Florence Nightingale Pledge

I solemnly pledge myself before God and in the presence of this assembly, to pass my life in purity and to practise my profession faithfully. I will abstain from whatever is deleterious and mischievous and will not take, or knowingly administer any harmful drug. I will do all in my power to elevate the standards of my profession, and will hold in confidence all personal matters committed to my keeping and all family affairs coming to my knowledge in the practice of calling. With loyalty I will endeavour to aid the physician in his work and to devote myself to the welfare of those committed to my care.

Lady with the lamp

Florence Nightingale, the lady with the lamp who served humanity and who is the patron of the Nursing community was born in a rich English family. She sacrificed her comforts and luxurious life to become a supervisor of a hospital in London. In the Crime on war of 1854, she nursed the wounded soldiers. She devoted herself to clean the wounded and nurse the sick soldiers even at nights with a lamp in her hand. So she is called the lady with the lamp. She wrote a number of books on the health of the armed forces and nursing. She established a school for nursing and guided many young women. To lead a life of sacrifice and dignity as nurses. She did in the year 1910. Every nurse should cherish her way of life, do her duty and work true to the pledge.

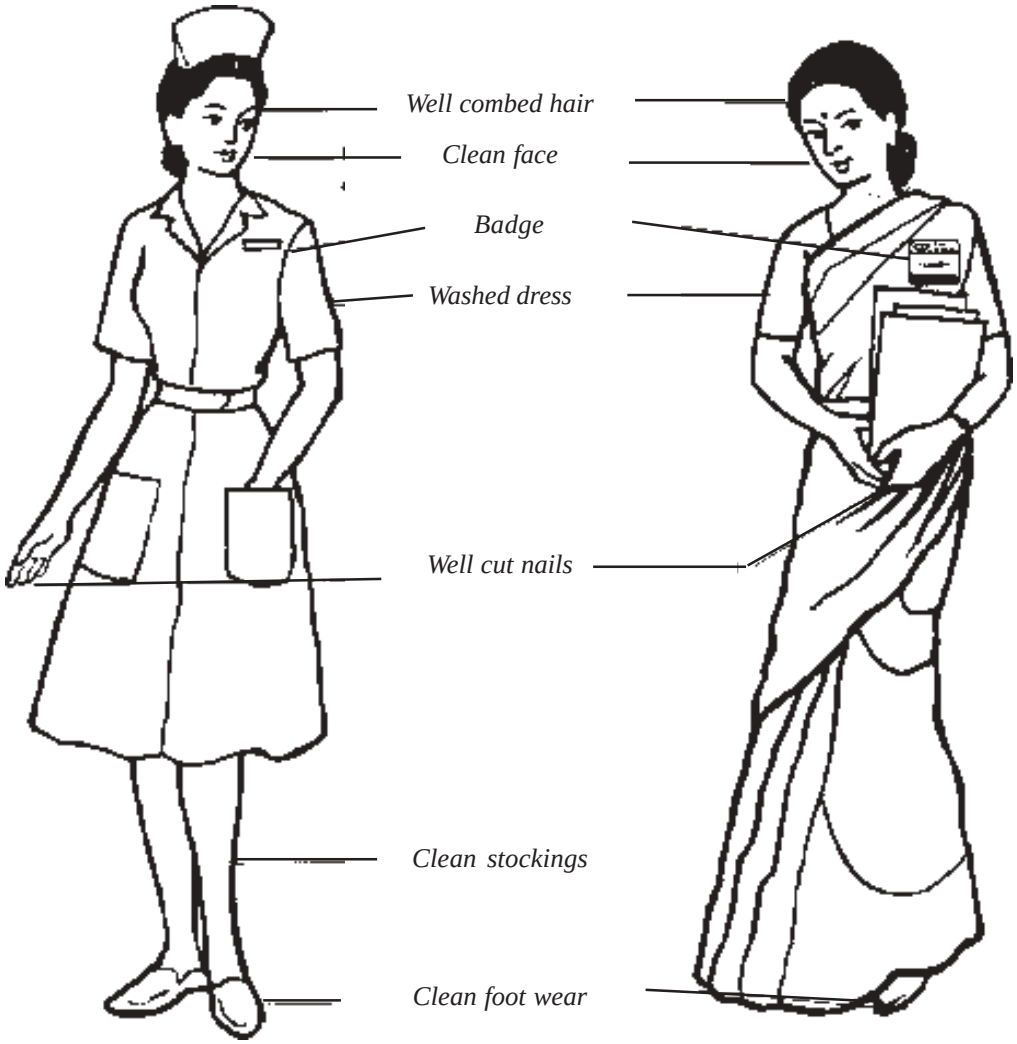
Chapter 2
Introduction

Definition and principles

The word nursing means ‘nourishing’ therefore it has come to mean tending and helping all who needs it, especially the sick. Those who enter this profession must have a real desire to do the work, and must be physically healthy. Ophthalmic nursing demands accuracy of judgement and manual dexterity as the eye is only part of the patient, who especially if elderly, may have a number of general diseases.

Qualities of a good nurse

Qualities of good personality are required to become a good nurse. These qualities should be further developed throughout the period of training. Kindness, sympathy and respect for each individual patient, regardless of age, sex, race or social class are essential qualities for the successful care of the sick person. However, the nurse must learn to be strict when it is necessary for the patient’s good.



Reliability and punctuality in carrying out nursing duties is essential. Patients are dependent upon nurses for their general well being while in hospital. A nurse must always be conscientious in her work no matter how much pressure she is under to get things done quickly. A short cut in a sterilisation procedure may result in cross infection. Importance is rightly placed on complete reliability in carrying out instructions, and punctuality in giving drugs and recording observations.

Tact and understanding is required in nursing. A patient may have difficulty in adjusting himself to the hospital environment and need help and understanding from the nurse. Each patient should be treated as an individual and helped to maintain his individuality and independence. Courtesy, consideration and loyalty are necessary in communicating with patients and hospital colleagues. Apart from the qualities already mentioned, a nurse needs to develop emotional maturity and during the early days of her training she needs help and support from trained members.

Rules for cleaning and maintenance of units

The daily cleaning of the hospital is carried out by a separate domestic staff, however the nursing staff is responsible for making sure that it is done properly so that cross infection does not occur. Dust is liable to be heavily contaminated by pathogenic organisms, so cleaning must never be carried out immediately before ward dressings are undertaken. All the members of the nursing staff should know the time when routine cleaning is carried out, so that they may plan dressings and other sterile procedures accordingly. Cleaning should be done with the minimum amount of noise so that the patients are not disturbed. Patients should be asked to lie on their beds while floor cleaning is undertaken.

When patients are discharged from the hospital it is usually the nursing staff who clean the beds and lockers. They should be thoroughly washed over with an antiseptic solution and dried. A clean cloth should always be used for this purpose. The ward sister must ensure that an adequate stock of cleaning materials is always available. Cleaning should be undertaken in such a way as to prevent the spread of infection. All staff must be thoroughly versed in the principles. To avoid the spread of dust, a damp cloth should be used for cleaning surfaces. Cleaning materials should be used economically.

The cleaning of bedpans and urinals are the concern of the nursing staff. They should then be placed in an automatic bedpan washer in which the bedpan can be enclosed to be flushed with hot and cold water. The sister should ensure that the domestic staff clean washbasins and toilets on a daily basis. This is absolutely essential to prevent the growth and multiplication of microorganisms. Nursing staff should be consulted when new items of furniture and equipments are to be purchased to ensure that such items are the most suitable in terms of maintenance ie. surfaces should be smooth, with no indentations in which dirt can accumulate.

Bed making

Skilled bed making is absolutely essential in helping to prevent cross infection. Movement of the bedclothes dislodges microorganisms from the bed into the air. Bed making should be carried out using smooth movements to avoid unnecessary disturbance of the air above the bed, so minimizing the area over which microorganisms may be airborne. All the equipment which may be required should be available at the bedside before stripping the bed. Two nurses should work together so that the bed is made efficiently and quickly. Bedclothes should be stripped on to a chair placed at the foot of the bed. Care should be taken to prevent the bedclothes from dragging on the floor; picking up microorganisms, removal of debris from the sheets and straightening out any creases, helps to prevent formation of bed sores.

How to make up an unoccupied bed

Bed making

Collect clean sheets and pillow case and place them on a chair at the foot of the bed. Spread out the bottom sheet over the mattress making sure there is enough to tuck in at both top and bottom. Starting at the top of the bed, tuck in the sheet, mitering the corners. Make sure there are no creases in the bottom sheet. Tuck in all round the sides.

Spread out the top sheet evenly, allow a turnover of 15-20 inches at the head end. Tuck in it at the foot end, mitering the corners but don't tuck the top sheet in at the sides. Allow to hang loosely on either side of the bed. Put the pillow in the pillow case and place at the head of the bed.

How to make an occupied bed

Explain to the patient that his bed is to be made. Collect clean sheets/pillow case and place them on a chair at the foot of the bed. The patient should be kept covered with a sheet to maintain his dignity. Loosen the bottom sheet from the mattress. Roll the bottom sheet to the centre of the bed so the patient does not feel afraid of falling out. Roll the bottom sheet to the centre of the bed.

Roll the patient gently on to the opposite side. Remove the dirty sheet and place in the linen basket. Smooth out the new bottom sheet and tuck in at the top, bottom and sides. Turn the patient back into the middle and support him while changing his pillow. Replace the top sheet if necessary. Ensure the top sheet is loose over the patient's feet. Make sure the patient is comfortable leaving the bed side.

Chapter 3
Care of the blind and personal care of patients

Blind people often manage to move around unaided in their own homes or in familiar surrounding, but when admitted to hospital they become upset and afraid to move around in the wards. The nurses must take time to explain the layout of the ward and the location of things the patient needs to use. He must be warned of any hazards, for example equipment in the ward over which he could trip or hurt himself. Doors which are left half open are dangers to the blind, so too is anything left out of its accustomed place. Tidiness is important.

The blind patient should be encouraged to walk about. When guiding him it is best if having first offered him a bent arm to hold, the nurse then walks slightly ahead. A blind patient should be approached by quietly saying his name and then by gentle touch on his arm. Failure to give adequate warning may frighten the patient. When leaving the room, the nurse should always tell the patient she is going. The nurse must always remember to tell the patient first what she is about to do, sympathy and understanding are essential when caring for the blind but to offer pity is unkind. The nurse will do the patient the greatest kindness by encouraging him to be independent.

Methods of guiding a blind person

There are times when blind people need help from sighted people in getting around, even those who are very good at travelling alone. Occasionally, both the blind person and the sighted helper feel frustrated or embarrassed. The sighted person can be unsure of how to help, fusses and overdoes things; the blind person feels foolish or murderous, depending on his or her temperament. These notes are for sighted people helping blind people to get about. Like most skills the techniques suggested here improve with practice.

Linking arms

For walking side by side indoors or out, stand by the blind person with your arms straight and fingers pointing to the ground. Ask your partner to take your arm. He or she should hold it firmly, just above your elbow, with the fingers on the inside of your arm and thumb on the outside. Your partner's elbow should be bent.

Linking arms

By holding your arm like this the blind person will be half a pace behind you, making it easier to tell when you are turning, by the movement of your body. There is no need to move your arm.

Check that your partner's feet are pointing in the same direction as your; if not, you could soon be parting company!

To make reading easier, from now on we will refer to the grip arm (yours) and the grip hand (the blind person's), which link you and your partner.

Walking in single file

You will often need to do this in shops, restaurants and other busy areas. Your partner will walk behind you instead of at your side.

So that the blind person knows to move in behind you, move your grip arm to the middle of your back,

keeping it straight. Your partner should step in behind you, still holding onto your arm. He/she must keep his/her arm straight or risk stepping into your shoes.

Your partner's arm may be uncomfortable in this 'diagonal' position, so he/she can change hands. For example, if your partner was holding your left arm, he/she drops his/her hand and grips with the left.

When there is room to walk side by side again bring your arm back to its normal position at your side and your partner returns to your side.

Changing sides

There will be times when you will need to change sides, especially when negotiating a door. You stay where you are, while your partner, keeping his/her hand on your back, slips in behind you, transferring his/her hold to your other arm as he/she moves to your other side.

It is important that your partner does not lose contact.

Doorways

Getting through a doorway is a little more complicated. If the door's hinge is on the left, the blind person should be on your left with his/her left hand free. Describe it as "door left". The reverse applies if the hinge is on the right.

As you turn the door handle and the door moves, your partner will know if it is moving inwards or outwards. As you walk through the doorway, your partner moves the back of his/her free hand to the door, slides it along and finds the handle. He/she follows you, slips his/her hand to the handle on the other side of the door and closes it.

Steps and Stairs

Whether you are going up or down, you should be one step ahead so that your partner does not take imaginary step into space.

Going upstairs

Face the stairs, using the normal hold and say "stairs up". Step up, placing your weight on the first step. Your partner will feel your arm move and this is his/her cue to start. As you climb the second step, he/she is on the first. When you reach the top, take a slightly longer stride forward and stop, allowing your partner to negotiate the last step.

As your partner feels his/her arm resume its usual position, he/she will know that you are both on the level again.

Going downstairs

As you approach the stairs, say "stairs down" and stop. Some blind people like to slide one foot to the edge of the stair to gauge the distance, before moving.

Put your foot on the first step; as your partner feels you move, he/she step down, by which time you are on the second step. When you reach the bottom, stop and wait for your partner to draw level with you. He/she will know that he/she has reached the bottom because his/her arm returns to its normal position.

If you are not tall as your partner, the changing arm movement is not so clearly felt. But, if you take your first step with the foot on the same side as the grip arm, the movement is more obvious.

Seating

Never back a blind person into a seat.

Single chairs and settees

If possible approach the chair centrally, but from whichever side, always place your grip hand on the back of the chair. The movement is enough to let your partner know the position of the back. Let your partner slide his/her hand down your arm to the chair back. It is now up to your partner to move into the chair, feeling the side of it with the calf of his/her leg and, if necessary, checking the seat depth with a hand.

Chairs with tables

Guide your partner to the table, using the above way to find the back of the chair. With one hand on the back of the chair, your partner moves the other forward to find the table; this will help to show how far to pull out the chair before sitting down. A tip for a blind person, if he/she is not sure if he/she is 'square' to the table, is to bring the thumbs together on the edge or under the table, then slide them out to either side. If the edge seems to slant, adjust the chair accordingly.

Rows of seats

Most blind people prefer to be lead into a row of seats – change sides if necessary. When you reach your row, you and your partner sidestep (step – pause – step) until your partner is central to his/her seat, then leave the rest to him/her.

When you are leaving, step to the other side of your partner so you can lead out in the same sidestepping manner as you went in. When you are both in the aisle, you will need to about turn. Your partner releases his/her hold and your turn again to face each other, then turn again to face the exit. In other words you turn from 12'O clock to 6'O clock position or 180 degrees.

Care of the blind patient

The world health organisation estimates that about 30 million people in the world are blind, 29 million of these living in developing countries. Most of this blindness is from one of the following five conditions which are all either treatable or preventable.

Cataract

This is the cause of almost half of the world's blindness.

Trachoma

At least 5 million are blind from trachoma.

Xerophthalmia

In Asia alone it is estimated that 250,000 children a year go blind from xerophthalmia.

Onchocerciasis

This is a problem only in certain tropical areas. However, over 1 million people are thought to be blind from it.

Glaucoma

This is a wide spread and a common cause of blindness. It is difficult to agree on an exact definition of blindness. A patient may be completely blind, that it is to say he cannot distinguish light from dark, or he may be partially sighted but have such limited vision that it is of little use to him.

Personal care of the patient

Basic nursing care consists of helping the patient to carry out those health maintaining functions which he is unable to carry out for himself. Physiological needs of individuals are respiration, nutrition, excretion, activity and movement, sensory stimulation, comfort, sleep and rest, cleanliness and grooming. A normal, healthy individual does not usually require any help with the activities of daily living. We all like to take a daily bath, clean our teeth, comb our hair, wear clean clothes, and in order to feel fresh and tidy good personal hygiene is paramount to health. The majority of ophthalmic patients are able to look after their own personal hygiene. However, occasionally a patient may become ill while in the hospital and require basic nursing care.

Care of the mouth

Lack of normal mouth hygiene leads to halitosis, collection of dried secretion, microorganisms, and eventually to mouth infection. Patients may come to the hospital who have neglected their mouth hygiene. The nurse should offer help and advice in a tactful manner to such patients. For a patient who isn't ill, the best method of caring for the mouth is by cleaning the teeth. This removes debris and stimulates blood supply, maintaining the gums in a healthy condition and helping to prevent dental caries.

Mouth care should be given by the nurse if the patient is too ill to clean his own teeth. The aim is to maintain the mouth in a normal condition, i.e., with moist tongue, lip, and mucous membranes free from sores and odour and clean teeth. The procedure should be carried out as often as necessary to maintain this condition.

Apparatus required

An oral hygiene tray (mouth care tray) is required, which should contain the following:

Gauze swabs

A pair of artery forceps and a pair of dissecting forceps. A gallipot containing sodium bicarbonate 1:60 solution or hydrogen peroxide 1:12 for cleaning. Glycerine for crusts or sore areas. Potassium permanganate 1:2000 for mouth wash. Glass of water for final rinsing of the mouth. Two kidney trays- one for soiled swabs, the other to receive the used mouthwash. Rubber sheet and towel to protect the patients chest and bedclothes.

Method

Take the tray to the bedside and explain procedure to the patient.

Assist the patient to turn his head to the side facing you and arrange the rubber sheet and towel to protect both the patient and bedclothes. Secure a gauze swab in the forceps so that the ends of the forceps are completely protected by the swab. Moisten with the hydrogen peroxide or sodium bicarbonate solution and gently clean the teeth, gums, tongue, roof of the mouth and cheeks. Remove the dirty swab from the forceps by using the dissecting forceps. Use as many swabs as necessary to clean the mouth. If the patient can use a mouthwash assist him into a comfortable position to rinse the mouth with potassium permanganate solution and then water as many times as desired. Use the second kidney tray for a receiver (if the patient is too ill to use a mouthwash, proceed to the next stage).

Apply glycerine to the tongue and lips. If the patient has dentures, they should be cleaned in warm water with a toothbrush, using sodium bicarbonate solution. (Bathing a patient in bed - Bed bath), if a patient is too ill to go to the bathroom, he will need to be given a bed bath.

Principles

Make sure that everything needed for the bath is at the bedside before beginning so that the patient is not left during the procedure. Ensure the comfort of the patient throughout the procedure. Let the patient carry out as much of the bath for himself as he is able. Change the water as often as necessary so it remains warm and clean, and always change it immediately after washing the pubic area. The patient should feel refreshed as well as being clean at the end of the bath. Mouth care should be given, talcum powder applied, the nails should be clean and the hair combed.

Requirements

The equipment needed should be placed on a trolley so that it is easily transported to the bedside bucket of hot water and bucket of cold water, a basin and jug, soap and wash cloth, towels and clean bed linen, clean nightclothes for the patient, talcum powder (dusting powder) back lotion i.e. methylated spirit mixed with alum, nail scissors, comb, mouth wash tray and kidney dish bucket for dirty water, container for dirty linen.

Method

Explain the procedure to the patient, offer him the opportunity to pass urine. Screen the bed and close nearby windows. Remove the patient's nightclothes. Make sure the patient is covered with a blanket or sheet. Arrange the towel over the patient's chest. Check the temperature of the water with your elbow to make sure it is not too hot or cold. Wash, rinse and dry the patient's face, or better still, allow him to do this for himself. Use soap only if the patient normally does so.

Place the towel under the arm farthest away from you. Wash, rinse and dry this arm, paying special attention to the axilla area. Repeat for the other arm. Wash rinse and dry the chest and abdomen. In female patients pay particular attention to the area beneath the breasts. Change the water if necessary, ensuring the patient is covered over with a blanket/sheet.

Place the towel under the leg farthest away from you. Wash, rinse and dry this leg making sure that the blankets/sheet covers the parts not being washed. Repeat for the other leg. The pubic area should be washed next. The patient should do this himself if able to. Change the water, remove all the pillows except one and roll the patient on to his side facing away from you. Wash, rinse and dry the patient's back and buttocks.

Treat the pressure areas and make this side of the bed (change the bottom sheet). Turn the patient to face you and make the other side of the bed. Apply talcum powder to the patient and put on clean nightclothes. Change the top sheet and pillowcases. Attention to mouth care, nails and hair can then be given. Make sure the patient is comfortable before leaving the bedside. Record the procedure in notes, including condition of the patient's skin.

Chapter 4
Anatomy and Physiology

Human body is a miraculous creation performing innumerable intricate activities like a modern computer. The different systems in the body are organised by distinct tissues to carry out their functions, but they all work in unison. Anatomy deals with the internal structure of the body. It is important for the nurses to have a basic knowledge of Anatomy, Physiology and Microbiology. This basic knowledge will help them to understand diseases and their treatment.

The study includes the following systems

1. Anatomy of the body
2. Skeleton and Muscular system
3. Circulatory system
4. Digestive system
5. Respiratory system
6. Urinary system
7. Nervous system
8. Special senses
9. Ductless glands (Endocrines)

The study of the functioning of these systems is Physiology.

Basic facts of the body

We need food, water and oxygen to live. 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. The 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, carry the commands given by the brain as electrical impulses. The excretory products formed in the various organs and the carbon dioxide released after the utilisation 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.

Microorganisms like bacteria and virus are the enemies of the body, producing diseases. The white blood corpuscles serve like policemen killing the germs.

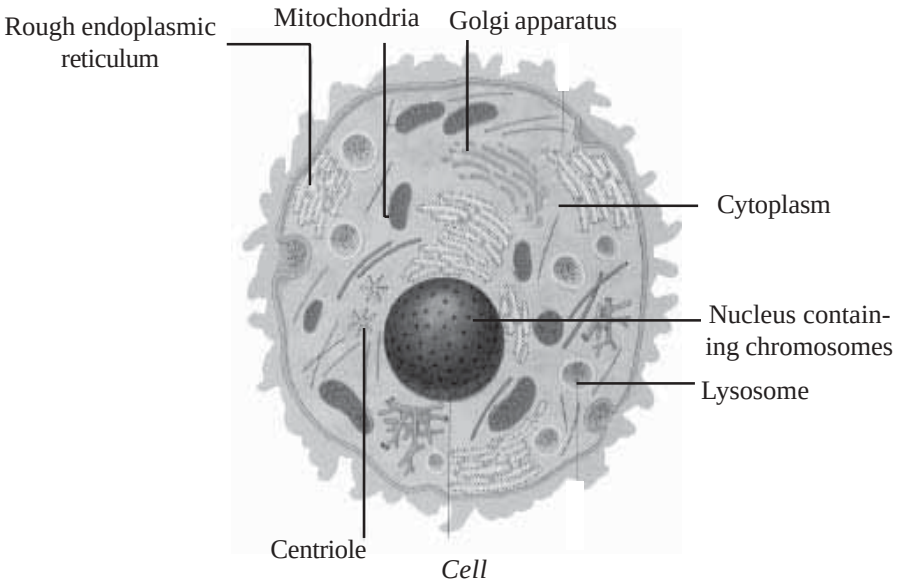
I. Anatomy of the body

The cell

Cells are the basic units of the body. Human body is made up of billions and billions of cells. The cells are classified according to their functions.

Cell structure

Cell is composed of a jelly like substance called the protoplasm. This is covered by a membrane, the cell wall. The protoplasm contains the nucleus, usually situated in the centre. During cell division, the nucleus divides into two, followed by the division of the protoplasm, to form two cells. A collection of such cells formed, constitutes the tissues.



Cell

Functions of the cell

General functions

1. Absorption of food and oxygen
2. Growth and repair
3. Reproduction
4. Excretion

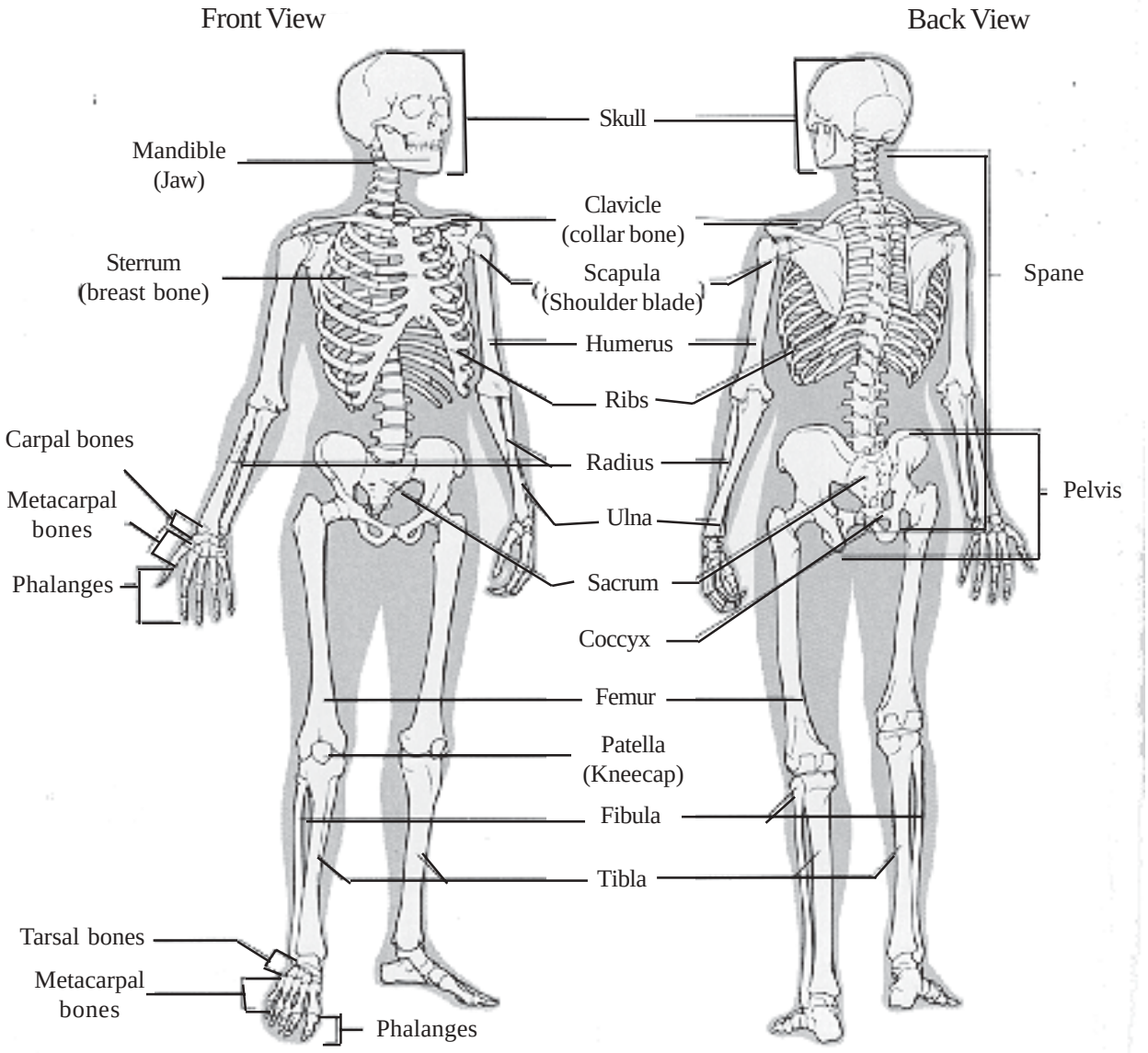
Specific functions

1. Epithelial cell: Performs the function of protection and secretion.
2. Ciliated cell: The movement of the cilia in the cells of trachea helps to remove the dust particles.
3. Connective tissue cells: These cells connect the tissues in different organs. Bone is the hardest connective tissue. It gives support and strength to the body.
4. Blood: The blood functions as a transporting system. The red blood cells separate oxygen from the inhaled air. The blood carries the oxygen and the nutrients to the different parts of the body. It takes the waste products to the excretory organs.
5. Muscle tissue: They help in the movement of the limbs.
6. Nerve tissue: They transmit impulses in one direction.
7. Membranes: They protect the tissues. They minimize friction. In glands, they secrete fluids.

Collection of cells of almost similar function forms the tissues. The different types of tissues contribute in varying proportions to form the organs. Organs engaged in the same function constitute the systems. Our body, thus consists of different systems, as mentioned earlier. These systems are studied in detail in the subsequent chapters.

II. Skeleton and muscular system

The skeleton gives shape and strength to the body. It helps the body to stand erect. Bones cannot function independently. When the muscles connected to them contract and relax, we are able to move the limbs.



Skeleton

Bones

Types of Bones	Examples
Long bones	Thigh bone
Short bones	Wrist bones
Flat bones	Skull bones
Irregular bones	Vertebra

There are 206 bones in our body.

The muscles are connected to them in the front, behind and lengthwise. The muscles are stimulated to contract by the nerves coming from the brain or spinal cord. They cause movements of the head, neck, trunk and limbs by contraction and relaxation.

Nurses of the visually disabled must learn that eyes are found in the bony sockets, orbits. They are kept in position by the ligaments. The six extra ocular muscles move the eyeballs. The nerves pass through the foramina in the bony orbit and connect the eye to the brain.

III. Circulatory system

The circulatory system is important and it consists of the Heart, Blood Vessels and the Blood.

Functions of the circulatory system

1. The system takes oxygen from the lungs to the other parts of the body and the carbon-dioxide from the different parts to the lungs.
2. The nutrients of the digested food are taken from the intestines to the liver.
3. The digested food converted to glucose energy in the liver enters the blood.
4. The energy got from the liver is taken to all parts of the body.
5. The waste products are taken to the kidneys.
6. The hormones from the endocrine glands are taken to their place of action.
7. Keeps the temperature of the body constant.
8. Keeps the water content in the body constant.
9. The leucocytes in the blood fight against diseases.
10. The platelets in the blood play a vital role in the coagulation of blood.

Blood vessels

Blood vessels are of three types - Arteries, Veins and Capillaries.

Arteries

The blood vessels carrying blood away from the heart are called the arteries. The aorta and its branches contain oxygenated blood. The pulmonary artery contains deoxygenated blood. The arteries have thicker and muscular walls than the veins. The pressure within the arteries is high. The arteries branch into smaller arteries and finally end as capillaries.

Capillaries

The capillaries have thin walls. The oxygen and nutrients can enter the tissues easily from the capillaries and the impurities from the tissues can reach the blood in the capillaries.

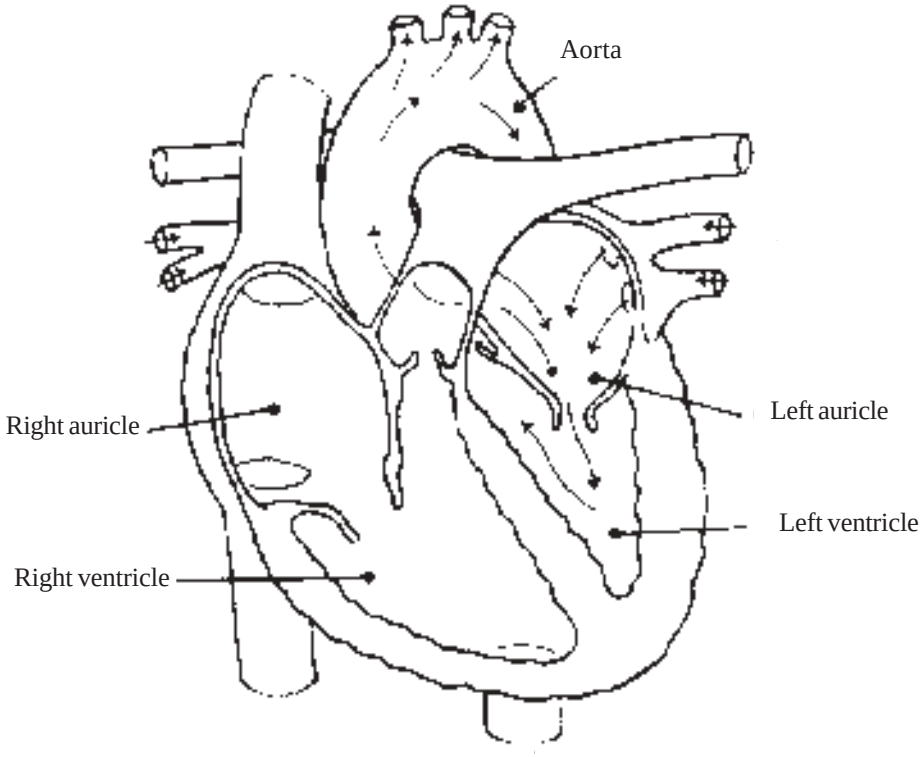
Veins

The capillaries lead on to venules which form small veins and finally large veins. The veins take the deoxygenated blood (carbon-dioxide) to the heart. Their walls are thinner than that of the arteries. Valves are present in their walls, which makes the blood to flow in only one direction. The blood flowing through the veins will have a lesser pressure and is dark red in colour. The intravenous injections are given through the veins. The veins near the skin are very useful, especially those at the elbow, wrist and ankle.

The pulmonary veins carry oxygenated blood from the lungs to the heart.

Heart

The heart is the most important organ in the circulatory system. It is situated in the middle of the chest. The upper chambers (atria) are the right auricle and left auricle and the lower ones right ventricle and left ventricle. Each auricle opens into the ventricle of its own side through an aperture, the atrioventricular opening. The two apertures are guarded by valves which will open only into the ventricle and prevent backward flow of blood. The valve on the right side has three flaps (cusps) and is called the tricuspid valve. The valve on the left side is mitral or bicuspid valve, with only two cusps.



Human heart

The right auricle receives the deoxygenated blood from the different parts of the body. This blood enters the right ventricle. When the right ventricle contracts, blood is forced into the pulmonary artery. The right atrioventricular valve prevents the blood from flowing back into the auricle. The pulmonary artery is guarded by the pulmonary valve, with three semilunar leaflets which prevents the regurgitation of blood

into the right ventricle. The pulmonary artery divides into right and left branches which enter the corresponding lung.

The purified oxygenated blood from the lungs reaches the left auricle through the four pulmonary veins. When the auricle contracts, the blood is pushed into the left ventricle through the mitral valve. The thick wall of the left ventricle, on contraction pushes the blood with great force into the aorta. The aorta is guarded by an aortic semilunar valve, which prevents regurgitation of blood into left ventricle. The aorta transports the oxygenated blood to all the parts of the body.

The heart beats about seventy two times (70-80) per minute. That is, it contracts and relaxes for about seventy two times a minute. When the auricles contract, the ventricles relax. When the ventricles relax, the atrioventricular valves open, but the aortic and pulmonary valves are closed. When the ventricles contract, the semilunar valves open and allow the blood to pass through the aorta and pulmonary arteries. At that time, the atrioventricular valves are closed.

The heart beat has two sounds. The first sound is ‘lub’ and the second is ‘dub’. The first sound is caused by the closure of the atrioventricular valves and the second sound by the closure of the semilunar valves. These sounds are felt as pulse at the wrist.

Blood circulation

There are three types of circulation

1. General or Systemic circulation
2. Pulmonary circulation
3. Portal circulation

General circulation

Oxygenated blood from the heart (left ventricle) enters the aorta, which gives off branches to supply the various parts of the body. First it sends blood to the heart through the coronary arteries. Then, it gives off the subclavian artery to the upper limb and common carotid arteries to supply the head and neck. The internal carotid artery enters the cranial cavity and supplies the brain and eye. The descending aorta in the thorax, gives off the bronchial arteries and the intercostal arteries. In the abdomen, the branches of aorta are the celiac artery, superior mesenteric artery and inferior mesenteric artery to supply the gastrointestinal tract, suprarenal arteries, gonadal arteries and renal arteries to supply the suprarenals, gonads and kidneys respectively. The aorta terminates as the two common iliac arteries. The internal iliac branch supplies the pelvic organs and the external iliac, the lower limb. The arteries take the oxygenated blood to the tissues of the different parts of the body. The carbon-dioxide and the waste products from the tissues enter the blood, which becomes dark red in colour. The deoxygenated blood drains through the veins. The venous blood from the upper part of the body – head, neck, brain and upper limbs reaches the heart through the superior vena cava. The deoxygenated blood from the abdomen, pelvis and lower limbs reaches the right atrium of heart through the inferior vena cava. This is general or systemic circulation.

Pulmonary circulation

The deoxygenated blood from the right ventricle enters the pulmonary artery. This divides into right and left branches and enters the corresponding lung. The oxygenated blood from the lungs is brought to the left auricle of heart through the pulmonary veins. This is the pulmonary circulation.

Portal circulation

This system of circulation commences as capillaries and ends as capillaries. Blood from the digestive tract, containing both deoxygenated blood as well as blood containing the absorbed nutrients enter the

portal vein. This terminates in the liver by dividing into branches and ends as capillaries. This system of veins are not provided with valves.

The blood reaching the liver through the portal vein contains nutrients and toxic products absorbed in the digestive tract. This blood is detoxified in liver and enters the circulation.

The blood reaches the kidneys through the renal arteries. The kidneys separate the waste products from the blood as urine. The purified blood comes out through the renal veins and enters the inferior vena cava.

Composition of blood

Human body has 5-5 ½ litres of blood. Blood consists of fluid and solids. The fluid is the plasma and the solids are the blood cells.

There are three major types of blood cells. They are:

1. Red Blood Corpuscles or Erythrocytes (RBC)
2. White Blood Corpuscles or Leucocytes (WBC)
3. Platelets or Thrombocytes

Red Blood Corpuscles

Red blood corpuscles are biconcave disc shaped cells. The RBC contains haemoglobin. This carries the oxygen. In normal persons, the number of RBC per cubic millimetre of blood ranges between 4.5 and 5 million. The red blood cells are formed in the bone marrow. There is no nucleus in the mature stage. The RBC transports oxygen from lungs and distributes it to all the parts of the body.

White Blood Corpuscles

White blood corpuscles are white or colourless. They possess a nucleus. The total count is between 6,000 and 10,000 per cubic millimetre. They are produced in the bone marrow and in the lymph glands. Their function is to fight and destroy the bacteria entering the body. They increase in number when a person is affected by disease. So, counting the number of WBC will help one to understand whether the person is infected or not.

WBCs are of five types. They are:

1. Neutrophils
2. Eosinophils
3. Basophils
4. Monocytes
5. Lymphocytes

Platelets

Platelets are very small irregular bodies. They number about 250,000 per cubic mm. They play a part in the coagulation of blood.

Plasma

The fluid in the blood is called plasma. The chemicals in the plasma help in the prevention of disease and coagulation.

Plasma contains

1. 90% water
2. Salts like sodium chloride, calcium
3. Proteins like albumin and globulin
4. The absorbed nutrients from the food such as glucose, fatty acids, amino acids and vitamins
5. Waste materials from the tissues like urea and carbon-dioxide
6. Antibodies and antitoxins
7. Hormones from ductless glands
8. Coagulating agents like fibrinogen and prothrombin

IV. Lymphatic system

The nutrients and oxygen from the blood are supplied to the tissues. The blood removes the excretory products. The tissue fluid is also drained through the lymph. The lymph is almost similar to the blood plasma. It contains lymphocytes. The lymphatic system consists of lymphatic vessels and lymph glands. Spleen is the largest mass of lymphoid tissue. The lymph nodes are abundant in the neck, armpit and groin. The lymph collects the waste materials and reaches the circulatory system. The lymph helps in fighting against many pathogenic organisms.

V. Respiratory system

The function of the respiratory system is to supply oxygen and send out carbon-dioxide.

Organs of respiration

- Nose
- Pharynx
- Larynx
- Trachea
- Bronchi
- Lungs
- Respiratory muscles

Nose

The wall of the nasal cavity is made up of bones and cartilages. The openings are the nostrils. It has hair like structures called vibrissae. They filter the dust particles. The olfactory nerves end in the nose. The sense of smell is carried through these nerves to the brain. The lacrimal duct also ends in the nose and excess tears reach the nose through it. Nurses attending on eye patients must have an accurate knowledge about it. When there is an obstruction in the tear duct, excess tears do not reach the nose but drop out from the eye. This is called epiphora. This obstruction can be treated in children by the probing method. For elders, surgery is the corrective measure.

Air enters the respiratory passage through the nose, passes through the pharynx, the larynx and then enters the wind pipe or trachea. The trachea is a tube supported by cartilaginous rings. It divides into two major bronchi. The bronchi divide and sub-divide into small bronchioles terminating in an alveolus or air sacs. The exchange of oxygen and carbon-dioxide takes place in the alveoli.

Respiratory muscles

The respiratory muscles are responsible for respiration. The muscles are diaphragm and intercostal muscles. The diaphragm separates the thoracic and abdominal regions. The intercostal muscles extend between the ribs. When these muscles contract, the ribs are pulled upwards. The muscular diaphragm contracts and flattens. The pleural cavity is enlarged and the atmospheric air rushes through the trachea into the lungs. This is inspiration. When the muscles relax, the diaphragm becomes arched, the pleural cavity gets compressed, forcing the air out of the lungs through the nose. This is called expiration. In the mean time, blood surrounding the alveoli receives the oxygen and reaches the heart.

Note to the nurses

1. We breathe in and out 17-20 times per minute. Children breathe faster.
2. When there is obstruction in the respiratory tract there will be difficulty in breathing. If a patient has one or two dentures, they must be removed when he/she faints or has to be given anaesthesia. The dentures may block the respiratory passage.
3. For asthmatic patients, the sputum may block the trachea. The trachea also contracts. So, the breathing difficulty will increase. This may happen suddenly and especially during nights. So such patients should be advised to have their medicine in hand. If necessary, call the doctor.

Next

1. Make the patient sit in a ventilated place in a lounging position with two pillows.
2. Give liquid food.
3. Give the usual medicine.
4. Call the doctor.

   If a heart patient has breathing difficulty, it may be a sign of heart attack. Call the doctor immediately.

VI. Digestive system

In the food we eat, there are carbohydrates, proteins, fats, vitamins, minerals and salts.

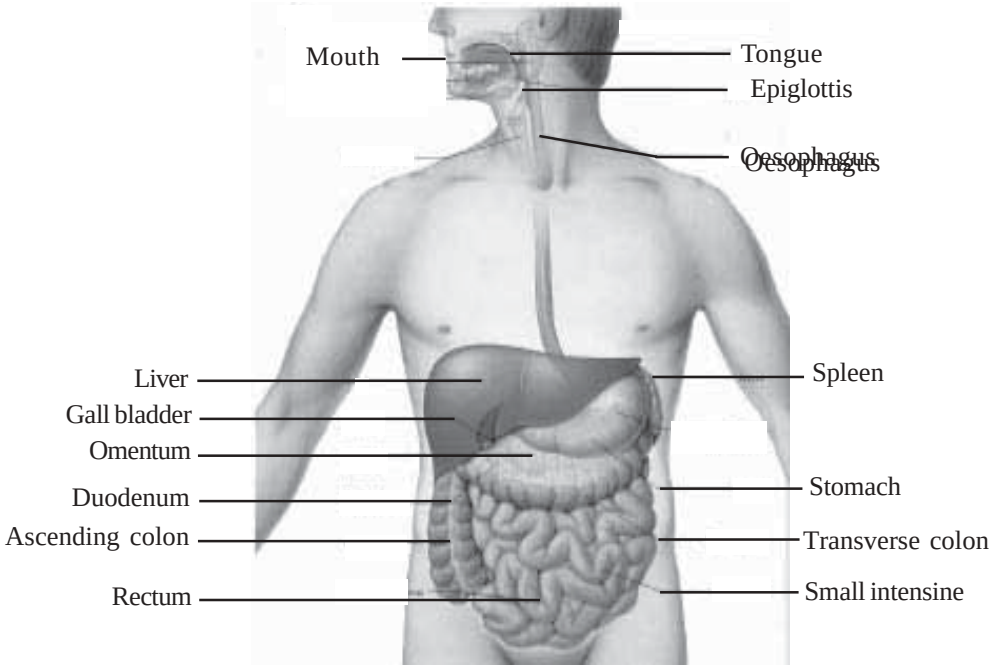
In the digestive system

1. Carbohydrates become glucose
2. Fats become fatty acids
3. Proteins become aminoacids.

   They are soluble and absorbed to help the body in building the tissues and to provide energy.

The digestive system does all this work. The organs and their functions are given below.

Organs		Functions
Mouth	Teeth, Tongue, Salivary glands	Chewing and grinding of food and swallowing
Oesophagus	Lined by stratified epithelium Muscular wall produces peristalsis	Food propelled down
Stomach	Muscular organ lined by mucosa containing gastric glands. Secretes gastric juice	Mixing of the food with the gastric juice
Small intestine	Duodenum	Receives pancreatic juice and bile
	Jejunum	Digestion of food
	Ileum	Absorption of digested food
Large intestine	Caecum	Absorption of water from fecal
	Colon	matter
	Rectum	Conversion from semiliquid to
	Anal canal	semisolid and excretion
Pancreas	Pancreatic juice secreted by pancreatic acini	Trypsin enzyme acts on proteins
	Insulin secreting ductless glands	
Liver		Secretion of bile – acts on fats
		Conversion of glucose into glycogen and storage
Gall bladder		Collection and concentration of bile



Digestive System

Functions of liver

1. Secretion of bile necessary for digesting fats
2. Storage of glucose as glycogen
3. Detoxification of toxins absorbed in the digestive tract
4. Preparing heparin necessary for preventing coagulation of blood
5. Preparing antibodies
6. Collection of iron and vitamins

Enzymes: Place of secretion and function

Enzymes	Place	Function
Ptyalin	Saliva	Converts cooked starch into maltose sugar
Pepsin	Gastric juice	Converts proteins into peptones
Renin	Gastric juice	Converts milk into curd
Trypsin	Pancreatic juice	Converts peptones into peptides
Amylase	Pancreatic juice	Converts cooked and uncooked carbohydrates to maltose
Lipase	Pancreatic juice	Converts fats into fatty acids and glycerol
Maltase	Intestinal juice	Converts maltose into glucose
Erypsin	Intestinal juice	Converts peptides into aminoacids
Lactase	Intestinal juice	Converts lactose into glucose
Sucrase	Intestinal juice	Converts sucrose into glucose

The food, chewed and mixed up with the saliva in the mouth, reaches the stomach, where it is well churned and pushed into the small intestine. In the small intestine, it is digested and the nutrients are absorbed. The food from the small intestine enters the large intestine, where some of the unabsorbed food materials and water are absorbed and the waste materials are excreted as faeces.

Bacteria or virus attacking the digestive system causes vomiting, diarrhoea and jaundice. So food must be well preserved.

The food taken in must contain all the nutrients in the appropriate ratio.

The diet which contains the different types of food stuffs in the proper proportion as required by the body for maintaining the well being of an individual is called the **BALANCED DIET.**

The food stuffs and their main sources are given below

Carbohydrates	Proteins	Fats	Vitamins and minerals
Wheat	Dhal	Oil	Greens
Rice	Beans	Ghee	Fruits
Maize	Groundnuts	Cheese	Milk
Potatoes	Soyabeans		Egg
Tapioca	Greens		Fish
Jaggery	Milk		Meat
Honey	Egg		Dhal
Sugar	Meat		Carrot
	Fish		Mango
			Papaya

VII. Excretory system

The waste products from the body are eliminated through the excretory system. 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

Organs	Waste products
Skin	Sweat
Kidneys	Urine
Lungs	Carbondioxide
Large intestine	Excreta

Lungs

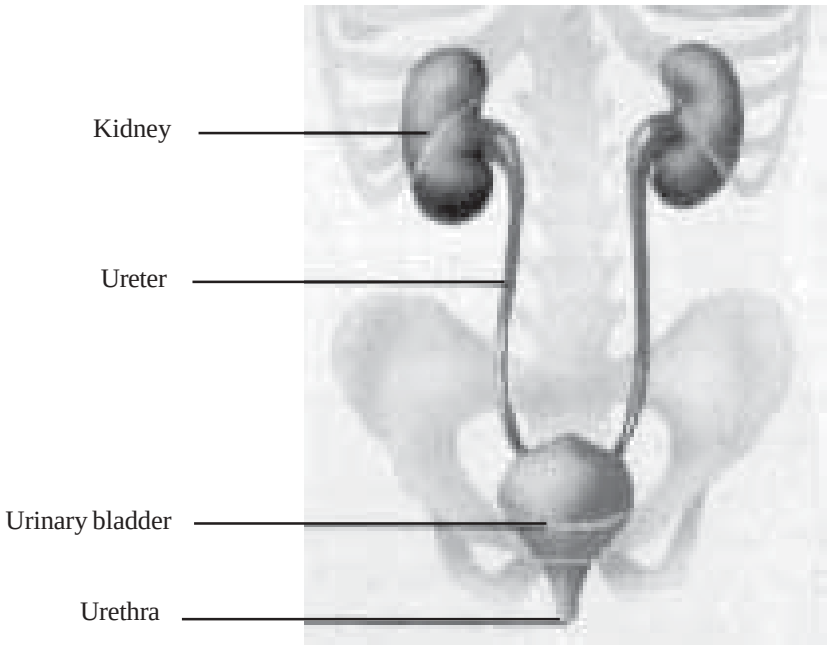
The lungs are a pair of respiratory organs present in the thoracic cavity. A maximum quantity of carbondioxide is exhaled during respiration through the lungs.

Skin

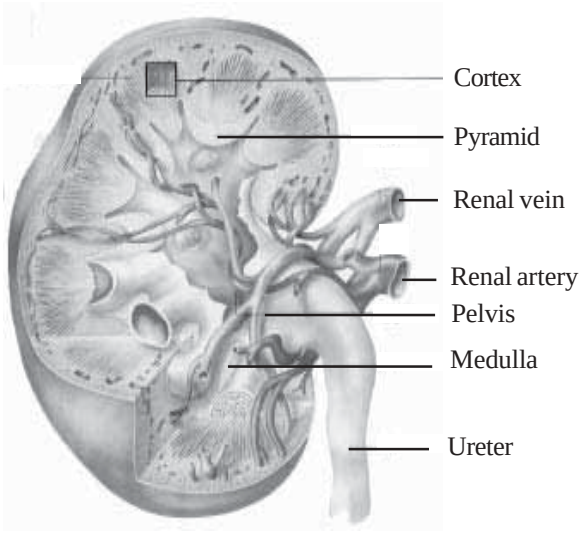
Skin is another excretory organ of the body. It is provided with sweat glands which excrete sweat containing excess salt from the blood. It also serves as an outer covering for the body, protecting it from microorganisms. It also helps the body to keep its temperature constant.

Kidneys

The principal excretory organs are a pair of kidneys, which remove urea from the blood. The kidneys are bean-shaped and dark red in colour. They are situated inside the abdomen on either side of the vertebral column.



Excretory system



Cross section of Kidney

The inner pale region is called the medulla. It has a number of cone-like structures called pyramids. The outer dense, granular region is the cortex. Each kidney is composed of a large number of nephrons, about a million in number. The structure of a nephron starts with a tuft of capillaries. The waste products in the blood are separated as urine by these nephrons. The ureter transports the urine from the kidney to the urinary bladder. The bladder leads onto urethra through which urine is passed out.

Functions of the Kidneys

1. Kidney excretes urea formed during protein metabolism.
2. Excretion of toxic substances.
3. Regulate the loss of excess water from the body.
4. It maintains the pH.

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 case of diabetic patients, it is excreted in urine. When diseases affect a person, the qualities of the urine change.

Examination of urine

Characteristics of normal urine

1. Colour: Yellow or clear.
2. Reaction: Slightly acidic.
3. Specific gravity: 1015-1025.
4. Odour: Characteristic.
5. Urine excreted in 24 hours: 1 ½ liters or 40-60 ounces.

Characteristics of abnormal urine

A. Colour

1. Light Yellow, dark green, when bile is mixed.
2. Cloudy or red when blood is mixed.
3. Milk-like or translucent when it contains pus.

Colour changes are also caused by some medicines.

B. Reaction

When urinary bladder is enlarged, urine will be alkaline.

C. Specific gravity

When there is sugar in the urine and when the kidney is infected, specific gravity will be high.

D. Odour

1. When there is decomposition, it will have the odour of ammonia.
2. When there is acetone, it will have a pleasant smell.
3. When there is the presence of E.coli bacilli, it will smell of fish.

E. Contents

Mucous, pus, blood clot, stone, bile.

F. The output of urine will be decreased for the following reasons:

1. Fever, heart disease, acute nephritis
2. Haemorrhage, diarrhoea, vomiting
3. Toxic state or reaction to certain medicines
4. When there is oedema

The output of urine will be reduced in certain normal conditions also.

1. Reduced intake of liquids
2. Excess sweating
3. After exercise
4. Hot climate

G. The output of urine will be increased in

1. Diabetes mellitus
2. Nervousness
3. Chronic dysfunction of kidneys

After taking drugs like digitalis, potassium citrate, urine output will be increased.

Tests for urine

Before testing the urine, examine its colour and odour. See also whether it is clear, cloudy or with sediments. Normal urine will be yellow with slight acidity.

Requirements

1. Test tubes, dropper
2. Test tube holder
3. Water
4. Urinometer
5. Litmus paper – red and blue
6. Filter paper and funnel
7. 10% acetic acid
8. Benedict's solution
9. Spirit lamp, spirit, match box
10. Kidney tray to receive the urine
11. Cloth to clean the test tubes
12. Washing facility

Method

A. To test reaction

Dip dry red litmus paper and blue litmus paper into the urine.

Result

1. If blue litmus changes red, urine is acidic
2. If red litmus changes blue, urine is alkaline
3. If there is no change in both, then the urine is neutral

Alkalinity is caused

- When urinary bladder is infected
- After citrate medicines are taken
- After consuming vegetables and exposing to air, urine shows alkalinity

Note: If urine is alkaline or neutral, before proceeding with other tests, make it acidic by adding a few drops of acetic acid.

B. Specific gravity

Specific gravity is the weight of the solid substances per unit. This is measured by floating the urinometer in the urine and taking the reading at the eye level.

Normal urine will have a specific gravity of 1015-1025

The specific gravity is higher

- When sugar is present in the urine
- When urine is dense

The specific gravity is lower

- When the patient has consumed a lot of liquid
- When there is dysfunction of kidneys

C. Albumin test

Take the urine in a test tube, keep it slant with a test tube holder against the flame. Heat the top portion to the boiling point. Compare the heated portion with the rest. If it becomes cloudy, add a few drops of acetic acid. If cloudiness disappears and the urine is clear, then there is no albumin. If it continues to be cloudy, then there is albumin.

Record as

1. Trace if albumin is present in small quantity
2. Albumin +, ++, +++
3. Loaded if it is more

D. Benedict's Test for sugar

1. Green – trace sugar +
2. Yellow – a small quantity ++
3. Orange – large quantity +++
4. Brick red – very large quantity ++++

If there is sugar present in the urine, proceed as follows.

E. Acetone test

Take a small quantity of urine (about 1" long) in a test tube. Add an equal quantity of ammonium sulphate crystals and shake well. Add three drops of 5% sodium nitroprusside and ammonia. If there is acetone present, a permanganate ring will appear at the top.

F. Urine culture

Give a sterile test tube to the patient and ask him to collect the midstream urine after cleaning the organ.The test tube must not come in contact with the hands or organ. The test tube is then closed tightly with a stopper. Write the name of the patient, I.P.No. Ward/room number on a tag and paste it. Send it to the lab.

Note

After the test is over, clean the test tubes with soap, brushing them with clean water. Keep them in their place. Funnel, urinometer and jar must be cleaned. The nurse must wash her hands clean. Record the results of the test in the register concerned.

VIII. Nervous system

The nervous system is closely connected with the eye. So, nurses of the visually disabled must have a clear knowledge about it.

The nervous system consists of

1. Central nervous system
2. Autonomic nervous system
3. Nerves

Parts	Subdivisions
Central nervous system	Cerebrum, cerebellum, midbrain, pons, medulla oblongata and spinal cord
Peripheral nervous system	Cranial and spinal nerves
Autonomic nervous system	Sympathetic and parasympathetic systems

Functions of nervous systems

1. Regulates the internal environment of the body through its control over the various organs.
2. Receives the impulses from the external environment through the sense organs.
3. Responds to the sensory stimuli by its motor functions.

When we see something, the eyes convey it to the brain. The brain responds to the message and sends the commands to the limbs of the body to produce some movement. If a nurse sees a patient, her brain perceives the message, and sends commands to her legs and hands. She moves towards the patient, looks at the identity card, which is again sent to the brain. On the commands of the brain, her mouth opens and asks questions. All these happen at the conscious level.

Reflex action

If the finger touches the fire, it is withdrawn at once. It is spontaneous involuntary action. Likewise, if a nurse sees a patient fainting, she will rush at once to her help. This is an involuntary reflex action. These impulses go urgently to the spinal cord, which gives the command.

In an emergency, one will act very quickly. The sympathetic nervous system releases adrenaline and increases the heartbeat. When a nurse finds a patient in an extremely critical stage, she will rush to the

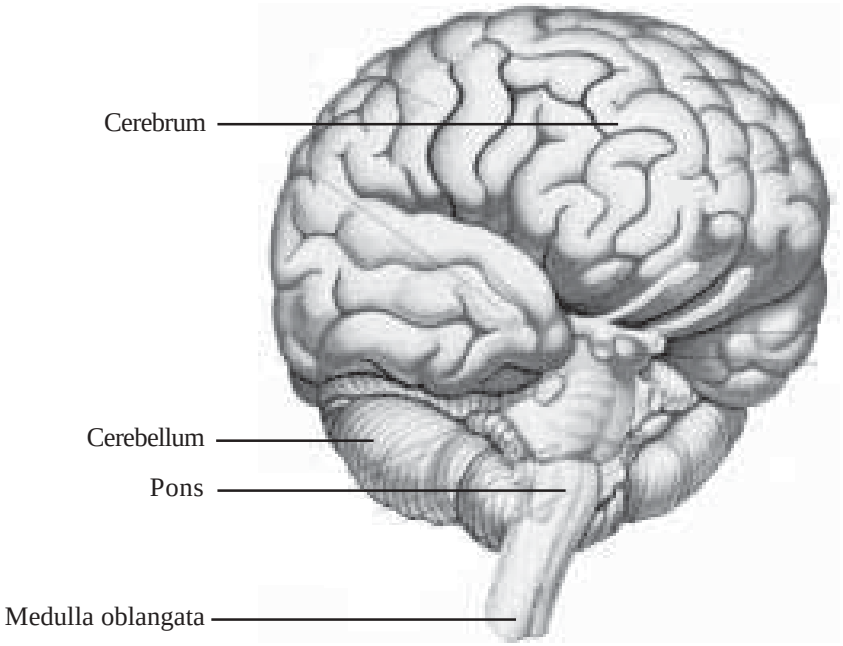
doctor for help; her heartbeat increases, her pupil widens. The parasympathetic system slows down the heartbeat. It exerts an inhibitory action.

Cerebrum

The largest part of brain is cerebrum. It has two hemispheres – right hemisphere and left hemisphere. Each hemisphere is further divided into four parts.

1. Frontal lobe
2. Parietal lobe
3. Temporal lobe
4. Occipital lobe

The occipital lobe is concerned with the visual function. However in diseases of the other parts of the brain also, the eyesight may be affected.



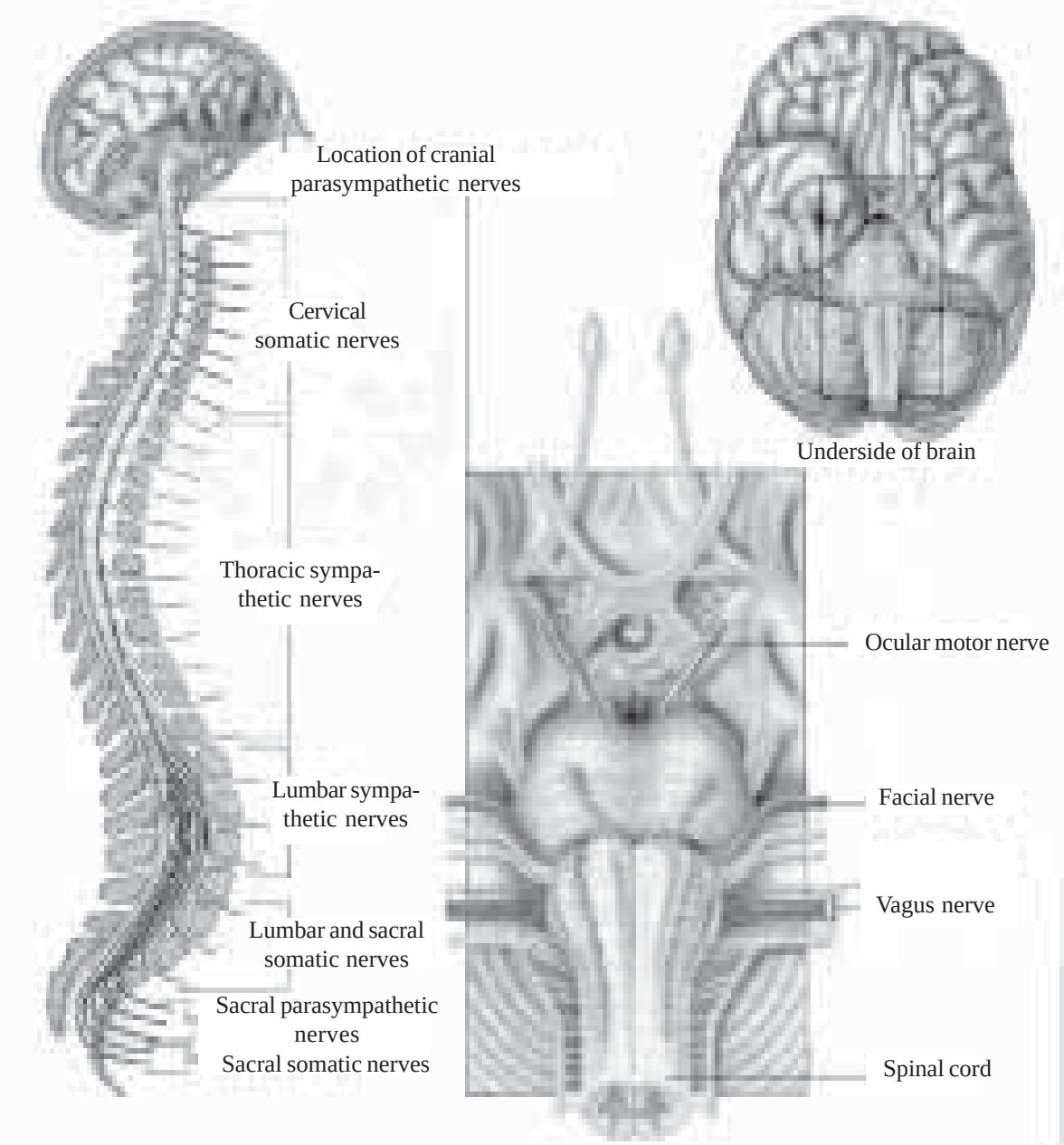
Human brain

Cranial nerves

There are 12 pairs of cranial nerves. These are connected with the movements and sensations in the head and face including the eye, ear and nose. Of these, 2, 3, 4, 5, 6 and 7 are closely connected with the eye. In addition, cerebellum and brain stem regulate the movements of the eyeballs. When these are affected, eyesight also is affected. Optic nerves go along the lower part of the brain to the occipital lobe. When this path or the occipital lobe is affected, field of vision and visual acuity are affected.

Spinal nerves

There are 31 pairs of spinal nerves. These control the other parts of the body.



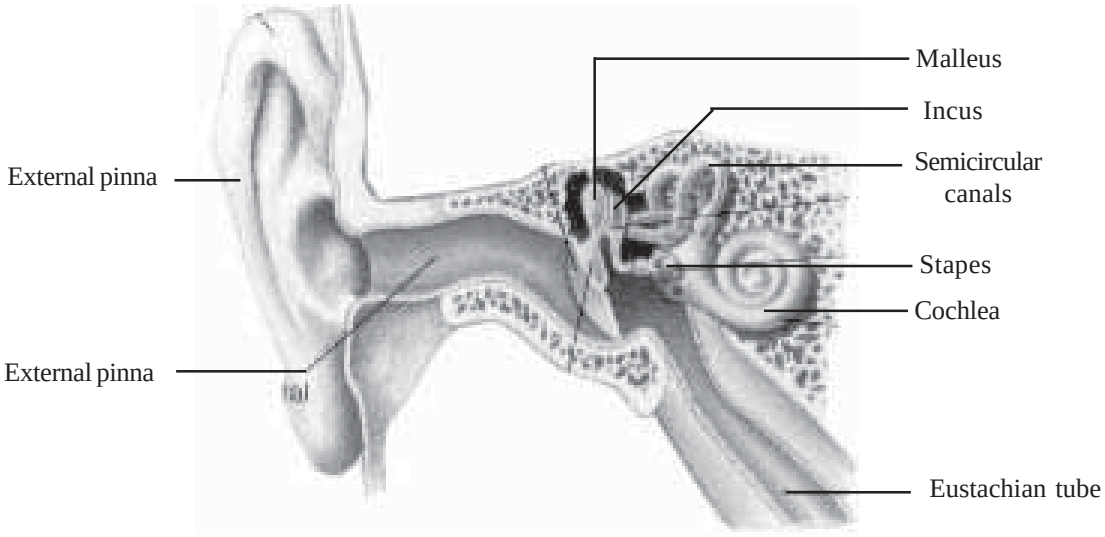
Brain and spinal cord

IX. Special Senses

There are five sense organs. They are eye, ear, nose, tongue and skin.

Ear

The ear receives the sound and passes it to the brain through the eighth cranial nerve. The ear is divided into three parts namely external ear, middle ear and internal ear.



Ear

The ear and the brain

The external ear receives the sound waves and sends them to the middle ear. The curved shape protects the ear from the entry of dust and insects. The tympanic membrane is situated at the depth of the external ear. In the middle ear, there are three chain like bones – malleus, incus and stapes. The inner ear consists of nerves, cochlea and semicircular ducts. They help not only in hearing but also in the maintenance of the equilibrium of the body.

If there is pus in the ear, it shows there is infection in the ear. This pus may spread to the brain and affect the eyes also. Certain diseases of the brain will affect the ear and the eye. So the nurse of the visually disabled must have a knowledge of the structure of the ear.

Endocrines

Endocrines are ductless glands. Their secretions, hormones are directly poured into the blood. The hormones are essential for the body. These hormones control the activities of the body in coordination with the nervous system. An excess or a deficiency of these hormones can result in various disorders.

The endocrine glands are pituitary gland, thyroid gland, parathyroids, Islets of Langerhans, adrenal glands and gonadal glands. Their hormones control and coordinate the activities of different organs and tissues.

- Digestion
- Metabolism
- Blood pressure
- Sleep
- Consciousness
- Body temperature
- Growth
- Salt water equilibrium
- Reproduction

are all regulated by hormones.

When thyroid gland is hyperactive, both eyes will protrude outside. This is called exophthalmos. This will affect the cornea. Double vision and defective vision may result and the eyes will become normal once the thyroid is treated. The instrument to measure this is the exophthalmometer. Further, tests like Hess chart, diplopia chart, muscle balance test and visual acuity are also necessary.

Chapter 5
Pharmacology

Medicines are chemicals extracted from plants, and animals used to cure and prevent disease. Some medicines are strong and if they are given beyond the prescribed doses, they may cause death. So they must be carefully handled.

1. Medicines must be kept under lock and key.
2. The name of the medicines must be clearly written on the label.
3. Keep the lid tightly closed.
4. Do not keep medicines when they change colour or are beyond the expiry date.
5. Medicines to be stored in cool place must be kept in refrigerators always.
6. Keep all medicines declared to be dangerous in separate locked cupboard. They must be recorded in special registers.
7. Do not handle any medicine without prescription by the doctor.

Applying eyedrops

Rules for the nurses

1. The reason for giving the medicine and dosage must be ensured.
2. Always handle medicines as prescribed by the doctor.
3. Give the right medicine in the right dose to the right patient at the correct time with proper explanation.
4. Read the label on the bottle and double check.
5. Shake the bottle especially that containing steroids.
6. Discard any medicine without a label.
7. Nurse must always administer the medicine to the patient directly, don't send it through another patient.
8. Record only after giving the medicine.
9. Watch out for allergy.
10. If a medicine is to be injected, use sterilised equipments; explain to the patient and follow the procedure carefully.

A study of medicine is pharmacology. It is good for the nurse to learn about the history of medicine. Now medicines are sold with their trade names. The nurse must know them both.

1. Trade name

This is the name given by the manufacturer.

2. Chemical name

The name of the chemicals constituting the medicine are given to it.

Types of medicines

A. Antibiotics

Antibiotics prevent the growth of bacteria and cure infections. There are many types of antibiotics. After identifying the bacteria causing the disease, the doctor prescribes appropriate antibiotics.

B. Analgesic

Analgesics are pain killers. They are

a. Aspirin

b. Paracetamol (Colpol) 800mg

c. Pethadin tetra chloride 2.5 mg or 5.0 mg

Analgesic can be given with or without sleeping doses.

C. Anti hypertensives

Anti hypertensives control hypertension. When the diastolic pressure is above 100 mm of Hg, anti hypertensives are given. Beta blockers is an example.

D. Gastro-intestinal medicines

Diseases of the stomach and intestine are controlled by some medicines.

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

b. Diarrhoea - Antibiotics, anti diarrhoeals and salt-sugar solution

c. Constipation - Constipation medicine

E. Diabetics

There are a few types of medicines: Insulin and tablets. Insulin is injected subcutaneously. Insulin is of three types. They react

a. immediately

b. at a moderate rate

c. slowly - long term

Ocular pharmacology

Drugs for use in the eye are classified according to their action as follows:

1. Mydriatics and cycloplegics
2. Miotics
3. Antibiotics
4. Anti-inflammatory drugs
5. Anti-viral drugs
6. Local anaesthetics
7. Tear substitutes
8. Diagnostic stains

1. Mydriatics and Cycloplegics

Mydriatic drugs dilate the pupil by affecting the dilatory and contracting muscles of the iris; cycloplegics paralyse the ciliary muscles to prevent the process of accomodation of the lens.

The following drugs are mydriatics

a. 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.

b. Homatropine 2- 5%

This is a derivative of atropine with a weaker and shorter action, wearing off after two days.

c. 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.

d. Tropicamide 0.5 – 1%

This is effective within 15 minutes and wears off by 6 hours

e. 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 by a few hours.

Reasons for using mydriatics are

1. Examination of the fundus.
2. The treatment of inflammatory eye disease eg: iridocyclitis. The effect of the drug is to relax the smooth muscles of the iris and ciliary body, thereby resting the eye.
3. Preoperative dialation of the pupil.
4. Refraction.
5. Postoperatively to prevent formation of synechiae (adhesions).

2. Miotics

Miotics are drugs which constrict the pupil. They are used in the treatment of glaucoma. Constricting the pupil opens up the angle of the anterior chamber which helps to relieve angle closure glaucoma. Miotics also increase the flow of aqueous through the trabecular mesh work and so lower the intraocular pressure in open angle glaucoma. The most commonly used miotics is:

Piolocarpine 1 – 4%:

The effect of pilocarpine lasts for about 8 hours. As well as being used in the treatment of glaucoma, it is also used to reverse the actions of a mydriatic after a clinical examination.

Other drugs used in glaucoma

In addition to miotic drugs, there are other drugs which reduce intraocular pressure in glaucoma.

These are as follows:

1. Beta-Blockers

These drugs lower the intraocular pressure by decreasing the production of aqueous fluid. They include:

Timolol 0.25 – 0.5%

Metipranolol 0.1 – 0.6%

Carteolol 1 – 2%

Betaxolol 0.5%

They are all used twice daily and have very few side effects in the eye. However, they are absorbed into the circulation and may cause asthma or a slowing of the heart rate in susceptible patients.

2. Adrenaline (1% drops)

This stimulates the sympathetic nerve endings and lowers the intraocular pressure by increasing the drainage of aqueous fluid from the eye.

3. Diamox (acetazolamide)

This drug inhibits an enzyme called carbonic anhydrase which acts in the production of aqueous fluid. It therefore 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. Unfortunately there are numerous side effects including tingling of fingers, gastrointestinal discomfort and occasionally, after prolonged use, kidney stones.

4. Osmotic agents

These act by drawing fluid out of the extracellular spaces (spaces between the cells) throughout the body. By drawing fluid out of the eye, they therefore lower the intraocular pressure. They also produce a rapid flow of urine and often headaches, so are only used in very urgent cases.

Examples are as follows:

Glycerol

This is a viscous liquid given by mouth in a dose of 1 to 1.5 ml per kilogram of body weight. It is usually diluted with fruit juice to make it taste better.

Mannitol 5 – 20%

This is given by intravenous infusion as a total dose of 2 gram per kilogram of body weight.

3. Antibiotics

Most eye infections due to bacteria occur in the conjunctiva or cornea, and so antibiotics are usually applied locally to the eye. Treatment should be given frequently for acute infections, especially if the cornea is involved. This means that drops should be applied at least every hour and ointments every 2 hours.

Bacterial infections which threaten sight (eg: Penetrating injuries and bacterial corneal ulcers) require subconjunctival antibiotic injections, if possible. If there is infection inside the eye (endophthalmitis), then systemic antibiotics will also be necessary. Very small amounts of certain antibiotics may be injected directly into the vitreous body by the doctor in severe cases of endophthalmitis. A wide range of antibiotics can be used for eye treatment which include the following:

Chloramphenicol 0.5% (Ointment)

This is the most popular antibiotic for local eye use. It has a wide range of activity, good penetration and it is cheap.

Tetracycline, penicillin, neomycin, gentamicin, polymyxin and sulfacetamide (or mixtures of these) are all commonly used as drops or ointment.

4. Anti-viral drugs

These act by inhibiting the metabolism of viruses. However, viruses spend nearly all of their life cycle inside the cell and so are relatively resistant to any chemotherapy. For this reason it is mandatory to apply anti-viral drugs frequently once an hour for drops, and once every 2 hours for ointment.

Idox uridine (I.D.U.) is available in drop and ointment form a much newer drug is Acyclovir which is available as ointment and can be given systemically. Both drugs are used in the treatment of herpetic corneal ulcers (dendritic ulcers).

5. Anti-fungal drugs

These drugs are used in the treatment of fungal corneal ulcers. Examples are as follows:

Natamycin:

This is useful in treatment of corneal abrasions with vegetable matter in hot humid climates. Reduces the virulence of fungal keratitis.

Clotrimazole, miconazole and econazole are all anti-fungal drugs with a good spectrum of activity. Any of these three drugs are the first choice for the treatment of established fungal keratitis. Nystatin and amphotericin B are both antifungal. Nystatin is rather weak and amphotericin rather toxic so it is preferable to use other drugs if available.

6. Anti-inflammatory drugs

The most powerful anti-inflammatory drugs are the corticosteroids. Hydrocortisone, prednisolone, betamethasone and dexamethasone are all used extensively for both local and systemic treatment of uveitis, and scleritis, and locally in allergic types of conjunctivitis and keratitis.

Betnesol – N eye drops are commonly used postoperatively to reduce inflammation following eye operations. Local steriod preparations are the most and because of their serious side effects, the results can be disastrous. Steroids act not only by suppressing the inflammatory responses in the tissues, but also suppress the body's defences against infection. If microorganisms are present, they will continue to multiply but the patients symptoms will improve because the inflammatory responses are suppressed. This complication is especially serious if there is Herpes simplex viral infection of the cornea. The infection will become very severe and persistent. Patients who receive local steroid treatment over a long period of time are at risk from two particular side effects. Cataracts may form, or there may be a rise in intraocular pressure (steroid induced glaucoma).

7. Local anaesthetics

Local anaesthestics drops are used to anaesthetize the cornea or conjunctiva in the following cases:

- Before removing foreign bodies
- Before surgery
- Before any examination which involves touching the cornea, eg: with a tonometer

- Before giving a subconjunctival injection
- Before syringing the lacrimal passages

The commonly used local anaesthetics include:

1. Amethocaine 1%
2. Benoxinate 0.4% Benoxinate causes less irritation than amethocaine
3. Lignocaine 4%
4. Cocaine 4%

This is a very powerful local anaesthetic which also constricts the blood vessels. It can cause the cornea to become hazy and is less frequently used than it used to be. Anaesthesia before surgery is retrobulbar and facial block is given.

8. Tear substitutes

Tear substitutes are viscous substances which help to maintain a thin film of fluid over the corneal surface. They are used in the following cases:

1. If the patient has a lack of tears
2. Lagophthalmos
3. Methyl cellulose and more recently, hypomellose eye drops are used as tear substitutes.

9. Diagnostic stains

Corneal damage either from an ulcer or following trauma may be demonstrated by the use of vital-stains, the commonest being:

1. Fluorescein 2%

This is useful for demonstrating defects in the corneal epithelium. It is also used in applanation tonometry to stain the corneal fluid. Diluted with saline it shows up green and the fluorescent effect is intensified by the using of light from a cobalt-blue filter.

2. Rose Bengal 1%

Rose Bengal stains diseased cells as in Herpes simplex keratitis, corneal ulceration and dry eye syndrome.

Some abbreviations

Some doctors will use abbreviations. Nurses must be aware of their expansion.

O.D – Once a day

B.D, B.I.D – Twice a day

t.d, tds. – Thrice a day

Q.I.D – Four times a day

SOS, PRN – Only when necessary

Stat – At once

Giving drugs to children

1. The quantity of the medicine to be given 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. The child must be sitting while administering the drug. If the child takes the drug happily, appreciate it. Don't force the medicine down the throat. For it is better the child sips it. Encourage the child to drink it on its own; or encourage the child to keep the fingers in the spoon.
5. Inform the doctor when a child refuses to take a particular medicine alone or vomits.

Injection of the drugs

Injection is the method commonly employed when

1. The drug should act quickly
2. The patient is vomiting
3. The patient is unconscious or cannot swallow the drug
4. Giving the drug orally is useless or when it cannot be given orally

Precautions

a. Injection of the drug must be resorted to, only when it is absolutely necessary. For the track of injected drug makes it more dangerous than that it takes when it is given orally.
b. Once the drug is injected, it cannot be drained from the body. So do not give the injection unless you know the exact quantity and its reactions.
c. Ensure that the drug is fresh and note the expiry date.
d. Use a sharp needle to prevent pain.
e. Choose a needle of appropriate length. Do not insert it up to the mount.
f. Get the help of others while giving injection to an unconscious patient or a child.
g. Choose the correct site. Follow the technically correct procedure.
h. Remember that the site of the injection can get infected or may form abscess. Injection is a toxin free technology. So see that all the equipments are properly sterilized. Wash your hands thoroughly. Handle the syringe and needle without touching the tip of the needle.
i. Some patients may develop an allergic shock. So keep anti allergic drug ready. You must do this even if the sensitivity test has not been positive.
j. Drugs like penicillin, ampicillin and antitoxins may cause allergic shock immediately. A patient, who has had itching, swelling or breathing difficulty previously for such drugs, is likely to have a severe shock. So ascertain from the patient about it. If he has had such reactions, do not give the injections. If not, do the sensitivity test and wait for 30 minutes before giving the injection.
k. If the patient becomes pale and starts fainting or develops breathing difficulty, give ½ ampoule (1/4 ampoule for children) of Adrenalin. Repeat it after 10 minutes, if necessary.

Requirements for giving injection

1. A sterile syringe and needles or sterilise them in water.
2. Sterile swabs.
3. Sterile forceps- a bowl with antiseptic lotion.
4. Distilled water in bottles or ampoules.
5. The drug for injection; a file of it is in the form of ampoules.
6. Spirit or savlon or iodine for cleaning the site.

7. A receiver for dirty swabs.
8. A bowl containing water to drop the used syringe and needle.

Syringe and needles

Use 26 gauge needles of 1.5cm length for intradermal injections as only 0.1 ml will be injected.

For subcutaneous injections use 1 to 2 ml capacity syringe 26 gauge needles of 1.5 cm length.

For intramuscular injection use 2 to 5 ml syringe.

For extracting drug from vials, use 20, 21 gauge needles of 3.5 cm long. For giving injections use 22 gauge needles of 3.5 cm long for adults and 23 gauge needle of 1.5 cm long for children.

For giving intra venous injection (I.V) use syringe of 5 ml to 30 ml capacity and needles of 22gauge, 3.5 cm long.

Intramuscular injections

Nurses of the visually disabled will normally give intramuscular injections. The purposes are

1. When the drug would cause irritation if given superficially
2. To get more benefit than if it is given subcutaneously
3. When larger amounts (5ml) are to be injected
4. To give drugs which are absorbed slowly

Sites for injection

1.Gluteal muscles

The gluteal muscles are in the buttock. Divide the buttock into four imaginary parts. Choose the upper and outer quadrant to avoid the sciatic nerve. This site is not suitable for children, as the nerve will become bigger only when they start walking.

2. Deltoid muscle

The delotoid muscle is on the upper part of the arm.

3.Antero-lateral aspect of the thigh

The vastus externus muscle of the outer aspects of the thigh is another site. This is good for infants especially below two years.

Method

1. Read instructions carefully and select the correct medicine.
2. Wash and dry your hands.
3. If the drug is in a vial, do not touch the cap. Wipe the cap with a sterilised swab. If it is in an ampoule the outside of the glass is wiped with a swab moistened with alcohol. Mark on the neck with a file. Hold up the ampoule in a piece of sterile gauge, break the neck of the mark.
4. The piston is inserted into the syringe, without touching the plunger.
5. With the help of sterile dressing forceps, hold the hub of the needle and fix it in the syringe firmly.
6. If the drug is in the form of powder, take the solute in the syringe, push the needle through the centre of the cap and push the piston. Shake the vial well.
7. Suck in air into the syringe to the quantity of drug required.

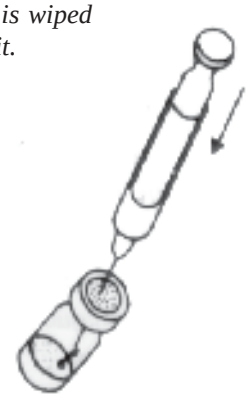
8. Push the air into the vial upside down and take in the drug in the prescribed quantity. Hold the syringe with the index finger and middle finger and use the thumb to push in the piston.

Fit the needle to the syringe by holding the base of the needle and front part of the syringe

The mouth of the ampoule containing distill water is wiped before breaking it.

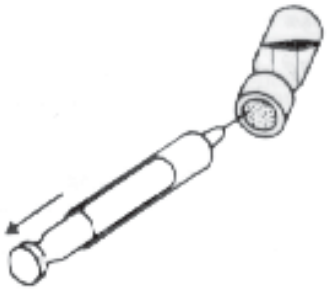
While filling the syringe, be careful not to touch the outside of the ampoule by the needle

The rubber cork of the vial containing powdered drug is wiped with a cotton dipped in boiling water/spirit, before introducing the needle



Now introduce the water into the vial through the syringe

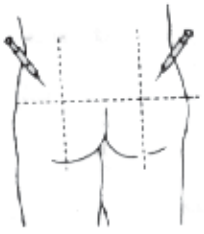
Shape well till the drug is dissolved



Fill the syringe with the drug

Push out the air in the syringe, containted above the medicine

9. If the drug is in the form of liquid, the needle is pushed through the centre of the cap and a little air is injected to facilitate the removal of the fluid. Hold the syringe vertical, push up the piston until the edge is on a level with the line showing the required quantity.
10. Remove the needle and fix a new needle. Push the piston in to remove the air, until the edge is on a level with the line showing the required quantity.



Upper and outer gluteal region is ideal for intramuscular injection

11. Keep the needle resting on a piece of sterile gauge and place the syringe on a tray.
12. Once again check whether the required drug is taken in the right dose for the right patient.
13. Explain to the patient what you are going to do and get his cooperation. If the patient cooperates you can choose the gluteal muscle. A prone position will be suitable. If you choose the deltoid muscle, make the patient sit and keep his hand akimbo. Hold the child's hand by his side.
14. Choose the site of the injection, rub it with a swab moistened with alcohol.
15. Stretch the skin with the left hand and inject the needle at right angle to the skin surface quickly and firmly deep into the muscle.
16. Before pushing in the drug withdraw the plunger a little. If the blood is drawn up into the syringe, then a vein is punctured and the needle should be changed.
17. Keeping the swab withdraw the needle. Use the swab to rub gently. Make the patient comfortable.
18. Record the date, time, drug, its quantity, name of the patient and sign your name.

Other injections

I. Subcutaneous (S.C)

Prepare the syringe and needle as for intramuscular injection. As stated earlier, subcutaneous injections are useful to give drugs which do not cause irritation and which are to be given only in limited doses. E.g. Adrenalin, atropin, insulin.

The drug is injected into the tissues below the skin and it reaches the blood circulation through lymph. Sites can be the arm or the thigh; and occasionally chest and abdomen.

A small piece of skin and subcutaneous tissue should be taken between the thumb and first finger of the left hand, pulling the skin fairly taut. The needle is inserted quickly and firmly into the fold of subcutaneous tissue and the piston pushed steadily down. The mop should be pressed on the skin while the needle is withdrawn.

II. Injection under the skin

Insert a small needle under the skin after cleaning and drying the site. Keep the syringe against the skin. The quantity will be 0.1 ml. There will be a small bulging.

Purposes

1. As a test of diseases e.g Schick test for diphtheria and Mantoux test for T.B
2. Sensitivity test before administering serum or penicillin
3. For BCG injection.

Sites

1. The inside of the fore hand between wrist and elbow, because here the skin will be thin and there will be little hair.
2. Left arm just below the shoulder. This site is chosen for BCG and there will be a scar.

Method

For sensitivity tests, inject 0.1 ml of the drug just below the skin (cleaned and dried) keeping the syringe parallel to skin. There will be a bulging. Watch for 30 minutes whether the site becomes red or edematous. Look for the general condition and for allergic reactions of the patient.

III. Intravenous injection (I.V.)

Intravenous injections are usually given by doctors when a very quick action is required in an emergency and when large amounts are to be given.

In addition to the usual requirements a tourniquet, a roller bandage and a thin rubber tube are required. The usual site for the injection is one of the large superficial veins on the front of the elbow.

Method

1. The skin should be cleaned round the site of the injection, after explaining the procedure to the patient. Keep the arm stretched and place a pillow under it.
2. The tourniquet is placed round the arm well above the elbow and then tightened to distend the veins.
3. The syringe is filled with the required drug and the piston is pushed to send out air. The needle is inserted into the vein.
4. When blood is seen, release the tourniquet. The drug is injected in. Take care that no air bubble is sent in.
5. The mop should be pressed on the skin while the needle is withdrawn. The patient keeps his hand folded for a minute.
6. Record the details of the injection.
7. Never use the syringe and needle again.

Infusion

Liquids are introduced into the body through infusion. Intravenous infusion of solutions is a method that is commonly used for infants and children suffering from dehydration. The solutions are 0.5 percent sodium chloride.

Intravenous infusion is commonly practised. A number of solutions including glucose and protein are infused, along with drugs.

The purposes of I.V drips are

1. To correct dehydration.
2. To feed patient who cannot be fed orally.
3. For patients in shock to keep the intraocular and extraocular fluid balance.
4. To correct serious electrolyte imbalance
5. To dilute toxins and diuresis of kidneys.

Methods

1.Closed method: A needle is introduced to the vein and it is connected to the transfusion apparatus.

2.Cut down method: The vein is cut down and a canula is inserted; or a polythene tube is passed.

Requirements for the closed method

I.V. apparatus: This can be disposable or reusable after washing in steam under pressure

a. Liquid is in bottle through which a needle is inserted. It is connected to a rubber tube of 1 metre long with a drip bulb and clamp.
b. Observation adapter connected to rubber tube and the needle inserted into the vein.
c. Another needle to allow air.

d. Sterilised towel and receiver.

e. 2 mm syringe, swabs, gauges.

Contents of tray

a. Forceps in antiseptic lotion.

b. Plasters, scissors and bandage roll.

c. Antiseptic to clean the skin.

d. Tourniquet or rubber tube.

e. Liquid for transfusion.

An I.V stand is required.

Helping for I.V. Infusion

1. Prepare the patient; bring all things required including the liquid for infusion.
2. Clean and dry hands. Keep the container with the liquid upside down in the I.V. stand; fix the rubber tube.
3. Cover the site with a sterlised towel and clean it.
4. Tighten the tourniquet round the arm to enable the vein to distend.
5. Insert the needle into the vein. When you see blood coming in, release the rubber tube.
6. Adjust the clamp so that the liquid drops at the required rate (40 to 60 minutes).
7. Secure the needle firmly with an adhesive stripping. Cover the area with a piece of cotton wool.
8. Clean the I.V. apparatus. The materials used must be washed, dried and kept in their place.
9. Watch out for symptoms of shivering, chest pain, allergy and inform doctor.
10. If there is any swelling at the site, there may be blockage in the needle or it is inserted in the wrong place. Inform chief nurse or doctor.
11. Record the treatment, liquid, quantity, time and reaction of the patient.

Chapter 6
Microbiology and Sterilisation

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. Diseases causing microorganisms are called pathogens. The disease causing organisms include bacteria, viruses, fungi and parasites.

A. 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 favourable 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 substances are called toxins; when released they circulate in the blood stream. In a severe infection they cause serious symptoms, collectively referred to as toxaemia.

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 spread and to treat infections. Shape is the most elementary method of classification.

a. Cocci: These are spherical or oval shaped bacteria.

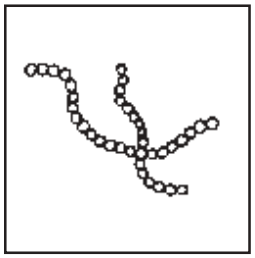
b. Bacilli: These bacteria are rod shaped.

c. Spirochaetes: These are corkscrew shaped or spiral bacteria. The coils of the spiral may be either tight or loose.

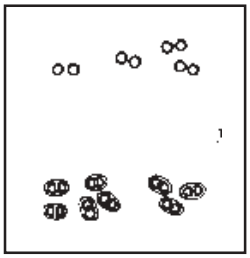
d. Vibrio: Comma shaped or curved rods.

e. Actinomyces: Branching filamentous bacteria.

Staphylococci

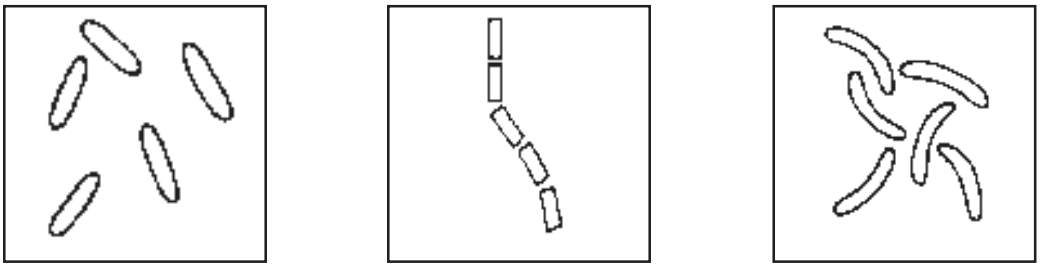


Streptococci

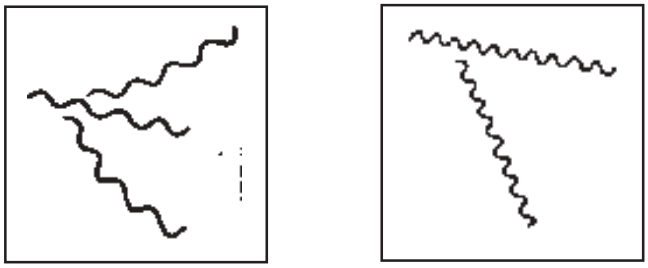


Diplococci

Cocci



Bacilli



Spriochaetes

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

Gram staining procedure

Bacteria are smeared on a glass slide. They are glued to the slide by heating. A stain called Gram crystal violet is added. After a minute it is washed in water. Then, a stain called Gram iodine is added and a washed. This is now kept in pink colour stain called Carbon Fuchsin for a minute and washed and dried. This is seen through the microscope. Red stain is added and washed again. After drying in air, it is seen through a microscope. Bacteria with violet colour are Gram positive and those which are red, are Gram negative.

Let us now study about certain bacteria and see how they cause diseases.

Gram positive cocci

1. Staphylococcus aureus

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

2. Streptococcus pyogenes (Haemolytic Streptococcus)

Gram positive cocci arranged in chains or pairs. The major source of Streptococcus pyogenes is 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 pneumonia

Gram positive diplococci. Pneumococci 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. 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 (Meningoccus 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. Cornyebacteria 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 anthrax causes the deadly disease anthrax. It also causes anthrax of the lid and conjunctivitis.

3. Clostridium species

They produce spores and are anaerobic. This bacteria 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 diarrhoea, 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

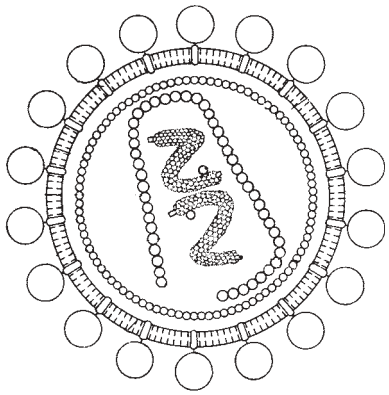
They are usually saprophytes in soil and live free in nature. Infection is acquired mainly by soil contamination, following injury. Common ocular infections caused are conjunctivitis, corneal ulcers and endophthalmitis.

Mycobacterium tuberculosis

Gram stain is not used for this. Acid fast staining is used. Infection caused is tuberculosis and it is acquired by droplet transmission. Tuberculosis is difficult to treat. Four antibiotics have to be used for 6-12 months. Because of increasing in HIV infection, tuberculosis is also increasing.

Viruses

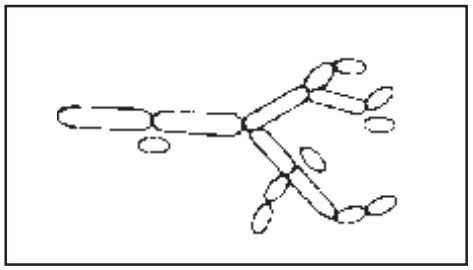
Viruses are smaller than bacteria and can be seen only by an electron microscope. Numerous types of viruses are there; some of them which commonly cause infections in humans are Pox virus, Herpes virus, Adeno virus, Hepatitis virus, Polio, Mumps, Measles and Rubella virus, HIV virus and Rabies virus. All these viruses cause a variety of symptoms ranging from the common cold, influenza to the fatal diseases such as AIDS, yellow fever rabies, etc. In ophthalmology Herpes viruses and HIV are important agent of disease 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 infection at birth e.g. Polio vaccine, MMR vaccine, Hepatitis vaccine.



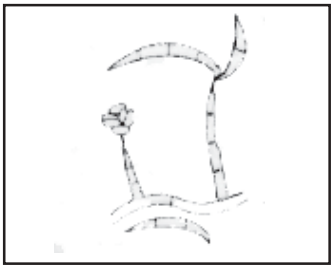
Virus

Fungi

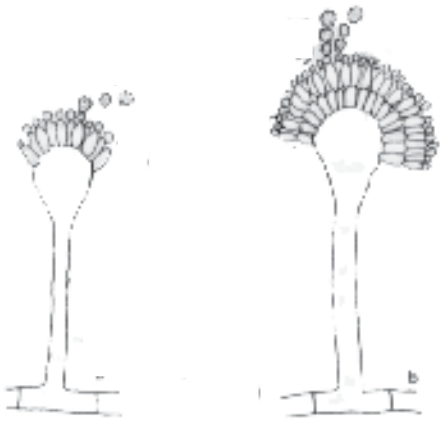
Fungi have been recognised as causative agents of human disease from very early times. Fungal infections are very common and some of them cause very serious and even fatal diseases. Most fungi are



Candida



Fusarium



Aspergillus

present in the soil as saprophytes and human infections are mainly opportunistic. It is very difficult to treat fungal infections. We have to use antifungals for a very long time.

The different disease 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, Penicillium are very common especially in ocular diseases like corneal ulcers and endophthalmitis.

Parasites

Parasites 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 be eating or drinking food and water contaminated by people's faeces which contain the ova and 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 – dysentry (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).

Sterilisation and Disinfection

History of infection control

In the second half of the 19th century a French Scientist called Louis Pasteur made two important discoveries about bacteria. First he discovered that many diseases are caused by bacteria and secondly that bacteria could be killed by heat. Pasteur's name has been used to describe this method of killing germs. Pasteurization is the process of heating milk to about 140^{o}F (60^{o}C) and keeping it at that tempera-

ture for ½ hour followed by cooling quickly to 13°C. This kills harmful bacteria (pathogens) and makes milk safe to drink. An immediate application of Pasteur's work was the introduction of antiseptic techniques in surgery by Joseph Lister, a British surgeon (1867) effecting a pronounced drop in mortality and morbidity due to surgical sepsis. Lister's antiseptic surgery involved the use of carbolic acid and was a milestone in the evolution of surgical practice. Also, surgical instruments were made aseptic by being dipped in carbolic acid solution. Lister's technique was a major advance in the battle against disease.

Definition

Sterilisation

Sterilisation is defined as the process by which 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 usually 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 microorgansims into the tissues. i.e. intravenous infusion, catheterisation. 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. Nurses 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. Nurses must always have their hair tied up so that it doesn't fall into 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, may 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. Opportunity for infection is minimised by unnecessary talking and movement.
9. Minimum exposure to wounds and minimum disturbances to clothing and linen also minimise infection.
10. As most of the infections are caused by droplets spread, one must cough with mouth closed.

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

A. Physical agents

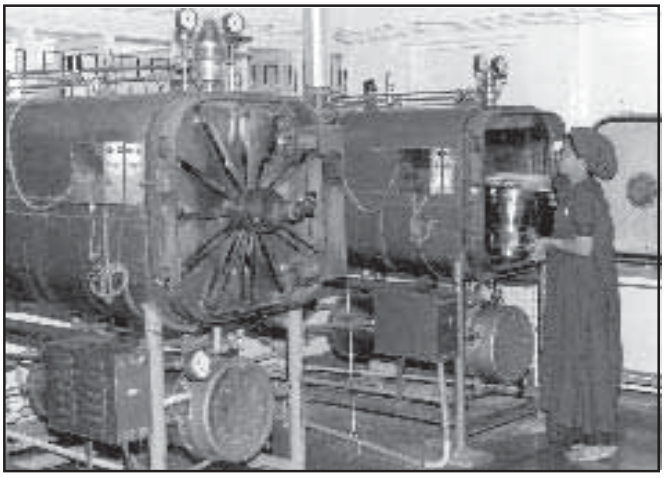
1. Dry heat: flaming incineration, hot air oven.

2. Moist heat: pasteurization, boiling, steam under normal pressure, steam under pressure (autoclave).
3. Filtration
4. Radiation
5. Gas sterilisation

1. Boiling

All pathogenic organisms are killed within 10 minutes of boiling at 90°-100° but the spore forming organisms like tetanus, gas gangrene, require a longer period of boiling.

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. Put the instruments in a tray with holes in the bottom to allow the boiling water to circulate. The instruments should be completely immersed in water. Allow the instruments to boil for 10 minutes after the water comes up to boiling point. The lid of the steriliser should not be opened during the period.



Autoclave

2. Autoclaving

This is a safe method of sterilisation. The mechanism is steam under pressure. Steam is water vapour, it is saturated when it contains a maximum amount of water vapour. Direct saturated steam contact is the basis of the steam sterilisation process.

The steam must penetrate every part and fibre of the item to be sterilized 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.

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.

Bowie dick test

To check whether the autoclave is functioning correctly 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-vaccum 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 instruments, it is especially useful for unblocking cannulae. 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 set and put in trays. Place the trays inside the bin after spreading a towel inside. Place one towel with autoclave tape on 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 so 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.

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 sterilization time is different. Set the correct pressure and timing. Close the door of the autoclave and switch on.

Unloading

Once the cycle has finished, 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 your hands. Store the sterile items in their designated place.

3. 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: Vitroprobes, cryoprobes, fibre optic light, lens, etc. Sterilisation time is 100 minutes at a temperature of 55 degree centigrade complete cycle takes 3 hours.

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 the bag or paper is not damaged before using. Before sealing the items in the bag, make sure there is no air in, to avoid rupture when the vaccum 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.

4. Hot air oven (dry heat sterilisation)

This method kills microorganisms by destroying their shape and agglutination (causing them to stick together). Sterilising time is 160 degree centigrade for 1 hour. As always instruments should be thoroughly cleaned before sterilising.

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.

B. Chemical agents

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

1. Alcohol
2. Formaldehyde (Formalin)
3. Glutaraldehyde (Cidex)
4. Iodine & Chlorine
5. Carbolic acid & Lysol
6. Ethylene oxide
7. Potassium permanganate
8. Bleaching powder

Qualities of good antiseptic

1. Should kill all microorganisms
2. Have speedy action
3. Be stable
4. Safe and easy to use
5. Must not cause irritation
6. Must not corrode metals

Chemical sterilisation

This method is mainly used for sharp instruments as boiling can blunt the sharp cutting edges of delicate instruments.

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

1. Cidex

This is a bactericidal chemical disinfectant. It kills microorganisms including spores. Microorganisms are killed 3-6 hours immersion. Spores are killed after 10 hours immersion.

Method of mixing cidex

A container of activator is supplied with the cidex can. Open the cidex can and add the activator, making sure it is all mixed in the solution. Care must be taken to avoid skin contact with cidex as it is corrosive. If this does occur, wash the affected part under running water. Cidex is also an irritant to mucous membranes so once it is added to a tray of instruments they should be covered with a lid. After mixing, the can of cidex can be used for 15 days. Record the date of mixing on the side of the can.

Preparation of instruments

Wash and dry the instruments carefully. Place the instruments in a tray. Add cidex to the instrument tray. Make sure all the instruments are completely immersed in the cidex. Cover the tray and let the instruments soak for 3-6 hours. Before use, the instruments should be rinsed thoroughly with distilled sterile water.

2. Formalin

Formalin is used to sterilise operation theatre and patient's room. This is available as tablets and liquid. It evaporates quickly and kills the germs. As it irritates skin, it is not used for skin.

3. Potassium permanganate

Potassium permanganate is used to clean wounds and for gorgling.

4. Alcohol

Pure alcohol will not kill bacteria. Only 50% or 70% solution is used. It takes one hour to kill ordinary microorganisms. It is used to clean hand.

5. Bleaching powder

This is used to clean excreta and urine.

6. Iodine

The tincture of iodine is used to sterilise skin.

7. Dettol

Used to wash hands at 2% to 5%. Add 10-20 drops of a glass of water and use to clean room.

8. Mercuric bicarbonate

This is used to sterilise rubber articles. This is strong. 1:1000 solution is used for 30 minutes.

9. Lysol

This is a mixture of carbolic acid and soap solution. Sharp instruments like needle, knife and scissors are kept for 4 hours.

Sterilisation of the operation theatre

The operation theatre is first wiped clean with soap water to the extent one's hand can reach. Then it is washed with water and wiped with dettol. Chairs and tables and other items are also cleaned like this. Then formalin 90ml mixed with boiled water is evaporated in osicare. This will ensure sterilisation of the theatre in 30 minutes. The theatre must be used 12 hours after sterilisation.

Guidelines for nurses in relation to microbiology

Outpatients

1. Madras eye (viral conjunctivitis) is caused by virus. As patients with Madras eye spread the disease all the time, 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 sterilized swabs and bandages closed.
4. Use new disposable syringes.
5. Keep tonometer clean.

Operation theatre

1. The work of the nurses in the operation theatre is important. They must always see that microorganisms never enter the theatre.
2. They must see that patients and assistants of the hospital follow the rules of the theatre and warn them accordingly.
3. Keep sterilised articles from any contamination.
4. The nurse 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 down 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.
5. If a nurse 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 nurse

1. The nurse must supervise whether sanitary staff cleans the patient's rooms.
2. Keep the bed sheets clean.
3. All waste materials must be immediately removed from the ward.
4. Keep in separate rooms patients with infectious diseases and those who have undergone surgery.

Chapter 7
Ward and Out Patient Nurses
(Records of Ward and OP)

Guidelines for Nurses of In and Out-patients

a. Irrigation of the eye
b. Dressing the eye
c. Revision of drug administration
d. Setting up trolley with required articles
e. Testing obstruction of lacrimal sac
f. Taking culture & sensitivity
g. Tension Recording
h. Eye lash clipping

A. Eversion of Lids

Lower lid

This is easy, the lid is drawn down and the patient is asked to look up.

Upper lid

Ask the patient to look down. Hold the upper lid with thumb and index finger and pull it away from the eye (see 7.1a). With the help of the small finger of the other hand a glass plate, the upper margin tarsal plate is pulled down and the lid is turned up (fig 7.1b).

After sufficient practice, eversion of the eyelid can be done with one hand only. This method is helpful in everting the lid when there is itching of the eye.

Eversion of eyelids

B. Irrigation of the eye

It is necessary to irrigate the eye when some alkaline substance falls on it. You need the following equipments:

Irrigating the eye

a. A bottle of sterilized normal saline
b. Kidney tray
c. Local anaesthetic
d. A towel to protect the patient's face
e. Sterilized swabs
f. Receiver tray

Procedure

a. Explain the procedure to the patient and ask him/her to lie down.
b. Put a towel around the patient's shoulder.
c. Wash and dry your hands.
d. Apply local anaesthestic drops.
e. The kidney tray is held firmly, against the face.
f. Separate the lashes with fingers. Instead of irrigating the eye first, practise on the cheek first.
g. Saline should be poured continuously and uniformly. Ask the patient to look up and down and sideways. In order to the expose the conjunctiva fully wash all parts of the conjunctival sac. Straighten the upper eyelid. Use the entire amount of liquid given to wash.
h. After irrigating the eye, dry the eyelashes with the sterilized swab. Remove the tray and see that the patient is comfortbale.
i. Record the procedure and remove the instruments

Note

Instead of a bottle, you can use intravenous infusion set. Suspend 0.9% sodium chloride solution from a drop stand and attach the infusion set to it. Wash the eye as detailed above. You can regulate the flow of liquid by adjusting the clip.

C. Removing subtarsal particle

It is easy to remove subtarsal particles. Seat the patient with a headrest. Focus good light on the eye. Evert upper eyelid and remove the particle.

D. Schiotz Tonometry

Schiotz Tonometer is the instrument which is used to measure the intraocular pressure. The intraocular pressure is measured from the resistance given by the tonometer foot plate to the curvature of the cornea.

Measuring intraocular pressure

Method of measuring intraocular pressure

Requirements

a. Schoitztonometer with 5.5 gm 7.5 gm and 10 gm weights.

b. A table of readings of the intraocular pressure.

c. 4% Xylocaine as local anaesthetic.

d. Swabs.

e. Kidney type tray.

Method

a. Explain the procedure to the patient and make him comfortable. He should be lying down with head on one pillow.

b. Wash and dry hands.

c. Instill local anaesthetic drops into the patient's eye.

d. Add the lightest weight to the plunger.

e. Ask the patient to look straight up.

f. Separate the eyelids, putting no pressure on the eye. Fingers should rest on the orbital margin.

g. Hold the tonometer so that the footplate rests on the centre of the cornea.

h. Look at the scale of the tonometer to find out the degree of indentation. If the weight is not enough to indent the cornea, use a heavier weight.

i. Use the chart to calculate the intraocular pressure for that particular weight, and that degree of indentation.

j. Record the intraocular pressure in the patient's notes.

Sterilising the Instruments

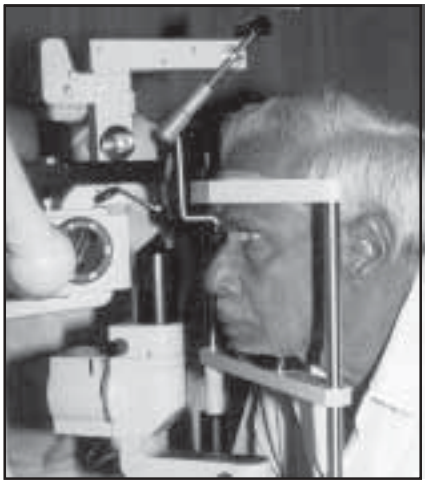
Before replacing the tonometer, dismantle it and clean the parts. Remove the weights, unscrew the plunger and clean them using swabs dipped in alcohol.

Note

The nurse must know which of the patients should not be subjected to this test.

E. Applanation Tonometer

Goldman's Applanation Tonometer is capable of measuring intraocular pressure accurately to 0.5mm. It is more accurate than Schiotz Tonometer. This is used with slit lamp microscope. It measures the area of the circle made flat by the instrument on the flat and spherical part of the cornea. It has a prism with external area of the tonometer. A measuring drum attached to the slit lamp is inserted into the handle over the chamber.



Applanation tonometry

Procedure

a. Explain the method to the patient and keep the patient in front of the slit lamp.

b. Apply local anaesthetic to the eye and add a drop of fluorescein with the help of a fluorescein paper.

c. Make the patient rest his chin in its place.

d. Use blue filter; focus the conjunctiva. Open the slit beam, which is angled at 45-60^0 to the chamber.

e. Make the patient open her eyes and keep that straight. There should be no friction between the margin of the lid and the instrument lest it causes the patient to blink.

f. When the patient is ready, arrange the measuring drum. Move it along with slit lamp control lever so that the tonometer is near the centre of the cornea.

g. Two bright yellow and green semicirles will be visible through the eyepiece of the microscope. Focus them with the help of the control lever so that the vertical lines separating the two parts is equidistant from top and bottom.

h. Adjust the measuring drum towards upper valves. The two semicircles superimpose. The reading at which the two semicircles superimpose is noted.

i. Multiply the reading by 10. The intraocular pressure is read in mm of Hg.

Note

As the tonometer touches the cornea, it may cause infection. So clean the applanating tip and sterilize it with an antiseptic.

F. Syringing Lacrimal Ducts

This is done to collect details about the lacrimal pathway.

Requirements

a. 2mm syringe

b. Normal saline

c. Local anaesthetic drops 4% xylocaine

d. Sterilised swabs

e. Blunt and bent .26 needle

Syringing lacrimal duct

Method

a. Explain the process to the patient.

b. Get the patient to lie down comfortably.

c. Wash and dry your hands.

d. Apply local anaesthetic drops.

e. Focus good light.

f. Make the patient look up, insert the needle dilator vertically through the sac hole and twist crosswise.

g. Inject saline gently, taking care not to increase the pressure in the track. An increase in pressure will affect the tissue. If the patient feels the taste of saline in the throat or nose, there is no obstruction. (Ask the patient to swallow the solution). If the solution comes through other puncture, then there is obstruction.

h. Before the patient leaves, ensure that the patient is comfortable.

i. Record the process and the result.

j. Clean the instruments and dry them.

G. Bandaging 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. Close the affected eye with an eye patch. Standing in front of the patient, take a turn on the cheek of the affected eye and around the head. Adjust the hole at the ear. Repeat the turn and finish pinning the bandage on the forehead over the good eye. Ensure the patient feels comfortable.

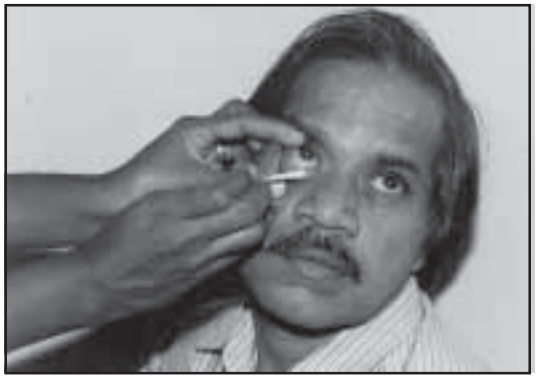
H. Conjunctival Culture

It is a usual procedure to take conjunctival culture on the eye before intraocular surgery. The following are required:

a. Spirit lamp

b. Culture plate (Blood agar)

c. Match box



a

b

c

Conjunctival Culture

Procedure

a. Explain the procedure to the patient and keep him relaxed on the chair.

b. Wash and dry hands.

c. Sterilize the platinum loop by heating it in the spirit lamp.

d. Make the patient look up, insert the sterilized loop over lower tarsal conjunctiva.

e. Taking the cap of the blood agar plate and without dipping spread the loop over the surface. Replace the cap.

f. On the cap of the agar plate write details regarding the eye of which culture is taken, serial number of patient and date. Send it immediately to the lab for incubation.

g. Record in the patient's register. Remove the equipment.

I. Keratometry

This is used to measure the curvature of the eye.

Preparation

a. Remove the spectacles if worn by the patient

b. Keep the patient's chin on the rest focus the eyepiece.

c. Adjust the chin rest

Procedure

One eye is recorded at a time. Other eye is occluded.

a. Keep the telescope against the eye.

b. Ask the patient to look at the image of her eye inside.

c. By adjusting up, down and sides, arrange the three circles.

d. Keep the + sign in the circle at bottom right.

e. Close with the help of the occluder on the side to focus of the cornea.

f. Bring the two + signs together by adjusting horizontal power wheel.

g. Bring the two – signs together by adjusting vertical power wheel.

h. Focus the two meridians.

Record

Record information about each eye separately. Likewise each meridian must be written separately as horizontal or vertical. The difference between the two meridians is the cylinder.

Example: RE: 42.50 at 180^{o} / 43.50 at 90^{o} = 1. OD cyl with rules

A Scan

With its help, it is possible to measure the axial length of the eye. It helps to find out the power of the intraocular lens.

Example

Normal Axial Length: 23 to 24 mm

Normal AC Power + 16.50 D/m

PC Power +18.50 D/m

Biconvex +20.00 D/m

J. Preparation of Patient for Fundus Examination

Opthalmoscopy or examination of the fundus is best performed in a dark room in order to facilitate pupillary dilation. However, for a better inspection of the fundus, the pupil should be dilated.

The nurse should explain the procedure to the patient who should be seated in a comfortable position with his head well supported. A quick acting mydriatic agent is used such as cyclopentolate 1percent or tropicamide 1percent. It may be necessary to instill more than one-lot drops to fully dilate the pupil and the nurse must check that the pupil is fully dilated before the patient is examined by the doctor.

K. Preparation of Patient for Fluorescein Angiography

Fluorescein angiography is used to help the diagnoses of conditions affecting the circulation, principally the retinopathies. In diabetic retinopathies minute aneurysms (a local saccular dialatation of a blood vessel) may be discovered long before apparent with the ophthalmoscope.

Fluorescein angiography depends on the property of fluorescein in blue light to fluoresce green. A 5 to 10% solution of fluorescein is injected into a vein in the arm and the fluorescence photographed as it passes through the vessels of the retina and choroid.

Fluorescein angiography

The following equipment is required for fluorescence angiography

a. Syringes and needles

b. Swabs soaked in spirit to clean the skin

c. Tourniquet

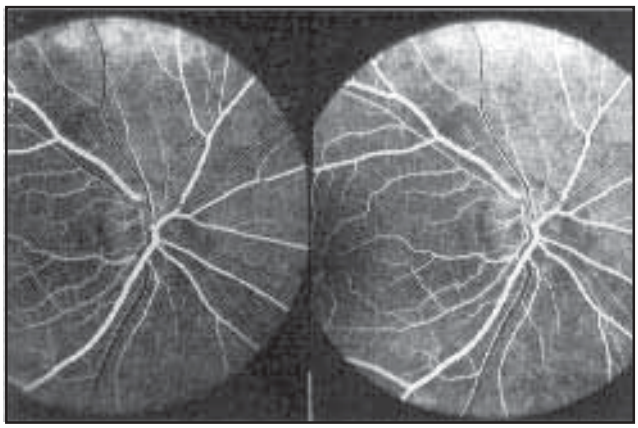
d. 5-10% fluorescein ampoules

e. Adhesive plaster

f. Adequate stock of film, both colour and high speed black and white should be available

g. Emergency equipment and drugs

The nurse should explain the procedure to the patient. Mydriatic drops are instilled to dilate the pupil.



Photograph of retina as flourescence passes through the blood vessels

The patient should be warned that his skin will go slightly yellow and the colour will be eliminated through the urine. He should be reassured that the yellow staining of the skin will disappear after a few hours. The patient should be comfortable with the head rest carefully adjusted. The camera used to record the passage of fluorescein through the eye has a motor-driver camera-back and the patient's head needs to be kept quite still while the successive exposures are made with high intensity flash.

NB: Emergency drugs and equipment must always be available as the patient may have an anaphylactic reaction to fluorescein.

L. Getting the patient ready for laser treatment

Laser which is acronym of Light Amplification by Stimulated Emission of Radiation amplified light waves. LASER beams are sent through the pupil to scale holes and other disorders of the retina to shrink blood vessels.

Laser is used in the following areas in ophthalmology

a. Argon

Argon laser emits blue, green light. This is used in the treatment of Diabetic Retinopathy in which blood vessels would leak.

b. Ruby

It adheres the retinal pigment epithelium with choroid thus facilitating to seal retinal holes. If the retina is near the choroid, this helps in closing the holes in the retina.

c. Yitrium Argon Garnet (YAG)

YAG is used in making an opening in thickened lens capsule which causes defective vision following extra capsular cataract extraction capsule opacity following Extra Capsular Cataract Extraction.

Procedure

Dilate the eye with a quick acting mydriatic agent like 1percent cyclopentolate or 1percent tropicamide. The pupil must be dilated to the maximum in LASER treatment. Explain to the patient that the treatment will not cause any pain. Apply local drops first and seat the patient comfortably near the slit lamp.

M. Visual field testing

It is not necessary for all patients to undergo visual field testing. This is done only for those who are suspected of having increased intraocular pressure or diseases in optic nerve or retina. Patients must be cooperative for this test. So it is difficult to do this test for children and the aged. Each eye is tested separately with the other eye occluded.

a. The Confrontation test

There is no special equipment for this test and it is easy, but is capable of identifying important field defects. This test compares the vision of the patient with that of the control.

The examiner stands 2 feet from the patient. Opposite eyes are masked. When the examiner closes her right eye, the patient's left eye is closed. The examiner moves her finger from the peripheral finger and notices when it comes into the field of vision. Both the patient and the examiner must see at the same time. The test must be performed for the four quadrants of vision.

b. Tanget screen, Bjerrum screen

This is a black screen of 2mt square stitched in a cobweb pattern around the corner of the fixation point. It measures the central 30^{o} field of vision.

Light is focussed on the screen. The patient is seated 2 metres from the screen and looks at the point in the centre. The patient with long sight may be allowed to wear his glasses during the test. One eye is covered. The examiner stands near the screen and ensures that the patient fixes at the tanget. The test object, a white plate or ball is brought from the edge of the screen to the centre. When the patient sees the object, he acknowledges it with a signal.

The examiner fixes pins at the points indicated by the patient. At the end of the test, the results are recorded. It is possible to pinpoint the blind spot with the help of the target screen.

It is important that the patient's attention does not waver during the test and she has to be warned now and then.

c. Goldman perimeter

Perimeter measures the complete field of side vision. The object protrudes outside. There is a half sphere in the perimeter. The brightness of the test object can be regulated. Further the patient's vision is monitored by an instrument behind the perimeter.

Explain to the patient what is expected of him/her. The patient must be attentive, calm and relaxed. There is no need for glasses. The patient keeps the chin on the resting place and is kept fixed at a white point in the centre of the perimeter. The plate revolves around it. The object can be changed according to the patient's vision for example, if the patient is young with a vision of 6/6 test can be conducted with objects of 1mm or 2mm. For people with lesser vision larger test objects are used.

The plate of the perimeter is illuminated. The test object is moved from the edge to the centre. Nearly 12 meridians must be tested. In every meridian, the object must be brought to fixation point. The patient indicates when the object is visible, when it disappears and when it appears and slowly disappears. The distance is plotted in graph.

N. Provocative Test

In finding whether there will be increased intraocular pressure, the following provocative tests are done.

a. Water drinking test

This test is a provocative test suitable for chronic cases of chronic open angle glaucoma intraocular pressure. The patient is empty stomached for 4 hours. In the morning she drinks one litre water within 5 minutes. The intraocular pressure in measured after 15 mts and after two hours. People with no trouble will have no or slight change in their intraocular pressure. But patients with intraocular pressure will have a pressure of 8mm of Hg.

b. Dark room test

This is a provocative test for closed angle glaucoma. The patient is kept in a dark room for one hour. The intraocular pressure is recorded an hour before and after it. The patient is not disturbed in any way, but she must not be allowed to sleep. This must be explained to the patient to get her cooperation. She can spend the time, say, by listening to some music in the dark room. A pressure of 5mm of Hg is positive.

c. Mydriatic Test

This test is also meant for closed angle glaucoma. Dilate the eyes with a weak mydriatic like 1% Hometropin. The intraocular pressure to recorded one hour before and after the application. Some rise of intraocular pressure by 5mm Hg is positive.

O. Setting up a trolley

Clean the dressing trolley before dressing. After removing everything, wash with soap and water, dry well and wipe with alcohol or disinfectant.

Articles to be kept in the trolley

a. Torch

b. Sterile pad, sterile cotton, sterile shield in a sterile bin

c. Keep the following in a tray: dilators, pilocarpine, antibiotic, steroid drops

d. Bandage roll, sterile towels in a sterile tray

e. Cheatle forceps

f. Sterile syringe and sterile tweezers and scissors

Record

Nurses have to maintain records of the patients. This enables the nurse to have relationship with a patient.

The record of the patient must be kept in the trolley readily available for the staff. They must be replaced after recording or referring. The record is essential for effective communication and for medico legal needs. Handwriting must be legible and clear. Illegible handwriting will lead to errors in treatment. The ward nurse has greater responsibility in this respect.

P. Additional duties for ward nurses

Clipping lashes

Clipping lashes is done to prevent spread of disease after surgery. Further it will help in giving sutures while surgery.

Process

a. Explain to the patient the procedure that lashes will grow in four weeks.

b. Seat the patient in a chair with a headrest.

c. Ensure good lighting.

d. Apply antibiotic ointment to the blade of the scissors.

e. First clip the upper lash. The patient looks down. Hold the upper lash with left index finger and clip upto the edge uniformly. Hands must not shake. The hair and the antibiotic cream must be cleaned periodically and fresh cream must be applied.

f. The same procedure is followed for clipping the lower lash.

g. Record and clean the instruments.

Q. Examining the eye after the surgery

a. The first bandage is given 24 hours after surgery.

b. Open the bandage, pads and eyelids.

c. Give sterile swab to the doctor with the help of a cheatle forceps. Clean the eyes.

d. Focus the torch on the eye when the doctor examines it.

The eye is examined as follows:

1. The lids are examined to find whether there is any swelling or tenderness. This will indicate allergy or infection.
2. There may be injury to the conjunctiva. There may be chemosis or oedema. This also may be due to allergy or infection. Or there may be slight swelling after surgery.
3. Cornea must be clear and bright. The eye may be cloudy due to keratitis or Iritis.
4. The anterior chamber must be clear. Appropriate treatment is given if there is hyphaema or hypopyon.
5. The pupil must be round. Its measurement is recorded. If the pupil is peaked towards one side, it shows prolapse of the iris. This is to be corrected by surgery.
6. Apply suitable eye drops.

S. Ward administration

The ward sisters role is to ensure the smooth and efficient running of the ward. The mangement of a ward is a challenging discipline and though difficult, very rewarding in its success.

Responsibilities include:

a. Maintaining adequate stocks of items used in the ward such as eye pads and bandages.
b. Maintaining adequate stocks of eye drops and general drops used in the ward ensuring safe storage.
c. Sending equipment for repair if necessary.
d. Sending torn linen for repair.
e. Checking expiry dates of drugs on a regular basis and replacing those expired.
f. Maintaining upto date and accurate nursing records.
g. Guiding and teaching the junior nurses.
h. Organising the staff duty making arrangements for staff leave, night duty and allocation to eye camps.
i. Making sure that all staff are aware of fire alarm procedures and how to evacuate the ward in case of fire.
j. Making sure that the ward is a clean and safe environment for the patient.
k. Communicating effectively with medical staff and other members of hospital staff.

Chapter 8
Physical observations (Temperature, Pulse, Respiration)

Temperature

The temperature of a body is a measure of its warmth or coldness compared with a standard, such as boiling or freezing point of water. Temperature is recorded with an instrument called thermometer. It is closed glass to be with a bulb at one end, containing mercury. When the temperature is taken, the heat causes the mercury to expand and rise up the tube. The tube is marked with a scale in centigrade or Fahrenheit. The Fahrenheit scale ranges between 94oF to 110oF. Normal body temperature is maintained by a controlling system of cells in the hypothalamus. A patient with a body temperature above normal may be said to have a fever. Pyrexia is the term denoting a body temperature raised above the normal range. Hypothermia is the term used for a state where the body temperature is below the normal range. Any deviation of the patient's temperature from normal should be reported.

Requirements

A tray containing the following items:

a. One bottle filled with antiseptic lotion
b. One bottle filled with soap solution
c. One bottle filled with water

   (Cotton should be placed into the bottom of the bottles to protect the thermometers)

d. One container of swabs
e. Two thermometers
f. Kidney dish for used swabs
g. A watch with a second hand
h. The patients temperature chart/notes and open

Areas which may be selected for recording the temperature

a. The mouth
b. The axilla
c. The groin
d. The rectum

The mouth

This is the most commonly used area for taking the patients temperature.

Method

a. Explain to the patient that you are going to take his temperature
b. Ask the patient if he has taken any hot or cold drinks within the past fifteen minutes (if so, use the axilla for taking the temperature)

c. Remove the thermometer from the lotion bottle, dip in the water bottle and wipe dry with a swab

d. Shake down the mercury

e. Ask the patient to open his mouth, place the thermometer under the tongue and tell him not to bite it when closing the mouth. He should be requested not to talk while the thermometer is in position.

f. Leave the thermometer in place for one or two minutes.

g. Remove the thermometer and read the temperature

h. Shake down the mercury

i. Place the thermometer in the soap solution, clean with a swab. Transfer to the lotion bottle

j. Record the patient's temperature in the chart

k. Reset the tray

Avoid taking the temperature by mouth if the patient is:

1. Infant or young child
2. Uncooperative patient
3. Unconscious patient
4. If the mouth is inflamed or sore
5. Mentally disturbed patient

Measuring temperature

The axilla or groin

Follow the same procedure, as above make sure the area is dry before taking the temperature. Gently hold the patients arm & leg in position.

The rectum

A separate tray and thermometer is kept for taking rectal temperatures. Rectal temperatures are recorded in babies and young infants, rarely in adults.

The pulse

The pulse is a wave of expansion felt in the arterial wall when a superficial artery is compressed by the fingers, when the blood flows through it. Attainment of skill in feeling the pulse requires practice. The normal pulse rate of an individual is 70-80 beats per minute. In children it varies with age as follows:

Infant up to one year=140 beats per minute

One year=120 beats per minute

Two to five years=100 beats per minute

Five to ten years=90 beats per minute

Adults=70-90 beats per minute

Method of taking pulse

a. Explain procedure to the patient

b. The patients arm should be comfortably supported on the bed or table otherwise place palm down across his chest.

c. Place two or three fingers (not the thumb) along the course of the radial artery on the thumb side of the wrist.

d. Observe the regularity of rhythm and force of the pulse before beginning to count the rate.

e. Use a watch with a second hand and count the pulse for one minute.

f. Record the rate on the patients'chart.

Respiration rate

A respiration consists of both inspiration and expiration. Average rates of respiration at rest are:

Infants = 34 to 40 per minute

Children aged 5 = above 25 per minute

Adults = 14 to 20 per minute

To record the respiratory rate

a. Avoid letting the patient know that his respiration's are being counted as it is may change the rate or rhythm. Respiration's can be observed while taking the temperature.

b. Observe the rise and fall of the patients' chest. Each one is counted as one respiration.

c. Use a watch with a second hand and count the respiration for one minute.

d. Record the rate on the patient's chart.

Chapter 9
Hypertension

Pressure exerted on the lateral wall of arteries when blood flows through them is measured as blood pressure.

Blood pressure is dependent on the following factors

1. Force of heart contractions
2. Elasticity of blood vessels
3. Volume of blood flow
4. Peripheral vascular resistance

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.

Pulse pressure is the difference between systolic and diastolic pressure. It is usually between 30 to 60 mm Hg. When blood pressure recording is written systolic pressure is always written as the top recording, diastolic pressure is written below systolic pressure e.g. 120/80 (Systolic/Diastolic)

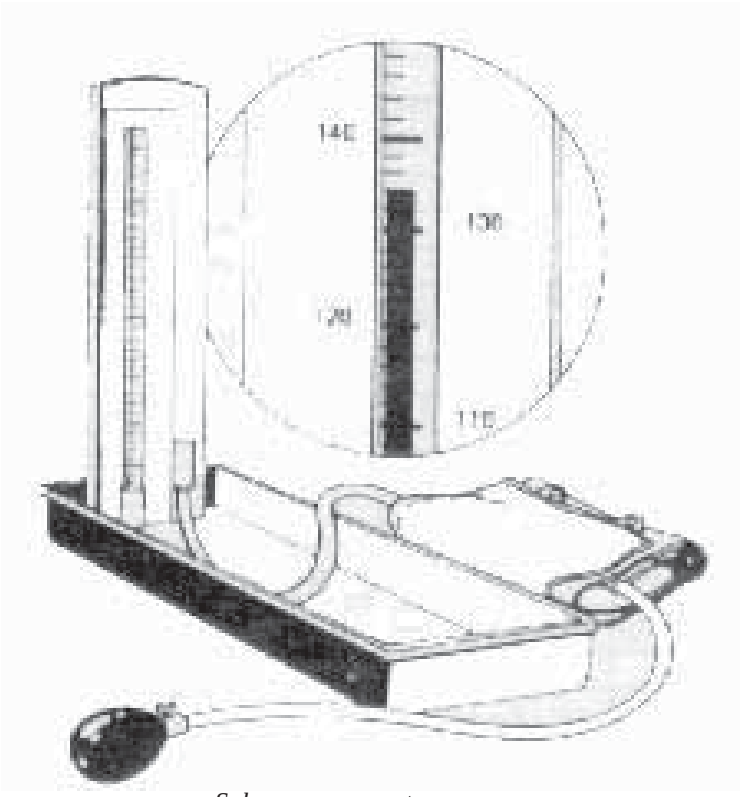
Measuring blood pressure

Blood pressure varies according to the age of the individual. Examples are given below.

	Systolic pressure	**Diastolic pressure**
Infants	70 – 90	50
Children	80 – 100	60
Adolescents	90 – 110	60
Adults	110 – 120	70 – 80
Elderly	130 – 150	80 - 90

Sphygmomanometer

This is the apparatus used for measuring blood pressure



Sphygmomanometer

Blood pressure recording method

1. Patient should be relaxed. He can be sitting or lying with his arm relaxed. Arm should be at the level of heart.
2. Cuff should be well tied around patient's arm with its lower edge about 1 inch above bend of the elbow. Centre of cuff should lie over brachial artery.
3. Manometer should be in the same level as the cuff.
4. Feel for the radial pulse or brachial pulse.
5. Valve is screwed tightly with fingers of one hand and cuff is inflated till pulse is impalapable. Note the pressure on the manometer. This is a rough estimate of systolic pressure detected by palpation (palpatory method).
6. Now inflate cuff to another 30mm Hg and apply diaphragm of stethoscope over brachial artery.
7. Deflate the cuff slowly until regular sounds called korotkoff sounds can be heard through stethoscope. This is recorded as the systolic pressure. Continue to deflate the cuff slowly at about 5mm Hg per second. The sounds muffle and then disappear. The point of disappearance is recorded as diastolic blood pressure. Cuff should be removed and neatly placed back in the box. Any sudden changes detected in blood pressure while recording, the senior sister or ward doctor should be notified.

NAME:

D.O.A.: ROOM: TREATMENT:

Date																				
Time	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E	M	E
280																				
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Chart for recording blood pressure

To take a patient's b.p

- position cuff on patient's arm with lower edge about one inch above bend of the elbow

Find patient's pulse by feeling at centre of arm with your finger tips

Position diaphragm of the stethoscope on patient's arm where you felt the pulse

Blood pressure measuring method

Hypertension

There are two main types of hypertension. Commonest form occurs in middle age persons called Essential hypertension, where no definite cause can be found. When hypertension is secondary to a recognizable disease (like renal, endocrine disease) it is called secondary hypertension and occurs in the younger age group.

Associated factors

Temporary increase in blood pressure can occur with anxiety and exercise in normal persons. Repeated blood pressure measurements is necessary to diagnose hypertension.

Risk factors for hypertension are obesity diabetes, raised blood cholesterol, familial lipid (fat) disorders and positive family history.

Symptoms

1. Headache
2. Giddiness
3. Palpitation
4. Chest pain

There may not be any symptoms and patient's hypertension may be detected only in routine examinations.

Complications

Heart

High blood pressure increases workload on heart causing heart failure. Heart attack or chest pain (angina) can occur, due to reduction in blood supply to the heart.

Kidneys

Causes proteinuria and renal failure due to damage to the functioning kidneys.

Brain

Patients can develop stroke due to high blood pressure causing rupture of blood vessels resulting in haemorhages in the brain. Reduced blood supply to specific areas of the brain can cause temporary loss of function.

Eye

Elevated blood pressure can cause thickening of retinal arteries. On severe cases swelling of optic disc called papilledema occurs. Enundation of lipids (hard exudates), micro infarction (cotton wool spots), and haemorrhages can occur in the retina.

Diagnosis

1. Urine for albumin is tested when hypertension is of long duration and damages kidney function.

Method of testing urine albumin

a. Add urine to test tube until it is two thirds full.

b. Boil the upper part of the test tube.

c. Compare the boiled part to the bottom part of the test tube.

d. If cloudiness is present add a few drops of acetic acid with a dropper.

e. If cloudiness does not disappear then albumin is present and it is positive.

2. Blood Urea - Normal value is 20 – 40mg/100ml
3. Serum creatinine – Normal values 0.8 – 1.2mg/100ml
4. Electro cardiogram (ECG)

Treatment

a. Salt restriction in diet

b. Weight reduction and exercises

c. To stop smoking

d. Relaxation

e. Drug treatment

Mild hypertensives can be managed by diet control and weight reduction initially. If there is no response then drugs can be used for management.

Principal drugs used in treatment are:

a. **η-Blockers:** Atenolol, metoprolol

b. Calcium Blockers: Nifidepine, amlodipine, diltiazem.

c. ACE inhibitors: enalapril, lisinopril.

d. Diuretics: Thiazides

Chapter 10
Resucitation - shock - signs and symptoms of different types

I. Resuscitation

Cardiac arrest is the sudden failure of the heart to supply adequate circulation. It occurs in two forms – a systole, when there is no contraction of the myocardium at all and ventricular fibrillation, when the contraction of the myocardium are uncoordinated and inefffective. The effective circulation must be restored within three minutes to prevent irreversible brain damage.

The most common causes of cardiac arrest are:

1. Myocardial infarction
2. Anaesthesia over dosage
3. Electrolyte imbalance
4. Drowning
5. Electrocution
6. Shock

The nurse must know:

1. How to diagnose cardiac arrest?
2. How to summon the emergency team?
3. How to initiate resuscitation effectively?
4. Where to find the necessary equipment?

Signs of Cardiac arrest are:

1. Unconscious patients without pulse, low or unrecordable blood pressure, absent respiratory movements.
2. Cyanosis
3. Cessation of heart beat
4. Dilated pupils - not a reliable sign in ophthalmology

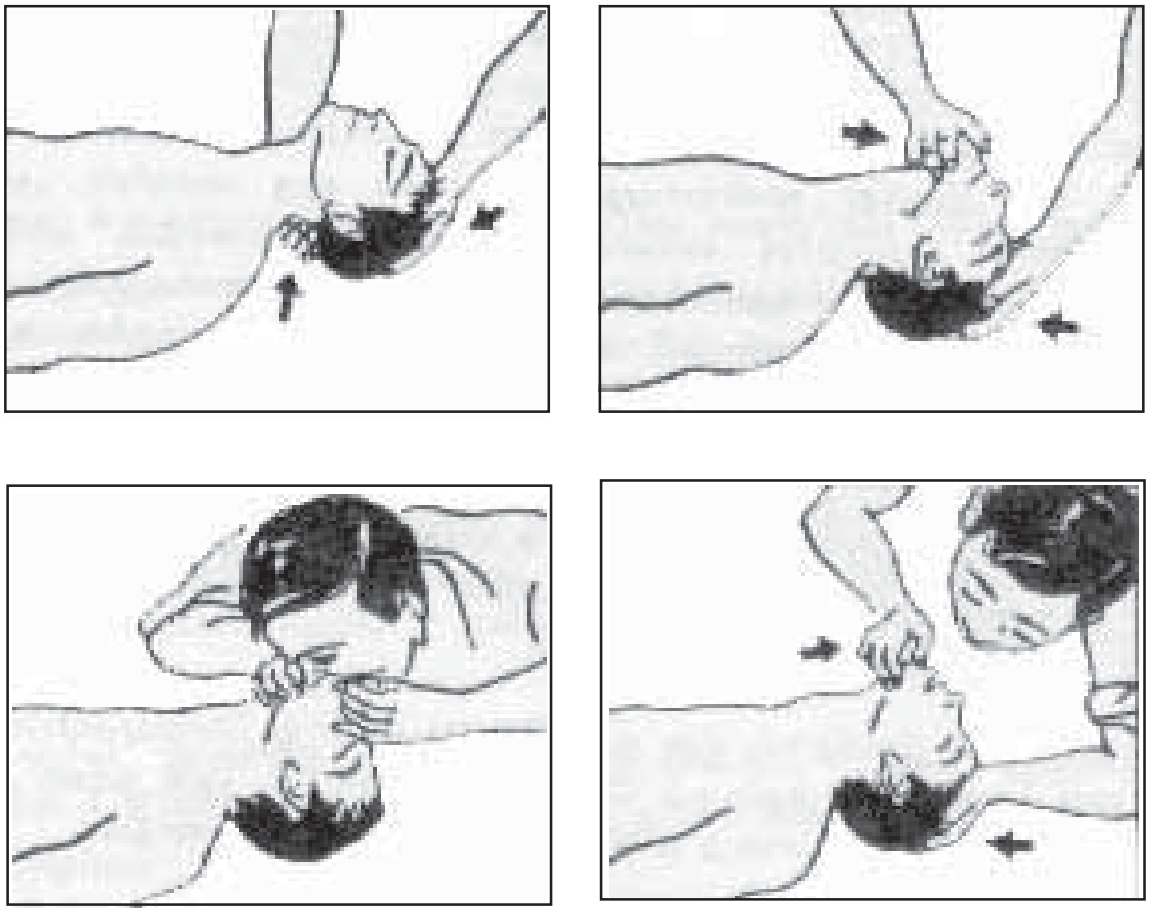
Upon discovering a collapsed patient the nurse must act quickly and calmly. Initially she should try to rouse the patient by shaking him carefully and calling out his name. The nurse must remember that the patient who has fainted has a palpable pulse.

If the patient is unresponsive the nurse should then call for help- alert a colleague to summon medical aid and bring the resuscitation trolley/ECG machine and defibrillator. On no account must the nurse leave the patient to look for help. It should only take a matter of seconds for the nurse to diagnose cardiac arrest. A useful aid to remember in emergency is simply to remember ABC.

A – Airway

B – Breathing

C – Circulation



Artificial respiration

The nurse should open the airway to see if it is clear. This is done by the combined maneuver of head tilt and chin lift. See fig1. Any obvious obstruction should be removed from the mouth. To establish if the patient is breathing the nurse should observe the patients chest to see if there is any movement or listen for breath sounds and feel for exhaled air on the back of her hand.

If the patient is not breathing, mouth to mouth or nose breathing should be commenced by the nurse. Initially, two slow full breaths should be given, each sufficient to cause the chest to rise. The chest should be allowed to fall between inflations. When a colleague arrives with the resuscitation trolley, an oral airway should be inserted and a bag and mask (ambu bag) used to ventilate the patient with. Before proceeding to this step, the nurse should establish if the patient has circulation by checking the carotid pulse. The pulse should be palpated for at least five seconds to ensure that the circulation has stopped. If the pulse is absent cardiac massage should be commenced.

Before doing so, it is important to ensure that the patient is lying on his back on a firm surface. Kneeling by the side of the patient, the nurse should locate the base of the heart. The position of the hands should be two fingers breadth above this point. The ribs are depressed forcefully and rythmically by about 3-5cm, 60-80 times per minute in an adult. The arms should be kept straight when performing cardiac massage. It is important not to compress too quickly otherwise the ventricles will not have enough time to refill with blood. Some find it helpful to establish the rhythm by saying one-one thousand, two-one thousand, three-one thousand. The hands must be carefully positioned and should not lose contact with the

point of compression. If too low, pressure on the xiphoid process may cause internal injury. The fingers should be raised; pressure by the fingers or the hand on the ribs may cause rib fractures.

If there are two nurses, one should carry out cardiac massage while the other delivers one breath after every fifth compression. If there is only one nurse the compression to ventilation ratio is 15:2. The nurse should check for the return of the pulse and breathing after one minute and thereafter every three minutes. If pulse and breathing are still absent, she should continue resuscitation until medical help arrives.

On arrival of medical help:

To be maximum help to the doctor, the nurse should be familiar with the location and use of equipment and drugs on the emergency trolley ECG electrodes will be required and applied at once to record heart rate and rhythm. The patient should be incubated immediately, ideally by an anaesthetist. If no anaesthetist is available, the attending doctor will have to incubate the patient himself and delegate a nurse to ventilate the lungs via an ambu bag connected to a continuous supply of oxygen. The doctor must set up an intravenous infusion as soon as possible in order to administer I.V. drugs.

If the patient is in ventricular fibrillation, this can be corrected by electrical fibrillation. The defibrillator machine delivers electrical shock to the heart muscle which stops the chaotic electrical activity and allows normal electrical conduction and normal heart rhythm to return. The doctor applies electrode jelly to the paddles to prevent skin burns. These are placed at the right upper chest and the left axilla so that the electric current will pass across the chest through the cardiac muscle. To avoid getting a shock, everyone should stand well clear of the bed when the defibrillator is operated. If defibrillation is unsuccessful the doctor has to give the patient I.V. Adrenaline 1mg, followed by I.V. Lignocaine.

If the patient is in asystole, there is no electrical activity and the ECG shows a straight line. Defibrillation will have no effect whatsoever because there is no electrical output from the heart. The doctor has to give the patient I.V. Adrenaline 1mg followed by I.V. Atropine 2mg.

Post resuscitation care

The patient's airway, breathing, circulation and blood pressure are assessed. The doctor should arrange for the patient to be transferred to an intensive care unit where he can be observed, monitored and treated (arterial blood gases and electrolytes should be taken by the doctor).

Notes about drugs in the emergency drug box

1. Adrenaline

This increases the heart rate and increases the force of cardiac contraction. It is supplied in 1ml ampoules of 1/10,000. Dosage is initially 1ml until an effect is obtained.

2. Isoprenaline

This primarily increases heart rate but also increases the force of cardiac contraction. It is supplied in 2ml ampoules of 50mg per ml.

3. Atropine

This increases the heart rate. It is supplied in 1ml ampoules of 600mg per ml.

4. Calcium chloride

This increases temporarily the force of cardiac contraction and will reduce the effect of dangerously high blood potassium. It is supplied in 10ml ampoules of 10% calcium chloride.

5. Lignocaine

This is local anaesthetic that acts on the heart to reduce electrical excitablility (It suppresses ectopic and the likehood of ventricular tachycardia or fibrillation) and is supplied as 10ml ampoules of 10mg per ml.

6. Aminophylline

This causes bronchodilatation and therefore relieves bronchospasm. It is supplied in 10ml ampules of 250mg/ml.

7. Hydrocortisone

This is an anti-inflammatory steroid used in anaphylactic shock. It suppresses tissue oedema and is supplied in 1ml ampules of 100mg.

8. Naloxone

This reverses the depressant and analgesic effect of opiate narcotics. Supplied in 1ml ampules of 400mg.

Very important:

When you take a drug for use from the box. Read the label to be sure it is the drug you have been asked for.

II. Shock

The supply of oxygen to the tissues is essential in the maintenance of life, this can only be ensured when the circulatory system is functioning normally. Sudden collapse of the circulation known as shock is one of the common and formidable conditions in clinical practice.

Clinical causes

1. Haemorrhage
2. Severe wounds
3. Severe burns
4. Multiple fractures
5. Pulmonary embolism
6. Myocardial infarction (heart attack)
7. Severe infection
8. Severe allergic reaction

Signs and Symptoms

Varies with type of shock

1. Apprehension, light headedness
2. Generalized itching
3. Swelling of eyelids, lip, tongue, hands, feet.
4. Skin colour pale and grey, slow capillary refill of nail beds.
5. Cool, moist skin
6. Weak, rapid pulse

7. Fast, shallow breathing
8. Low blood pressure

Types of shock

1. Hypovolemic – blood or plasma is lost from circulation to exterior of the body or into the tissues. Also may be due to dehydration.
2. Cardiogenic – failure of pumping action by the heart causing inadequate circulating blood volume.
3. Vasogenic or low resistance shock – widespread vasodilation causing increased capacity of circulation. Existing blood volume, even if it is normal, becomes adequate.

   Septic – caused by overwhelming infection:

   Anaphylactic – severe allergic reaction produced by the injection of a protein to which a person is sensitive, e.g penicillin, anaesthetic agent.

   Neurogenic – loss of sympathetic control (nervous system), can result from spinal anaesthesia.

Treatment

1. The patient should be laid flat, preferably in the head down position. This helps supply more blood to the brain.
2. Depending on the type of shock the volume of circulating blood should be increased as quickly as possible, by setting up and intravenous infusion.
3. Venous blood should be taken for grouping and cross matching in severe cases of hypovolemic shock.
4. Fluids to be administered Ringer Lactate or 0.9 normal saline in to be instituted until medical help arrives.
5. Injection adrenaline 1 amp subcutaneous is the drug of choice in anaphylactic shock.

Diabetes Mellitus

Anatomy

The pancreas is a yellowish gray gland situated behind the stomach. It is 18cm long and weighs 60 grams. There are cells called Islets of Langerhans in the pancreas which produce endocrine secretions.

Langerhans Islets

Langerhan Islets contains three types of cells

1. Alpha cell
2. Beta cell
3. Delta cell

Alpha cell and Beta cells produce harmones which help to maintain blood glucose levels.

Alpha cell

Glucagon is the harmone secreted by alpha cell. This promotes glycogen breakdown, thereby raising blood glucose levels.

Beta cell

These cells produce a harmone called insulin which lowers blood glucose by converting glucose to glycogen inside muscle cells. Insulin is produced when blood glucose levels are rising and glucagon when glucose levels fall in blood.

Diabetes mellitus

Diabetes mellitus is a condition which results from failure of the pancreas to secrete sufficient insulin to meet the body's requirements or due to defective insulin action.

Two main groups of diabetes are:

Type I diabetes

Usually occurs in the younger age group less than 30 years of age. It is due to hereditary factors or recent viral infection affecting the pancreas. These patients are thin and need life long insulin treatment, as there is no insulin secretion in their body. They are dependent on insulin for life.

Type II diabetes

Develops in the older age group more than 40 years of age. These patients are usually over weight. They have reduced production of insulin, so treatment can be diet control, oral antidiabetic drugs and insulin only if necessary.

Symptoms of diabetes

Insulin is required for glucose to enter cells where it is utilised. When insulin is absent or defective glucose cannot enter cells and remains in blood in high amounts. Symptoms of diabetes occur because body tissues are not able to utilise glucose.

1. Polyphagia

Patient's 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 volume of urine. Normal urine does not contain glucose. In diabetics, kidneys are unable to reabsorb the excess glucose, so it appears in the urine. When glucose appears in urine, it drains lot of water with it causing excessive urination.

3. Polydipsia

It is excessive thirst due to loss of water from the body.

4. Fatigue and Weight loss

In order to obtain energy, cells start using body fat and protein for energy instead of glucose. So this leads to weight loss and tiredness.

Some people may not have any symptoms. They are just discovered on routine urine and blood examination.

Investigations

1. Urine test

Presence of glucose in urine is known as glycosuria. This can be detected by Benedict's test or strip method.

Benedict's test – method

Patient is informed that his urine specimen is required for testing urine sugar. Urine is collected in a clean bottle.

- 5ml of Benedict's solution is added to clean test tube and boiled
- 8drops of urine is added to the above solution using a dropper. This is boiled again for two minutes. If there is a colour change it indicates that sugar is present in the urine.

  Green = +

  Yellow = ++

  Orange = +++

  Brick red = ++++

2. Blood sugar

Normal blood sugar is 70-90 milligrams in fasting state and 100-140 milligrams post prandial. Fasting blood sugar of > 126mg (70m mmol/l) and post prandial (2hour) blood sugar of greater than 200mg (11.0 mmol/l) is suggestive of diabetes.

3. Oral glucose tolerance test

In cases when blood sugar levels are not very diagnostic a oral glucose tolerance test is done. Patient is asked to fast 12 hours over night. Fasting blood and urine sugar is taken. 75 grams of glucose dissolved in water is given. Blood and urine specimens are taken at one hour and two hours. When fasting blood sugar is >126grams and 2 hours sugar level is more than 200 mg, diagnosis of diabetes is confirmed.

Treatment of diabetes consist of three main components:

a. Diet and exercise

b. Oral hypoglycemic agents

c. Insulin

Diet and exercise is the corner stone of diabetic management.

Diet

Sugar containing items are to be avoided. Balanced food within permitted calorie limits as prescribed by the doctor is taken.

Exercise helps in glucose utilisation and maintaining ideal weight.

Oral hypoglycemic drugs

Consist of 2 main groups

1. Sulphonyl urea – consist of drugs like Glibenclamide (Dasmil)
2. Biguanides – Met formin (Glycomet)

Drugs are started according to advice of family physician mainly used in Type II diabetes.

Insulin

Used in Type I diabetes life long and in Type II diabetics when blood sugar is not well controlled. Insulin has to be given only by injection cutaneously.

Types of insulin

1. Short acting
2. Intermediate acting
3. Long acting

1. Short acting insulin (Plain insulin)

Duration of acting is from 2 hours to 8 hours usually given 2-3 times per day.

2. Intermediate acting (NPH)

In this type of insulin action starts after 4 hours effective for 24 hours.

3. Long acting (PZI)

Effective for 24-36 hours once daily dose is enough.

Complications of diabetes

1. Acute complications
2. Chronic complications

Acute complications

1. Diabetic Ketoacidosis

It is a medical emergency occurs in

a. Infection or stress which increases insulin requirements.
b. Patients not on treatment
c. First time diabetic, previously undiagnosed.

Here blood sugar levels are very high (200-600mgms) due to lack of insulin, glucose is not available for metabolic energy instead fats are used by the body for energy. During fat metabolism, toxic products called ketones are formed, which gives rise to ketoacidosis.

Signs and symptoms

- Gradual onset
- Patient may be febrile
- Vomiting, abdominal pain
- Dry inelastic skin
- Low blood pressure and rapid pulse
- Deep sighing respiration
- Breath smells of acetone (sweat, sickly smell)
- Loss of consciousness
- Diagnosis is made by blood sugar estimation and presence of ketones in urine.

Treatment

1. I.V fluids are immediately started since patient is dehydrated. A large volume of about 6 litres is given rapidly. Normal saline or Ringer Lartate is given.
2. Short acting plain insulin is given hourly according to blood sugar level. Insulin is given intravenously in this condition. Insulin is given hourly till acetone is absent and blood sugar is less than 200 mg.
3. Serum electrolytes are estimated and potassium chloride and sodium bicarbonate given accordingly.
4. Antibiotics are started if signs of infection are present
5. Patient may be catherised to check hourly urine sugar and acetone.
6. Fluid balance chart – Intake and fluid output should be accurately recorded. When the patient is conscious, oral fluids are allowed.

2. Hypoglycemia

Occurs when blood sugar is low, less than 60 mg. Occurs in the following situations.

a. Too much of insulin
b. When food is missed
c. Increase in exercise

Signs and symptoms

a. Sweating – skin is warm and moist
b. Pallor
c. Weakness / dizziness
d. Palpitation
e. Loss of consciousness

Diagnosis is made by low blood sugar level

Treatment

Has to be immediate since brain cells can have irreversible death if glucose level is not immediately corrected.

1. When patient is conscious fluids with sugar or glucose can be given
   - Intravenous glucose – 25% dextrose 50ml is given in severe cases. This is followed by 5% dextrose fluid for few hours.
   - Glucagon injection 1ml is given if patient is unconscious

Points to differentiate between hypoglycemia and hyperglycemia

Clinical features	Hyperglycemia	Hypoglycemia
Onset	Gradual	Sudden
Skin	Dry and cold	Warm and moist
Pulse	Faint and fast	Normal
Blood pressure	Low	Normal
Breathing pattern	Deep and sighing	Normal
Breath smell	Acetone odour	Normal
Blood sugar	High	Low
Treatment	I.V. fluids, insulin	I.V. glucose

Long term complications

Occurs when diabetes is poorly controlled

1. Ocular

Diabetes affects eye causing cataract, diabetic retinopathy, retinal detachment and glaucoma. Permanent visual loss can occur due to above complications.

2. Renal

Long duration of poorly controlled diabetes leads to proteniuria and renal failure.

3. Heart

Increase in incidence of heart attacks occur. These people can have “silent heart attack” without any pain since nerves become insensitive to pain.

4. Brain

Stroke occurs more in diabetes

5. Nerves

Commonly affects peripheral nerves. Tringling occurs in fingers and toes, reflexes may disappear. Painless ulcers can occur in skin.

6. Feet

Poor circulation and peripheral neuropathy causes infection or injury to feet leading to gangrene and loss of foot. Diabetics need to take special care of their feet.

Chapter 11
Structure of the eye

Introduction

In chapter the basic anatomical structure of the eye with relevant clinical aspects are discussed.

The eyes are the most important organs of the human body. They help us to see the outside world and its objects and enjoy the beauty of nature. The eyes serve like a camera, capturing the scenes before it. The eyes are placed safe in a socket in the skull and are protected by the eyelids. Our eyes are more efficient than a film in a camera, capturing the scenes and sending it to the brain. Our brain processes the objects seen, and we are able to see and identify them. There are many important structures in our eye, which help in this process, like the cornea, lens, retina and the optic nerve.

This is how we are able to see, from a small matchstick light, to the stars in the sky.

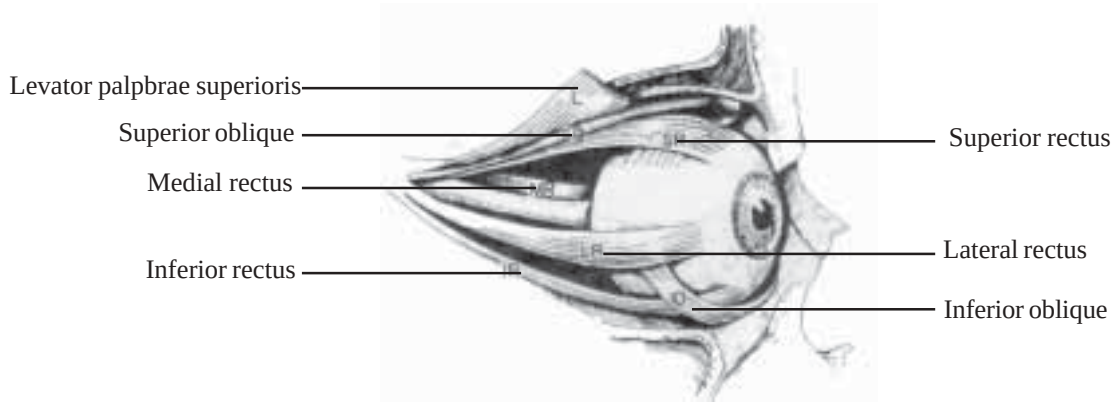
The eye is spherical in shape. There are 6 extraocular muscles present in the eyes which help in the movement of eyes in various directions. The extraocular muscles are supplied by nerves from the brain. There are 12 cranial nerves of which the second optic nerve the fourth and sixth nerve are connected to the eye.

As we have two eyes we can perceive the depth and distance. Depth perception is called Stereopsis. Binocular vision, is fusion of images as a single object seen by our two eyes.

The parts of the eye can be divided into three functional units. First is the protective part with eyebrows, eyelids and eyelashes, second is the lacrimal part which secretes the tear film. Third is the muscular part which helps in the movement of the eye. Fourth is the visual part with cornea, lens, and the retina through which light rays passes and is perceived as object.

Eyelids

There are two eyelids, the upper eyelid, and lower eyelid which is made of skin and soft tissues. The outer side is covered by skin and the inner side is made of mucous membrane. The upper eyelid is slightly bigger than the lower eyelid which helps in closing the eyes properly. The white tissue covering the eye is called the conjunctiva. The structure present between the outer skin and conjunctival tissue is called the tarsal plate. The tarsal plate helps in giving the structure to the eyelid. The eyelids protect the eyes from external environmental pollution.



Structure of eye muscles

In the eyelids there are small glands which secrete mucous like substance which mixes with the tears and forms a protective tear film over the eyes. We frequently blink with our eyelids which help in maintaining the tear film.

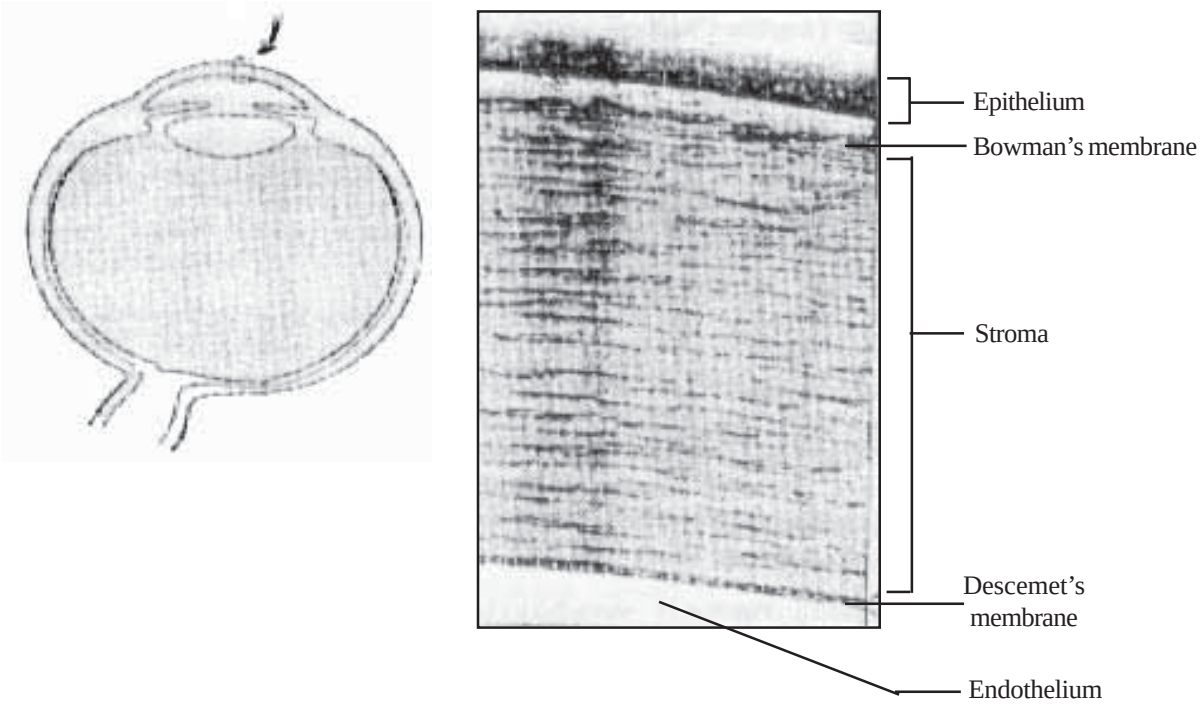
There are muscles in the eye, called extra ocular muscles, and are present outside the eye. They are the superior rectus, medial rectus, the lateral rectus, the inferior rectus, the superior oblique and inferior oblique. If due to some reasons one or more of the extra ocular muscles do not function with their normal strength, then the eyes cannot see the objects properly as the position of the eyes are changed. Then the patient will complain of double vision or otherwise called Diplopia.

Conjunctiva

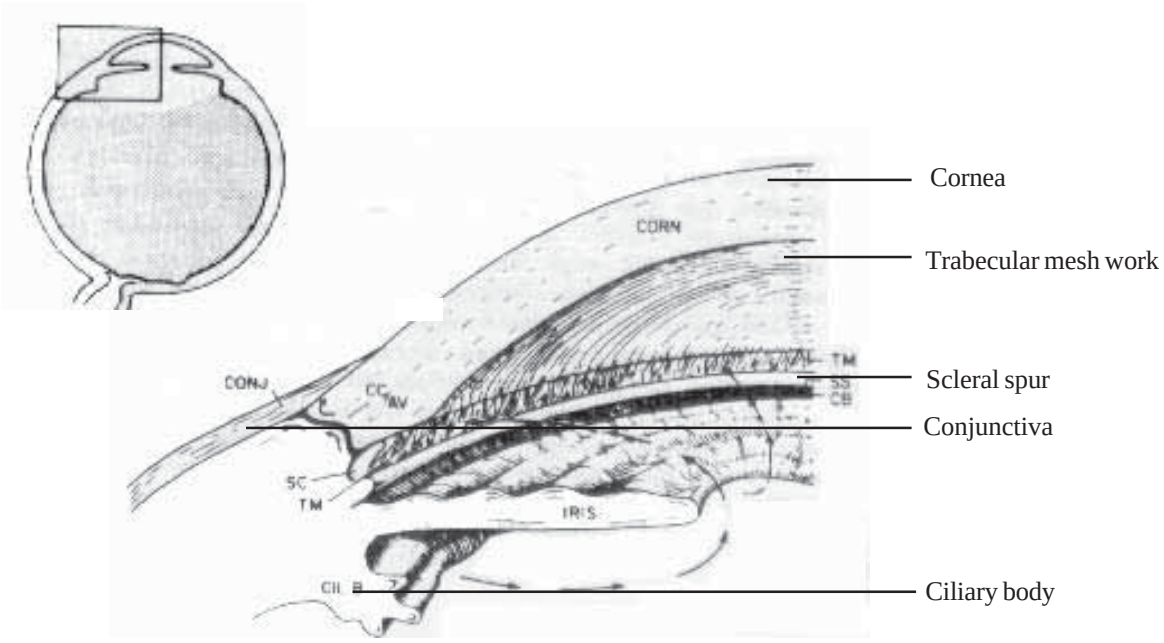
This is a thin white membrane covering the eye with blood vessels. There are minute glands producing mucous which are present in the palpebral part of the conjunctiva which is the inner reflected part of the conjunctiva under the eyelid. The other part is the Bulbar conjunctiva which we see as the white of the eye.

Cornea

The cornea is a transparent watch glass like structure, spherical in shape present in front of the eye. This structure is like a window to the eye. Cornea measures about 11.5mm in horizontal length. There are no blood vessels in the cornea. The cornea gets its nutrition from fluid like substance called the aqueous humour. There are 5 layers in the cornea. If any major damage occurs to the cornea then it results in blindness.



Structure of cornea



Front region of the cornea

Anterior chamber

The space between the cornea and iris is called the anterior chamber filled with aqueous humour. Which is secreted by a structure called ciliary body. If the aqueous is turbid then it results in defective vision. The depth of anterior chamber is 2.5 mm deep. It is shallow in young children and old people.

Iris & Pupil

Behind the cornea there is a brown circular diaphragm like structure called the iris. It consists of 2 types of muscles, the circular muscles and radial muscles. The central opening of the iris is called the pupil. Normal size of pupil is 2.3 mm depending on the intensity of light the size of the pupil decreases or increases. In some diseases the pupil will not react to light i.e. it will not constrict on showing a torch light. This can occur in optic nerve disease, retinal disease etc.

Lens

Behind the iris is situated, a transparent, structure called the lens. The lens has 3 parts. The outer structure is the cortex and the central substance is the nucleus. The lens is covered by a capsule. The nutrition of the lens is supplied by the aqueous humour. The shape of the lens is altered to see objects at near and distance. Light rays passes through the lens and falls on the retina when the lens looses its transparency it becomes an opaque structure, through which light cannot pass. This is called as the cataract.

Vitreous gel

There is a colourless, transparent gel like substance behind the lens. It is about 5.7 cc in volume. The vitreous gel is like the white of an egg, giving shape to the eye. Vitreous consists of 99% water, and the

rest is made of a substance called hyaluronic acid. Normal persons complaining of few black specks floating before the eye is called Muscae Volitantes other wise called the vitreous opacities.

The coats of the eye

There are 3 coats of layers in the eye.

Sclera

The outer coat is the sclera, which protects the sensitive parts of the eye. This is the white portion of the eye which covers the outer eye. This is covered by conjunctiva which is a thin white membranous tissue.

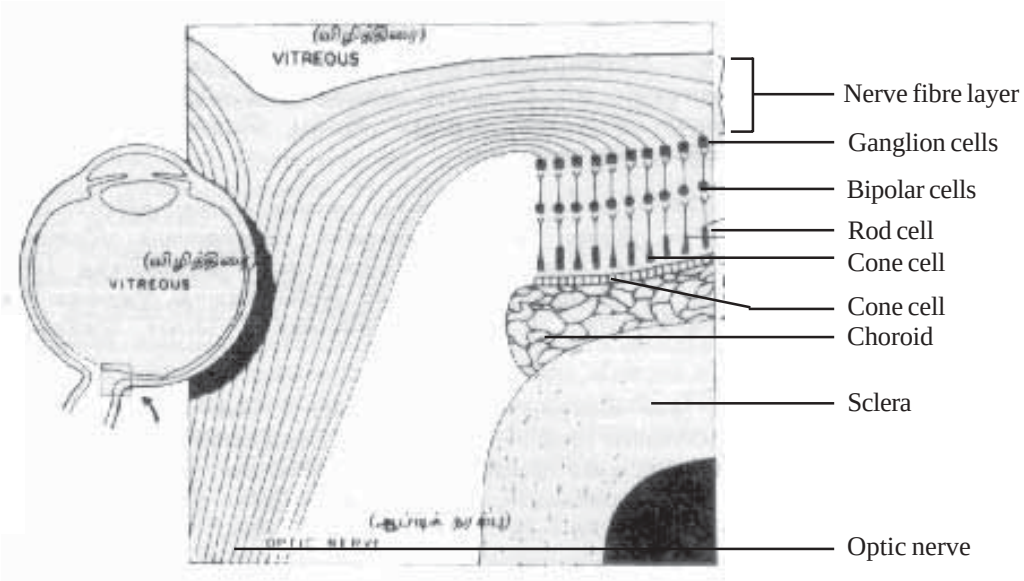
The extra ocular muscles are inserted to the sclera.

Choroid

The choroid layer is situated inner to the sclera. The choroid tissue is dark brown in colour which is fully made of blood vessels in layers. This choroid supplies nutrition to the retina, vitreous and other sensitive structures of the eye. The choroid prevents the scattering of light.

Retina

The retina is the inner most structure of the eye. The rays coming from the objects fall on the retina. The retina is made of neuronal tissues. Retina is basically transparent, cellophane like tissue. The colour is due to the reflection of the light from the choroidal vessels. The inner side of the retina is related to the vitreous and the outer side is related to the choroid layer. There are arteries and veins in the retina. The most sensitive part of the retina is the macula. The inner portion of this is the fovea. The reflection of light seen from the walls of the fovea is the foveal reflex. There are nerve fibres in the retina which converge in an oval structure called optic disc which is the head of the optic nerve entering the eye. The optic disc is pink in colour with a central depression called the optic disc cup. In diseases like glaucoma where the pressure in the eye is raised this cup is enlarged.



Retina

Rods and cones

The rods and cones are the photosensitive organs. Rods are necessary for might vision. Cones are necessary for night as well as light vision. The rods are 120 million in number. Cones are 6 million in number. Rods have a special substance called

Rhodopsin; which is formed by vitamin A and the cones consists of 3 types of pigments which are responsible for colour vision. Defective colour vision is called colour blindness.

Chapter 12
The Red eye

Though conjunctivitis is an important cause of red eye, there are many other reasons that causes red eye. It is essential for an ophthalmic nurse to know in detail about them, as it is one of the commonest complaints for which a patient comes to the outpatient clinic in a Eye Hospital.

The important causes of redness in eyes are as follows:

A. Conjunctivitis
B. Injury
C. Ulcer
D. Iritis(i.e.) Inflammation of the Iris
E. Glaucoma.

Conjunctivitis

Inflammation of the conjunctival tissue is called conjunctivitis. It is generally caused by virus or bacteria. Conjunctivitis can also be due to allergy in which case it is called Allergic Conjunctivitis.

The symptoms in conjunctivitis will be redness, excessive tear secretion and constant irritation. Conjunctivitis due to bacterial infection will cause Ropy discharge, and stickiness of eyelids in the morning. In case of viral conjunctivitis there will be more tears secretion and itching than discharge. Conjunctivitis occurs in young patients less then 20 years of age, which is called spring catarrh or the vernal kerato conjunctivitis. It is a misnomer as it occurs in summer months with intense itching inability to see light (Photophobia) often found in boys than in girls. It involves both the eyes. It is a self-limiting disease (i.e.) it resolves on its own as patient ages. Spring catarrh is treated with steroid eye drops as Betamethasone and Dexamethasone. But long term use of such topical steriod eye drops is harmful which may result in glaucoma, where there will be raised intraocular pressure, that damages the eye.

Injury

Injury can result in oozing of blood under the conjunctival tissue resulting in sub conjunctival haemorrhage. This is also an important cause of redness in the eye, which can occur due to a trivial injury, which is usually a self-limiting condition in 2-3 months time.

Corneal ulcer

Redness can also occur in case of a corneal ulcer. A trivial injury to the corneal tissue with a thorn prick, or by fall of husk on rubbing the eyes, may result in corneal ulcer. The corneal ulcer is caused by microorganisms, like bacteria or fungi present in these vegetable matter. Virus can also cause ulcer of the eye which is called viral keratitis. There will be watering photophobia and pain in the affected eye. The corneal sensation is decreased. It is important that patient should seek the medical help from qualified eye specialists. Instead when patients use native medicines like herbal juice, mothers milk, blood of chicken or castor oil the ulcer will aggravate resulting in permanent damage to the eye.

Glaucoma

Glaucoma results due to raised intra ocular pressure, damaging the optic nerve head, causing defect in the visual field of a patient, which may result in complete, total, irreversible, Blindness forever in

life. Patients can present with symptoms of Haloes around light and defective field of vision. Once Glaucoma is diagnosed, patient has to continue medicines and periodical eye examination by an eye specialist throughout his life.

Iritis

Iritis is inflammation of the Iris, which causes eye pain, redness, watering, photophobia and floating of black spots before the eye. The cause of Iritis has to be diagnosed by an eye specialist who will give proper treatment.

Conjunctivitis, which occurs in neonates is called the Gonococci conjunctivitis. It was once a dreadful disease caused by Gonococci. It occurs during delivery, but now it is rarely seen.

Chapter 13
Infection of the eye

Infection of the eye can be caused due to various microorganisms. We will see some of the infections caused by such microorganisms in this chapter.

Conjunctivitis (Inflammation of the conjunctiva)

This was mentioned in the last chapter as one of the causes of redness. Here a detailed description of the disease, causative agents and treatment given will be discussed. As already mentioned conjunctivitis can be caused due to microorganisms, allergy and chemical agents. There will be redness associated with a gritty sensation in the eye. Vision may not be seriously impaired unless the cornea is affected.

Acute catarrhal or acute mucopurulent conjunctivitis

In this case there will be Ropy discharge, watering, stickiness of eyelids on waking up and glaring of light. There will be mild lid oedema. This is an infective conjunctivitis caused by bacteria like Staphylococcus, Koch-weeks Bacillus, and Pneumococcus. This can occur at any age with preference for any sex, and occurs in bad hygienic conditions.

Treatment

The ideal treatment is to take a conjunctival swab for culture to isolate the organism and to find its sensitivity to any antibiotic.

The discharge should be cleaned with, a cotton twig or a plain cloth that is boiled and cooled, kept in a sterile container. Antibiotic eye drops like chloramphenicol (Vanmycetin) eye drops which has a good coverage or otherwise called broad spectrum eye drops, which can kill most of the microorganisms should be instilled after washing the hands.

The eyes should not be bandaged. Patient can wear dark goggles. No steroid eye drops should be used. The disease is contagious. The patient should use his towel, handkerchief separately.

Ophthalmia neonatorum

Ophthalmia neonatorum is a disease involving both eyes (Bilateral) of the new born where there will be purulent discharge, chemosis (Swelling) of the conjunctiva, which used to be responsible for 50% of blindness in children. Ophthalmia neonatorum usually manifests in the first week of life, The disease is contacted during birth from the mothers infected vaginal tract caused by Neisseria gonorrhoea, Staphylococcus aureus. Gonococcal ophthalmia neonatorum is a serious and violent condition, involving cornea.

Normally tears are not secreted in the first 6 weeks of life, therefore any secretion from the eye in this period should be considered abnormal.

Treatment

Prophylactic medication can be given by Crede's method where a drop of 1 percent silver nitrate is instilled in each eye of the infant soon after birth. The procedure may cause mild chemical conjunctivitis which is self limiting. The standard regimen is instillation of penicillin drops in a concentration of 5,000 to 10,000 units/ml every minute for half an hour, ever 5 minutes for another half an hour and then half-hourly instillation's till the infection is controlled.

Trachoma

The word trachoma is derived from a Greek word meaning rough. It is one of the oldest and more spread disease affecting more than 400 million people all over the world. It was found in China at 2,700 BC and in Egypt at 1,900 BC

Over crowding, abundant fly population, unsanitary conditions, low personal hygiene contribute to the disease. In India it is common in North India.

Aetiology

Caused by a virus called Chlamydia trachomatis.

Clinical Features

Children are commonly affected.

The symptoms include foreign body sensation, watering, itching, photophobia and redness.

The signs include congestion, diffuse papillary hyperplasia, and follicles in upper tarsal conjunctiva. There will be blood vessels involving the upper margin of cornea. This is called **pannus**, which is invariably present in trachoma. If this condition persists, or no treatment is given then it can result in complications like Ectropion, (eyelid turning outward) Entropion (eyelid turning inward) and Xerosis (Dryness of the cornea)

Treatment

1) Painting of conjunctiva with 1 percent silver nitrate.
2) Sulpha cetamide eye drops in the form of Aebucid 20 percent instilled 4 times a day for 1 month
3) Gentamycin oinment 1 percent at bed time.
4) Atropine oinment 1 percent at bed time.
5) Treatment of complications by correction of entropion, trichiasis.

Blepharitis

Blepharitis is a chronic inflammation of lid margin.

Clinically it occurs in two forms squamous blepharitis, and ulcerative blepharitis.

Squamous Blepharitis

This is common in children who suffer from dandruff of the scalp. Characterised by small white scales at the root of lashes. If the scales are removed the underlying area is found to be hyperaemic but not ulcerated. Treatment includes management of dandruff, application of topical antibiotic eye drops, lid hygiene by cleaning lid margins with cotton tipped stick wetted in baby shampoo and systemic antibiotics depending on the severity of the disease.

Ulcerative Blepharitis

It is an infective condition of lid margin characterised by deposition of yellow crusts at roots of eyelashes with swelling of lid margins and falling of lashes. If the crusts are removed they leave small round ulcers which bleed readily.

It is common in debilitated children with poor personal hygiene. Treatment consists of softening of the crusts with warm 3% sodium bicarbonate lotion, proper removal of crust and application of antibiotic eye oinment.

Stye

It is inflammation of the eyelid, Zeis Glands, resulting in painful swelling of lid margin. It is common in young adults and often occurs in crops. Hot compress is beneficial in initial stages but when the abscess is formed it is evacuated by a small incision or by pulling affected cilium.

Chalazion

It is a chronic inflammation of the meibomian gland, resulting in a painless round smooth swelling which can be felt by passing the finger over the lid. Treatment includes, making an opening of the swelling and removing the contents of it.

Chapter 14
Visual acuity and measurement

Visual acuity forms an important aspect of eye examination. Each eye has to be tested separately and recorded in the case sheet. If he is already wearing a glass, his visual acuity without glasses and with his present glasses has to be noted separately. The power in his present glasses has to be found and noted in the case sheet. This will help the eye specialist to decide whether a change is necessary for his glasses.

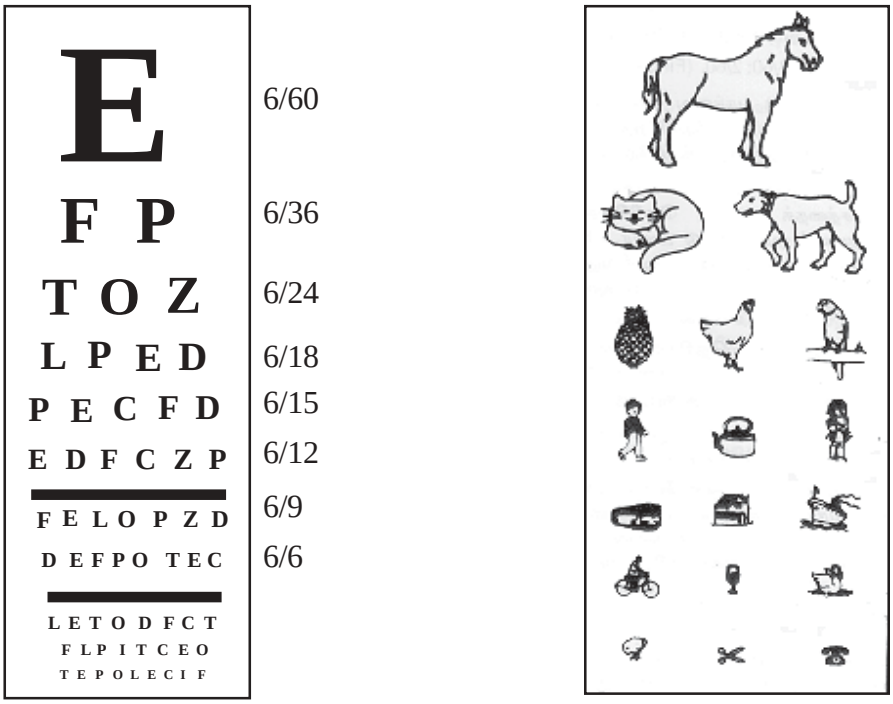
For visual acuity measurement a Snellen's chart is used. The chart is designed in such a way that it gives a very good subjective measurement of patient's visual acuity. The chart has to be kept at 6 metre distance, or at 20 feet, with good illumination of light. For illiterate persons a 'E' chart is used, where the letter 'E' is facing different directions. For children a pictorial chart is used with pictures of different sizes and visual acuity is measured, which needs lot of patience and care to the child. The following steps will help to do a visual acuity measurement in a methodical way.

Steps

1. The chart is kept at 6 metre distance or at 20 feet. A normal person should be able to read the last line of the chart at 6 metre distance. Hence normal vision is mentioned as 6/6 or 20/20.

Measuring the visual acuity

2. The patient is made to sit at 6 metre distance, from the chart and he is explained how the test is performed.
3. If we want to test the patient's right eye patient's left eye is closed with the opaque card and asked to read the letters with the right eye. He or she should not cover the eyes with finger, as they may see the card through fingers.
4. The patient is asked to read the letters from each line and the smallest sized letter the patient is able to read at 6 metre distance is noted. For example each line is marked with figures 6/60, 6/36, 6/24, 6/18, 6/12, 6/9, 6/6, which has to be noted.
5. For patients who are illiterate, we use a 'E' chart. The alphabet 'E' is marked facing different directions. Patients have to find out in which direction the letter 'E' is facing and show with their fingers.



Snellen's chart

6. For patients who cannot read the letters at 6 metre distance, we use our fingers at different distance showing different numbers and finally arrive at a visual acuity measurement. For example 3/60, 2/60, finger count (FCF).
7. For patient's who have still defective vision we stand near the patient holding our hand moving just in front of the eye asking whether the patient can see the hand movements. If patient can see this then we record Hand movement (HM)
8. For patients who still cannot appreciate even hand movements. We hold a torch light at 10cm distance and ask the patient whether he can appreciate the light. If he says yes we record as perception of light present. Next we have to ask from which direction light is coming, checking in the 4 directions as upper, lower, right side, and left side. This is noted as projection of light (PR), It forms an important measurement as patients with retinal detachment can have in accurate projection of light.
9. If the patient is not even able to perceive light we record it as blind patient.
10. Now we can close the right eye repeat all steps for checking the left eye and record separately in the case sheet.

If the patient's visual acuity is less then 6/6 then we use a pinhole. The size of the pinhole is 1mm which is present in a trial set. Such a pinhole can be made using an X-ray film.

If there is improvement in his visual acuity measurement then it can be due to one of the following reasons:

1. Refractive error especially myopia
2. Cataract
3. Corneal scar or irregularity of cornea

For near vision testing, for patients aged more than 40 years, the near vision chart is held at 40cm distance and tested.

Chapter 15
Refractive errors and spectacles

Normally light rays coming from an object should fall on the retina to form a distinct image. If the parallel light rays coming from the object either fall in front or back of the retina then refractive errors are corrected with spectacles of concave or convex lens.

1. Hypermetropia

Hypermetropia is a refractive error where light rays coming from an object falls behind the retina. This can be due to the following causes:

a. Curvature hypermetropia

The curvature of the cornea is smaller than normal.

b. Axial hypermetropia

An abnormal shortness in the length of the eye results in Axial Hypermetropia.

c. Index hypermetropia

Accounts for the Hypermetropia in old age. It is due to the increased Refractive index of the cortex of the lens

Hypermetropia rarely exceeds 6-7 Dioptres. The newborn is almost Hypermetropic. We should know some thing about eyestrain other wise termed as “Accomdative Asthenopia”.

A healthy young individual has an ample amount of accomdation and if he happens to be Hypermetropic he will accommodate for distant and near objects without his conscious. If he is continuously doing near work the ciliary muscle is likely to produce symptoms as irritation of eyes, headache which is called Accomdative Asthenopia.

Effects of accomdation on hypermetropia

Total hypermetropia

The Hypermetropia that is elicited after complete paralysis of accomdation after application of Atropine.

Latent hypermetropia

It is the amount of Hypermetropia, which is corrected normally by the tone of ciliary muscle.

Manifest hypermetropia

It is the Hypermetropia that remains uncorrected when the accomdation is not actively exerted in other words it is total Hypermetropia minus latent Hypermetropia

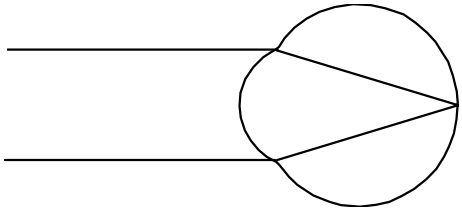
Treatment

Treatment of Hypermetorpia is by prescription of correct convex spherical lens.

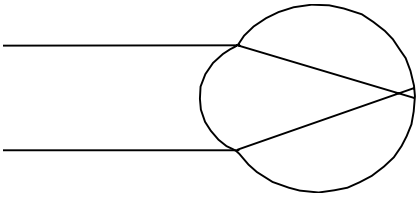
2. Myopia

It is an error of refraction in which parallel rays of light from infinity come to focus in front of retina when accomdation is at rest.

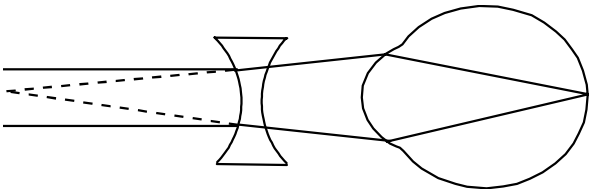
Aristotle (384-322BC) is credited with First Distinguishing myopia. Galen (131-201AD) coined the term myopia from myein (to close and opens eye) as he observed that myopics half closed the eye to see.



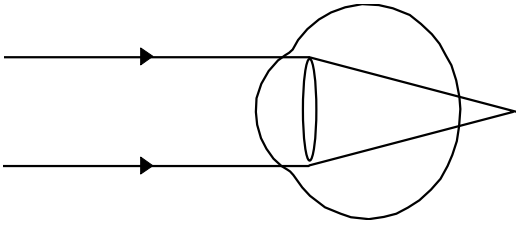
Emmetropia



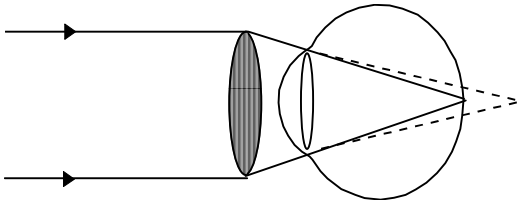
Myopia



Myopia corrected



Hyperopia



Hyperopia corrected

Myopia is classified based on axial length as

Physiologic 25.5mm

Intermediate 32.5mm

Pathologic >32.5mm

Based on Refractive power

Physiologic< -3D

Intermediate –5D to –8D

Pathologic > -8D

Clinical types

Axial myopia

When the antero posterior length of eyeball is normal

Curvature myopia

When the curvature of the cornea or lens is more than normal.

Index myopia

When the refractive index of different media, particularly the lens is more than normal.

Other clinical types

Congenital myopia

It is present at birth and may be unilateral or bilateral.

Developmental myopia

The power of the glasses increases usually during the years of study in schools and colleges and then remains steady. This is the commonest type of myopia.

Pathological myopia

The myopia rapidly progresses, where there will be degenerative changes in retina.

Symptoms

1. There is reduced visual acuity for distort objects but near objects are seen clearly.
2. Usually there is no complaint of headache as in Hypermetropia.
3. The patient may complain of seeing black spots floating in front of eye, due to vitreous opacities.

Treatment of myopia

Corrected by

a) Prescribing concave spherical lens.

b) Contact lens is an ideal substitute in high myopia

c) Latest Treatment: 1. Radial Keratotomy 2. LASIK Treatment.

3. Astigmatism

It is an error of refraction in which the parallel rays of light from infinity cannot converge to a point focus due to unequal refraction in different meridians of the eye.

Causes of astigmatism

a) Unequal curvature of the cornea.

b) Decentering of the lens due to subluxation.

Types of astigmatism

Irregular astigmatism

When the refractive power changes irregularly in different meridians as in corneal defects.

Regular astigmatism

When the refractive power changes uniformly from the meridian to the other.

Symptoms

1. Diminished visual acuity

2.Headache due to exertion of accomodation.

Treatment

a) In regular astigmatism the error is corrected by suitable cylindrical lens.

b) In irregular astigmatism contact lens will have to be used.

4. Presbyopia

This is not an error of refraction but as the age advances after some time the lens gets harder and sets in an unaccomdated form. The loss of accomdation is not considered abnormal but proceeds throughout the whole life.

Symptoms

1. Near vision after the age of 40 decreases with blurring of letters. The vision becomes better if the book is held further away from the eye, than the normal reading distance, which is 40cms.
2. Professionals who do close work, for long hours, like watch repair workers, Gold smiths get the symptoms early.
3. Hypermetropes tend to have the symptoms earlier then other emmetropes.

Treatment

The treatment of presbyopia is to provide the patient with convex lenses so that his accomdation is reinforced and his near point is brought within a useful working distance.

Chapter 16
Diseases affecting the eyelids

Introduction

Eyelids are movable curtains in front of eyes. They protect the eyes from strong wind and injurious agents falling into eyes. 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 Palpbrae Superioris) and circular muscles. Lids protect 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.

A. Congenital anomalies of the eyelids

1. Crypto blepharon: Rare condition resulting in failure to differentiate into lid structures. Skin passes uninterrupted from fore head over the eyes to cheek.
2. Coloboma of lid: Small notch to absence of entire length of eyelid especially upper eyelid. This has to be corrected by plastic surgery.
3. Distichiasis: Two or more row of eyelashes.
4. Epicanthus: Cresentic fold of skin running vertically between lids and inner canthus (nasally).
5. Telecanthus: Normal interpalpable distance but wide intercanthal distance.

Palpable fissure slants: Upwards and downwards slants of palpable fissure as in Down's syndrome.

6. Ankyloblepharon: Fusio of the lid margins.
7. Congenital Entropion
8. Congenital Ectropion

B. Ptosis

Ptosis means drooping. LPS or Levator Palpabrae Superioris is the muscle responsible for elevation of upper eyelid. When it weakens the upper eyelid will slacken and will fall on the eyes. This will affect vision and will require surgical correction.

Ptosis can be caused either by congenital or acquired means. Congenital ptosis may be present since birth and both eyes may be affected. It can be either neurogenic or myogenic in etiology. Myogenic is due to poor development of LPS. It can also be caused by mechanical or traumatic causes. Ptosis may be corrected immediately after birth or a few hours following birth. Eyes in such children may not open fully or the upper eyelid may raise slightly. Ptosis that are acquired are due to mechanical or traumatic in etiology. Ptosis is measured using marginal reflex distance.

In a case of ptosis, one must look whether the eyelid covers the eyeball fully thus affecting vision. If one eye is affected early treatment is mandatory. If surgery is not done early it will result in amblyopia or lazy eye and vision cannot be regained. If vision is not affected then treatment can be delayed. However, surgery correction of the affected eye must be done within a year or two. Then the vision in that eye

must be improved. If both eyes are ptotic then the child will assume a position which will have the following components viz head bent backwards; muscles of forehead will undergo contraction, eye will be lifted up in an effort to see. Parent should be alerted by such a posture, should bring the child for early treatment.

Ptosis is an early symptom in ocular myasthenia. This could also coexist with systemic myasthenia where the muscles of the body will also become weak. It can also affect both eyes. Essentially management of this disease is medical. This condition must be borne in mind before depending upon surgery for correction of ptosis.

It is better to sort to surgery if the defect is congenital. If ptosis is acquired the cause for it must be investigated. If it is due to inflammatory swelling on the eyelids, it can be treated with a course of antibiotic NSAID. If the ptosis is due to levator damage or nervous damage, complete recovery is difficult.

C. Trichiasis

The eyelashes growing inward is Trichiasis.

They are of the following types:

1. The lashes at the eyelid margin will grow inward
2. The eyelashes will grow in an irregular manner
3. Entropion the margin of the eyelid is turned inwards.

The margin may be normal, but hairs of the lash may grow inward. So when the eyelids are batted, there will be constant irritation in the eye. The tissue of the outer layer will be damaged and there will be pain, tearing, photophobia and corneal ulcer. This is generally caused by scars on the outer surface of the eye.

Other reasons

a) Allergy to the margin of the eyelids, injury caused by acids or alkalis, and surgery on the eyelids

Treatment

1) Epilation: If the hairs grow inward, they may be plucked with a tweezers. If they grow, they must be removed after a few weeks. 2. Electrolysis is another method in which the hairs are burnt. After giving an anaesthetic injection to the margin of the eyelid, the roots of the hair are electrolysed by passing low Galvanic current. This is a permanent cure.

Surgery

If a lot of hair grow inward, surgery has to be done. Mostly the inward growing of the lashes is accompained by entropion and entropion correcting surgery will set right both the defects.

Cases in which surgery is not undertaken contact lens or a shell to cover the cornea may be used. This will prevent the friction on the cornea and the irritation and associated symptoms.

D. Entropion

Here the margin of the eyelids is turned inwards. Because of this, the eyelashes also will be directed inward. This will cause constant irritation, tearing and photophobia. There are three types of entropion.

1. Infantile Form: This occurs in infants. This is caused by the fatty substances pushing the margin of the eyelids inwards. There is no need for any treatment in such cases. They will be cured on their own. This does not cause any damage to the cornea.
2. Cicatricial Form: The outer layer of the eye below the upper eyelid and the tarsal plate may have scars

which cause the tissues to shrink and the margin of the eyelids to curl inwards.

3. Spasmodic Form: Because of the sudden movements of the muscles controlling the eyelids, the margin will curl inwards.

Symptoms

a. There will be irritation every time the lashes are batted causing rubbing on the cornea.

b. Pain, reddening and photophobia are other symptoms. Sometimes because of constant irritation, there will be injury to the cornea resulting in ulcer. When the wound heals there will be permanent corneal opacities.

Even healthy children will develop infantile form of Entropion. The cicatricial form is caused generally in chronic Trachoma which affects the outer layers of the eyeball. They may also be caused by injury to the eye or the scars due to acids and alkalis like lime damaging the inner muscles of the eyelids. The spasmodic form occurs in old age when the muscles controlling the eyelid get weak or when the fat in the eyelid gets depleted. Infection on the eyelid or bandage to the eye for a prolonged duration may also cause the drooping of the eyelid.

There are simple procedures to correct the spasmodic form. If bandaging causes it, bandaging must be avoided. The margin of the lower eyelid can be pulled slightly with an adhesive tape. The lower lid can be lifted by even keeping a piece of cloth under it. Wearing a Contact lens will give better results. Such cases can be corrected by surgery.

Entropion

E. Ectropion

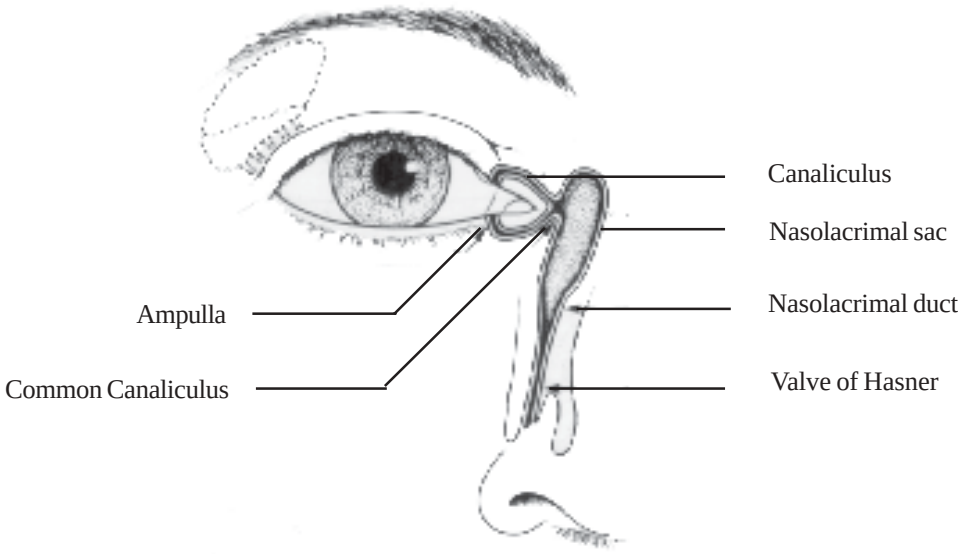
In contrast to the entropion, in ectropion the margin of the eyelids will curl outward. The eyelids cannot be fully closed and the eyeball will be visible. This occurs in the upper eyelid or lower lid or both.

There will be constant epiphora on closure, dry eye and exposure keratitis due to this. This condition is generally found among old people in which the eyelid muscles get weakened and loss of fat is prominent. This can be corrected by surgery.

Chapter 17
Lacrimal glands

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 tear secreted evaporates to a great extent and the rest get collected in a small space near the nose. From there they reach lacrimal sac, two holes called lacrimal puncta through 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 lacrimal sac and from there come out through the nose. That is why there is watering in the nose when recovery.



Lacrimal System

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. One reason may be abscess in the nose. 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. People above middle age are generally affected. Men are more likely to be affected than women. 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 lacrimal fistulas.

The symptoms of lacrimal sac inflammation are watering of eyes, white pus discharge, 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. Patients who need surgery for

cataract or corneal surgery in the eye have such infection, the sac must be removed first. The lacrimal sac removal gives this condition. 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. Other 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. This is 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. Even if this fails in some children it becomes mandatory surgery. Therefore, if there is watering in the eye with discharge, an ophthalmologist must be approached to ascertain whether the problem is due to lacrimal sac. Therefore an ophthalmologist must be approached if patient presents with the symptoms mentioned above.

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 tears 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 for a long time, germs will collect there, multiply and discharge will occur. There are two types of surgical procedures to correct this. One is by 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 managing 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 listed here.

1. Foreign bodies like speck of dust, sand, and iron sticking onto the corneal surface.
2. Dust in upper eyelids will cause friction during lid movements (causing injury to the cornea).
3. The eye lashes grow inward (Trichiasis).
4. Elderly people will have growth called concretion in the upper eyelid. This also will rub with the cornea and cause tearing.
5. Abscess in the inner side of the lids.
6. Leprosy patients (Lagophthalmos).

7. Corneal ulcer.
8. Rise in intraocular pressure.
9. Conjunctivitis.
10. Defective vision. Patients do not wear glasses and strain themselves, then there will be tearing. Some will have difficulty when the muscles do not function properly while reading. This can be corrected by simple exercises.
11. Pterygium and pinguecula may grow causing tearing.
12. Postoperatively sutures may cause irritation.
13. (Dry eye) tearing will be less. But such patients have a feeling of tearing.

Chapter 18
Diseases affecting the cornea

Cornea forms one fifth of the front part of the eyeball. It is a clear membrane like colourless glass. It is circular with slight convexity and inner concavity. As the iris which is behind it, is visible it appears black like it. 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:

a. Epithelium
b. Bowman's layer
c. Stroma
d. Descemet's membrane
e. Endothelium

Endothelium is made up of 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 when they pass through it, if the cornea is not clear, the light rays cannot pass through, vision will be affected.

It is important for us to know the diseases affecting the cornea. For 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.

I. Congenital defects in the cornea

a. Micro cornea

Cornea will be smaller than its normal size from birth. There will be defect in distant vision as the angle of anterior chamber will be developed fully there is a possibility of glaucoma.

b. Macro cornea

Cornea will be bigger than its normal size from birth. There may be differences in the front part of the eyeball.

Note that there is no treatment for these two defects.

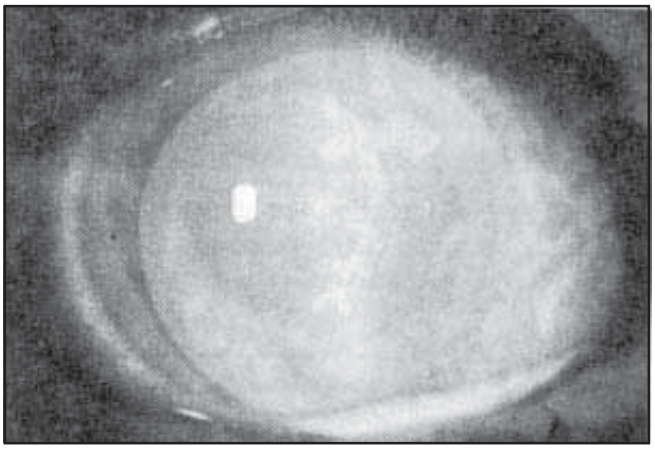
II. Corneal ulcers

The inflammation of the cornea may be caused by the bacteria present in the body or by the microorganisms attacking from outside. Infection may be caused by virulent microorganisms getting attached to epithelial defects.

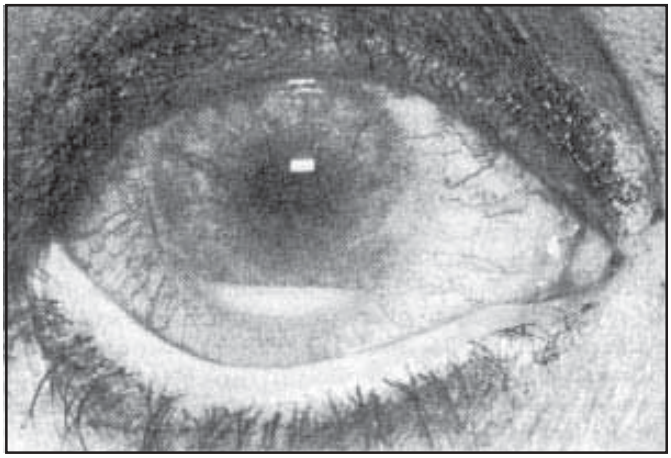
Corneal ulcers are caused by microorganisms from outside. When there is injury to the epithelium, microorganisms will foot hold it. Examples are specks of dust in the wind sticking to the cornea, thorn or twig hitting the eye, bran falling on the eye or mud falling on it while ploughing the field. When the epithelium gets even slightly damaged, there might be ulcer in the cornea in a few hours. Within a few days most of the tissues will be damaged, and it will take many days for the ulcer to heal. Scars will be formed in the cornea leading to permanent loss of vision. If the infection is severe, there is a danger of losing the eye.

A. Inflammation and ulcer caused by bacteria

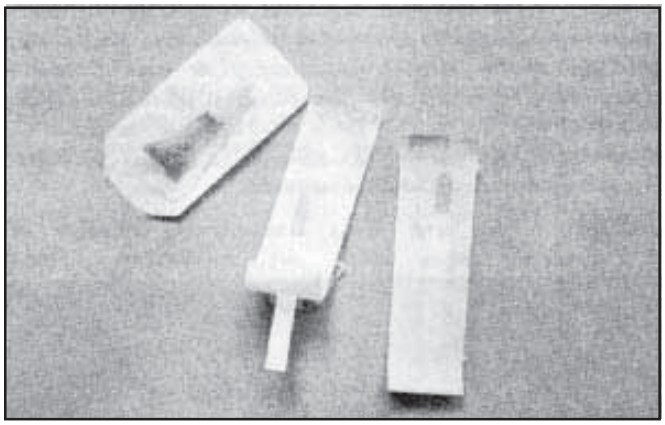
Many kinds of bacteria may cause inflammation and ulcer in the eye. Important among them are Streptococcus, Pneumococcus, Pseudomonas and Staphylococcus. There will be severe pain in the eye. There will be photophobia, watering and congestion around the cornea.



Corneal ulcer



Hypopyon



Flourescein strip

In severe ulcers, there is yellowish white colour of infiltrate. The ulcerated cornea has epitheliated defects. There will be inflammation of iris along with it. In less severe cases, proper treatment will heal the ulcer with a faint scar. Severe ulcers will take many days to heal. The scars will be dense and cause visual diminision.

Treatment

Before starting the treatment the kind of bacteria must be identified. Then appropriate antibiotic drops must be applied every 5 minutes for the first 30 minutes, then once in one hour or two hours. It is important to find out whether there is a block in the lacrimal sac. If there is, it must be surgically removed. If the ulcer is large the selected antibiotic may be given by subconjunctival injection.

B. Inflammation caused by virus

The corneal ulcer may be caused by virus. There will be small vesicles in the cornea. One of the causes may be viral attack on the face or respiratory organs. The small vesicles may open soon and the ulcer will appear like branches of a tree. Normally this follows a viral attack on the throat, trachea and other upper respiratory organs.

They can penetrate the layers of the cornea. There will be vascularisation. This type of ulcer will spread to other areas and result in a big ulcer in the cornea. Without proper treatment, or if steroids are used, they will get aggravated.

Treatment

Starting immediate treatment will stop the aggravation of the ulcer and lessen the scar on the cornea. If it is found that the epithelium is slightly damaged, treatment must be started immediately. In the initial stages the ulcers can be mechanically debrided. But this must be done with care, without affecting the other parts. Antiviral drugs also are used. Sometimes, diseased cornea can be replaced by keratoplasty.

C. Herpes zoster

Herpes zoster may occur in cases already attacked by measles. The virus will be lodged in the 5th cranial nerve ganglion. First there will be fever and tiredness. Then the disease starts with acute pain with burning sensation in the part of the face from the tip of the nose to the scalp. In a few hours, the path of the nerve will redden and will have red boils, which will form pustule and ultimately become scar. There will be swelling around the eye, irritation, tearing, twitching of the eyelid and pain. As the branches of the corneal nerves are affected, cornea will lose its sensation. The pain may lessen when the eruptions

disappear or it may continue for months or years. As in some cases, third and sixth trigeminal nerves are affected. Facial palsy also may occur. So they may not be able to close the eye and cornea will be further affected. As an after effect, glaucoma may occur.

Herpes Zoster

Treatment

There is no satisfactory treatment for Herpes zoster. Symptomatic treatment must be followed. To reduce pain, pain killers must be used. Sulfonamide powder, penicillin ointment may be used for the eruptions on the skin. To avoid complications, antibiotic, antiviral and cortisol mixed ointments must be used continuously.

If there are symptoms of glaucoma, appropriate tablets must be given. To prevent after effects of the loss of sensation to cornea, the two eyelids may be closed surgically.

D. Fungal corneal ulcer

Certain fungi also cause inflammation and ulcer in the cornea. When leaves, twigs and thorns of plants cause damage to the cornea, fungal attack is expected. Further, when herbal juices are applied for minor injuries or when specks in the eye are removed with the help of the hooks or tongue, fungal ulcer occurs. This is very severe. First, the ulcer will have white, dry look and a yellow ring might be found around it. Soon this will deteriorate leaving a deep ulcer. Inside the eye, pus will collect behind the cornea.

When fungal infection is suspected, scraping from the ulcer are examined under microscope to ascertain it. Further tests will help to identify the kind of fungus.

Treatment

Antifungals like Miconazole, Ketaconazole, Nistin and Natamycin and other suitable drops are applied once an hour. Unless complete cure is ascertained, the treatment must not be stopped. They are likely to recur and it takes a long time for the ulcer to heal.

Whatever be the type of infection, if Atropine drops are used along with other drugs, it will prevent future complications and after effects.

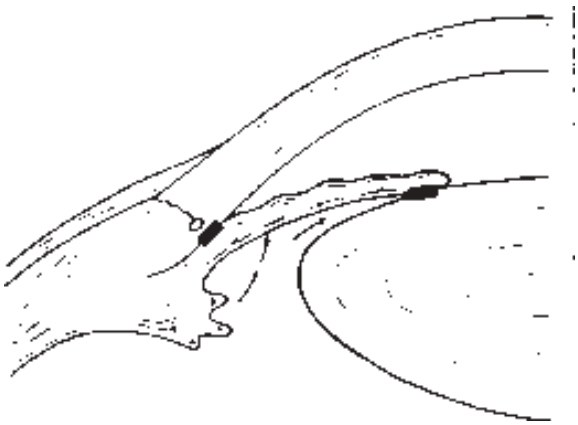
Again irrespective of the kind of microorganism affecting the eye, sometimes the layers of the cornea will be damaged and there may be a perforation. In such cases the aqueous humour in the anterior chamber will ooze out and this can lead to adherent leukoma or secondary glaucoma.

Chapter 19
Glaucoma

The vision lost due to Glaucoma cannot be restored. Vision once lost is permanently lost. So 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

a. One 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 field of vision is lost. In course of time direct vision is also affected. In such cases patients go to the ophthalmologist at an advanced stage.



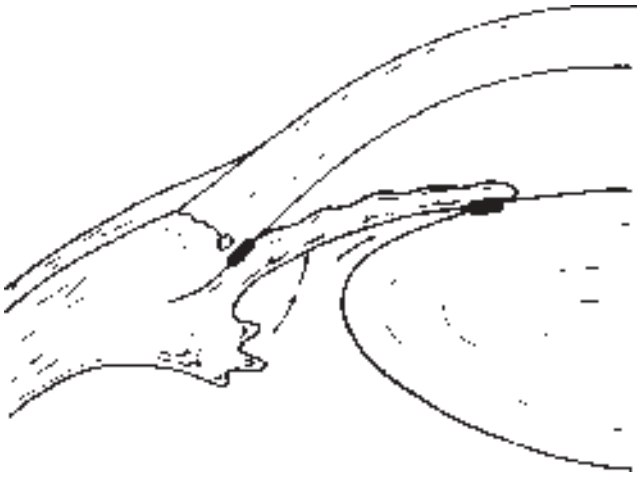
Flow of aqueous

Open angle glaucoma

b. 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. So they will at once approach the doctor. But 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. 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 burst.

Buphthalmos



Pupillary block angle closure

Visual fields

How is glaucoma diagnosed?

The following tests are conducted

- Slit lamp examination
- Tonometry
- Fundus examination
- Testing visual fields. Now 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 between 35 and 40 and above 40
- If some one in the family or any blood relation has Glaucoma
- Diabetic patients
- Blacks
- People who change glasses frequently due to myopia

Treatment

There are three treatments available

a. 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.

b. Laser treatment: This is followed for the two types of Glaucoma. They are called Laser Trabeculoplasty and Laser Iridotomy. Patients need not stay long in the hospital but can take up their work next day itself.

Laser treatment for glaucoma

c. Surgery: If the medical and laser treatments are not effective, surgery is the only alternative.

Note the following

a. Glaucoma is not a form of cancer.

b. Trachoma and Glaucoma are two different diseases.

c. There is no connection between hypertension and Glaucoma.

d. There is no connection between Glaucoma and block in lacrimal sac.

e. Glaucoma is not an infectious disease.

f. All people above 40 years must get their eyes examined once in two years.

Glaucoma patients should note

a. Follow instructions of the ophthalmologist.

b. Eye drops must be used without fail.

c. Eye drops must be applied to the eye.

d. Must not stop treatment without doctor's advice

e. People in the family and relatives must get themselves examined.

f. Must inform about it to other doctors when consulted

g. It is not possible to cure Glaucoma completely. But it is possible to control it and keep the vision by continuous treatment.

Remember that your ophthalmologist is the protector of your eye and you should follow his advice.

Laser treatment for glaucoma

What is glaucoma?

As already explained, when the intraocular pressure increases beyond limit, 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 such Schiots scale normal pressure should be between 15mm and 20mm Hg.

Glaucoma affects the optic nerve connecting the eye and the brain leading to blindness. When the pressure increases, the branches of the optical nerve increases. The symptoms, as already indicated are pain in the eye, head ache and seeing rainbow like halos around lamps.

In Laser treatment, a hole is drilled through the iris with the help of 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 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 structure 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 blockade. 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 get the muscles shrunk by directing laser beams. 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 such separate treatments become necessary 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. It must be applied 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.

Chapter 20
Diseases of the retina

Retina is an important part of the eye and it is made of minute tissue structures. It is the most inner layer of the three-layer tissues. 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 retina is affected due to congenital defects, injury to the eye, other physical ailment or old age, the patient may lose vision.

Examine eyes once a year

It is important for every one to have their eyes examined at least once a year.

Hypertensive retinopathy

Increased blood pressure causes damage to the blood vessels. In the eye the damaged blood vessels can cause sudden stoppage of blood supply causing total loss of vision, or can cause bleeding inside the eye. To prevent this the blood pressure should always be kept under control.

Diabetic retinopathy

Scientific advancement has revolutionised the management of the eye as in other fields. Diabetes affects many organs of the body including eye, brain, heart and kidneys and many are not aware of it. In countries like the U.S. loss of vision is mainly due to diabetes. But in developing countries like India, cataract and diseases due to malnutrition are so prevalent that eye diseases caused by diabetes are not noticeable. But nowadays the number of people affected by diabetes has increased in India too. Because of good medical facilities available, diabetic people live longer. In this context, if proper attention is not given, the main organs of the body will be affected. One such organ to be affected is the eye and so, it must be prevented. Let us see here about how diabetes affects the eye, measures to prevent the disease and also the modern methods of treatment.

It is estimated that about 4 percent of the population are suffering from diabetes. Of them 80 percent get their eyes affected in duration of 15 years.

Eye involvement is seen in 20-40 percent cases of diabetes. It causes cataract, blockage of blood vessels, and glaucoma. Most importantly blood vessels get damaged. There will be haemorrhage and cotton wool spots accumulate. Retina is affected and loses its efficient functioning resulting in a condition is called Retinopathy. The most important fact to be noted is that when such changes are taking place in the retina, many may not have any symptoms in their eyesight. In the place of damaged blood vessels, new ones develop and spread through the back. They may burst any moment resulting in haemmorhage. Then only the difference in sight is noticed. Suddenly there will be loss of eyesight in one eye and then only such patients will approach the ophthalmologist. But by that time it would have been too late and permanent damage would have occurred. As some do not notice any difficulty they may not consult an ophthalmologist. And when they do it they would have reached a stage beyond any modern treatment. They will lose their sight permanently.

What should a diabetic do to prevent such an eventuality and to control further damage?

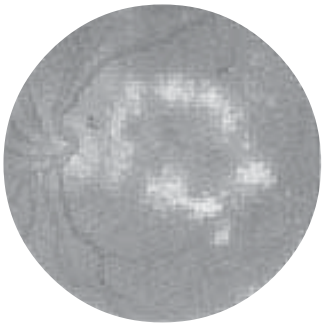
The diabetics must control their disease by food restrictions and there by and reduce blood sugar level. By careful management one can prevent damage to eye. The therapy must be continuous and not intermittent by injection or drugs.

It is difficult to predict which type of diabetes will have eye involvement. The chances are high for long term diabetics. For, this depends more on the duration of the disease than the amount of sugar present in urine and blood. Of diabetic patients for more than 25 years, the chances of eye involvement are 85 percent. So the only alternative is to get the eye examined. As the sugar level is tested, the eye also must be tested. If one waits till symptoms appear, then he may be affected beyond treatment.

The changes in the eye can be identified by a complete eye examination. Though the changes that occur in other organs of the body like kidney or brain are the same, the changes that take place in the eye can be directly noticed. It is possible for the patient to get proper advice and follow the prescriptions. There will be no pain in the test and it is completed in a few minutes. One can undergo the test once in 3 or 4 months.

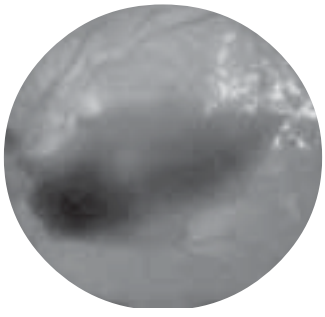
If, in some cases, the retina has been damaged to some extent, other tests also must be carried out. One of them is to inject drug through a blood vessel in the hand, take pictures (FFA) of the retina and find out the changes on it. On the basis of the test, the ophthalmologist will give appropriate treatment. If any patient does not listen to the doctor's advice, then he will lose his eyesight. There are drugs to control diabetes, but there is none to prevent the changes. But there are procedures using laser to correct the defects, depending on the nature of the disease. As stated earlier, diabetes must go in for eye tests often, and act accordingly.

The retina is affected in two ways. In some cases, there will be leakage, haemorrhage and edema (macular edema) in the centre. If only the peripheral parts are affected and not the centre, there will be no change in vision. If frequent tests are not carried out, the patient may not be aware of the disease till the central part is affected. If laser treatment is given before the central part is affected, loss of vision can be avoided.



Macular oedema

The next type is more severe. If hypertension also accompanies this, the damage will be severe. The blood vessels in the retina will be blocked and the retina becomes lifeless without nutrients. So secondary vessels develop and they burst causing haemmorrhage. Such patients will have the changes for a number of years without any outward symptoms. And due to haemmorhage they lose vision suddenly. But, timely diagnosis and proper laser treatment would prevent loss of vision. Laser treatment will stop haemmorhage.



Haemorrhage in retina

This laser treatment which has been found out after a lot of experimentation, can prevent loss of vision due to diabetic retinopathy by 50 percent. But it must be noticed that the state can be stabilised and deterioration can be arrested. But if diabetes becomes severe, even laser treatment will not be helpful. There will be haemmorhage and loss of vision.

Latest surgical procedures can help restoration of vision partially. Here, the blood is removed from the eye and the retina is set right followed by laser treatment and introduction of fresh liquid. Patients may get

sight, just sufficient to move around. This surgical procedure is available in India too. So the disease must be diagnosed early and proper treatment must be given.

It is important that people are made aware of this disease through newspapers, radio and T.V. People who had diabetic retinopathy must tell others and those who have lost sight must advise others.

In short, 80 percent diabetics have a chance of their eyes affected. Most of them may not be even aware of the disease, as there will be no symptoms. If they wait for the symptoms, there will be no chance of recovery. Only proper investigation at appropriate time will give scope for treatment. There are surgical procedures and laser treatments for the disease. All must be aware of them.

Retinal detachment

When there is a small hole or rupture in the retina, liquid seeps through its layers.

Retinal detachment is the result of many reasons. Because of a hole in a weak retina, vitreous liquid seeps through it and detaches it from the adjacent layer. Another cause may be a severe injury to the retina. There are other reasons also. Treatment for congenital cataracts or high myopic or both, injury to the eye, haemmorhage in the retina, development of new blood vessels in the retina are reasons for retinal detachment. The risk is 8 times more for myopic patients than others. The higher the defect the greater the risk. And this risk is more prevalent in men than in women. And post cataract operative risk is found only 1 to 2 percent.

In many cases, a disease called Eale's disease is responsible for retinal detachment. There will be frequent and copious haemorrhage. There are a number of researches undertaken to find the reason. Due to an injury, there will be haemorrhage which mixes with the liquid. These haemorrhages will coagulate and in their places form fibre tissues. They draw the retina inward causing retinal detachment. Juvenile diabetics also have their retina affected leading to retinal detachment. Retinal detachment is an unresolved problem for ophthalmologists. One fourth of the patients who get retinal detachment in one eye will have their other eye also affected. There are generally no warning signals for retinal detachment. But there may be lightning like flashes in the initial stage.

Because of haemorrhage there may be black spots in the field of vision. Patients may complain of carbon particles falling or of seeing through the cobwebs. When the retina is getting detached, the patient says that he sees a curtain on one side of the field of vision. If the detachment takes place in the centre, the patient complains of seeing through water. These symptoms may occur on different occasions.

When the retina gets detached and folded, the entire vision will be blocked. If the disease is diagnosed early, the holes and the places where haemmorhage takes place can be closed and the torn and folded parts can be brought together. There will be 85 percent cure but this has to be done before the detachment. There may be some interval, say a few weeks to a few months between the two.

Treatment

Treatment has to be given carefully. When holes and small quantities of haemorrhage appear powerful light beams are directed on them to close them. This will prevent retinal detachment. But for this procedure to be effective, the changes in the retina must be identified before the haemorrhage. This procedure is ineffective after haemorrhage. The vision lost cannot be retrieved. But it will help maintaining the sight left. The treatment may have to be repeated more than once for a few patients.

Laser treatment

In another procedure, instead of laser beams, cryo is used to close the holes and blood vessels. The first procedure is done when the holes and haemorrhage are found in back portion of the eyeball and the second i.e. (cryo) when they are found in the front part of the eyeball.

When there is retinal detachment, the liquid behind it must be removed; then only it can get itself attached again. This procedure involves major surgery. Before 1950, a patient undergoing such a surgery for the retina to be reattached had to spend 28 days in bed, with both eyes bandaged and the head kept without movement with sandbags. But today's latest surgical procedures keep the patient recover in a short period. The success rate is 85 per cent. Improvement in surgical procedures and modern equipments to examine the retina availability to estimate its disintegration makes this possible.

Women who have myopia must remember that they have a higher chance of retinal detachment and approach the doctors as soon as symptoms occur.

Eale's disease

Now let us learn about the Eale's diasease. Eale's disease is the one in which young people have haemorrhage in the retina. Though it was diagnosed by Henry Eale's as early as 1880, the cause and the course of it are not known. So the treatment also is symptomatic. This is a big health problem. Though this is prevalent all over the world, it is more widespread in temperate regions. One in 200 to 250 is affected by it in India. In England the incidence is one in 4800.

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. As it affects young men mostly it is a socioeconomic problem.

Causes of the disease

How Eale's disease occurs is only conjectural. It is surmised that the following may be causes:

1. Tuberculosis
2. Allergy to Tuberculosis protein
3. Infection in other organs like teeth, ear, nose – Focal sepsis
4. Thrombo Angitis Obliterans or Buergers Disease.

Two doctors explained in 1911 that tuberculosis might cause Eale's disease. Many supported this conclusion. But attempts to locate tuberculosis bacteria at the site have failed. Many get Eale's disease without any sign of tuberculosis.

Inability to locate tuberculosis bacteria at the site of the disease and signs of tuberculosis after recovery in some patients, is given by the positive result of injecting tuberculosis protein in the skin and this has made many experimenters arrive at the "Allergy to Tuberculosis Protein" theory. Results of some experiments also have supported it. For example as an experimental measure, tuberculosis germs were injected to rabbits to cause swelling and inflammation. There were white corpuscles around the blood vessels in the retina. There was inflammation and haemorrhage. But many experiments could not prove beyond doubt that all patients suffering from Eale's disease had allergy to Tuberculosis Protein.

Infection to other parts

It is surmised that infection of the teeth, skin, tonsil glands and sinus may cause Eale's Disease. This surmise is confirmed by the incidence of Eale's Disease in such cases.

Buerger's disease

This is a Smoker's Disease. When there is an obstruction in blood vessels, especially in the leg, blood circulation is blocked; tissues in the toes get shrunk and decay. There will be severe pain. Some experimenters are of the opinion that such Smoker's Disease causes Eale's Disease.

Other causes

Other studies indicate that changes in blood cause Eale's Disease. Blood vessels in the retina have inflammation and swelling. It occurs in other infectious diseases like veneral diseases, leprosy, tuberculosis which infects man and animals.

So there is no definite cause for Eale's Disease. But one can conclude that something happens in blood circulation which causes haemorrhage in the retina. Perhaps it is due to antibodies in the body. Initially, due to some external reasons, blood vessels may be damaged. The later developments may be because of reaction in the tissues. But one does not know why these reactions affect the blood vessels in the eye and not those in other parts. So it is necessary to study this problem extensively.

It is clear that foreign particles causing reaction in the tissues are responsible for Eale's Disease. Further it must be noted that this disease is prevalent among young men. It affects both eyes, 50% of them get cured without any treatment and that it is prevalent in temperate regions. Further it is not clear whether other diseases in the body are responsible for Eale's Disease. So many causes together may be responsible for it. No genetic reasons have been attributed to it.

Its prevalence among men, mostly in temperate regions, its relation to sexually transmitted diseases and environmental causes must be borne in mind. The real proven cause for the disease is still a mystery. Eale's Disease generally causes inflammation of the veins capillaries-. However the capillaries of the arteries may also be affected. First it begins with the periphery of the retina; then spreads at the back. As a result, knots in the blood vessels, development of new blood vessels, recurrent haemorrhage and complications are formed. The affected blood vessels cause haemorrhage and lead to Retinal Detachment.

Symptoms of the disease

Though 70 to 80 percent have both eyes affected, only one eye gets the disease first. How much visual acuity is affected depends on the quantity of blood collected in the vitreous chamber and on the refractory power. Loss of vision is caused by more haemorrhage in the posterior chamber than that in the walls of the blood vessels. The vision will be so much affected that the patient can see the fingers presented in front of the eyes or feel light only.

In the beginning, if the back of the eye is examined one can see the expansion of the veins at the periphery of the retina, irregularity and discontinuity of the veins. There will be slight haemorrhage also. When it increases it mixes with vitreous humour and makes it cloudy. When the disease becomes acute, the capillaries of the artery are affected. This can be diagnosed by injecting flourescein through the vein. In these places new capillaries can also be seen. After a few days blood collects in the lower part of the eye socket and the retina can be seen. The coagulation of the recurrent haemorrhage, inflammation of the retina and detachment of the retina can also be noticed. Some patients will have inflammation of cornea, the block in central vein of the retina and Glaucoma.

There are four stages

1. The expansion of veins and narrowing of the angularity and disconnection of the veins.
2. Due to changes in the vein, inflammation of the veins and haemorrhage in the retina.
3. Haemorrhage that recurs.
4. Inflammation of the retina, Retinal Detachment, Loss of vision. At first Macula is not affected. Some will have frequent haemorrhage leading to fibrous tissues infiltration. This will result in the weakening of the optic nerves

Signs and symptoms of Eale's disease

1. Partial or complete loss of vision in both eyes at a young age.
2. For young patients the vitreous humour will become non-refractory and vision will be cloudy.
3. In one eye, there will be inflammation and star like appearance in macula.
4. Coagulation of blood and block in the capillaries or central vein of the retina in the young.
5. Inflammation of blood vessels and choroid.
6. Glaucoma in one eye of the young.
7. Complicated cataract in the young without Myopia.
8. In the young age, inflammation and membrane growth in the retina in one or both eyes.
9. Retinal Detachment in one eye in the young.

It is impossible to predict in which of the affected eyes there will be changes in the retina, development of blood vessels, haemorrhage, as the symptoms and cause of Eale's Disease differ from person to person. There is no record of the aggravation of the disease and the connection between myopia, glaucoma, decay of the optic nerve and scars on the retina. There is no possibility of knowing the interval between the appearance of first symptoms of the disease and first haemorrhage between two recurrent haemorrhages, the time of formation of new blood vessels and other events in the course of the disease.

Sometimes, it is possible to identify the reactions by injecting fluorescein into the retina.

Deciding on the final course of the disease

The final course of the disease depends on the frequency of the haemorrhage and the interval between two haemorrhages. Because of frequent haemorrhages, fibre tissue will form and spread. Retinal Detachment, Glaucoma and other complications may occur.

However 50 percent of patients with minor symptoms or one time haemorrhage will get cured without any treatment. But it is difficult to decide which of the patients are fortunate like this.

Treatment

Treatment is given based on previous experiment time. It is mostly disappointing.

Treatment is through injection.

Anti-tuberculosis treatment

These are usual procedures. Injecting Cartizon through the outer layer of the eye has been found to be effective.

X-ray treatment

X-ray treatment helps in reducing the changes in the retina.

Destroying the affected tissues

It is generally hold that the new blood vessels and the knobs in the vessels must be destroyed. To do this photocoagulation is adopted. As blood vessels and knots coagulate, there will be small scars in these places. This prevents formation of new vessels. As the affected parts are in the periphery this treatment does not affect the major part of the retina. However, this treatment may cause complications.

Instead of heart, extreme cells can be used to make the blood vessels inactive. But there are few records about it. Though there is immediate benefit, haemorrhage will take place again.

Vitrectomy

The posterior chamber is filled with jelly like substance. This gives shape to the eye. As due to the haemorrhage Eale's Disease mixes with it, becomes reddish and cloudy and loses its refractive nature. It results in loss of vision. So the liquid is removed through surgery and replaced by another suitable liquid. However, if the retina has been damaged, there is no chance of improvement in vision.

So the disease must be diagnosed at an early stage and suitable treatment must be given.

Chapter 21
The care of the eyes of school children

The importance of the eyes for human beings need not be over emphasised. They give light and life to man. They are the instruments of knowledge and their symmetric positions in the face adds beauty to it. They reflect their inner thoughts and feelings. If they lose their lustre, life becomes meaningless. So it is important that one hold eyes dear to one's life.

Whose responsibility?

Eyesight is basic for reading and writing. Eyes are windows to the outside world, to knowledge. We get 85% of our learning through eyes. It is held that if there is defect in vision there may be defects in mental growth. So, if there is any problem with the eyesight of children, it must be immediately attended to and investigated. Then only appropriate therapy can be given. A timely intervention may save eye-sight. Children constitute 40 percent of our present population in India. Ten crores of them are of school going age. Their eyesight must be the concern of everyone.

This responsibility falls on parents, teachers and doctors. The first symptoms in defective eyesight of a child will be noticed by parents. Next, it is the teachers who have to identify any deviation from normal vision. Teachers in schools must arrange for medical examination of the children. As such inspections are done hastily doctors fail to notice eye defects.

Doctors must examine the eyes of the patients carefully. They must also instruct parents and teachers about the methods of identifying defective eyesight.

The following symptoms will help one identify the problems in the eye:

a. Inability to see letters clearly. Letters in a line may appear superimposed or zigzag.
b. Writings on the blackboard or cinema cannot be seen unless they are very close.
c. Strain to the eye by continuous reading will cause headache, tiredness, pain or watering in the eye.
d. Unclear – blurred vision.

The appearance of the eye when it is affected

a. The margins of the eyelids will be red and swollen.
b. Frequent styes
c. Both eyes will not be of the same size
d. One or both lids will be closed as if in sleep
e. The eyeballs will be moving across or lengthwise continuously or occasionally (Nystagmus)

What children with defective eye sight experience

One can notice the following modes of behaviour

a. Children with defective vision may strain the eyes while reading or doing any work. They may skip a line while reading or they may have regression. Or they may be slow in reading.
b. They will twitch their eyebrow unnecessarily, they will widen their eye, see with a squint and have difficulty while reading.
c. Keeping books and objects very close to the eye, avoiding continuous work of same kind.
d. Squeezing the eyes as if to clear the sight.

e. While seeing objects near or far away, some will shut or close one of the eyes or unnecessarily bend their body or bend or push forward the head.

f. Straining the eye for doing some work continuously and getting tired easily.

g. Faltering or knocking at small stones or objects on the road while walking because of poor vision.

h. Poor performance in school games and sports because of short sight.

i. Shyness of (sun) light (photophobia) or colour blindness.

j. Lack of attention in studies and poor performance.

These are different symptoms of defects in eyesight. Parents and teachers must be alert to identify such cases. These symptoms may be temporary because of common cold, but if they are persistent, examination of the eyes becomes imperative.

The defect must be correctly and quickly diagnosed by an expert ophthalmologist in the beginning itself and appropriate remedial measures must be undertaken for prevention or cure.

All children going to high school must be given a colour discrimination test. Colour blindness cannot be cured. But a diagnosis of such a defect will help treating the child properly especially by discouraging him/her from taking up studies or profession which require colour discrimination.

Medical examination must include examination of the eye. When there is any illness it may affect eyes. Likewise a disease in the eye may affect general health. So medical professionals must remember that examination of the eye is an essential component of general medical examination. They must also impart the necessary training to teachers and parents to identify the defect in eyesight.

Eye care plan

a. Eyes must be washed with clean water everyday.

b. Towels, handkerchiefs and pillows used by children suffering from conjunctivitis must not be used by others. This will prevent cross infection. The child with conjunctivitis must be asked not to rub the eyes with the fingers. This will prevent the disease from spreading to the healthy eye.

c. Children with defective eyesight must wear glasses continuously. Parents and children must instruct them to do so and get such children examined by an ophthalmologist at least once a year.

Chapter 22
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 done one will have double vision. And the eye that is rejected will have sight slowly deteriorate.

Squint (left eye)

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 appear as child grows. If it continues after 6 months, the child surely needs the attention of an eye specialist. It must be noted that squint in the infant may be an early symptom of Retinoblastoma.

Squint (right eye)

Parents must watch their children from infancy to find whether they move the eyes together, 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, bathing the eyelids or keeping the objects close to the eyes are other symptoms. Such children having such symptoms 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

a. Glasses to correct the fault
b. Patching of the good eye
c. Applying eye drops or ointments
d. Special types of exercises
e. Operation

Myopia and astigmatism can be corrected by glasses

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 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.

Chapter 23
Cataract

Definition of cataract

Cataract is a term applied, when the Human lens loses its transparency and becomes opacified. Hence the light cannot pass through the lens in required level and fall on the retina, to produce a image.

Types of cataract

Immature cataract

When the lens is not completely opacified and still some amount of clear lens remains in it.

Mature cataract

When the lens totally opacifies, and it appears white where the whole lens loses its transparency.

Mature cataract

Senile cataract

This is the most common type of cataract occurring in the general population. As the age advances like the hair becomes grey, the lens also becomes grey then to white. The three main types will be Nuclear when it involves the nucleus, if it involves the cortex then it becomes Cortical and when it involves posterior capsule it is called Posterior Subcapsular.

Traumatic cataract

This can be due to a thorn injuring the lens, or any other foreign body entering the lens where the lens loses its transparency and becomes cataractous.

Childhood cataract

Childhood cataract

Thirty five percent childhood cataract are inherited and the rest of them are due to various causes like radiation, enzyme deficiencies, trauma, etc.

Steroid induced cataract

When a person is using topical steroid eye drops, or systemic cortico steroid tablets for a prolonged period then it leads to cataract formation.

Surgical treatment of cataract

Cataract cannot be treated or salvaged by giving medicines. The only treatment of cataract is by surgery. The surgery for cataract in present day has acquired varied dimensions from a barbaric couching to the advanced phaco emulsification with foldable IOL surgery in at least possible incision, bringing patient the earliest rehabilitation.

The types of cataract surgery

Intracapsular cataract surgery

If we recollect the anatomy of the lens, it has capsule with an anterior plastic bag like position and a posterior bag like structure inside which is the lens matter. This is like milk in a polythene bag. The intracapsular cataract surgery is by removing the lens including the whole bag. A cryo probe is used which is inserted in a dilated pupil and placed on the lens. As the probe becomes colder, the lens sticks to it. The probe and the lens are pulled through the pupil into anterior chamber and out of the eye.

Extracapsular cataract extraction

This is the most commonly performed surgery throughout the world at present time whatever may be the technique in practise.

Here the posterior capsule is left behind. After the advent of intraocular lenses, in the last 10 years the planned extracapsular cataract extraction with IOL implantation is the most preferred surgery in high volume ophthalmic centres and in eye camps.

Procedures involved in planned ECCE

Preoperative work up includes the following:

- General ophthalmic examination giving importance to the pupillary reaction to rule out an optic nerve or posterior segment pathology
- Tension
- Duct
- Systemic examination including
    - Blood pressure
    - Urine sugar
- Anaesthesia
- Retrobulbar or a peribulbar block with lignocaine
- Facial black
- Eye massage

Preparation of the eye

- Cleaning the external ocular structures, the eyelids, brows and the adnexa with betadine and wash with saline
- Lid speculam
- Fixation of the globe with a binded suture of superior rectus

Standard surgical steps

1. A limbal or a fornix based conjunctival flap elevation
2. A mid limbal groove incision, followed by a stab incision at 11'Oclock of limbus
3. Introduction of visco elastic substance
4. Closed chamber anterior capsulotomy by can opener technique
5. Extension of the incision with scissors
6. Cortex removal by irrigation and aspisation using simcoe cannula
7. Placement of IOL in the bag
8. Wound closure with interrupted or continuous sutures

Recent technique

Using phaco emulsification of the lens matter using a titanium tipped probe that has an irrigating and aspirating part which works under suction pressure.

Here the incision is made by making a scleral tunnel and entering the clear cornea. The incision is made 2mm from the limbus extending to 6mm, enough insert an optics of the lens only. This is a self healing wound which requires no sutures.

SICS

The small incision cataract surgery does not recognise a sophisticated phaco emulsification machine. But involves the same steps as:

1. Scleral tunneling
2. Continuous curvilinear capsulorhexis of anterior capsule
3. Hydrodissection
4. Nucleus delivery using an irrigating vectis by a sandwich technique
5. IOL implantation
6. No need for suturing

Hence the techniques advances with new standards in the coming millenium for better quality vision to the mankind.

Chapter 24
Exercises to the muscles of the eye

In chapter 22, we discussed squint, its causes and treatment including exercise to the muscles of the eye. Here we will describe in detail the exercises to be given to the muscles.

As indicated earlier, when a person fixates at an object, one eye fixates at it and the other eye turns in any direction – in, out, up or down. This is called squint. The squint is of two types: In one type, the squint may not be manifest. After certain tests it will be diagnosed. This is called Heterophoria. People with this defect will develop headache, pain in the eye after reading or sewing for a long time, photophobia, blurred or double vision when reading small letters close to the eye. Such patients will be tested and recommended to wear glasses. If this is not effective, certain exercises are prescribed. They are given through instruments.

One of them in Synotophore. This equipment will show whether both eyes have the same image simultaneously and the extent of the squint. For example, two different images – eg. Car, car shed, man, house – must fall separately on the retina and the function of the brain merges them. Likewise, two similar but incomplete figures must be perceived as a single total figure. These will be identified by the equipment. If there are defects in these araises, proper exercises can be given through the equipment.

When there is a slight squint causing headache, burning sensation, pain in the eye after straining and double vision, exercises can be given with the help of this equipment. Further when there is merging of images after surgery for squint, exercises are given to stabilise it.

Cheiroscope is another equipment which gives exercises to see two images together like butterfly and the net. A picture is kept and its image is reflected by a piece of mirror kept at an angle. The patient looks at it through + 8 lenses and draws the image on a paper kept under the equipment. In another method the picture of the butterfly is kept in a place. The picture of the net is kept below the equipment. The operator moves it asking the patient to catch the butterfly in the net. This enables both eyes to perceive the same images.

Remy separator is another equipment. On a wooden plank of 12” x 2” two different figures e.g. house and man, drawn on a transparent glass are fixed on two sides of one end. At the other end, the patient keeps it on the nose and looks through the glass at a distant object. The image of the house will form on one eye and that of the man on the other. They will appear to be in the same place due to the action of the optic nerve. This exercise will correct the in-out squint. Further the ability for both eyes to see together will improve, if affected.

Another method is to use a prism of different powers to assess the degree of squint and to give exercise. All these exercises can be done only in hospitals

Exercises to be done at home

Two figures of the same size, say of cats will be printed on a post card. There will be some differences between them. The patient will keep it at distance of 12” to 14” from the face, hold a pencil between the cats and looking at it move the card close to the nose. Then the patient will see three or four cats. Of them, one at the centre will appear complete but blurred. The patient will close and open the eyes till the image is clear. The image at the centre will appear clear and the ones near it blurred and separate. This exercise may be done ten times a day.

The squint which is obvious and can be noticed by others is called Heterotropia. This cannot be corrected by exercise. One of the eyes may be affected. If this is noticed in the child, parents must take the child to an eye specialist without considering the defect as a sign of luck.

Chapter 25
Headache

Headache is a common symptom, the cause of which can be as simple and harmless as the 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 is very common.

Diagnostic approach

History

Most information is derived form 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

The following table classifies causes in these categories:

Cause	Associated feature which (if present) aid diagnosis	Recurrent Attacks	Further investigations (if required)
Acute			
Sinusitis	Preceding 'cold'. Nasal discharge	*	X ray nasal sinuses
Migraine	Visual, neurological aura, Nausea, vomiting	*	
Cluster headache	Lacrimation, nasal discharge	*	
Glaucoma	'Misting' of vision 'haloes' around objects	*	Ophthalmological evaluation
Retrobulbar neuritis	Loss of vision (unilateral)		Visual Evoked Response
Post-traumatic	Following head injury		Skull Xray, CT scan
Drugs/toxins	On vasodilator drugs		

Haemorrhage	Sudden onset Vomiting, neck stiffness Impaired conscious level		CT scan Lumbar puncture
Infection(meningitis, Encephalitis	As above, but more gradual onset with fever		
Hydrocephalus	Impaired conscious level Impaired upward gaze		CT scan, MRI scan
Subacute			
Infection (subacute, Chronic meningitis) Eg. TB, Brain abscess	Impaired conscious level, fever, neck stiffness, focal neurological signs		CT scan, Lumbar puncture
Intracranial tumour Hydrocephalus	Vomiting, papilloedema, impaired conscious level, Focal neurological signs	*	CT scan MRI scan
Benign Intracranial Hypertension	Vomiting, papilloedema 6th nerve palsy	*	CT scan MRI scan
Temporal arteritis	Thickened, tender Scalp arteies		ESR Temporal artery biopsy
Chronic			
Tension type headache	Anxiety, depression	*	
Ocular 'eye'strain'	Impaired visual acuity	*	Refraction
Drugs/Toxins	On vasodilator drugs		
Cervical spondylosis	Neck, shoulder, arm pain	*	X ray cervical spines

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 commonest 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 investigation.

Although **intracranial tumours** are uncommon in children, when they occur they tend to lie in the **midline** (eg. Medulloblastoma, pineal region tumours.) As a result, obstructive hydrocephalus 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, eg. Personality change, develop.
- If the head circumference increases
- If the child is under 5 years of age

Headache: Specific causes.

A. Tension type headache

This is the commonest form of headache experienced by 70% of males and 90% of females at sometime in their lives.

Characteristics

Diffuse, dull, aching, ‘band-like’ headache, worse on touching the scalp an 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, eg. 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

Obtained 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 neurotransmitters, 5 hydroxytryptamine (5 HT, synonym: serotonin0 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, verigo, limb paraesthesia, even tetraparesis. 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 6 Th . 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, adolesecence, early adult life or menopause.

Differential Diagnosis

1. Partial (focal) epilepsy (in hemiplegic or hemisensory migraine)
2. Aneurysm compressing 3rd cranial nerve 9in ophthalmoplegic migraine)
3. Transient ischaemic attack 9in hemiplegic or hemisensory migraine0
4. Areteriovenous malformation- give rise to well-localised but chronic headache
5. Hypoglucaemia

Management

(i) Identification and avoidance of precipitating factors

(ii) Prophylaxis: - pizotifen (5HT2 receptor blocker)

- Propranolol (beta adrenergic receptor blocker)
- Methysergide (5 HT 2 receptor blocker0

(iii) 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 refractory cases prednisolone is used.

D. Giant cell (Temporalo 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 bllod 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' information, 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 basiler artery may cause brain stem or bilateral occipital infraction.

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 60 mg daily, prevents visual los or brain stem stroke, as well relieving the headache. If complications have already occurred eg. blindness, high dose parenteral steroids are given.

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 of MRI scan of the brain are essential.

F. Headache Due To Intracranial Haemmorhage

Characteristics

- instantaneous onset
- severe pain, sperading 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 psture, eg. bending. X ray sinuses opacified.

Treatment

Decongestants or drainage.

Ocular

Refraction errors may result in ‘muscle contraction’ headaches; resolves when corrected with glasses. Glaucoma does not produce headache without other symptoms, eg. misting of vision, ‘haloes’. Cupping is seen of fundoscopy.

Dental disease

Discomfort localised to teeth. Check for malocclusion. Check temporomandibular joints.

Systemic causes

Headache may accompany any febrile illness or may be the presenting feature of accelerated hypertension or metabolic disorders, eg. hypoglucaemia, hypercalcaemia.

Many drugs produce headache

- through vasodilatation eg. bronchodilators, antihistamines
- on withdrawal eg. amphetamines, benzodiazepines, caffeine.

Chapter 26
Loss of sight due to malnutrition

One can not obliterate from one's mind the image of infants and children with protruding rib cages and pot bellies lying on the lap of their mothers. The pathetic sight is seen in all the underdeveloped countries, where food is scarce and malnutrition haunts the children.

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 vitamin affects the eye, and it is estimated that about half a million children become blind every year as a result of this deficiency. In South India 37% of children losing eyesight suffer from Vitamin A 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. As the effects are seen in the eye in the form of dryness, it is called 'Xerophthalmic' 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 spots' may be seen. In severe deficiency 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, at the same time, wrote a poem about night blindness and liver given as cure.

Vitamin A is associated with protein-energy malnutrition. Apart from inadequate diet, diarrhea, 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 liver. When the child is breast fed, the child gets poor supply of Vitamin A from mother's milk poor in Vitamin A. Again the deficiency occurs when supplementary food is delayed after four months. When the infant has diarrhea, 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 Vitamin A deficiency.

Signs of Vitamin A deficiency

Night blindness

The first manifestation of Vitamin A deficiency is night blindness. This is caused by the damage to the cylindrical light sensitive rod cells in the retina. Patients with this defect can not see in dim light, and at night. The disease can be noticed when the child falters in the dimlight 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 called Bitot in 1863. Conjunctiva becomes dry and wrinkled. Pearly grey elevated patches are seen. Now the number of children below five affected by this is less. But it is high in school going children.

Dry conjunctiva

The conjunctival epithelia 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 ulcer. But it is also due to the dryness of cornea. The layer of the cornea will be partly or fully damaged. This results in lesions, making cure difficult.

Cornea becomes soft and gets dissolved. The liquid inside will come out as the eye ball will shrink. This will take place very quickly.

Lesion or scar appears in the cornea when there is injury or infection to it to children with malnutrition. It is held that this occurs when there is a deficiency of Vitamin A and protein.

These signs and symptoms need not take place one by one 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 year and 6 years, Vitamin A of 2 lakhs 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 1 lakh 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 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 till 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 for adults. Children below six get enough Vitamin 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. In villages, vegetables rich in Vitamin A which are easily available must be given to children.

Vitamin A is fat soluble. For Vitamin A to be absorbed a small quantity of fat is required. So some oil or fatty food must be added to the diet daily.

Chapter 27
Penetrating injuries of eyes

Injury of eyes is an emergency situation and mandates urgent attention. As cornea occupies the major part of the eye, it gets hit in most injuries. Sharp instruments, rods, bricks, glasses, nails, flying missile, metallic particles, blasts and road accidents may cause injury to eyes.

The conjunctiva may also be affected. If the object is big the eyelids also may be injured. As soon as the injury occurs, the eye must be bandaged and the patient must be taken to the nearest hospital. There the nature and depth of the injury and the effect on sight will be examined. It must be borne in mind that foreign particles flying fast may hit the eyeballs and get lodged inside the eye. It may be an iron particle or glass or piece of wood. If there is penetration, an X-ray has to be retained I.O.F.B (metallic) can lead to long term complications taken.

If the injury to the cornea is with uniform edges like a cut, it will heal without any complications. It will have a minute scar. Before suturing the wound caused by glass pieces, the edges of the wound must be closely examined for glass pieces. If there is protrusion of iris, immediate surgery is recommended.

In cases of damage to conjunctiva, cornea and iris, carefully planned surgery must be undertaken. Surgery must be done at the earliest convenience. It is important to remove foreign particles lodged inside the eye. The particle lodged in the wound or in the anterior chamber must be removed during surgery. Before attempting to remove the particle present in the anterior chamber the exact place must be located.

Particles lodged in the lens

A particle penetrating the eye and getting lodged inside takes place in industrial accidents. Generally adults between 30 – 40 years are affected. People handling hammer, chisel and needle are affected most. The metallic particles penetrating the eye may get lodged inside the eye at the back. Flying particles like bullets may go to the bone cavity. The examination, records after all tests, the wound of penetration in the eye and about the extent of damage to the tissues. The metallic objects lodged at the back (posterior segment) were removed from behind the back with the help of electromagnetic instruments. The particles embedded in the front are removed from the front of the eye itself

Results of investigation

Most of the injuries, unless unexpected, can be prevented. 1/3 of the people injured in the eyes are below 10 years. Many reach the hospital very late. The delay may cost sight. The use of ‘operative microscope’ helps in careful examination of the eye and planning on the course of the surgery. Operation with the help of microscope has restored eyesight to many. It is possible to unite the edges correctly by sutures.

If the penetrating injury occurs in early age, the eye may become less active and lose eyesight either because the cornea develops a scar, or because of changes behind the lens. The removal of particles penetrating the eye does not ensure eyesight. Only 25 percent got back their sight. As for others, they could not get better vision. Likewise when particles embedded in the front of the eye are removed the tissues are not damaged as against removing those lodged at the back. So vision is improved in such cases. In cases of magnetic foreign bodies – the foreign bodies can be removed and hence have a better prognosis.

So safety measures must be strictly followed.

Because of the penetrating injury to one eye, the other eye also may get affected. This is called sympathetic ophthalmitis. The eye that is affected is the inducing eye and the other eye is sympathetic eye.

The inflammation stretches from the outer surface through iris, ciliary body, and choroid to the optic nerve. So both eyes are affected.

Signs and symptoms

The primary reason is the penetration after accident or surgery. If iris and ciliary muscle are involved in such injuries, there will be sympathetic inflammation. This is dangerous. Sympathetic ophthalmitis is also observed when there is injury and penetration in the cornea. But suppuration prevents development of sympathetic ophthalmitis. A few days after the injury to one eye, the other eye is affected. It takes more than 10-15 days. But if the injury is healed well, the other eye is not affected. The first symptoms are irritation and watering in the healthy eye before the onset of sympathetic ophthalmitis. There may be pain and low vision. Many changes may take place inside the eye also.

Treatment

Prevention is always better. Occasionally, in badly lacerated eye the affected eye may have to be removed. When there is no possibility of restoration of sight, it is better to remove it within 10 days. It is to be removed when the injured eye gives unbearable pain and when there is no light perception.

However, if the sight can be stabilised in the injured eye, we must wait. The patient with sympathetic ophthalmitis must be closely watched. Applying atropine drops, giving corticosteriod orally and locally, the hot water fomentation, rest and wearing dark glasses may be helpful. Careful treatment will restore eyesight to many.

Chapter 28
Ocular and periocular tumors

The eye along with its surrounding structures like connective tissue, nerves, blood vesels, fat, muscles and glands have the potential to give rise to virtually any known neoplasm anywhere in body. However, certain types of tumors are more common and specific to this organ. A brief discussion of the more important tumor follows.

Lid tumors

Lid tumors are generally seen in older age group and in people who are more exposed to sunlight. Neoplasia must be suspected in any new growth appearing on the lids and growing; and in any preexisting growth which increases in size, gets ulcerated, changes colour, becomes painful or leads to loss of measures undertaken. The most important lid tumors are:

1. Basal cell carcinoma
2. Squamous cell carcinoma
3. Sebaceous cell carcinoma

Basal cell carcinoma

It is the most common malignant lesion of the eyelids. It occurs in old age, is more common in white skinned people and involves lower lid in maximum number of cases. Basal cell carcinoma appears in two forms clinically. It may appear as a nodule on the lid with overlying fine blood vessels, loss of cilia and with or without ulceration. The second type is a diffuse variety wherein the tumor causes thickening of the involved area and appears without any clear cut boundary. Basal cell carcinoma causes destruction of the involved areas. It spreads to involve other parts of the lid and in advanced cases, the orbit. But metastasis, that is, spread to other parts of the body does not occur. The treatment is surgical excision of the involved area along with a surrounding rim of normal tissue, so that all the tumor mass including the one which is not visible to the naked eye, is removed. For patients who refuse surgery or who are unfit for surgery radiotherapy and/or cryotherapy can be done.

Squamous cell carcinoma

It is the second most common malignant lesion of the lids, after basal cell carcinoma but occurs much less frequently. It is outnumbered by basal cell carcinoma by 10:1. Clinically squamous cell carcinoma appears as a nodular or an ulcerated lesion on the eyelid. Unlike basal cell carcinoma, this neoplasm has the potential to spread to distant body organs, apart from local spread. Therefore the treatment in the form of surgical excision with a rim of normal tissue or radiotherapy has to be much more aggressive and faster to achieve a cure.

Sebaceous cell carcinoma

This malignancy is rare as compared to basal and squamous cell carcinoma, nonetheless is important as it can be mistaken for a chalazion. Sebaceous cell carcinoma arises from the glands in the lids. Most commonly the gland involved is meibomian in tarsus. The tumor appears as a growth from the tarsus with loss of cilia in the affected area. The upper lid is involved much more frequently than lower lid. However, the tumor is often misdiagnosed as chalazion must be looked at with suspision and biopsy of the lesion taken. Sebaceous cell carcinoma is treated, as other lid malignacies by wide surgical excision including a rim of normal tissue.

In any case of lid malignancy, after the removal of the tumor a defect remains. This defect needs reconstructive surgery to give proper shape and function to the lid. If the defect is small it can be corrected by mobilising additional tissue from the nearby area of lid and closing the defect. But, if the defect is large, grafts are needed. These grafts can be taken from other lid of the same eye, lids of the other eye, pre and post auricular area etc.

Intraocular tumors

The most important intraocular tumor is retinoblastoma. It is the most common intraocular malignancy of childhood, occurring in 1 out of ever 15,000-34,000 live births. The average age of the child when the tumor is diagnosed varies from 1 to 3 years. About 25-30 percent of the cases having retinoblastoma have it in both the eyes and pass on the tumor to next generation, that is, it is hereditary. 50-55 percent of the retinoblastoma cases are unilateral and non hereditary. Retinoblastoma from neurosensory retina and grows either towards the vitreous cavity or towards the choroid. A child harbouring retinoblastoma presents most commonly with leukokoria or a white reflex from the eye – amourotic cat's eye reflex. Diagnosis is by visualizing the tumor mass projecting from retina into the vitreous cavity. The cases in which the tumor is not seen but there is a suspicion of the tumor, are advised ultrasound and/or CT scan. Retinoblastoma spreads by invading the choroid and the optic nerve. Metastasis to various parts of the body occurs once the tumor cells enter the blood stream. The treatment should be instituted as early as possible to avoid distance spread which shortens the life span of the patient. In most of the cases, by the time the malignancy is diagnosed, it is quite late. Therefore, the treatment is enucleation of the eyeball. In cases in which the tumor is small, laser photocoagulation or cryotherapy can be tried. On the other hand, if the tumor has progressed that much, that it involves the orbital structures, exentration of the orbit with radiotherapy are indicated.

Orbital tumors

The orbit, with its complex architecture comprising of the eyeball, extraocular muscles, nerves, vasculature, fat and glands is capable of giving rise of various tumors. A brief discussion of the relatively more common orbital tumors is given below.

Rhabdomyo sarcoma

It is the most common primary malignant orbital neoplasm in children. Rhabdomyo sarcoma arises from the embryonic remnants of mesoderm. Clinically it presents as rapidly progressing painless proptosis in 7-8 year old child. Rhabdomyo sarcoma is a highly malignant tumor, which involves removal of all the orbital contents with the tumor mass. Radiotherapy and chemotherapy have also been successful in treating the condition. However, if metastases occurs, it significantly lowers the patients life span and chemotherapy is the only treatment option left.

Leukemia

The acute form of leukemia, specially all acute mycloid leukemia, may cause proptosis due to orbital infiltration. Most commonly the child develop acute bilateral proptosis. Peripheral blood smear shows the leukemia changes. The treatment is chemotherapy.

Optic Nerve Glioma

This tumor occurs in the firs decade of life. It arises from astrocytes within the optic nerve and causes enlargement of the optic nerve. The child having optic nerve glioma comes with mild proptosis and visual loss. Optic nerve glioma is a very slowly growing tumor, so it can be observed. Surgical excision entails

resecting the affected optic nerve, therefore it is undertaken only if the vision is profoundly less than normal. Optic nerve glioma can have intracranial extension with time making regular follow up manadatory.

Cavernous Haemangioma

Cavernous haemangioma is one of the commonest orbital tumors seen in adulthood. It causes a slowly progressive painless proptosis in a young adult. Vision is not affected. The origin of the tumor is probably progressive opening and dilatation of preexisting abnormal blood vessels. The tumor is well encapsulated and consists of vascular spaces. It does not spread to other organs in body. Surgical excision of the tumor, toto, is curative.

Chapter 29

Foreign particles on the eye

Specks of dust, waste and carbon particles, blown by wind may stick to the surface of the eye. If it is not removed at once, it will cause irritation and opening the eye will be painful. If it sticks to the cornea, its epithelium will be damaged and an ulcer might develop. Ulcer in the cornea affects eye sight. Bacteria, virus and fungi may enter the eye, multiply and cause a lot of problem. It takes long time for the ulcer to heal and depending on the scar, the sight may be affected permanently.

If foreign particles fall on the eye, it must be washed with clean water. The affected person must be made to lie comfortably and a kidney dish is kept above the ear. Clean water must be poured slowly asking the patient to roll the eye and widen it. The whole eye must be washed. If the foreign particle does not stick to the eye but lies simply on it, it will be washed away. But if the irritation continues even after washing the eye, and if the particle is visible, the patient must go to the doctor. He will remove the particle after applying local anaesthesia. It must be realised that rubbing the eye or batting the eyelids will make the particle stick more firmly and this will damage the eye tissues.

So if a foreign particle is seen on the cornea, no attempt must be made to remove it. After bandaging the eye, the person must be taken to the doctor.

Construction workers, and workers involved in white washing buildings will suffer from lime, mortar and cement injury in the eye. These substances will cause irritation and severe injury to the eye. Children playing with polythene bags containing soap nut powder, or lime will get them in the eye. Then the eye must be washed with clean water continuously. The wash should be copious. The patient must be taken to the doctor immediately

Acidic or alkaline substances may fall on the eye of people working in laboratories or certain industrial units. Eyes must be washed with clean water and the person must be taken to the doctor. The substances causing irritation can be removed. These substances which burn the tissues cause ulcers on the surface. When they heal the conjunctiva will stick and the patient may not be able to open the eyes.

Ten days after birth, some infants, may have watering and pus in the eye and they will not be able to open their eyes. They must be taken to an eye specialist immediately. This is caused by the microorganisms present in the vagina of the mother during child birth. If they are not attended to immediately, they may lose their eyesight.

Pieces of stone or particles of iron may enter the eye, and may penetrate the cornea of people working in smithies or lathes. This will cause pain and might affect eye sight. When this happens, the affected eye must be lightly bandaged and the patients must be taken to the doctor.

Car accidents and crackers may cause injury to the eyes. Only an eye specialist can estimate the extent of damage to the eye. There may be haemorrhage and this unprotected state may allow microorganisms to enter the eye and cause infection. So a clean piece of cloth must be kept on the eye and bandaged. The patient must be taken to the doctor.

When the eyelids and the tissues around it are hit hard, there will be haemorrhage and the blood collects in the cavity and coagulates. There will be black eye. There might not be any injury or the eye may have a blow out fracture. The eyelids may swell anyhow, they must be separated and the eyesight must be examined. The eye specialist will examine whether the tissues around the eye are damaged and will give treatment.

Children playing with sharp objects like rods or sticks, may be hit by the sharp objects. When the agricultural labourers plough the fields, mud may splatter and fall on the eye. Eye has to be cleaned with pure water several times. If a thorn has prick, occurs the cornea may be damaged. The eye must be covered with a clean piece of cloth and the patient must be taken to the doctor. Many patients approach the eye specialists only with corneal ulcer because of native medication. Even when the injury heals there will be permanent damage to the eye in the form of scars.

In villages when a particle falls on the eye, it is removed with the help of the tongue of a quack. This practice is harmful. If the foreign particle is embedded, it cannot be removed by the tongue. The microorganisms on the tongue will cause infection.

In acute congestive glaucoma there will be unbearable pain, reddening and watering of the eye with headache and vomiting. Such cases must immediately approach an eye specialist. He will start the treatment to reduce pressure and save eye sight.

Sometimes cataract may mature and burst. It will be painful. If it is not surgically removed, there will be pain with loss of eye sight.

Whatever be the defect, applying herbal juice or self medication will cause complications leading to loss of sight.

How to prevent injuries to the eye

At home

Many household equipments may cause injury to the eye

- The nozzle of the vaccum cleaner must be kept away
- Wear protective glasses while using strong chemicals

In industries

When engaged in work, flying missiles like metal particles may fall on the eye.

- Always wear protective glasses
- Examine the instruments before use. Follow the procedures given
- Use protective mask while involved in welding or similar work to protect the eyes from the welding flash
- In many cases, carelessness, may cause injury to the eyes of children. Toys or playing objects may also cause injury. So when choosing a toy, bear in mind the age of the child and his ability to use them. Avoid giving bow and arrow or gun to the children. When children play, their parents/teachers must watch them carefully.
- Do not allow the children to play with sharp articles like scissors and knives.

In the garden

Many garden equipments and chemicals may cause injury to the eye.

- Do not allow any one to stand in front of you while removing the grass.
- Children must be careful while walking under branches of trees. The nozzle of chemical sprayers must be kept away from the user.

While washing the car

- Remember that the exhaust fumes and sparks may cause severe injury to the eye.
- Put out cigarette or open flame before opening the bonnet. If you want to see the engine at night, do not use open flame; use a torchlight; use protective glasses ready. Don’t lean on the battery while joining wires. While watching a game keep away from places where crackers are exploded.

Chapter 30
Enucleation and artificial eye fitting

It is unfortunate that one should lose an eye. In order to save life or to save a healthy eye, diseased eye has to be removed. This chapter deals with conditions which require it, the after effects and how artificial eye fitting is done to restore facial appearance.

In enucleation, the eye ball and a part of the optic nerve is removed. The outer layer (conjunctiva) is left back. The major reasons for removing the eye ball are:

a. Tumours of the eye
b. To save the healthy eye when the other eye has inflammation due to severe infection.
c. When the eye is damaged beyond recovery in accidents or attacks.
d. Painful blind eye

There are two procedures by which the eye is removed depending upon the nature and type of the disease. In one procedure, the sclera is kept intact and all the inner parts are scraped. This is called evisceration. In another procedure, the eye ball is completely removed and this is called enucleation. Whatever be the procedure, the pain subsides immediately. In corneal ulcer and perforation, contents of the eye come out and the eye will shrink with time. In such cases artificial eye cannot be fitted.

The following complications may arise due to enucleation

A. Change in the shape of the socket

When the eye is removed many changes take place in the structure and functions of the socket.

i. The supply of blood becomes less.
ii. The fatty substance protecting the eye from shock and pressure will shrink and become small in size.
iii. The muscle controlling the eyelids weakens.
iv. If the eye is removed in childhood, the socket bones will not develop properly.

B. Sympathetic ophthalmia

As already pointed out in chapter 27, following injury to one eye or after surgery, the choroid, iris and ciliary muscles may be inflammed. The other eye also can develop similar inflammation. This condition called Sympathetic Ophthalmia. The infection in one eye may affect the other through the optic nerve because the optic nerves of both eyes cross each other under the cranium. Sympathetic ophthalmia does not occur immediately. It can even occur after months or years. But if the injured tissues of the eye get healed, the other eye is not generally affected. Symptoms of sympathetic ophthalmia are irritation, watering and photophobia. There will be pain and dimness of sight. They may subside and recur.

The onset of Sympathetic Ophthalmia may be slow or may be sudden severe. The eye becomes red and the irritation becomes severe. A close examination (with slit lamp) will reveal the changes. When it becomes severe the iris become thick and will have new blood vessels on it. The intraocular pressure will increase. The vitreous fluid will become turbid and opaque. Finally there will be retinal detachment.

Treatment

The onset of the above state must be prevented. When it is certain that the restoration of vision to the affected eye is not possible, it must be surgically removed within 10 days of injury/infection in order to

save the healthy eye.

But, if it is possible to save sight at least partially, removal of the eye may not be necessary.

In the early stages of Sympathetic Ophthalmia, atropine drops, cortesone, and antibiotics must be given. The eye must be given rest. The general health of the patient must be maintained, as the treatment will be prolonged.

Haemorrhage

When the eye is removed, there may be profuse bleeding. Before cutting the optic nerve, it must be squeezed well and blood vessels must be incinerated. Bleeding can be further presented by pressing with sponge like gelform or layers of gauze in the socket.

Rarely, while removing the eye, perforation in the eye can also occur accidentally. The muscle controlling the eyelid, conjunctiva and tenons capsule must not be damaged at any cost.

Infections

After surgery, the socket can be infected. This can be treated with antibiotics administered orally or directly to the socket by application of topical drops.

Drooping of the eyelid

During surgery, the upper muscles controlling the eye will be strained. The third nerve fibres of the eye and the muscles controlling the eyelid lose their strength. So the eyelid will droop fully or partly. Care during surgery will prevent such complications.

Shrinking of the tissues of the socket

If the conjunctiva is not separated from tenons capsule carefully, the socket will become elevated and it will become difficult to fix artificial eye.

Cysts

Cysts may form in 20% of the patients after surgery. If they are big it will be difficult to fix artificial eye and they may have to be removed.

Evisceration

Hence there is no need to remove the eye completely, the conjunctiva and tenons capsules are kept intact, the damaged inner parts are scraped.

There are many advantages

a. There will be little change or damage to the socket. Complications are averted. The muscles connecting the tissues of the eyelid and the tissues controlling the conjunctiva are also not damaged. So the movement inside the socket is not affected much.

b. So when the artificial eye is fixed, there is possibility of good movement. The drooping of the eyelid and other complications do not occur after surgery.

c. Some experts are of the opinion that when the eye is removed because of serious infection range, the tissues of the socket and brain may be infected causing inflammation of the membrane in the brain. So, in such conditions of infection, evisceration is better. But others feel that the possibility of such infection is less, because of modern antibiotic therapy.

d. Both procedures are equally good to alleviate extreme pain.

e. Evisceration can be done easily and in a short time. So this is suitable for weak patients.

The surgeon has to decide which procedure is better for a particular patient.

Fitting artificial eye

After removing the damaged eye, an artificial eye made of acrylic may be fitted to give an appearance of a real eye. After fitting artificial eye, the socket will not look empty. The lashes do not cause irritation.

The artificial eye has to be fitted as early as possible after fitting, the wound heals after surgery, at least within a month. It must be washed and kept clean. It cannot be removed during sleep at night. In case of problem due to the artificial eyes it must be changed with care.

Chapter 31
Dispensing of spectacles

This chapter deals with the dispensing of spectacles. The raw material used to make lens is known as 'Blanks'. There are number of varieties of blanks with varied diameters and thickness according to the power required. By means of machines known as spindle machines or by surface generators, the required curvature is made and then smoothed and polished. After finishing both sides the lenses are checked and they are filled in a frame.

Blanks are imported from U.S.A., U.K, Germany and other countries. In our country there is blank manufacturing unit at Durgapur but it is inadequate. So we have to import blanks from outside. Depending on the power required we select the blank for example for a cataract lens of +120 Dsh the blank must be 14mm thickness and 5mm diameter. Bifocal blanks, which are used for distance and near, are also being imported. This kryptok bifocal blank is made up of crown and flint. Flint button is fused with the crown at the reading area. For each power there are separate die (tool) to produce the curvature on the blank. The tools themselves will change the curvature after grinding lenses several times and they are to be set correct by trueing and testing with a metal guage. When the two surfaces are ground and polished, they are marked, cut, edged and fitted in a already selected frame.

In optical shops different varieties of frames are arranged and displayed. These frames are made of different varieties, plastics, shells, and metals. These materials are mostly imported from other countries. Some of them are produced in our country. Costly frames are imported from foreign countries and the cost will depend upon the size and the quality of the frame.

Patients with the spectacle prescription given by the doctor go to the optical shop for purchasing spectacles as per the prescription. They select the frame according to their choice, taste and fashion. The optician will ultimately help in deciding the suitable frame. The lenses were prepared as per the prescription, some times readymade lenses are available. Then lenses are examined for the power axis etc and optic center is marked. The two optic centers are kept opposite to the pupillary centers. The I.P.D. (Inter Pupillary Distance) is usually written in the RX. The other face measurements are taken at the optical shop by the salesman. The correct centering is needed to avoid prismatic effect and the subsequent discomfort and if the prismatic effect is more in the vertical meridian it can produce diplopia.

Afterwards the spectacles are tested in lensometer for its power axis and centering and sent to the sales counter. The spectacles are worn in the patient's face, and adjustments are done if necessary.

After wearing glasses patients may complain about headache, blurred vision and discomfort. Patients wearing spectacles for the first time will have some adaptive symptoms but if it persists even after two weeks then causes must be investigated. These may be due to decentring, power variation, axis not being correct, the frame not suitable, vertex distance problem, error in pantoscopic tilt, base curve difference of the old glass and present glass, incorrect segment height in bifocals etc.

Some patients wearing photochromic lenses which will darken in out-door and become clear in indoor. Research shows that this glasses keep the pupil dialated, more rays are allowed in so that they are likely to get cataract earlier. They are of many, types photogrey, photocrown. They are also called sun sensor or photo chromatic lens.

In addition to bifocals there are trifocals and multifocals. The latest of the multifocal is progressive lenses or varilux lenses which can be used for any presbyopes. This gives clear vision from infinity to near and resembles like a single vision glass, having no segment margin. This lens will have no jump effect and chromatic aberration.

There are protective lenses such as tinted lenses to absorb harmful radiation such as ultra violet and infra red rays. Unbreakable or toughened lenses are useful for children and other people working in hazardous circumstances.

Anti reflection coating lenses are very useful for drivers in the night to avoid ghost images formed by reflections from the surface of the lens and glare.

Theory classes for optician trainees

1. Introduction
2. Anatomy and physiology of the eye
3. Optics
4. Refractive errors
5. Types of lenses (spherical and toric cylindrical lenses, bifocal, trifocal, toughened)
6. Lenses formation (lensometer)
7. Thickness of lens calculation
8. Centering and decentering
9. Prismatic effects by decentering lens
10. Surface power calculation
11. Surfacing and grinding
12. Cutting and fitting of lenses in frames (glazing)
13. Lenses inspection
14. Optic center marking and axis marking
15. Tramposition: simple and toric
16. Writing of prescription
17. Varilux or progressive lens, types and mechanical details and fitting procedure
18. Tinted lenses
19. Polaroid lenses
20. Anti reflection coating
21. Photo chromatic lenses
22. Lenticular lenses
23. Types of frames
24. Frame selection
25. Counselling and communication skills
26. Face measurements salesmanship

Types of spectacle frames

- Materials used in frames
- Frame measurements
- Types of faces
- Choice of colour
- Final fitting adjustments
- Final checking
- Final fitting and manipulation
- Checking bifocal fitting
- Advice to patients