohol, cleaning fluids, gasoline, kerosene

Emergency management in chemical injuries:

- Record visual acuity
- Thorough irrigation of the eye
- Antibiotics
- Cycloplegics
- Steroid eye drops
- Vitamin C tablets

Central retinal artery occlusion

In this condition the blood supply to the retina is cut off leading to the death of retinal cells. This eye condition is similar to cardiac arrest. Hence early treatment helps in regaining vision.

Symptoms : Sudden painless loss of vision

Signs : Diffuse pallor of retina, cherry red spot at macula

- Rule out risk factors like hypertension and diabetes

Emergency management in CRAO

- Ocular massage (has greater effect if done with in 6 hours)
- Paracentesis
- Vasodilator medicines
- Interventions after 12 hours means visual prognosis is very poor

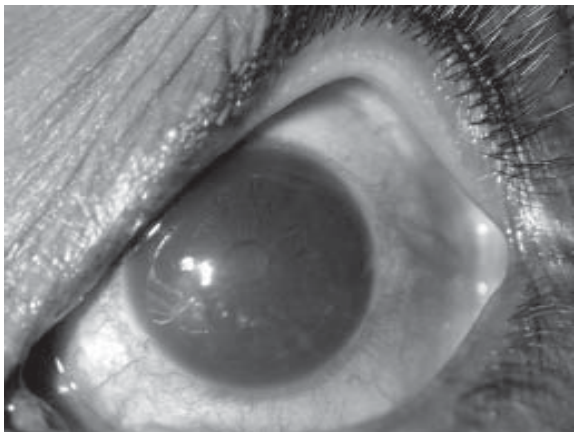


Fig. 13.2

2. Other emergency conditions

Emergencies in cornea

a. Corneal foreign body

Common foreign bodies in cornea are (Fig. 13.2)

- Dust - blown by wind
- Stone, metal and glass - while hammering, chiseling and lathing
- Paddy husk, wood, vegetable foreign bodies in agriculture laborers

Management

- Removal under local anesthesia
- Superficial foreign bodies can be removed with irrigation
- Antibiotics
- Pad and bandage

b. Corneal abrasions

Superficial injuries of the cornea without infections

Management

- Antibiotic ointment
- Cycloplegics
- Pad and bandage

c. Corneal ulcers

Breech in the cornea with infections is called ulcer. Ulcer may be bacterial, fungal, viral, parasitic, or immune related.

Management

- Eye shade
- Specific antimicrobial agents
- Cycloplegics
- Pain killers

d. Gonococcal conjunctivitis

Common in newborn babies. Risk of corneal perforation is greater.

Management

- Penicillin eye drops

e. Perforating injuries of cornea

Here sharp objects lacerate the full thickness of the cornea.

Management

- Immediate pad and bandage
- Surgical repair

Emergencies in glaucoma

Acute attack of angle closure glaucoma

Obstruction to the flow of aqueous humor following narrowed angle structures results in sudden raise of intraocular pressure resulting in acute angle closure glaucoma.

Signs and symptoms

- Severe pain
- Increased intraocular pressure
- Conjestion of the eye
- Corneal oedema
- Shallow anterior chamber

- Pupillary sphinter atrophy
- Glaucomatous optic nerve head cupping
- Nausea and vomiting

Management

- Pilocarpine eye drops
- Timolol eye drops
- Pain relievers
- Oral diamox tablets
- Interavenous mannitol (if needed)
- Laser peripheral iridotomy
- Check BP before starting mannitol as it may cause hypotension
- Ask for history of asthma before giving Timolol drops. It should be avoided in asthma patients.

Absolute glaucoma with pain

End stage glaucoma with high intra ocular pressure produces pain due to stretching of the layers of eye ball.

Management

- Measures to reduce pain
- Measures to reduce introcular pressure

Lens induced glaucoma

a. **phacomorphic glaucoma:** increase in size of the cataract lens obstructs the flow of aqueous humor and increases intraocular pressure.

Management

- Measures to reduce intra ocular pressure
- Cataract extraction with intraocular lens implantation

b. **Photolytic glaucoma:** rupture releases lens materials at the angle of anterior chamber, increasing the intraocular pressure.

Management

- Topical steroids
- Measures to reduce intra ocular pressure
- Cataract extraction with intraocular lens implantation

Pupillary block glaucoma

Blockage at the pupil causes reduced flow of aqueous humor from the posterior chamber to the anterior chamber resulting in increase in intraocular pressure. Pupillary block may follow obstruction by lens, IOL, vitreous, organized inflammatory exudates, etc.

Management

- Measures to reduce intra ocular pressure
- Mydriatics
- Laser iridotomy
- Surgical intervention if necessary

Emergencies in cataracts and post cataract surgeries

1) **Traumatic cataracts:** they are lens opacification following penetrating or blunt injuries of the eye with or without rupture of the lens capsule.

Management

- Evaluation of the amount of cataract by slit lamp examination
- Evaluation of other associated ocular injuries
- Posterior segment evaluations by indirect ophthalmoscopy or by ultrasound scan
- Plan for cataract extraction with or without intra ocular lens implantation

2) **Post operative wound leaks:** it is clinically evident by weak surgical wound, shallow anterior chamber, leak of aqueous humor, with or without reduced digital tension

Management

- Immediate pad and bandage
- Surgical intervention if necessary

3) **Post operative iris prolapse:** usually follows weak surgical wound

Management

- Immediate pad and bandage
- Repeat surgical intervention

4) **Post operative endophthalmitis**: it is a dreadful condition following introcular surgeries characterized by infection of internal ocular tissues.

Signs and symptoms

- Sudden visual loss
- Pain
- Exudates in anterior chamber
- Exudates in the pupillary area
- Loss of fundal red reflex
- Ultrasound Bscan helps in diagnosis

Management

- Intensive antimicrobial treatment following culture and sensitivity
- Painkillers
- Intravitreal antimicrobial agents
- Vitrectomy

Emergencies in Orbit

- **Orbital cellulitis:** inflammation of orbital tissues is called orbital cellulitis. It causes intense pain and swelling. Risk of extension into the brain is common especially in diabetics and immune compromised patients.

Management

- Oral and parental antibiotics
- Pain killers
- Cautious usage of steroids if necessary
- Imaging techniques like CT scan in non responding cases
- Orbital trauma (fracture of orbital walls)

Management

- Pain killers
- X-rays
- CT scan
- Surgical intervention if necessary
- **Abscess in and around orbits:** an abscess is a localised collection of pus. Abscess around the orbit usually lid abscess or lacrimal abscess

Management

- Pain killers
- Antibiotics
- Incision and drainage
- Daily cleaning and dressing
- Pan ophthalmitis: inflammation of all layers of eyeball following infection.

Management

- Pain killers
- Antibiotics
- Eviseration

Emergencies in Neuro Ophthalmology

- **Optic neuritis:** inflammation of the optic nerve is called optic neuritis. Inflammation of the optic nerve head is called papillitis and inflammation of retro orbital portion of the optic nerve is called retrobulbar neuritis.

Signs and symptoms

- Sudden loss of vision
- Pain with extra ocular movements
- Pupil abnormalities: relative afferent pupillary defect (Sluggish pupillary reflex compared the normal eye due to an optic nerve defect)
- On swinging torchlight from normal to abnormal eye, the pupil will dilate instead of constricting

Management

- Oral and parental steroids
- Traumatic optic neuropathy: usually follows road traffic accidents in young males

Signs and symptoms

- Sudden loss of vision following injury to the eye brow
- RAPD

Management

- Oral and parentral steroids
- Cerebro vascular accidents: results in bleeding into the brain which may cause visual loss. Usually occurs in old age, diabetes and hypertension. Vital signs should be monitored. Air way maintenance, BP, pulse monitoring

Management

- CT brain
- Neurologist referral

4. **Head injury**

Management

- CT brain
- Neurologist referral

5. **Papilloedema:** non inflammatory oedema of the optic nerve head secondary to increase in intra cranial pressure. Also seen in conditions of malignant hypertension and pseudo tumor cerebri.

Signs and symptoms

- Headache
- Transient obscuration of vision
- Visual acuity and colour vision usually normal
- Visual fields show enlarged blind spot

Management

- Record blood pressure
- CT Scan brain
- Neurologist opinion

Emergencies in retina

1. CRAO (described earlier)
2. Retinal tears: breaks in the peripheral retina

Signs and symptoms

- Flashes of light
- Floaters - inform the ophthalmologist immediately
- Indirect ophthalmoscopy reveals the breaks

Management

- Laser barrage
- Periodic follow up

3. Retinal detachment: separation of neuro sensory retina from the retinal pigment epithelium. It is common in high myopia.

Signs and symptoms

- Sudden or progressive loss of vision
- Field defects
- H/O seeing floaters and flashes of light.
- Management : surgical repair.

Practical exercises

1. Irrigation of the eye

It is necessary to irrigate the eye when some chemical substance falls on it.

Equipments needed

- A bottle of sterilized normal saline
- Kidney tray
- Local anaesthtic (4% xylocaine eye drops)
- A towel to protect the patient's face
- Sterile cap to protect ears
- Sterilized swabs
- Receiver tray

Procedure

- Explain the procedure to the patient and ask them to lie down
- Put a towel around the patient's shoulder and a cap over the patient's head covering the ears
- Wash and dry your hands

- Apply local anaesthetic drops
- The kidney tray is held firmly, against the patient's face.
  - Separate the lashes with fingers. Instead of irrigating the eye first, practice on the cheek
  - Saline should be poured continuously and uniformly. Ask the patient to look up and down and sideways. In order to expose the conjunctiva fully wash all parts of the conjunctival sac. Straighten the upper eyelid. Use the entire amount of liquid given to irrigate.
  - After irrigating the eye, dry the eyelashes with the sterilized swab. Remove the tray and see that the patient is comfortable.
  - Record the procedure and remove the udrf materials.

Note

- Repeated syringing with isotonic saline in to the conjunctival sac can be done.
- For alkali injuries irrigation for at least 30 minutes and for acid injuries at least for 20 minutes is recommended.
  - Time factor is important; the time between the fall of the chemical agent and irrigation determines prognosis of vision.

2. Vitals monitoring

In conditions of cerebro vascular accidents, head injuries and papilloedema following the space occupying lesions of brain, essential monitoring of blood pressure, pulse, temperature and respiration is mandatory.Notification and urgent call of the doctor in case of deterioration has to be done. (usually there will be decline in BP and decline in pulse rate.)

3. Ocular massaging

It is helpful in conditions of central retinal artery occlusion when patients presents earlier than 48 hours of manifestations.

Procedure of giving ocular massage

1. Can be given digitally or with a three mirror gonioscope
2. Over the closed leds use fingers to give moderate pressure over the globe intermittently
3. Initially give pressure for 10 seconds then release pressure for 5 seconds
4. Continue alternate pressure and release of pressure for a maximum period of 20 minutes
5. Meantime an ophthalmologist should be called and other modes of reestablishing retinal blood flow should be initiated

Key points to remember

Do's

1. *Take the patient's medical history in detail*
2. *Check visual acuity to establish a baseline measure*
3. *Ask questions to help to identify the nature of a foreign body if one is suspected and gather details of the accident*
4. *In case of chemical burn, collect the data regarding the name or type of chemical involved, the extent of exposure to the chemical*
5. *Notify the ophthalmologist or other staff immediately.*

Don't's

1. *Unnecessarily touch or handle an eye that has a laceration or rupture*
2. *Apply pressure to the globe while attempting to open the lids*
3. *Administer drops or other medications without authorization from the physician and instruction on the proper methods.*
4. *Use previously opened bottle of eye drops for a patient who may have a penetrating eye injury (always use a new unopened, sterile bottle)*
5. *Touch the dropper of the container*

Student exercise

Fill in the blanks

1. *True emergencies are _____ and _____*
2. *Ocular massage in CRAO is effective within _____of onset*
3. *Lens induced glaucomas are _____ and _____*
4. *Retinal detachment is a separation of _____ layer from _____ layer*
5. *Seeing flashes of light and floaters are suggestive of _____ following trauma*

Choose the most appropriate answer

1. *Which of the following is not a treatment of chemical injury to eye?*
   1. *Irrigation* 2. *Antibiotics*
   3. *Cyclopedias* 4. *Ocular massage*
2. *Following are the symptoms of an acute attack of angle closure glaucoma except*
   1. *Severe pain* 2. *Congestion of blood vessels*
   3. Corneal edema 4. *Floaters and flashes of light*
3. *Phacolytic glaucoma is due to*
   1. *Blockage at pupil*
   2. *Increase in size of cataractuous lenses*
   3. *Rupture of cataractuous lenes*
   4. *Shape of the layers of eyeball*
4. *Ocular massaging is useful in*
   1. *Chemical injuries 2. Phacolytic glaucoma*
   3. *Endophthalmitis 4. CRAO*
5. *Irrigation of eye is the treatment of*
   1. *Chemical injuries 2. Phacolytic glaucoma*
   3. *Endophthalmitis 4. CRAO*

Exercise

1. *What is the first step in management of a patient with chemical injuries of the eye?*
2. *Name two of the most common ocular emergencies and how to handle them*
3. *What are the do's and don'ts to remember in case of ocular emergencies?*
4. *Distinguish between emergencies and non-emergency conditions of the eye.*
5. *Review the emergency procedure guidelines with your senior staff member.*
6. *Write an assignment about the different ocular emergencies, various drugs and procedures used to handle them.*
7. *Set up a time to role play patient screening and emergency exercises with experienced members of the office staff*
8. *Demonstrate the procedure of irrigation*

CHAPTER 14 COMMUNITY OUTREACH PROGRAMME

OUTLINE

Need and importance of community outreach programme
Community outreach activities

GOALS

To enhance the Ophthalmic Assistant's understanding of the importance of community outreach program.

OBJECTIVES

The OA will be able to

- Describe the importance of community out reach programs
- Explain the different types of outreach programs
- Define the role of OA in outreach programs

CHAPTER 14
Community Outreach Programme

Introduction

There are an estimated 45 million blind people worldwide; 12 million of them live in India. While these figures are staggering the fact that more than 80% of this blindness is needless - that is, it can be prevented or cured, makes a community approach to eye care extremely crucial.

India was the first country to launch a nation-wide programme to tackle this problem. But in spite of the best efforts of the National Programme for the Control of Blindness (NPCB) India still has the largest number of blind people in the world.

The problem of blindness particularly in developing countries is not solely a medical problem but also a social one. In our experience it is common for blind people to be neglected both by family members and their community. They are considered to be an unwanted burden. As the unfortunate saying goes " A blind person is someone who has a mouth with no hands."

Need and importance of community outreach

Since cataract which is a major cause of blindness and visual impairment is a curable disease it is important to look at all the different factors that prevent people from accessing treatment. These factors have socio-economic implications and are listed below:

- A basic lack of awareness about common eye diseases and treatment methods
- No one to accompany the blind person to the hospital (many of these people come from daily wage earning families)
- Lack of money for transportation
- Fear of surgery

Because of their lack of awareness and poverty they continue to remain needlessly blind. The social and financial hardships created by blindness gravely affect individuals, families, and the nation at large (Fig. 14.1).

Fig. 14.1 Patients with bandages in the camp

Objectives of outreach program

- Since cataract is the major cause of blindness, the main objective of conducting eye camps is to identify people with cataract and provide them with the necessary treatment, that is, surgery.
- Second objective is to detect glaucoma cases by routine tonometry and in suspected and proved cases of glaucoma, to refer them to the base hospital for treatment.
- To prescribe glasses for refractive errors.
- To detect and treat (operate when required) diseases such as pterygium, chronic dacryocystitis and other infections.
- To refer school children in the villages for correcting refractive errors, squint,amblyopia, nutritional deficiencies etc.
- To undertake health education of the community on proper care of eyes and vision.

- To develop and maintain relationship with the community.
- To market the facilities offered.
- To train medical staff and develop their capacity.

Why we need to organise outreach programmes

Most developing countries are now challenged with the problem of blinding cataract and a huge backlog. Over 60% of this blindness is due to cataract which can be cured by a simple surgery.

In the rural areas where health care facilities are primitive, blindness is more pronounced (1.62%) constituting over 75% of the population) than in urban areas (1.03%).

Free eye camps are a major step in this war against needless blindness. They provide a link to the rural masses by reaching out, seeking the needy patients and restoring their vision.

Community outreach activities

An eye camp is an activity in which a medical team from the hospital visits the village and examines people's eyes to detect any problems. Those with eye problems are offered the necessary treatment either at the campsite itself or at the hospital, depending on the nature of the problem.

Different types of outreach programs

Screening (diagnostic) camp

The medical team examines the patients for eye problems and treats minor problems on the spot with medication. People who need surgery or speciality care are advised to come to the base hospital. No surgery is performed at the screening camp.

Outreach surgery camp

In places like Nepal and Afghanistan where the populations are scattered it is impractical to take the patient to the base hospital. It is advised to perform cataract and minor surgeries like DCT, pterygium, chalazion etc. in a fixed facility at the community level.

Village volunteers programme

In a study conducted by Aravind Eye Care System, London School of Hygiene Topical Medicine and an NGO at the community level on the uptake of eye care services through eye camps, it was found that only 7% of the people who need eye care services in the target village (which is within 5 kms of the camp site) were aware that an eye camp was conducted. It is neccssary to increase and improve the eye care service delivery to all the needy people in rural, tribal and inaccessible areas and involve the community based social service organizations, which are engaged in different health care activities in terms of trained volunteers, to identify all kind of ocular defects and vision impairments. The involvement of the NGO, commitment of the volunteers, efficient and effective training at the base hospital, scientific ways of identification and mobilization of needy people, can help these become sustainable. It is a continuous process to create awareness at the community level.

School eye health scheme

It is estimated that 5- 7% of school going children (up to 15yrs) have eye defects. Refractive error accounts for 5% of the total defects. In order to optimally utilize the resources, it is advisable to train school teachers (1 teacher : 100 children) to assess vision.

Role of OA in the eye camps

As a student

Eye camp gives a lot of opportunity for the OA to see a variety of cases in these outreach camps. Those who attend camps utilize the opportunity to improve clinical skills. They can also see patients with diabetic retinopathy, glaucoma, retinitis pigmentosa in camps. These are the patients who are not normally reaching a hospital in time. Most of the patients are not able to access the service. Since we go to their doorsteps we are able to see these cases, examine and counsel them. Pupil examination forms an important aspect of ophthalmic clinical

Fig. 14.2

examination. Abnormalities can give information for diagnosis. It can be caused by an optic neuritis, or glaucomatous optic atrophy.

Cataract screening alone does not form a comprehensive approach in eye camps. By neglecting camps, a trainee looses the opportunity to see cases in large numbers. Over a period of time, the trainee, learns many things by their mistakes. Seniors are there to help the students in dealing with the complicated cases and decision-making. Learning is an art and it comes from practice.

As a leader

For an OA, eye camps are challenges to develop individual leadership capabilities. Coordinating the whole team, maintaining discipline, punctuality and culture of all involved are to be taken care of.

The cordial relationship with the sponsors who conduct eye camps, an informal talk, a friendly smile make them feel comfortable. The quality of leadership makes the camp sponsor not only satisfied but also willing to continue the service to the community. Listening patiently to the complaints of patients and communicating in a proper way is essential rather than just examining with the torchlight and directing them to the next stage in the camp.

As a team worker

An eye camp team consists of doctors, OAs, patient counsellors, optician and camp organiser. As a team member, coordinating important tasks with the help of other staff forms a major step for the success of a camp. The OA creates a team spirit in the group and arranges to see a large number of patients in a quick and orderly way. The OA should not work as an individual but work as a buffer to improve the quality of the team. The accountability of the team is a result of the contributions of each member of the team.

Magnitude of blindness in India

Blindness due to cataract still remains a big challenge to both the medical and social welfare fields. Most developing countries are now facing the challenging problems of blinding cataract, with a huge backlog and a growing elderly population contributing to the increase of new cases. A national survey conducted in 1987 by WHO - NPCB shows an increase in the prevalence of blindness due to cataract from 55% in 1975 to 80% in 1987 and in Tamil Nadu 88% of total blindness is due to cataract.

The total population in India is over 1 billion of which 75% lives in villages which have very few eye care facilities. In India out of 30 million eyes, only 3.5 million is operated every year. In Tamil Nadu 3.6 lakhs eyes are operated, of which 60% of surgeries are performed by Non Governmental Organizations. These statistics shows the magnititude of the problem and the importance of private hospitals handling the problem. An outreach programme plays a vital role. The village people will feel comfortable with them as they talk their language. They also can go down to the villager's level of understanding and explain their disease and make them give their consent for surgery or treatment.

Summary

The OA learns from this unit the importance of conducting outreach programs. This program goes to the door step of those who need this type of medical help and helps them to enjoy the benefits. The different types of outreach programs enable people of all age levels to get assistance.

Key points to remember

- *The problem of blindness particularly in developing countries is not solely a medical problem but also a social one*
- *The social and financial hardships created by blindness gravely affect individuals, families and the nation at large*
- *There are different types of camps*

Student exercise

Answer the following

1. *What are the objectives of outreach program?*
2. *What are the types of camps?*
3. *What is the role of OA as a trainee?*
4. *What is the role of OA as a team member?*
5. *Write a short note on the magnitude of blindness in your country.*

CHAPTER 15 OPHTHALMIC TERMINOLOGIES

OUTLINE

Anatomy of the Eye
Cornea
Lens
Conjunctiva
Ocular muscles
Operating room facilities
Refraction
Special investigations
Dark room procedures
Eye lids

GOALS

The Ophthalmic Assistant will understand the terms used in ophthalmology

OBJECTIVES

To OA will be able to

- Name the different parts of the eye
- List the types of drugs used for the patient
- Discuss the terms used in refraction
- Define the terms used in different procedures

CHAPTER 15
Ophthalmic Terminologies

Introduction

Studying medical terminology is very similar to learning a new language. The words first sound strange and complicated, although they may stand for commonly known English terms. The terms otalgia, meaning ear ache and ophthalmologist meaning eye doctor are examples. Medical terms are very much like individual jigsaw puzzles. They are constructed of small pieces that make each word unique, but the pieces can be used in different combinations in other words as well. Some medical terms are pronounced alike but are spelled differently, which accounts for their different meanings. Even when the terms are spelled correctly, terms can be misunderstood because of incorrect pronunciation. In this unit the OA learns the medical terms, understands their meaning and usees them appropriately.

- Eye Ball - The globe or ball of the eye
- Proptosis - Protrusion of the eyeball
- Eyelid - Upper lid and lower lid, these two structures cover the eye from the front
- Cornea - Clear circular transparent portion of the external coat of the eyeball
- Micro cornea - Cornea size smaller than normal
- Megalo cornea - Cornea size larger than the normal
- Lacrimation - Increased tear production due to reflex sensory stimulation
- Photophobia - Sensitivity to light
- Hypopyon - Pus in the anterior chamber
- Leucoma - Opacity of cornea
- Adherent leucoma
  - Adhesion of a part of the iris to a white corneal scar
- Alkali burns
  - Corneal burn caused by alkali chemicals such as sodium hydroxide (caustic soda), potassium hydroxide (caustic potash) or calcium hydroxide (slaked lime)
- Bullous keratopathy
  - Blister like elevation of the corneal epithelium. It results from excess fluid in the stroma and epithelium due to loss of the dehydrating mechanism of the cornea, and is usually caused by damage to the endothelial cells. It may result in blindness and pain
- Keratomalacia
  - Softening of the cornea often occurring in sever vitamin A deficiency
- Herpes zoster ophthalmicus
  - Reactivation of the chicken pox virus affecting the skin over the distribution of the fifth nerve, which may produce corneal ulcers, iritis and secondary glaucoma
- Arcus senilis
  - It is a grayish white circular line of lipid deposition in the cornea near the limbus, usually seen in aged persons. Harmless
- Keratoconus
  - In this condition central or paracentral cornea undergoes progressive thinning and bulging. Patient develops high astigmatism
- Limbus
  - It is a structure at the junction of the cornea and conjunctiva
- Keratoplasty (corneal grafting)
  - Corneal transplantation is a procedure where abnormal host corneal tissue is replaced by healthy donor corneal tissue

- Choroid - is a highly vascular coat of the eye that nourishes the outer layer of the retina.
- Sclera - is the hard, firm, fibrous outer coat of the eye which is contiguous to the cornea.
- Iris - coloured membrane in front of lens usually brownish black coloured.
- Pupil - is circular opening in the center of iris.

Anatomy

- Anterior segment - referring to the front part of the eye.
- Angle of the anterior chamber is the angle that lies between the iris and the cornea and through which the aqueous fluid flows out of the eye.
- Gonioscopy - examination of the angle of the anterior chamber.
- Anterior chamber - the portion of the eye lying between the cornea and the iris.
- Posterior chamber - is a triangular space between the back of iris and the anterior surface of the lens.

Lens

The lens of the eye is a transparent biconvex structure situated between the iris and the vitreous.

- Cataract - an opacity of the crystalline lens.
- Hypermature cataract - a cataract in which the lens of the eye becomes white and opaque, and hard.
- Mature cataract - an opacity of lens of the eye that has become completely opaque
- Nuclear cataract - a cataract largely confined to the central portion of the lens, the nucleus.
- Senile cataract - an opacity of the lens occurring in the aged.
- Traumatic cataract - a cataract following any injury to the eye

Conjunctiva

- Mucous membrane that lines the eyelids and wraps around the front part of the eyeball to end at the limbal junction of the cornea.
- Conjunctival sac - the potential space, lined by conjunctiva, between the eyelids and the eyeball; cul - de - sac.
- Dacryocystorhinstomy (DCR) - a communication is made between nasal mucosa and nasal lacrimal sac flap.
- Epilation - the mechanical removal of eyelashes or cilia by the roots as performed in the removal of misdirected eyelashes.
- Eversion of the eyelid - the folding back of the eyelid.
- Extraction - removal. In the eye it refers to the surgical removal of the lens (cataract removal).
- Filtering procedure - an operation for the release of aqueous into the subtenon or subconjunctival space by fistulisation through the sclera.
- Fundus - inside of the eye. Primarily the retina, the macula, the optic disc, and the retinal vessels that can be seen with an ophthalmoscope.
- Implant - an artificial insert placed in the eye, socket or orbit. Also introcular lens implant.
- Lacrimal gland - a gland that secretes tears; it lies in the upper outer angle of the orbit.
- Limbus : the annular border between the clear cornea and the opaque scleral - conjunctival area
- Orbit - the bony cavity containing the eye, which is formed by the frontal sphenoid, ethmoid, nasal, lacrimal and maxillary bones.
- Panretinal photocoagulation (PRP) - complete laser photocoagulation of the retina.
- Peripheral iridectomy - a section of iris is excised so that aqueous can drain from the posterior chamber to the anterior chamber.

Pterygium

- A triangular fold of growing membrane that may extend over the cornea from the white of the eye. It occurs most frequently in persons exposed to dust or wind over a long period of time.

Tarsorrhaphy

- A temporary or permanent surgical union of the upper and lower lid margins. It may be temporal (lateral) nasal (medial) or completes.
- Vitreous is a jelly like substance behind the lens and in front of the retina.
- Vitrectomy is a surgical procedure to remove a portion of vitreous from the eye.
- Retina is a layer of sensory receptors for light and is composed of rods and cones.
- Retinal detachment is separation of the retina in which the anterior sensory layer detaches from the posterior pigment layer.
- Retinopathy is a general term denoting any pathological occurrence in the retina.
- Diabetic retinopathy is retinopathy seen in diabetic patients.
- Hypertensive retinopathy is retinopathy seen in hypertensive patients.
- Retinopathy of prematurity is an obliteration of developing blood vessels in an immature retina initially caused in the premature newborn by a high concentration of oxygen.
- Buckling - means operating for retinal detachment by resecting a portion of the sclera and implantation of foreign material to indent the outer coats of the eye.

Eye muscles

- Medial - means towards the center
- Lateral - means away from the center
- Superior - means upper
- Inferior - means lower
- Intraocular - means within the eye

Intraocular pressure - the pressure of the fluid within the eye.

Glaucoma - is characterised by a sustained elevation of intraocular pressure.

Aseptic Environment - Is one that is free from bacteria and pathogenic spores.

Sterilisation - Is the killing of all living organisms including spores.

Disinfection - Is the killing of most pathogenic organisms but not necessarily spores.

Autoclave - Is a piece of equipment that provides heat and moisture under high pressure to sterilise materials.

Drugs

Anaesthetics, local given by injection; only the area infiltrated is locally treated. Agents employed in ophthalmology include procaine and lidocine (Xylocaine).

- Antibacterial drugs - originally derive from bacteria and fungus molds. Synthetic antibiotics are common.
- Cyclogyl - a rapid onset, short - acting synthetic drug that causes mydriasis and cycloplegia after being dropped into the eye. Used prior to refraction, especially in children.

Miscellaneous terminology

Abscess - localized area of inflammation.

Bell's phenomenon - upward - and - outward deviation of the eyes occurring in sleep or with forcible closure of the eyelids.

Refraction

The phenomenon of bending light as it passes from one transparent medium to another of different density is known as refraction.

Refractive Index

The refractive power of a substance in comparison with that of air is spoken of as its refractive index.

Convergence

The process of directing the visual axis of the two eyes inward to a new point.

Cross cylinder

A lens consisting of two cylinders of equal power, one being plus, the other being minus, set 90 degrees apart.

Cycloplegic

A drug often used in refraction, which temporarily places the ciliary muscle at rest and dilates the pupil.

Depth perception

Ability to perceive the solidity of objects and their relative positions in space; also called stereoscopic vision.

Divergence

The outward rotations of the two eyes to see in the distance.

Glare

Irregularly scattered light that interferes with the focused retinal picture and reduces visual acuities.

Automatic refractors

An instrument whose purpose is to provide an accurate assessment of the refractive error of the eye.

Emmetropia

When parallel rays of light strike a physiologically normal eye they are refracted to converge upon the retina where they focus, forming a circle of least diffusion, with the eye in the state of rest (without accommodation).

Ametropia

Parallel rays of light are not focused upon the retina with the eye in the state of rest, such as in refractive error.

Hypermetropia

Eye is relatively short; images are formed behind the retina. Patients will complain of difficulty while doing near work and reading.

Myopia

The eye is relatively long; images are formed in front of retina. Patient will complain of difficulty seeing distant objects.

Astigmatism

A refractive error that prevents light rays coming to a single focus on the retina due to different degree of refraction in various meridians of the eye.

Anisometropia

Is a condition in which there is a difference in the refractive error of the two eyes.

Aniseikonia

If the difference in the refractive error of the two eyes is very large, image of unequal size will appear on the retina and be transferred to the brain.

Aphakia

is the condition in which the crystalline lens is absent from the pupillary area.

Presbyopia

Is a condition in which the ability to accommodate for near vision decreases because of loss of elasticity of the crystalline lens of the eye and weakness of the ciliary muscles. Condition is seen above the age of 40 years.

Visual axis

A line that connects a point in space with the fovea centralis of retina.

Spectacles

Prescribed glasses that are worn to correct refractive error.

Contact lenses

Are thin shells of transparent plastic designed to be worn over the anterior portion of the eye ball (on the cornea).

IOL - Intraocular lens

PCIOL - Posterior chamber intraocular lens

ACIOL - Anterior chamber intraocular lens

Special investigations

1. **Tonometry:**

   The introaocular pressure can be determined accurately with instruments known as tonometers.

   a. Indentation tonometer - Schiotz tonometer is quite popular.

   b. Applanation - Goldmann tonometer.

2. **Slit lamp examination**

   It is essential for detailed examination of the eye. Uses high magnification to view external and internal structures of the eye.

3. **Gonioscopy**

   To examine the angle of the anterior chamber. Gonioscopy is very useful in diagnosis and management of various glaucomas.

4. **Ultrasonography**

   Uses sound waves to examine posterior segment of the eyeball (such as retinal detacement) when visual exploration is impossible owing to presence of cataract, blood in the eye, corneal opacities.

5. **CT scan: (Computer assisted tomography)**

   Converts x-ray pictures into digital computer codes to make high resolution video images.

6. **Fluorescein angiography:**

   In this test a green dye (fluorescein) is injected in the arm and photographs of the fundus are taken. Retinal capillaries as small as 5 microns which could not be visualised can now be clearly seen with the help of fluorescian angiography. It is very useful in diabetic retinopathy, hypertensive retinopathy, papilloedema, central serous retinopathy.

Dark room procedures

These procedures are done in dark room(dim light)

Retinoscopy

This is done to estimate the refraction of the eye objectively.

Direct ophthalmoscopy

The pupil should be dilated. The direct ophthalmoscope is used to examine the fundus (optic disc, vessles and macula)

Indirect ophthalmoscopy

The pupil may be dilated. Binocular indirect ophthalmoscope is worn on the examiner's head. The fundus is examined by throwing the light into the patient's eye. In this examination the periphery of the retina can be seen.

Tests

Amsler grid

A chart with horizontal and vertical lines for testing the central field of vision for scotomas and detecting macular distortion.

Cover test

A test used to detect strabismus ; when the fixating eye is occluded, the eye that is not in proper alignment must make a motion to pick up the target.

Ishihara test

A test for defects in recognising colours, based on the tracing of numbers or patterns in a series of multicolored charts or plates.

Eye lids

Stye

Is a circumscribed, acute inflammation at the edge of the lid.

Chalazion

Is a chronic granulomatous enlargement of one of the meibomian glands.

Blepharospasm

Is a condition in which there are involuntary and forcible eyelid closures.

Trichiasis

Is an inversion of a varying number of eye lashes so that they rub against the conjunctiva or cornea.

Ectropion

It is a rolling out of the margin of the lid.

Symblepharon

Is a cicatricial attachment between the conjunctiva of the lid and the eye ball.

Lagophthalmos

This is the condition of incomplete closure of the palpebral aperture when an attempt is made to shut the eyes.

Ptosis

Drooping of eyelid.

Conjunctivitis

Is an inflammation of conjunctiva characterized by redness of the eye and conjunctival discharges.

Ophthalmia neonatorum

It is an acute purulent conjunctivitis occurring in new born.

Trachoma

It is a chronic follicular keratoconjunctivitis of infectious origin. It is an important cause of blindness.

Phlyctenular keratoconjunctivitis

It is an allergic condition caused by endogenous bacterial protein, which in most cases is tuberculous.

Bitot's spots

Small triangular silvery white patches on the outer and inner side of the cornea, covered by a material resembling dried foam which is not wetted by tears. Caused by vitamin A deficency.

Summary

The above given medical terms are to be learned by the OAs and used often among colleagues and while talking to the patients. The medical terms should be used but the appropriate explanations should be given to the patient. It is very important for them to learn the spelling and write the terms without spelling mistakes.

Student exercise

Fill in the blanks

1. *Lacrimation means* ———————————— ——— *production due to reflex sensory stimulation.*
2. ———————— *is a structure at the junction of cornea and conjunctiva.*
3. ———————————— *is a jelly like substance behind the lens and in front of retina.*
4. *Cycloplegic drug often is used in* ———————— ———— *which temporarily places the ciliary muscle at rest and dilates the pupil.*
5. ———————— *examination is essential for detailed examination of the eye.*

CHAPTER 16 INDIVIDUAL DEVELOPMENT

OUTLINE

Planning
Communication skills and time management
Situation analysis
Decision making and problem solving
Delegation of responsiblities
Team building and leadership qualities
Computer skills

GOALS

To enable the Ophthalmic Assistants to plan their work and discharge their duties in a timely and effective manner.

OBJECTIVES

To OA will be able to

- Plan and communicate to others the needs of the department
- Manage time and make appropriate decisions
- Solve problems by delegating responsiblities
- Inculcate leadership qualities and build a team to achieve the goals
- Use computer for day to-day activities

CHAPTER 16
Individual Development

Planning

Planning means having a view of the future and deciding in advance where we would like to be, and what is to be done in order to reach there.

Planning starts with the definition of the objectives and the formulation of the specific goals or targets to be achieved. Goals are derived from the analysis of existing situations of an organisation and, once defined, provide a sense of direction to all the managerial activities. In order to achieve the goals, specific plans are drawn up. Objectives, goals or targets provide answers to the question, 'where is the organization heading.

The planning process can take anywhere from one day to a year depending upon

- The size and complexity of the organisation.
- The level of disagreement within the organization about the future.
- The extent to which change in organisational strategy is necessary to adapt to changing environment.

Organising the planning process

The process of planning a programme can be difficult, but it can also bring a number of rewards. In addition to producing a well organized programme, the organisation as a whole can be strengthened by successfully confronting the challenges of the planning process.

- **Motivating staff***:* Reaching agreement on goals and on how to achieve them is called motivating because everyone involved ends up with a shared vision and with concrete ideas about how to surmount obstacles. In order to achieve the vision, motivation of staff is required.

Basic elements of planning

1. Evaluation of present conditions: recognising the present conditions and inadequacies that require change.

   Once these undesirable conditions are identified, the question arises of what to do about them. It is the existence of alternative answers to this question that gives rise to planning.
2. The time factor: The timing of events. Success of planning depends on the ability of the organisation to understand that short-range planning can be successful only if it is carried out in the context of adequate long-range planning.
3. Collection and analysis of data: Effective planning depends on the quality and quantity of data available to the organisation. Consideration must be given to the relevant data from the present and the past and an assessment must be made of possible future events.

   It is the right establishment of assumptions or forecasts of the future that have a bearing on present actions.
4. Hierarchy of plans: All the plans within the organisation are interdependent and mutually supportive.

   Proper attention to these factors should result in plans that are objective, structured and yet flexible. The probable success depends on the extent to which plans are developed with these aspects in mind.

People react negatively to pressures. These negative reactions invariably create blocks in effectiveness. Many pressures can be avoided by good planning that provides orderliness.

Need for planning

- It attempts to minimise uncertainty by forecasting the future and also minimises the chances of mistakes
- It focuses on objectives or goals of the organisation and their accomplishment
- It leads to economy in operation
- It helps in effective decision making
- It helps in controlling activities
- It helps in coordinating the operations of an enterprise

Planning process

There are four steps involved in a planning process:

- Perception of opportunities: It is very important to be aware of opportunities. To be effective, planning should anticipate and meet conditions as they develop. Hence planning requires a realistic diagnosis of opportunities.
- Establishment of goals: The second step in planning is to establish the goals to be achieved for the whole enterprise and each of its sub units. Goals should be measurable so that the performances of the enterprise and its sub units can be evaluated.
- Appraisal of planning premises: Premises are the factors in the environment that affect the achievement of goals. In fact planning in any organisation rests on several premises. The planning premises may be grouped as external or internal.
- Exploring of action paths and selection of a course of action: The last step in the planning process is to explore and evaluate alternate plans of action and determine a specific action plan.

Once the goals have been established and the factors affecting plans taken care of, actual action plan in the form of programs and budgets are formulated.

How to improve your planning abilities

Planning is written about and talked about more than it is done. Here are some ideas that will encourage you to plan your activities in advance.

- Force yourself to plan.
- If you fail to plan, you are by default planning to fail.
- Schedule uninterrupted time every day to do your planning.
- Anticipate possible problems you could encounter in your project because of people, material, or mechanical failures. Purposely provide preventive actions and contingency plans in important high risk situations.
- When planning a project, plan in thinking time.
- Plan for tomorrow, tonight. Your subconscious will help organize while you sleep.
- Each day anticipate the sequence of activities that you will do to attain the objectives you seek.
- Think about your entire week. How will important projects be sequenced?
- Do your planning on paper to capture all of your ideas and to be sure none of them get lost. We can only work mentally with about seven pieces of information without losing something. Write your thoughts down and you will be able to utilize everything you think of during your planning process.
- When developing a specific plan, list the activity steps individually on small pieces of paper and then sequence the pieces of paper. Then write the whole plan out in sequential order.
- If you must, leave your office and get away to do your planning in a quiet place where you can think.
- Don't hurry the process. Something will get overlooked.
- When things go wrong, it can generally be traced back to a poor job of planning or failing to follow an existing plan.

- List key words that relate to a project. They will fit into and help you in planning. Keep records of how long it takes to do an activity. You can use this information for future scheduling.
- Take the first few minutes of any time block and dedicate it to planning that block.
- Whether you call it planning time, thinking time, quiet time or meditation, the payoff in increased productivity will be high.
- Schedule one weekend away each quarter and make it a top priority. Mini-vacations are refreshing.
- Encourage your staff to create their own plan and then to explain it in detail to you.
- Sit quietly and mentally rehearse the steps in your plan. Use your imagination to visualise the steps being taken. You will sense where additional steps need to be added and will anticipate problems to prevent.
- Consider settling for 90% completion of 90% of the projects. The final 10% may not be worth the cost to attain them.
- When starting a new project or activity, take a moment to quietly review, mentally, the steps you will follow.
- Set your own due dates for projects earlier than the actual deadline.
- Put schedules in writing. Publish them and then follow up with them.
- If you cannot identify the objectives and steps to take to get to a goal, it is unrealistic.
- Mentally organize before proceeding.
- Stick Post-It-Notes on paperwork to indicate or highlight scheduling and due dates.
- Remember the 6 P's of planning: Proper Prior Planning Prevents Poor Performance.
- Schedule formal planning meetings with your staff regularly.

Communication

Communication is a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior" (Webster, 1983). Communication is classified into two types

- Verbal
- Non - verbal

Verbal communication

A great deal of our life is taken up with verbal communication. We are often unconsciously influenced by the things around us:

- Newspapers
- Television, radio, films
- Magazines
- Advertising boarding

The most effective communications are usually face to face and involve:

- A sender / speaker
- A receiver / listener
- A purpose / the reason for the communication

Non - verbal communication

- Eye contact
- Gestures
- Distance/Proximity
- Facial expression
- Posture
- Written information
- Touch
- Dress/appearance
  - Cloth / uniform
  - Tidiness of appearance
  - Hair style
- Personal space

Barriers to effective communication

- Filtering
- Selective perception
- Emotions
- Language
- Lack of effective listening

What affects the reception of verbal messages?

- Background noise
- Language barriers
  - Different languages
  - Accents
  - Use of jargon
- Fear/anxiety
  - Patient may not really be listening or want to hear.
- Impaired understanding
  - Mental state
  - Age
- Speed of speech
- Tone of voice

Communications skills

- Adapters
  - learning to control emotions, getting on with others.
- Attitude
  - body movements indicate attitudes: friendly, or cold
- Voice control
  - Tone, pitch, volume, rhythm, hesitation, pauses
- Jargon / local phrases or expressions
- Questioning
  - Open, closed, timing, content, level of disclosure.

While communicating

- Speak slowly
- Make eye contact
- Use simple language
- Ask one question at a time
- Give one piece of information at a time
- Use gestures
- Exhibit affirmative head nods and appropriate facial expressions
- Encourage the other person to speak
- Avoid distractive, background noise, actions or gestures
- Avoid interruptive the speaker
- Don't over talk
- Do not shout

Difficulties with communication

- Too much information
- Too little information
- Interest
- Previous knowledge
- Assumptions
- Incorrect information
- Inability to express oneself
- Status of persons involved
- Communication skills
- Questioning techniques: the use of closed or open questions, the type of knowledge required, level of disclosure
- Gender
- Culture / Background

Reasons for communication

To teach or learn something

To obtain/accomplish something

To express feelings

To solve problems

To stimulate interest

To socialise

To entertain

To provide support

To question or to answer
To organise
To justify
To discipline
To pass on information
To clarify

Twelve strategies for effective communication

Medical settings require members of healthcare teams to communicate, collaborate and solve conflicts in order to provide good patient care, yet often these skills are not taught.

Poor working relationships between inter-disciplinary team members (such as attending doctors, house staff, medical students, nurses, social workers, and support staff) may negatively affect patient care and the teaching environment. Conflict can arise from communication difficulties and differences in status, education, roles and goals.

In academic medical settings, healthcare team members share the same goal to provide optimal care for the patient and effective training for house staff and students. Giving team members the opportunity to improve their communication skills facilitates their work together. The following strategies, or early response skills can help healthcare team members communicate more effectively and resolve conflicts.

- Be respectful and professional in your interactions.
- Listen intently to the other person. By allowing the other person to present their story without interruption, you show that you will treat it thoughtfully and respectfully. You also learn what the other person's wants or needs. Active listening may uncover hidden agendas. By listening to and understanding the underlying needs you increase the likelihood of reaching a solution.
- Try to understand the other person's viewpoint. To reach understanding and correct misunderstandings, repeat back or paraphrase what you hear. "It sounds like you are saying. .. is that what you mean?" Gather information and ask for clarification. The information you gain will help you to determine a responsible course of action.
- Acknowledge the other person's thoughts and feelings. "You seem frustrated." "You seem upset." "That's another way to look at it." Acknowledgment does not mean agreement. You can validate feelings without agreeing with the content of what is being said. This strategy builds trust and promotes constructive problem solving.
- Be cooperative. Assume good faith. To promote working together, use words such as "joint" and "mutual," rather than "either, or".
- Look for shared concerns. It often helps to focus on smaller issues first, before moving to more difficult issues. Return to common interests if things begin to escalate.
- State your feelings. Use words such as "I think" and "I feel," but rely on facts and information. Avoid judgments and accusations. Be consistent and predictable; avoid surprises as they can erode trust.
- Don't take things personally. Don't respond in kind to threats or personal attacks. If needed, take a break. "I am angry. Can we talk about this later after I cool off?"
- Learn to say, "I was wrong." Apologising when it is appropriate can be particularly effective.
- Don't feel pressured to agree instantly. Try not to solve the problem prematurely. "Let's consider the next step and find a time to meet again."
- Think about possible solutions before meeting. What do you really want? What might you give in order to get it? Is there a compromise you can live with? Offer and ask for solutions. A neutral third party might be useful. Plan to follow up as a way to monitor the resolution.

- Think of conflict resolution as a helical process. Handling conflict is not a linear process, and conflicts are rarely resolved in one interaction. Rather, participants return to the spiral, readdress issues at a higher level, and sometimes regress before reaching a resolution. Real progress is gradual, often step by step.

Time management

Time management is about using time effectively to achieve tasks. It is about helping you to set out in life what you want to achieve. Time management isn't only for your working life, it also applies to your personal, social and family life. So it is worthwhile to learn how to manage your time.

Is time management necessary?

Time is scarce! Once a minute is lost, it is lost forever. We should manage time as we would manage money. Time management is for everyone, rich and poor, man and woman, young and old, in work or not working or in any type of profession. By managing time effectively one can derive deep satisfaction from their occupation, become more productive and achieve greater rewards for their efforts.

Know yourself

Analyze your strong and weak points, understand certain characteristics in you which will enable you to overcome your shortcomings. Certain questions are worth answering.

1. When do you function better - in the morning or in the evening?
   - For 'morning' people the hours before noon are most productive. They are lethargic in the afternoons and evenings. 'Evening' people are just the opposite. Know your productive hours, carry out your high priority projects during that time and reserve the less frenetic activities to the non-peak hours.
2. What type of a worker are you – intensive or extensive?
   - The intensive worker works with great concentration and he is fast, whereas the extensive worker takes longer to complete a task and he should learn to be faster.
3. Are you people oriented or are you task oriented?
   - People oriented types prefer personnel or sales jobs, while task oriented types are happy with analytical paper work.
4. Are you 'diffusion style' manager or a 'focused style' manager?
   - Diffusion style manager attends to several projects at once, while the 'focussed style' manager concentrates on only one project at a time.
5. Are you the compulsive type or the 'laid back' type?
   - While the compulsive type works too much, the laid back type is slow and easily diverted.

Personal time analysis

The first step in managing time is to establish just where it has gone. Unless you know what is going on at the moment, you can not take necessary steps to save time. The way to find out is to conduct a personal time analysis.

- Take one day and analyse it in detail, describing in a time diary what you did at quarter - hour intervals.
- About a week later analyse each day, detailing what you did at the same quarterly - hour intervals.
- By the end of the week, categorise the tasks listed and examine the data. You may find that little time is devoted for high priority areas while coffee breaks and chitchats take up considerable time.
- Now that you know your problems, cut down time spent on such useless activities.

Once you have prioritized your time, you will find your efficiency rising.

Organise yourself

Set goals for yourself, both short and long term. Have a weekly plan in different roles of your life ie., sister ,daughter, mother, wife, student, worker etc. Set aside time for recreation, exercise, spiritual activity, studies, etc,. Lay down particular activities to be carried out in different roles during the week. Such weekly planning enables the individual to handle minor crisis or unexpected events as well. Similarly plan your day, allotting your day's activities into must be done, should be done and might be done. Make sure your daily time budgeting is realistic. You will find the weekly and daily plans enjoyable and enriching. The implementation of daily and weekly plans will see you moving forward towards achieving your goals.

Timely tips for time management

Following are some ideas that may be helpful when you seek to manage your time effectively.

1 Be time conscious. Be aware of the passage of time.

2 Get an early start. Remember the early bird catches the worm.

- Develop and defeat the deadline. A plan of action helps to achieve targets on time.
- Avoid telephone trap. Don't make a number of calls to the same person for different reasons.
- Know your prime time and handle your tough tasks then.
- Avoid after meal rest being flexible about your eating time and also by eating light.
- Acquire pencil and paper habit and note down things that you want to remember later.
- Develop the art of listening and thus avoid misunderstandings.
- Look for shortcuts in all your activities.
- Prioritise your mail. Classify it into must do, need to do, like to do, and junk mail and place them in respective folders.
- Streamline correspondence by designing your letters short and sweet and to the point.
- Learn to say NO to unreasonable demands. Make others handle their responsibilities and don't take on sundry jobs.
- Don't postpone unpleasant or difficult tasks, if they are important.
- Keep an open mind in everything you do and it will help you get along with people better.
- Work during work hours only. Analyse your daily schedule. Identify your time wasters and develop a positive time management attitude.
- Find a concentration hideaway when you can't handle interruptions. Or use 'Don't disturb' board.
- Delegate your work so that you have more time and follow up to ensure the job is well done.
- Be decisive. Even if a decision goes wrong, don't fret. You can rectify it.
- You needn't be a perfect ten. Perfectionism delays completion of tasks on time.
- Monitor your time management attitude and keep it positive. Do personal time analysis at least twice a year.
- Keep fit and don't neglect your health. Keeping fit controls your tension and stress level. Exercise your body at least half an hour every day. Meditation can help you maintain a calm and healthy mind.

Time wasters

Beware of the following time wasters when you proceed to manage your time effectively. Eradicate them.

- Telephone interruptions.
- Drop in visitors.
- Scheduled and unscheduled meetings.
- Crisis situations without any plan to tackle them.
- Lack of priorities and deadlines.
- Attempting too much at a time.

- Unrealistic time estimates.
- Indecision and lack of delegation.
- Inability to say NO.
- Lack of clear communication.
- Constantly working late or taking work home
  - Failure to complete one task before starting another
- Trying to tackle the uncontrollable
- Failure to listen carefully
- Over commitment (Take on too many tasks at one time)
- Poor delegation (or failure to delegate)

Stop procrastination

The most damaging amongst the time wasters is procrastination. It is frequently emotional in nature, which brings back memories of bad feelings or pain faced in the past. As a result people put off things indefinitely and consequently suffer from adverse effects like ulcer, heart attack, etc. Procrastination can be overcome by the following:

- Identify and understand what you are putting off.
- When a task seems too big, chop it down into smaller units and do one at a time.
- Do a task right away and thus remove anxiety.
- Set a time frame for the tasks.
- Plan your task and work your plans.
- Consult people when tasks involve them.
- Avoid uncertain phrases like " I wish", " I hope". Instead affirm that "you will".
- Have a meeting with yourself every night to review your accomplishments.
- Don't worry about perfection. The quality of efforts counts, not perfect results.
- Visualize completion of task and realise how free you will be from anxiety.

Stephen R. Covey, the celebrated author classified activities into:

Urgent and important - Category A
Urgent and not important - Category B
Not urgent and important - Category C
Not urgent and not important - Category D

Too many people focus only on 'A' and to get relief they turn to 'D', paying scant attention to 'B' and 'C'. People who stay off 'B' and 'D' and cut down 'A' to size by spending more time on 'C' are the ones who have mastered the key to effective time management.

God, in His wisdom has given us all a limited number of hours in a year to achieve our goals both material and spiritual. If they are wasted it is neither refundable nor repeatable. How much we accomplish in the time available depends entirely on how effectively this precious gift of God is utilised for achievement of success.

Time management principles

1. List your goals and set priorities

Goals are those things that you want to accomplish and that give you direction. Priorities help you sort out the important and high value activities from the low value activities.

2. Make a daily "TO DO" List

Before you start each day – spend 15 minutes listing those things that you want and need to accomplish. At the end of the day spend 15 minutes reviewing your "TO DO" list to see how you did. Then start a "TO DO" list for the next day in advance.

3. Start with A's and C's

Begin working on high-value (pay-off) activities. Pick holes, pieces, small chunks and start working on it.

4. Ask, "What's the best use of my time now?"

When you get stuck and hung up trying to do something, pause and ask yourself this question. If

the answer is something other than what you are doing, then do it.

5. Handle paper only once

Sit down and sort materials into three piles (A-B-C) at the beginning of each day. Start with the "A" pile and ask "What do I need to do with this?" Do not put it down until you have done something with it. (Remember that "A's" mean something of high value and only you can do – it cannot be delegated).

6. Do it now

If you ask, "What is the best use of my time now?" and the answer is something specific, then do it. Do not wait – DO IT NOW!

Decision making

Definition

Decision-making is the selecting of an alternative, from two or more, to determine an opinion or a course of action.

Types of decisions

- Routine and strategic decisions
- Personal and organisational decisions
- Operational decisions
- Structured and unstructured decisions
- Initiative or forced decisions
- Problem and opportunity decisions

Individual decisions

- Decision made by an individual.

Group decisions

- Important and strategic decisions which may result in some changes in the organization
- Inter departmental decisions - by groups consisting of managers of the respective departments

Advantages of group decision

- Consultative process
- Broad based
- Specialist expertise could be utilised
- Group members gain a sense of belongingness
- Tasks are well distributed
- Coordination of tasks results in better performance

Disadvantages of group decision

- Delay in making decisions. Quick decisions are not possible
- Time consuming
- Lengthy process
- Implementation becomes difficult
  - Group can be dominated by one or two members
  - Too many people spoil the action
  - Individuals get lost in the group and loose their initiative

The decision – making process

- Identification of problems
- Deciding priorities among the problems
  - What is the real problem?
  - What are the causes and effects of the problem?
  - Is this problem very important?
- Can they be solved by subordinates?
  - Which is the right and most important problem to be solved?
- Developing alternative courses of action
- Evaluating alternatives
  - Evaluate by using some criteria like time, cost, risk, results expected, deviations anticipated, resources available for implementation.
- Selecting the best alterative
- Effective implementation and follow-up action

How to make effective decisions

- Timing of decisions
- Complete information and effective communication

- Top management support
- Certainty of goals and premises
- Principle of flexibility
- The size of commitment and its impact on people

Difficulties in decision making

- Incomplete information to the manager
- Unsupporting environment, physical & organizational
- Non-acceptance by subordinates, non-participation
- Ineffective communication
  - Implementation becomes difficult
- Incorrect timing
  - Right decision at the right time

Methods of decision making

Many types of decision-making models can be studied and used by teams. Understanding decision-making models allows teams to make intentional choices about which model might be most appropriate for the various decisions that they confront. Individuals benefit from understanding making models by becoming aware of how cognitive and affective biases can both positively and negatively impact how we work to influence our team on making a decision. Being aware of our biases can limit any negative impact of our biases. The models below describe how we work to affect and manipulate the team decision-making process, sometimes in productive ways and at times in detrimental ways. As a team, understanding decision-making models so that the team can make the best decision is valuable. The best decision is described as a decision that

1) Would not have been thought of by an individual alone.
2) Is a sound solution to the problem.
3) Is a decision based upon input, as unbiased as possible, from each team member.
4) Addresses the team's goal for the decision-making process.

Johnson and Johnson describe seven methods or processes that a team might use to make a decision. Each method, along with its strengths and weaknesses, is discussed below.

Method 1. decision made by authority without group discussion

Process

The designated leader makes all decisions without consulting group members. Strengths / Weaknesses

- Takes minimal time to make decision
- Commonly used in organisations (so we are familiar with the method)
- High on assertiveness scale
- No group interaction
- Team may not understand decision or be able to implement it
- Low on cooperation scale

Appropriate times for method 1

- Simple, routine, administrative decisions; little time available to make decision; team commitment required to implement the decision is low.

Method 2. decision by expert

Process: Select the expert from group, let the expert consider the issues, and let the expert make decisions. Strengths / Weaknesses:

- Useful when one person on the team has the overwhelming expertise
- Unclear how to determine who the expert is (team members may have different opinions)
- No group interaction
- May become popularity issue or power issue

Appropriate times for method 2

- Result is highly dependent on specific expertise, clear choice of expert. Team commitment required to implement decision is low.

What tools are available to assist teams in making decisions?

In addition to creating an environment for effective decision making and reaching consensus on methods for making decisions as a team, there are tools that can assist teams in formulating and reaching decisions. Many of these tools were developed in the 1990s as companies worked on improving quality and introducing self-managed teams into the workplace.

- Brainstorming
- Affinity grouping
- Multivoting
- Criteria matrix

Many other tools are available to facilitate creativity, planning and quality control.

Method 3. decision by averaging individuals' opinions

Process: Separately ask each team member their opinion and average the results.

Strengths / weaknesses

- Extreme opinions cancelled out error typically cancelled out
- Group members consulted
- Useful when it is difficult to get the team together to talk
- Urgent decisions can be made
- No group interaction, team members are not truly involved in the decision
- Opinions of least and most knowledgeable members may cancel
- Commitment to decision may not be strong
- Unresolved conflict may exist or escalate
- May damage future team effectiveness

Appropriate times for method 3

- Time available for decision is limited; team participation is required, but lengthy interaction is undesirable; team commitment required to implement the decision is low.

Method 4. decision made by authority after group discussion

Process: The team creates ideas and has discussions, but the designated leader makes the final decision. The designated leader calls a meeting, presents the issue, listens to discussion from the team, and announces their decision. Strengths / Weaknesses

- Team is used more than in methods 1–3
- Listening to the team increases the accuracy of the decision
- Team is not part of decision
- Team may compete for the leader's attention
- Team members may tell leader what they want to hear
- Still may not have commitment from the team to the decision

Appropriate times for method 4

- Available time allows team interaction but not agreement; clear consensus on authority; team commitment required to implement decision is moderately low.

Method 5. decision by minority

Process: A minority of the team, two or more members who constitute less than 50% of the team, make the team's decision. Strengths /Weaknesses

- Method often used by executive committees
- Method can be used by temporary committees
- Useful for large number of decisions and limited time
- Some team perspective and discussion
- Can be railroading
- May not have full team commitment to decision
- May create an air of competition among team members
- Still may not have commitment from team to decision

Appropriate times for method 5

- Limited time prevents convening entire team; clear choice of minority group; team commitment required to implement the decision is moderately low.

Method 6. decision by majority vote

Process: This is the most commonly used method in the United States (not synonymous with best method). Discuss the decision until 51% or more of the team members make the decision. Strengths/ Weaknesses

- Useful when there is insufficient time to make decision by consensus
- Useful when the complete team-member commitment is unnecessary for implementing a decision
- Taken for granted as the natural, or only, way for teams to make a decision
- Team is viewed as the winners and the losers; reduces the quality of decision
- Minority opinion not discussed and may not be valued
- May have unresolved and unaddressed conflict
- Full group interaction is not obtained

Appropriate times for method 6

- Time constraints require decision; group consensus supporting voting process; team commitment required to implement decision is moderately high.

Method 7. decision by consensus

Process: Collective decision arrived at through an effective and fair communication process (all team members spoke and listened, and all were valued). Strengths / Weaknesses

- Most effective method of team decision making
- All team members express their thoughts and feelings
- Team members feel understood
- Active listening used
- Takes more time than in methods 1–6
- Takes psychological energy and high degree of team member skill (can be negative if individual team members not committed to the process)

Appropriate times for method 7

- Time available allows a consensus to be reached; the team is sufficiently skilled to reach a consensus; the team commitment required to implement the decision is high.

Method 7. Takes well-practiced communication skills by all team members

Review prior section on environments for decision making and other minidocuments on effective communication and conflict management.

Problem solving

Problem: A problem may be defined as a discrepancy or difference between an actual state of affairs and a desired or ideal state of affairs.

Problem solving: It is the process of resolving the unsettled matters or finding an answer to a difficulty. It is a process that results in a solution to a problem, and it involves changing the actual state of affairs until it is identical with the desired state of affairs.

Four concerns in solving a problem

- Determining the actual or current state of affair.
- Specifying the desired state of affairs.
- Determining the best means of moving the group from the actual to the desired state of affairs.
- Implementing the plan.

Basic steps in problem solving

- **Define the problem**: Make sure you fully understand the current situation before attempting to solve the perceived problem.

- **Define your objective**: Be clear on what the situation will be like after you have solved the problem. Start to consider how to cross the gap between where you are and where you want to be.
- **Diagnose the size of the problem and what causes it.**
- **Gather and interpret information**: Collect and organize information on the what, who, where and when of the problem situation. Focus on facts and not on opinions. Once you have established these facts you can then start to focus on why something is happening. When investigating why something is happening, consider there may be multiple causes. Also be aware of your own views - watch that you are not fitting the facts to meet a subjective view.
- **Formulating alternative strategies or plans for solving it**: Having gathered your information and fully understood the problem situation, now is the time to generate options for solving the problem and reaching your objective. Try to be creative with your options and don't evaluate your ideas as you go – this will inhibit creativity. Also, listen to your hunches, which you can evaluate in the next step.
- **Evaluate and choose a solution**: Deciding on the best solution involves listing pros and cons, examining consequences, measuring against criteria, testing against your objective and selecting a workable solution. If you have previously identified multiple causes you may need a combination of solutions to deal with each cause. Expect to have some misgivings about even the best solution you have chosen. There is rarely a perfect solution to a problem so, provided you have followed the previous steps, don't wait for the perfect solution to come along.
- **Implement the solution**: This involves planning, taking action, monitoring the action and reviewing progress in moving from the current problem situation towards your objective.
- Evaluate the success of the strategy used.

Blocks that inhibits problem solving

- Lack of clarity in stating a problem.
- Inadequate information.
- Vertical thinking – beginning with a single definition and pursuing problem resolution without considering other possible definitions.
- Poor communication.
- Only one thinking language – Thinking about a problem only in words, for example, instead of visually, symbolically, emotionally, etc.
- Past experience can cause stereotyping, considering present problems only as variations on problems faced in the past.
- Separating figure and ground – not deleting irrelevant information and filling in needed information.
- Premature testing of alternative strategies or premature choice.
- A critical, evaluative and competitive climate.
- Artificially constraining problems – defining the boundaries of problems too narrowly.
- Not perceiving commonalties – Fearing to see relationships between disparate elements.
- Lack of inquisitiveness – fearing to appear ignorant if questions are asked.
- Bias against thinking.
- Inadequate motivation.

For a problem that you have, the following questions can be useful in establishing the problem:

WHO - else has the problem?
- needs to solve it more than you?
- has already solved it?

WHAT - do you know about it?
- can be changed about it?
- assumptions are you making about it?

HOW - will you know that it has been solved?
- will you set about solving it?
WHERE - does it fit into the big picture?
WHEN - will the problem get better?
WHY - is this a problem?
- do you want to solve it?

Now think about the problem in the light of your answers.

- Is the problem any clearer?
- Are you closer to solving the problem?

Delegation of responsibilities

Meaning of delegation

Entrusting responsibility and authority to a deputy to enable them to accomplish the task assigned to them.

Ex: As the chosen leader of a team, you could assign tasks and decisions to different group members.

Meaning of directing

- Assigning tasks and duties without power & authority.
- It is a beginning of a process.
- A superior continues to be responsible for the work delegated to sub-ordinates.
- It is vital & essential to the management, process.

Delegating

- Assigning tasks with responsibility, power and authority.
- It is an end result of delegation of authority at various levels.
- A superior is relieved from his responsibility the work delegated.
- It is optional.

Types of delegation

General delegation

Authority granted to any person to perform the functions in their department / division. Supervision plays a vital role to regulate the authority given to sub-ordinates.

Specific delegation

It is functional in character. Ex: Production manager be delegated authority for production.

Written delegation

By written orders, instructions etc.

Unwritten delegation

By custom or usage

Formal delegation

As per the organization structure.

Ex: sales manager is assigned responsibility and authority for promoting sales.

Informal delegation

Duties are not formally assigned but assigned on understanding the that a particular person can perform the task in a better way.

Downward delegation

From superior to sub-ordinate.

Upward delegation

From sub-ordinate to superior.

Sideward delegation

From one employee to another employee of the same rank.

When to delegate

- When workload is more for delegator
- When one wants to improve the skills of the subordinate
- When the subordinate is idle

- At the time of retirement
- When one enhances their skill they should be given extra work by delegation

Points to consider before delegation

- What work needs to be done ?
- What the delegatee is expected to do ?
- The targets or standards the delegates have to achieve.
- The date by which the delegates are expected to do it.
- The extent of authority given to the delegates .
- The progress reports the delegatee must prepare and submit.
- How the delegator proposes to guide and monitor the delegatee.
- The resources to be allotted to the delegatee to carry out the work.

Steps for effective delegation

- Select the right person.
- Clearly specify your preferred goals / results.
- Give information on what, why, when, who, where and how.
- Delegate responsibility and authority.

Responsibility

Obligation of a subordinate towards superior.

Get feedback about progress

Through written report, weekly meeting,

- Maintain open lines of communication.
- Motivation
- Training
- Evaluate
- Reward performance (any form)

Advantages of delegation

- Higher efficiency
- Sharing responsibilities
- Increased motivation
- Develops the skills of sub-ordinates
- Better outcome of work
- Shared workload

Barriers to delegation

- Organisational barriers
- Inadequate information and resources
- Psychological barriers
- Reluctance to delegate authority by managers
- Reluctance to accept delegation by subordinates

Why managers are reluctant to delegate

- Fear of loss of power
- Lack of confidence in subordinates
- Fear of being exposed
- Difficulty in briefing
- Risk avoidance

Why subordinates are reluctant to accept delegation

- Risk avoidance
- Fear of criticism for mistakes
- Inadequacy of information & resources
- Lack of self-confidence
- Inadequate incentives
- Lack of interest
- Excessive workload
- Lack of knowledge regarding the work

Tips for effective delegation

- Before delegating authority, make the nature and the scope of the task clear to the delegatee
- Assign authority proportionate to the task
- Make the subordinate clearly understand the limits of his authority
- Give the subordinate some positive incentives for accepting the extra responsibility
- Train the subordinate properly. Make sure you guide and monitor him

- Create a climate of mutual trust and goodwill.
- Do not make the subordinate accountable to more than one superior. There should be no overlaps or splits in delegation.

Team building

Team building is an effort in which a team studies its own process of working together and acts to create a climate that encourages and values the contributions of team members. Their energies are directed toward problem solving, task effectiveness, and maximizing the use of all members' resources to achieve the team's purpose. Sound team building recognises that it is not possible to fully separate one's performance from those of others.

A team is defined as a reasonably small group of people who bring to the table a set of complementary and appropriate skills, and who hold themselves mutually accountable for achieving a clear and identifiable set of goals.

Team building works best when the following conditions are met (Francis and Young 1979).

1. There is a high level of interdependence among team members. The team is working on important tasks in which each team member has a commitment and teamwork is critical for achieving the desired results.
2. The team leader has good people skills, is committed to developing a team approach, and allocates time to team-building activities. Team management is seen as a shared function, and team members are given the opportunity to exercise leadership when their experiences and skills are appropriate to the needs of the team.
3. Each team member is capable and willing to contribute information, skills, and experiences that provide an appropriate mix for achieving the team's purpose.
4. The team develops a climate in which people feel relaxed and are able to be direct and open in their communications.
5. Team members develop a mutual trust for each other and believe that other team members have skills and capabilities to contribute to the team.
6. Both the team and individual members are prepared to take risks and are allowed to develop their abilities and skills.
7. The team is clear about its important goals and establishes performance targets that cause stretching but are achievable.
8. Team member roles are defined, and effective ways to solve problems and communicate are developed and supported by all team members.
9. Team members know how to examine team and individual errors and weaknesses without making personal attacks, which enables the group to learn from its experiences.
10. Team efforts are devoted to the achievement of results, and team performance is frequently evaluated to see where improvements can be made.
11. The team has the capacity to create new ideas through group interaction and the influence of outside people. Good ideas are followed up, and people are rewarded for innovative risk taking.
12. Each member of the team knows that they can influence the team agenda. There is a feeling of trust and equal influence among team members that facilitates open and honest communication.

Characteristics of good team building

- High level of interdependence among team members
- Team leader has good people skills and is committed to team approach
- Each team member is willing to contribute
- Team develops a relaxed climate for communication
- Team members develop a mutual trust
- Team and individuals are prepared to take risks
- Team is clear about goals and establishes targets
- Team member roles are defined

- Team members know how to examine team and individual errors without personal attacks
- Team has capacity to create new ideas
- Each team member knows he can influence the team agenda

Team building will occur more easily when all team members work jointly on a task of mutual importance. This allows each member to provide their technical knowledge and skills in helping to solve the problem, complete the project, and develop new programs. During this process, team building can be facilitated as members evaluate their working relationship as a team and then develop and articulate guidelines that will lead to increased productivity and team member cooperation.

As part of this process, team members need to learn how to manage conflict, evaluate performance of the group, and provide feedback and support that will encourage each member to meet their commitment to the team and the organization.

Team performance can best be evaluated if the team develops a model of excellence against which to measure its performance.

Team effectiveness

When evaluating how well team members are working together, the following statements can be used as a guide:

Team goals are developed through a group process of team interaction and agreement in which each team member is willing to work toward achieving these goals.

Participation is actively shown by all team members and roles are shared to facilitate the accomplishment of tasks and feelings of group togetherness.

Feedback is asked for by members and freely given as a way of evaluating the team's performance and clarifying both feelings and interests of the team members. When feedback is given it is done with a desire to help the other person.

Team decision making involves a process that encourages active participation by all members.

Leadership is distributed and shared among team members and individuals willingly contribute their resources as needed.

Problem solving, discussing team issues, and critiquing team effectiveness are encouraged by all team members.

Conflict is not suppressed. Team members are allowed to express negative feelings and confrontation within the team which is managed and dealt with by team members. Dealing with and managing conflict is seen as a way to improve team performance.

Team member resources, talents, skills, knowledge and experiences are fully identified, recognized and used whenever appropriate.

Risk taking and creativity are encouraged. When mistakes are made, they are treated as a source of learning rather than reasons for punishment.

After evaluating team performance against the above guidelines, determine those areas in which the team members need to improve and develop a strategy for doing so. The team leader should be the liaison between the team and upper management. The team leader needs to know and work with upper management to obtain a full commitment from them in support of the team's program.

However, when this happens, team members must realize that they have a major responsibility to make maximum use of the resources and support provided.

- The team leader can encourage team member growth, and should be willing to take some risk by having members whose resources are relevant to the immediate task provide the leadership.
- The team leader should be fair, supportive, and recognised by team members as one who can make final judgments, work with upper management, and give direction to the team as needed.

- As team members build committment, trust, and support for one another, it will allow them to develop and accomplish desired results. This commitment, trust, and self-determination by each team member is critical in achieving a sustained high level of performance. Team members will learn to appreciate and enjoy one another for who they are and will help keep one another on track. The team will have developed its working methods so that they become an informal set of guidelines.

A focused team

When the team resources are focused and members are all working to accomplish the same purpose, teamwork can be very rewarding and productive. This is best accomplished when team members use a proactive approach rather than a reactive approach to accomplish their purpose (Adams, 1987).

The proactive approach manifests such characteristics as:

- The team members take a positive approach in jointly determining the way they are going to work together as a team and what they want to have happen. When individuals and the entire team choose to operate this way and are willing to set petty differences aside, unbelievable results become possible.

  When individuals adopt this attitude and commit to use their resources, knowledge, and skills to contribute to the goals of the team, alignment with the team's overall purpose comes about. This will not happen unless both the team leader and team members choose to do so.
- Having a well-defined purpose or vision of what the team will accomplish is a very powerful force for the team leader and members. Goals are aligned with the team purpose, and team members are empowered to accomplish the goals. This process leads to a high level of team productivity.
- Team members have a positive attitude toward change and are willing to accept and allow change to occur as needed in order to accomplish desired results.
- Team members understand that patience is required, and that for some goals, a long-term commitment is needed to accomplish the desired results.
- Interests of both the team leader and team members are focused on desired results rather than on short-term problem- solving activities.

  If people learn to focus simultaneously on both the current situation and the desired results, problems that arise will be solved as part of the total process of achieving the desired results.
- The sixth characteristic of a well-functioning team is that the members have a strong feeling of control within the team. They are able to establish priorities and then commit time and resources for accomplishing these tasks.
- The seventh characteristic of a well functioning team is team members verbally and publicly support each other. They recognise that negative comments about others tear the team a part.
- Team leaders and members that make a conscious, sustained effort to make these seven characteristics a part of their mind set will find that both creativity and accomplishment of desired results will be much higher than it would be otherwise.

Team leader

There are several ways in which the team leader can contribute to creating a positive climate within the team. One of the most powerful forces is to put forward, in cooperation with team members, an exciting vision/purpose of what the team is to achieve. Once the vision is developed, it needs to be kept in front of the team members as a reminder of what they wish to accomplish.

The team leader where possible should help select or influence the composition of team members. Selection should be based on the

willingness of people to work in a team setting and the resources, both people skills and technical components, they are able to bring to the team.

The team leader can provide the leadership for helping the team develop an understood and accepted set of principles that will contribute to their success. Included in this set of principles should be norms for operating within the group, criteria for evaluating success, standards for determining quality of performance, and an identified reward system to recognise the team's successes.

Leadership

Learning to be an effective leader is one of the most demanding tasks you will face. Some of the responsibilities and roles you will need to play are listed below.

Leader responsibilities

- Safety
- Honesty
- Establish trust
- Teach skills
- Be vulnerable
- Role model
- Provide balance
- Adapt to situation(s)
- Make decisions
- Provide motivation
- Facilitate group interaction
- Move group from A to B
- Be sensitive to needs of group
- Deal with expectations of others

Leader roles

- Listener
- Confidant
- Initiator
- Decision-maker
- Mediator
- Observer
- Authority
- Advisor
- Communicator
- Friend
- Advocate

Functions of a leader

This model of leadership is based on the premise that in working with a group there are two basic functions which need to be attended to. One is working to accomplish the tasks the group has set out to do. The other is ongoing maintenance and development of relationships within the group. Thus there are two basic types of roles or behaviors for leaders to engage in-Task Roles and Relationship Roles. Examples of these roles are identified below.

Task roles/functions/behaviors

- Information and opinion giver : Offers facts, opinions, ideas, suggestions, and relevant information to help group discussion.
- Information and opinion seeker : Asks for facts, information, opinions, ideas, and feelings from other members to help group discussion.
- Starter : Proposes goals and tasks to initiate action within the group.
- Direction Giver : Develops plans on how to proceed and focuses attention on the task to be done.
- Summarizer : Pulls together related ideas or suggestions and restates and summarizes major points discussed.
- Coordinator : Shows relationships among various ideas by pulling them together and harmonizes activities of various subgroups and members.

- Diagnoser : Identifies sources of difficulties the group has in working effectively and the blocks to progress in accomplishing the group's goals.
- Energiser : Stimulates a higher quality of work from the group.
- Reality tester : Examines the practicality and workability of ideas, evaluates alternative solutions, and applies them to real situations to see how they will work.
- Evaluator : Compares group decisions and accomplishments with group standards and goals.

Relationship roles/functions/behaviors

- Encourager of Participation: Warmly encourages everyone to participate giving recognition for contributions, demonstrating acceptance and openness to ideas of others, is friendly and responsive to group members
- Harmoniser and Compromiser: Persuades members to analyze constructively their differences in opinions, searches for common elements in conflicts and tries to reconcile disagreements.
- Tension Reliever: Eases tensions and increases the enjoyment of the group members by joking, suggesting breaks, and proposing fun approaches to group work.
- Communication Helper : Shows good communications skills and makes sure that each group member understands what the other members are saying.
- Evaluator of Emotional Climate : Asks members how they feel about the way in which the group is working and about each other, and shares their own feelings about both.
- Process Observer : Watches the process by which the group is working and uses the observations to help examine group effectiveness.
- Standard Setter : Expresses group standards and goals to make members aware of the direction of the work and the progress being made toward the goal and to get open acceptance of group norms and procedures.
- Active Listener : Listens and serves as an interested audience for other members, is receptive to others' ideas, goes along with the group when not in disagreement.
- Trust Builder : Accepts and supports openness of other group members, reinforcing risk taking and encouraging individuality.
- Interpersonal Problem Solver : Promotes open discussion of conflicts between group members in order to resolve conflicts and increase group togetherness.

Principles of leadership

Know yourself and seek self-improvement

In order to know yourself, you have to understand your be, know, and do, attributes. Seeking self-improvement means continually strengthening your attributes. This can be accomplished through reading, self-study, classes, etc.

Be technically proficient

As a leader, you must know your job and have a solid familiarity with your employees' jobs.

Seek responsibility and take responsibility for your actions

Search for ways to guide your organization to new heights. When things go wrong, as they will sooner or later, do not blame others. Analyze the situation, take corrective action, and move on to the next challenge.

Make sound and timely decisions

Use good problem solving, decision making, and planning tools.

Set the example

Be a good role model for you employees. They must not only hear what they are expected to do, but also see.

Know your people and look out for their well - being

Know human nature and the importance of sincerely caring for your workers.

Keep your people informed

Know how to communicate with your people, seniors and other key people within the organisation.

Develop a sense of responsibility in your people

Develop good character traits within your people that will help them carry out their professional responsibilities.

Ensure that tasks are understood, supervised, and accomplished

Communication is the key to this responsibility.

Train your people as a team

Although many so called leaders call their organisation, department, section, etc. a team; they are not really teams they are just a group of people doing their jobs.

Use the full capabilities of your organisation

By developing a team spirit, you will be able to employ your organisation, department, section, etc. to its fullest capabilities.

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