Pamphlets on Causes and Prevention of Hearing Loss - A Teaching Aid for The Layman

Register No. M 9518

An Independent Project submitted as part fulfilment for the

First Year M.Sc. (Speech & Hearing)

to University of Mysore.

ALL INDIA INSTITUTE OF SPEECH AND HEARING

MYSORE-570 006

May-1996

Dedicated to
My Parents
and Akka

CERTIFICATE

This is to certify that the independent project entitled "Pamphlets on Causes **and Prevention of Hearing** Loss - **A Teaching Aid for The** Layman" *is a bonafide work done in part fulfilment for the year degree of Master of Science (Speech & Hearing), of the student with Register No. M 9518.*

Mysore
May 1996

Director
All India Institute of Speech and Hearing
Mysore - 570 006

CERTIFICATE

This is to certify that the independent project entitled
"Pamphlets on Causes and Prevention of Hearing Loss - A Teaching Aid for The Layman" *has been prepared under my supervision.and.guidance.*

Mysore
May 1996

Dr. (Miss) S. Nikam
Guide

DECLARATION

I hereby declare that this independent project entitled "Pamphlets **on** Causes **and Prevention of Hearing** Loss - **A Teaching Aid for The** Layman" *is the result of my own study under the guidance of Dr. (Miss) S.Nikam, Professor and Head, Department of Audiology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier at any other University for any other Diploma or Degree.*

Mysore
May 1996

Register No. M 9518

ACKNOWLEDGMENTS

*My sincere thanks to **Dr.S.Nikam,** Director, All India Institute of Speech and Hearing, Mysore, for her guidance, support and encouragement throughout this project.*

*I thank **Mrs. P. Manjula** and **Mrs. C.S. Vanaja,** rendering their help whenever I needed.*

*Dear **Papa** and **Mama** - even if I sometimes forget to tell you, the strength of your love, your support and enthusiasm means the world to me.*

***Akka** - Thanks for always being there when I need you I wouldn't trade you for anyone or anything in the world.*

***My friends** - thanks you for caring. Your support and rich humour has made all the difference in my life Each one of you will always hold a special place in my heart.*

***Spaceage** - Many thanks to you for having typed this manuscript Your attention to detail and willingness to undertake even the most tedious task is appreciated greatly.*

Reg No. M 9518

CONTENTS

INTRODUCTION

Man has been bestowed with wonderful gifts from nature, the gift of thiking, the gift of speech, the gift of smiling, the gift of sight and lost but not last the gift of hearing.

Now, for the purpose of communication the hearing system and the speech system play an important role. Our ideas, thoughts and feelings are communicated to others by means of speech, and the hearing apparatus helps us to hear the speech of others and also our own speech. Imagine the state if one had as power of speech or could not hear what you are trying to say, life would no longer be the same. Therefore, the gifts of nature have to be protected.

"Prevention is better than cure", this statement will be valid for generations to come. If one has to prevent, one should have an awareness of the impinging harm. In a vast country like India where the populations runs in crores and crippling handicaps such as poverty and illiteracy are present, spreading awareness among the general public is of chief importance.

People benefit from such information and thus help in reducing the incidence of various disorders.

On and off, professionals of speech and hearing have been doing the job of creating awareness among people. People have benefits from such public

education programs. Research and surveys have proved taht public education

has difinitely helped to decrease the prevalence of the disorders.

There are various modes through which public education can be brought about. Television, radios, news papers, posters etc are some of these. Pamphlets are also a media through which public education in conducted.

Pamphlets generally contain very precise and relevant information which are wirtten in simple language comprehendable to the average man. They give a general picture about the topic being discussed and also provide information on how/whom to contact if further information is needed.

In this project some of the questions regarding speech and hearing, arising in the minds of most common people are addressed. There are, in all, 5 pamphlets. Each pamphlet is accompanied with its general introduction separately. The pamplets have been prepared keeping in mind public education.

INTRODUCTION TO PAMPHLET NO. 1.

Sound and Hearing

Just close your eyes for a minute and listen. Initially we hear nothing, but slowly we become aware of so many sounds which are familier to us but to whcih we do not pay any attention.

As we continue on this trend of thought some very basic questions arise in our mind, such as :

What is sound?

What is it made up of?

How does it affect us?

How do we hear it?

How do we measure it?, etc.

The following topic deals with explanations for such quesions. It is impossible to study the abnormalities of human hearing without a basic understanding of the physics of sound and some of the properties of its perception and measurement.

Now, sound is generated when some force sets an object into vibration. The sound is carried through the air around us. On the form of a pressure wave. When a sound wave reaches the ear it is father processed and hearing takes place.

Sound can be described interms of measurable attributes such as:

Frequency:

Intensity

Phase

Human reactions to sound are pyschological and reflect such subjective experiences as pitch, loudness, sound quality and the ability to tell the direction of a sound source.

Thus, we see that sound can be defined in terms of either physical or psychological phenomena.

In the physical sense, sound is a series of disturbance of molecules within a medium.

In the psychological sense, sound is an auditory experience - the act of hearing something.

When air molecules are disturbed by a body set into vibration, the molecules move away from the point of disturbance. They strike the adjacent molecules. Because of the elasticity of the medium, the molecules return to their original point of rest. (after having displaced the adjacent molecule). When the molecules are pushed close together, they are said to be condensed / compressed and when space exists between areas of compression; this area is said to be rarefied. This successive compression and rarefaction of the molecules sets up a motion called waves, sound travels in the form of waves.

Frequency:

Nothing may transpire without the passage of time. Frequency is the means of explaining how frequently the body vibrates over a period of time.

Increase in the number of vibrations results in a higher frequency. Similarly decrease in the number of vibrations results in a lower frequency.

Frequency is expressed as cycles per second (c.p.s) or Herlz (Hz).

Intensity:

Intensity refers to how much the body vibrates or the strength of the particle vibration. Depending on this energy is produced. Intensity is the amount of sound energy per unit area. Intensity of sound decreases as the distance between the sound source and listener is increased.

Intensity is expressed in decibles (dB)

Decibel is the unit for expressing the ratio between two sound pressures or two sound powers.

Quality:

Some sounds may be very pleasing to hear, but others may be very harsh or irritating. Here we are referring to the quality of sound.

Example: Different people like different kinds of music. Music liked by some people may seem to irritate others.

Any unwanted sound is noise.

How Do We Hear Sounds:

When sound is produced it travels in all directions. The sound waves are collected by the pinna which is part of the external ear and directed through the ear canal at the end of which lies the ear drum.

Now, the ear drum vibrates and these vibrations are transmitted to the middle ear.

The middle ear has three small bones also called ossicles. They help in transmission of sound energy from the outer ear to the inner ear. The middle ear matches the acoutic impedance of air to the impedance of the inner ear..

The sound is then transmitted effectively to the inner ear without much loss due to impedance mismatch.

The inner ear has sensory haircells and fluids. When sound is transmitted to the inner ear, movement of the fluid occurs and this in turn causes. Stimulation of the hair cells. This is picked up by the nerves (VIIIth cranial nerve) and the message is taken to the brain where meaning is art ached to it.

There are two ways in which sound reaches the inner ear.

(i) Air conduction route:

Which has just been described, i.e., through the outer ear to the middle ear and the inner ear.

(ii) Bone conduction route:

The inner ear lies within the skull bones. Vibration of these bones causes movement of thefluid in the inner ear directly.

This causes movement of tiny cilia on haircells called stereocilia and transmission of impulses to the brain takes place.

The human ear can perceive sounds in only a certain range of frequencies (audio frequencies) i.e., between 20-20000 Hz. and intensity range from (0-20 dBSPL), Intensities of 140 dBSPL and above cause pain.

If there is some damage to the auditory or hearing system, the ear will not be able to pick up or transmit sounds efficiently and this leads to hearing loss.

PAMPHLET NO.l:

Sound and Hearing:

We hear so many sounds in our daily life.
What is sound?
What is it made up of?
How, do we measure it?
This pamphlet helps to solve such doubts read on.

What is sound?

Sound is said to be produced when some force sets an object into vibration.

Example Veena, Guitar etc.

How does sound travel?

Sound, produced by the sound source such as Veena, drum etc. is carried in all directions by the particles of the medium surrounding it, be it a solid, liquid or gaseous medium. Sound travels in different velocities or speed in different media.

Sound travels as a pressume wave and only when a sound wave strikes the ear; hearing takes place.

How do we measure sound ?

Sound can be described in terms of measurable attributes such as:

* Frequency.
* Intensity
* Quality

Frequency:

This is the rate or the number of times the sound source vibrates per second. Increase in the number of vibrations results in a higher frequency.

Frequency is expressed in Hertz(Hz) or cycles per second (cps)

Ex: Drum produces low frequency sound and whistle produce high frequency sounds.

Intensity:

This refers to the strength of the particle vibration or how much energy has been transferred.

Ex: When a pin is dropped, only a small sound is heard but when a balloon bursts, the intensity is more, therefore, the sound is much louder.

Intensity is expressed as decibels (dB)

Quality

Some sounds may be very pleasing to hear, but others may be very harsh or irritating. Here, we are referring to the quality of sound.

Ex: Different people like different kinds of music. Music liked by some people may seem to irritate others.

Noise: Any unwanted sound is noise.

How do we hear sound ?

When sound is produced; it travels in all directions. The sound waves are collected by the pinna, which is a part of the external ear; and directed to the ear canal at the end of which lies the ear drum. Now, the ear drum vibrates and these vibrations are passed on to the ossicles of the middle ear.

The middle ear has three small bones / ossicles. They increase the sound energy by a complex process. The sound is then transmitted to the inner ear.

The inner ear has sensory haircells and fluids. When sound is transmitted to the inner ear; movement of the fluid occurs and this in turn causes movement of the haircells. This is picked up by the by the nerves (VIIIth cranial nerve) and the message is conveyed to the brain via. the auditory pathway where is interpreted

There are two ways in which sound reaches the inner ear.

(i) Air conduction route: which has just been described.

i.e., Throughthe outer ear, middle ear to inner ear and then to auditory centers in the brain.

(ii) Bone conduction route: The inner ear lies within the skull bones. Vibration of these bones causes movement of the fluid in the inner ear directly. This causes movement of haircells and transmission of impulses to the brain.

The human ear can perceive sounds in only a certain range of frequencies. Between 20 - 20,000 Hz, and in an intensity range of 0-120 dBSPL. Intensity above 140 dBSPL causes pain.

If there is some damage to the auditory or hearing system, the ear will not be able to pick up or transmit sounds efficiently and this leads to hearing loss.

INTRODUCTION TO PAMPHLET NO. 2.

THE EAR AND HEARING LOSS

For primitive man, survival largely depended on the acuity of his senses. his hearing, particularly, served as his radar screen. The footfalls of friend or enemy, the movement of game, the differential vocal calls of group members, the messages transmitted via drums, were all scrutinised by this versatile warning system. Undoubtedly, those who stood the test of time where those endowed with good hearing.

Our hearing is no less vital for us than it was for those in the bygone ages. From birth onwards, important links with the environment are forged and maintained through the sense of hearing. Children learn to talk by listening to and imitating people around them. Much of our knowledge about the world, people and places is gained through our ears. We rely on our hearing to alert outselves as well as to bring to us the pleasures of sound-both natural and man-made. Our hearing also performs a reassuring function in continuously transmitting information about the environment.

A hearing defect, therefore, can profoundly affect an individual's life. Children born with severe hearing loss are deprived totally or partially of a major channel of learning. In addition, defective speech skills and abnormal voice quality are common results, further, linguistic skills such as reading, listening and writing may also be adversely affected. The effect of even a mild hearing loss would be much more pronounced in children than in adults.

For older persons also, the impact of hearing loss is devastating. Withdrawal from active living may follow as other skills become affected. In

normal speech production, the speaker hears himself and can identify or correct any error he makes. Since this feedback is not available to the severely hearing impaired individual, deterioration of speech may follow. In addition, his judgement of distance and location of the sound may become disturbed. Hence, hearing loss imposes barriers that not only create loneliness and frustration but also endangers an individual's life.

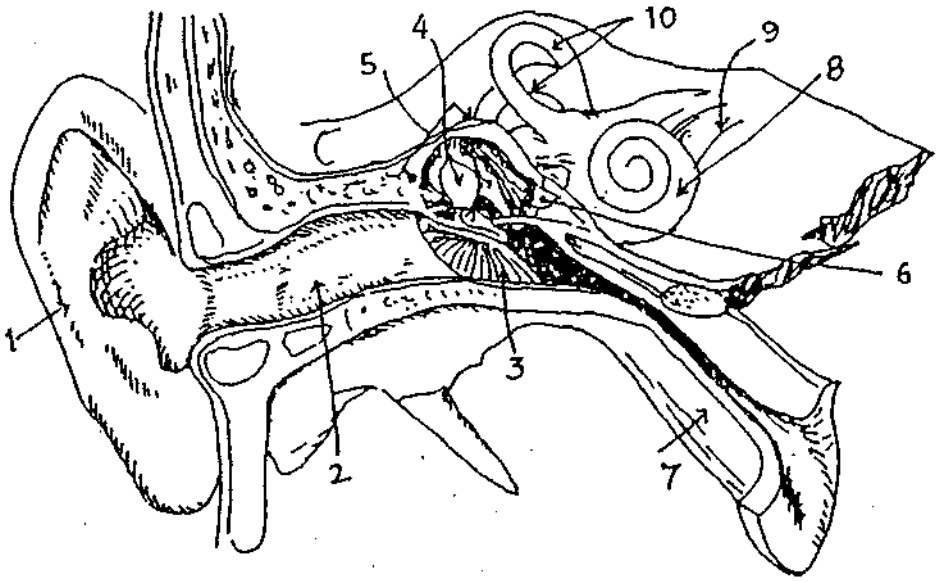
Hearing loss may set in gradually or may be acquired suddenly. In the fomer, at the outset, only the ability hear soft sounds such as whispers or a watch tick may be lost. After a lapse of months/years the condition worsens. Difficulty then may be encountered in listening over the phone, in a lecture hall or in following conversation. Sudden hearing loss on the other hand, may be total and acquired within a few hours.

Hearing loss can be caused by several factors which may operate before, during or any time after birth. It could also be hereditary. Such loss could be apparent at the time of birth or may manifest itself in late childhood or in early adulthood.

A brief description of the hearing mechanism is included here to facilitate better understanding of the causes of hearing loss.

THE HEARING MECHANISM

The different parts of the auditory pathway are discussed below. The hearing mechanism can be divided into four parts viz., the external ear, middle ear, inner ear and the auditory pathway.



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3. EAR DRUM
4. MALLEUS
5. INCUS
6. STAPES
7. EUSTACHIAN TUBE
8. COCHLEA
9. AUDITORY NERVE
10. SEMI CIRCULAR CANALS

The external ear consists of the pinna and the external auditory canal, the pinna is a flap like structure that is visible externally. The ear canal is a curved tube leading inwards to the ear drum. The external ear aids in collecting and channelizing sound waves for onward transmission into the middle ear. It also aids in determining the direction of sound sources.

The middle ear is an air-filled cavity bounded by six sides. It contains a chain of three tiny bones, the ossicles, which connect the ear drum with the bony wall of the inner ear. It also contains certain muscles, ligaments and the opening of the eustachian tube. The contraction of the muscles controls the movement of the ossicular chain. The ligaments connect the ossicles with the walls of the middle ear thereby acting as supporting structures. The eustachain tube connects the middle ear with the upper portion of the throat (nasopharynx).

The middle ear is an important structure as it bridges the external and the inner ear. If the middle ear were to be absent, transmission of vibrations from the external to the inner ear would not have been efficient.

The innermost portion of the ear, the inner ear, houses the organ of hearing (Cochlea) and the organ of balance (vestibular system). The former is composed of many specialised cells and other supporting structures. These are surrounded by a fluid medium. The fluid is set into motion by the vibrations transmitted by the ossicles. This fluid movement in turn, activates the hair cells, resulting in generation of electrical impulses.

The impulses generated in the cochlea travel along the auditory nerve to the brain. Some of the nerve fibres of the auditory nerve starting from one ear, on their way to the brain, cross over to the opposite side, terminating in the opposite side of the brain. Thus, some nerve fibres starting from the right ear would terminate in the left half of the brain while some others starting from the same ear would ascend to the same half of the brain. Each ear is hence represented in both hemispheres of the brain.

Enroute to the brain, the fibres of the auditory nerve form way-stations at various levels in the pathway with other nerve cells. The fibres finally reach the "hearing centre" in the brain. Impulses arriving here are analyzed and interpreted as sound.

Another set of fibres begins at the higher centres and descends to the cochlea. Thus, there is two way communication between the ear and brain. Impulses can travel upwards from the cochlea to the higher centres and downwards from the higher centres to the cochlea.

A defect in structure or function may occur in any part of the auditory system. Depending on the location of the defect, the problem may be one of sound transmission from the external to the inner ear, conversion of these vibration into

electrical impulses conduction of these impulses to the higher centres or in their analysis and interpretation.

The major causes of hearing loss are herein grouped with reference to the parts of the ear they affect.

CONDITIONS ASSOCIATED WITH HEARING LOSS

The External Ear:

Hearing loss in the external ear may be caused by several factors which are outlined below:

a) Congenital malformations:

i) **Malformation of the pinna:** This could be complete absence or an incomplete development. This condition does not cause a significant hearing loss if the other structures of the ear are intact

ii) **Closure of the ear canal:** Closure can be complete or partial, in one or both ears. In such cases the hearing handicap may not be significant because the alternative mode of transmission - through the vibration of the skull bones-enables the signal to reach the inner ear. However, it is often accompanied by malformation of the middle and inner ear, in which case hearing loss may be severe, i.e., speech and other environmental sounds will not be audible to the individual.

b) Blockage of the ar canal: This could be caused by:

i) **Impacted wax:** Hardened wax may completely or partially seal off the ear canal, preventing sound waves from reaching the eardrum or hindering the movement of the eardrum. Hearing loss may be mild in such cases, i.e., difficulty may be encountered in hearing soft sounds.

ii) **Foreign bodies:** Foreign bodies like seeds or pebbles may cause hearing loss by blocking the ear canal or by causing injury to the eardrum. They may be inserted into the ear canal by children during play. In the case of adults, insets constitute the most commonly found foreign bodies, hearing loss may be of mild to moderate degree.

c) Infections of the external ear:

The external ear can be infected by various organisms, the most common being the fungal infection observed among swimmers. This could give rise to mild hearing loss, it may be accompanied by symptoms such as itching and pain.

The Middle Ear:

Hearing loss associated with the middle ear may arise due to:

a) Rupture or perforation of the eardrun:

The eardrum may be torn while removing wax with a sharp object like a hairpin, by foreign bodies by exposure of the ear to sudden loud sound or because of some disease conditions in the middle ear cavity. When this occurs, sound waves that strike the eardrum are not effectively transmitted to the inner ear.

b) Infections of the middle ear:

Middle ear infecdtion is one of the most common causes of conductive hearing loss. Infections of the nose or throat such as a cold or sore throat can be transmitted through the eustachain tube to the middle ear. While blowing the nose hard, nasal secretion may be forced into the eustachian tube and then to the middle ear where it can cause infection.

When it is infected, the middle ear gets filled with fluid. As the amount of fluid increases, pain in the ear gets worse. Finally, it tears open the eardrum. The fluid drains out through the external auditory canal and the pain is reduced. Such a spontaneous recovery may not occur if the infection persists and the condition becomes chronic.

If proper treatment is instituted in the early stages, hearing returns to normal or near normal. However, if untreated, middle ear infections can lead to

several complications like meningitis, encephalitis or brain abscess. Caution should particularly be exercised when the discharge is scanty and foul-smelling.

c) Ossicular abnormalities:

For normal sound conduction, the ossicles must be properly connected not only with each other, but also with the eardrum at one end and the oval window situated on the bony cochlear wall at the other. Hearing loss results if there is:

i) Congenital absence of one or more ossicles.

ii) Accidental fracture of one of the three ossicles.

iii) Improper connection among the ossicles themselves

iv) Fixation of one of the ossicles

v) Fluid or any growth in the middle ear which impedes the movement of the ossicles.

vi) **Otosclerosis:** This is a hereditary condition affecting stapes (one of the ossicles) and the inner ear wall. The prevalence of otosclerosis among Indians is fairly high. Initially only the conductive mechanism is affected and can be rectified surgically. However, if untreated, the disease process cantinues, eventually it may involve the inner ear too.

The inner ear and the Auditory Nerve:

Hearing loss can be caused by problems of the inner ear and the nerve leading from it to the brain. Any hearing loss resulting from impairment of the cochlea or auditory nerve is called sensorineural hearing loss. This type of hearing loss can be caused by:

a) Congenital malformation of the inner ear:

Maldevelopment of the inner ear can be caused by pathological conditions affecting the mother during pregnancy. Such as bacterial or vital infections, drug consumption, exposure to X-rays or any injury to the mother.

Birth complications like prolonged labour, instrumental delivery, or inadequate oxygen supply, could result in damage to the inner ear or higher centres in the auditory pathway.

The probability of occurrence of malformations of the inner ear is greater in children born in families with a history of hearing loss. In cases of hereditary hearing loss, malformations may range from a mild anomaly to complete absence of the cochlea.

b) Destruction of the hair cells of the cochlea:

The cochlear hair cells can be adversely affected by several factors, as mentioned below:

i) Aging: Advancing age is the most common cause of sensorineural deafness. This type of hearing loss is called "Presbycusis". It is attributed to physiological degenerative changes affecting the hair cells, supporting structures in the cochlea and the higher centres in the auditory pathway.

Presbycusis does not become apparent in all people at the same age. There are some old people who have good hearing and young or middle aged people who have a hearing loss due to aging.

ii) Trauma/injury: Permanent injury to the structures within the cochlea can be incurred by exposure to a sudden blast of sound like an explosion, gunblast, etc. Profound sensorineural hearing loss can result from such an injury.

A violent blow on the external ear, too, can cause permanent damage to the inner ear. Sensorineural deafness may also be caused by fracture of the skull bone (temporal bone) housing the auditory structures. This may result from automobile and other accidents

ii) Noise: Continuous exposure to noise like that in factories, engine rooms, etc., can gradually lead to sensorineural hearing loss. The sensation of decreased hearing sensitivity after coming out of a noisy place. Such as a flour mill, is commonly experienced. After a few hours rest to the ears, hearing reverts to normal. However, this temporary hearing loss can become permanent if exposure continues over longer periods of time. How fast hearing-impairment occurs depends on the level and composition of noise present, duration of exposure and the susceptibility of the person to noise. Intake of drugs concurrent with noise exposure, has been known to increase the probability of hearing impairment.

iv) Drugs: Certain drugs like Quinine, Streptomycin, Kanamycin etc., have proven to be harmful to the ear. They are known to destory the hair cells and other structures within the cochlea. Since they are life-saving drugs, a total ban on their use is not possible.

v) **Vital and bacterial infefctions:** Impairment in hearing may arise subsequent to viral or bacterial infections. Viral infections like mumps, measles, and small pox are known to cause hearing loss. One example of a bacterial infection which could severely depress hearing is typhoid.

"Brain Fever" (encephalitis, meningitis) following viral or bacterial infections could also damage the inner ear. These conditions could affect one or both ears causing severe hearing problems.

Additionally, infections of the inner ear following surgery or a spread of infection from the middle ear could also bring about significant hearing loss.

c) Changes in the pressure of inner ear fluids:

Hearing loss may result from alterations in the secretion, absorption and/or composition of the inner ear fluids. For instance, Meniere's disease, associated with pathological changes in the inner ear fluids, is characterisded by fluctuating sensorineural hearing loss, dizziness and tinnitus. Since both the hearing and balance mechanisms are situated close together, the symptoms related to malfunctioning of the two systems may coexist.

d) Abnormalities in the blood supply to the cochlea:

Degenerative changes in the cochlea resulting in hearing loss may arise from rupture or blockage of the main blood vessles or its branches supplying the cochlea. Hearing loss arising from inadequate blood supply is usually of sudden onset. It may be accompaznied by other symptoms such as dizziness. Sudden hearing loss due to vascular insufficiency is usually reversible if immediate medical attention is sought.

e) Destruction of the nerve cells of the auditory nerve:

The auditory nerve can get damaged along its pathway from the cochlea to the brain Tumours may arise on the auditory nerve. The tumour pressing on the auditory nerve may damage it, depending on its size and location. Hearing loss, nausea and dizziness are the common complaints. The ability to descriminate between speech sounds is also severely impaired in such cases.

Auditory Processing Disorders:

There are people who do not have hearing loss as it is conventionally undrstood. Such individuals have difficulty in utilizing all the information present in the sound stimuli even though they do not seem to differ from normal hearing persons in responding to soft sounds. They may also display deficits in attention, memory and reading skills.

Other causes of Hearing Loss:

Non-organic hearing loss is, as the name suggests - functional or psychological and without any organic basis. The person develops a hearing loss either consciously or subconsciously as an escape from emotional stress or responsibilities or to get certain benefits like monetary compensation.

From the foregoing, it is clear that the hearing mechanism is a delicate structure liable to damage by a number of factors. While some of these factors are beyond our control, there are many instances where appropriate and timely precautions could preserve one's hearing. Undergoing hearing tests periodically is one simple step that would aid in early detection and treatment of hearing defects. It must be remembered that hearing acuity once lost may not be regained. No

effort should therefore be spared to safeguard the magnificent device which is our hearing mechanism.

PAMPHLET NO. 2.

THE EAR AND HEARING LOSS:

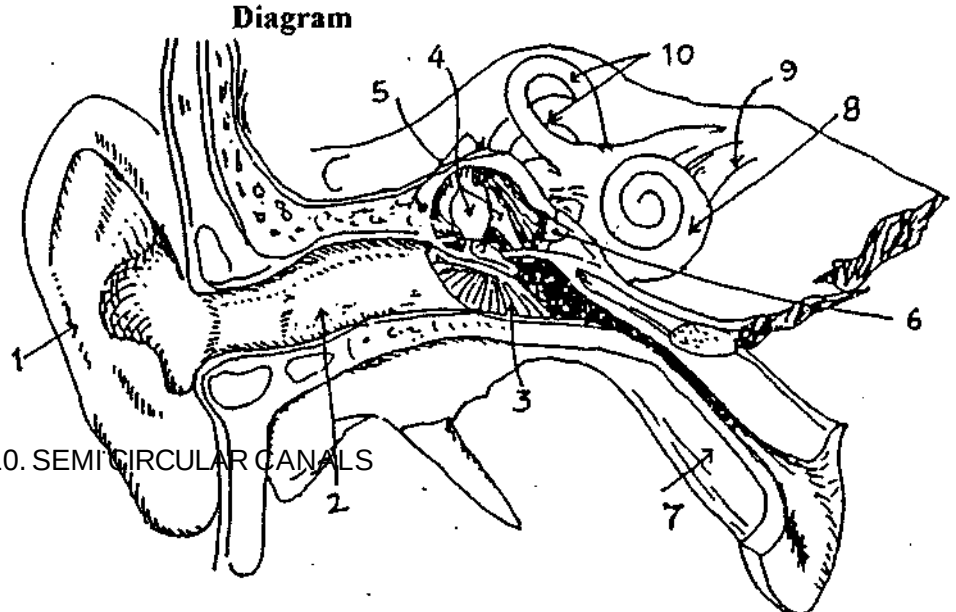
Man has five senses which are basic for his survival. They are the sense of vision (eye) olfactory/smell (nose), gustatory/taste (tongue), audition/hearing (ear) touch (skin).

Audition is one of the senses. The ear helps us to hear.

The ear has many parts and each part helps in its own manner. Damage to any part could lead to a loss in hearing. The parts of the ear and causes of hearing loss are discussed below:

The ear can be divided into four parts: External ear, middle ear, inner ear and auditory pathway.

Diagram



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10. SEMI CIRCULAR CANALS

The external ear consists of the pinna and the external auditory canal. The pinna is that part of the ear which we can see from outside. The ear canal is a curved tube which ends at the ear drum. The external ear helps in collecting the

sound waves and transferring them to the middle ear. It also plays a role in detecting the direction of sound sources.

The middle ear is an airfilled cavity, enclosed within six walls. It has a chain of three small bones called the ossicles which connect the car drum to the inner car. The middle ear also has connection with the nasopharynx through the eustachain tube.

The third part of the ear is the inner ear. It has the organ of hearing (cochlea) and the organ of balance (restbolar system). The cochlea has fluid, the movement of which activates haircells and this creates hearing impulses. These impulses travel along the auditory nerve to the brain.

The causes of hearing loss are many. They could affect any part of the ear, and cause hearing loss.

The External Ear:

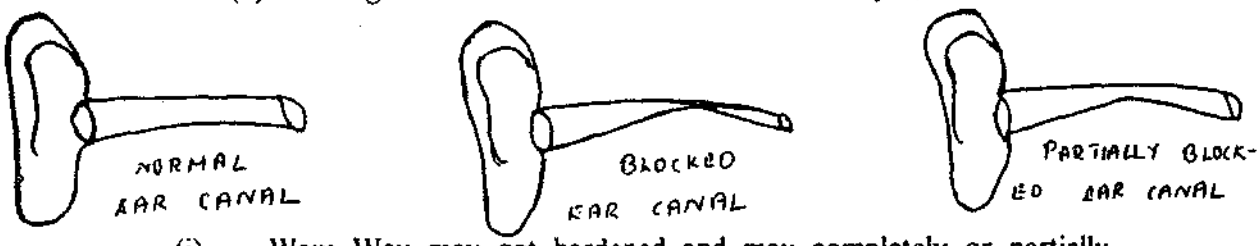
Hearing loss is the external ear may be caused by several factors which are discussed below:

(a) Congenital Malformations or abnormal formations of the ear: (especially the external ear) present since birth.

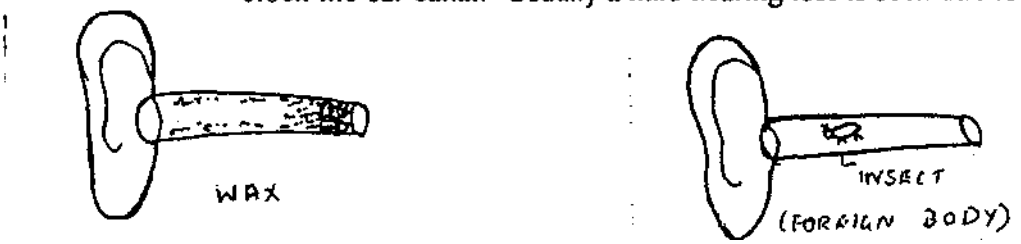
(i) Malformation of the pinna: This could be, complete absence or an incomplete development of the pinna. It usually does not cause much hearing loss.

(ii) The ear canal could be closed. This could be complete or partial, in one or both ears. Even this condition usually does not cause much hearing problem.

(b) **Blockage of ear canal**: This could be caused by:

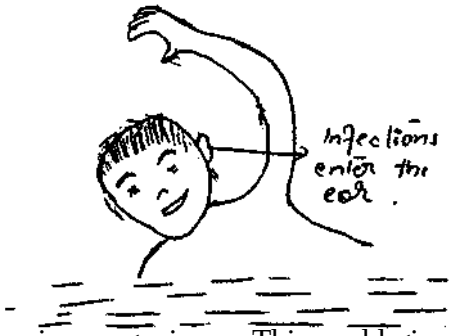


(i) Wax: Wax may get hardened and may completely or partially block the ear canal. Usually a mild hearing loss is seen due to this.



(ii) Foreign bodies: such as seeds insects, paper etc., may block the ear canal. The hearing loss in such cases would be of mild to moderate degree.

(c) **Infections of the external ear**:

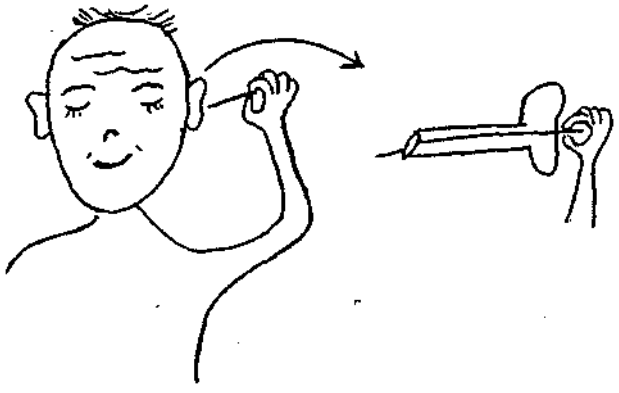


The external ear can be infected by various organisms. This could give rise to mild hearing loss, occurring along with other symptoms such as itching and pain.

THE MUDDLE EAR:

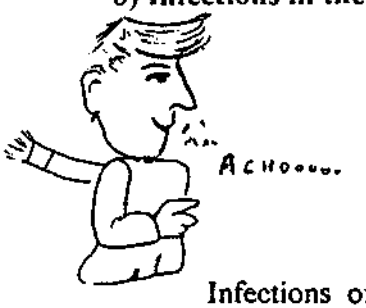
Hearing loss due to middle ear could be because of the following causes,

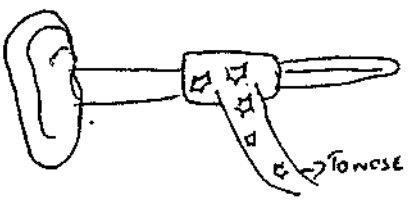
a) Rupture or tear of the ear drum.



The ear drum could be damaged while removing wax with any sharp object like; hair pin, or by a sudden loud sound near the ear or because of some disease in the middle ear cavity. Because of this, the sound waves are not transmitted properly to the inner ear.

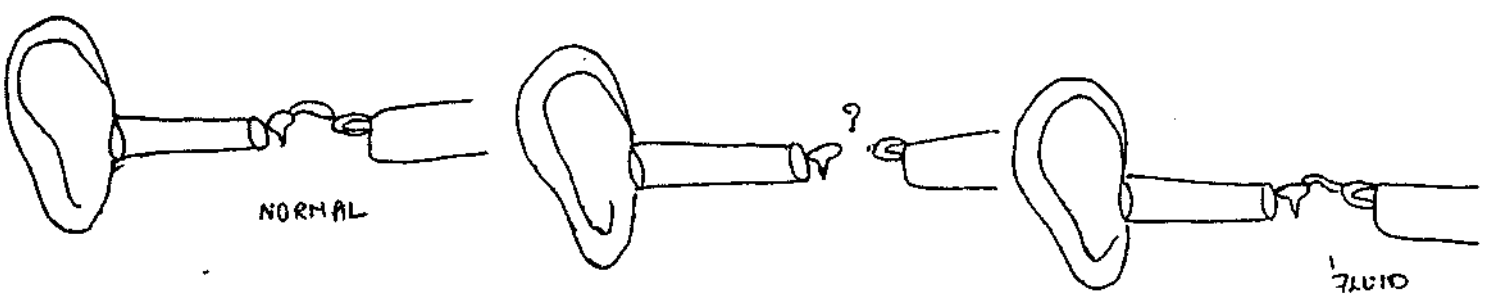
b) Infections in the middle ear.





Infections of the nose or throat such as cold could travel through the eustachian tube into the middle ear and cause infection. This infection leads to collection off luid in the middle ear, and later, the ear drum may tear open resulting in ear discharge. The hearing loss could be temporary or permanent, if long standing.

c) Ossicular abnormalities:



Hearing loss results if there is:

(i) Absence of one or more ossicles since birth

(ii) Accidental damage to any or all ossicles.

(iii) Improper connection among the ossicles.

(iv) Fluid collection or growth in the middle ear which affects movement of the ossicles.

(v) Otosclerosis: This is a disease where the hard bone of the stapes turns into spongy bone and so transmission of sound is affected. Temporary hearing loss occurs. It can be surgically restored. If nothing is done, the disease process continues and may reach the inner ear also.

INNER EAR AND AUDITORY NERVE:

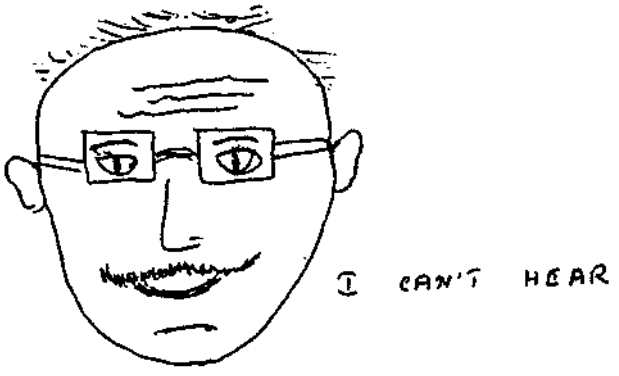
Hearing loss in the inner ear or the nerves usually cause permanent hearing loss. The causes are.

a) Malformation of the inner ear:

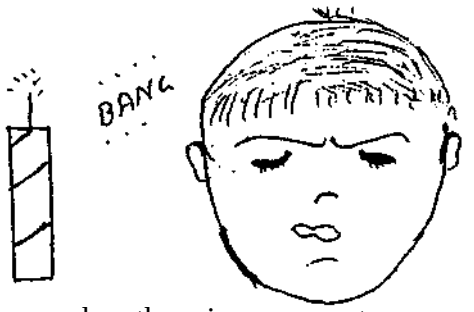
Due to some conditions affecting the mother during pregnancy such as infections, exposure to X-rays, taking drugs, or any injury to the mother, the inner ear of the child may not be fully developed.

Birth conditions such as, prolonged delivery, cessarian delivery, etc., could cause damage to the inner ear or higher center in the auditory pathway i.e., the nerves.

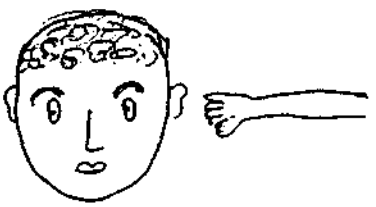
b) In the cochlea:

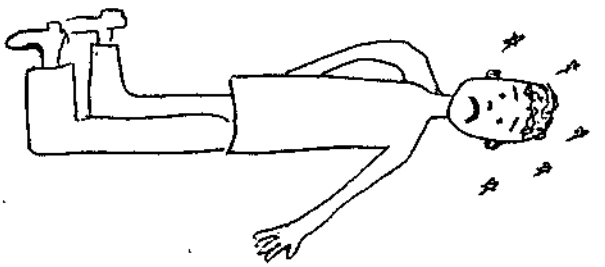


i) In some cases due to aging, the hair cells in the cochlea and the nerves could get affected causing permanent hearing loss.



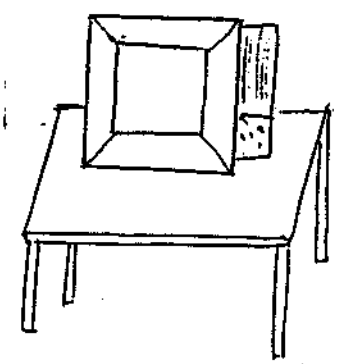
ii) Some times when there is exposure to a very loud sound the





If some one hits the ear with great force it could damage th inner structures and cause hearing loss.

iii) Noise:



If the ear is continuously exposed to noise like in factories, it could lead to hearing loss.

(iv) Drugs: Some drugs when taken are known to destory haircells in the cochlea and cause hearing loss.

(v) Virel and bacterial infections like mumps or typhoid could also lead to hearing loss.

(vi) After operation of the middle ear, some infections can occur which may cause hearing loss.

c) The inner ear is filled with fluid. Any change in the fluid pressure can cause hearing loss and also loss of balance of the body.

d) Abnormality in the blood supply to the cochlea may be present and this could be another cause for hearing loss.

e) Some times tumours or infections destory the nerve cells of the auditory nerve. The message is not sent to the brain and therefore hearing loss could result.

Other causes:

Some people may not be able to cope up with emotional stress. As a result, they may feel they have a hearing loss even though all the structures in the ear are normal.

INTRODUCTION TO PAMPHLET NO.3

CASE HISTORY

All of us have visited a doctor at one time and another. If we observe carefully we see that the doctor not only asks us questions regarding the current problem but also probes into the medical history. He asks us questions like:

"Did this happen before"

"At what age was it first seen"?

"What treatment was taken and for how long "? etc.

Why does the doctor do this? Why not just deal with the current problem? Why ask about events which occured years back ago? There is a very important reason for this.

First, let us answer the question.

What is case history?

Case history is a procedure wherein the history of the patients problem is looked into and details retgarding the patients prior condition is taken, which gives us important clinical information.

Minute, but significant data is collected from the history which gives us a much better picture of the factors leading to the present condition. The diagnostic process begin with information gathering. There are several methods of information gathering such as: case history taking, reports from other professionals, observation, reports maintained by the case, questionnaires; clinical testing etc. Case history is an important topi which aids in diagnosis.

Case history taking is conducted in an environment away from noise. There should not be any distracting pictures or books which may draw the.

attention away from the topic on hand. Interference of other people into the room should be minimum. The patient should be made comfortable and relaxed before case history is taken so that he/she feels free to give all the necessary information. Case history can be obtained in different ways. The examiner may directly ask questions to the patient or patients relatives or anyone who is aware of the individual" s life style and the changes occurring within it. The examiner may also give some questionnaires or inventories to acquire further information.

The case history taking differs based on the age and problem of the patient. For children, case history taking would generally involve obtaining general information initially, and later on the pre natal history (any disease, infection, trauma etc., which affected the mother during pregnancy), the perinatal history (complications during pregnancy like prolonged labour, breech delivery etc.) the post natal history (any problem which the infant faced soon after birth)

Questions regarding issues such as consaguinity (blood relationship between the parents) family history and if the problem is congenital or acquired. If acquired, then data regarding the age of onset, progress of the problem patients state before the occurrence of the problem is acquired. To evaluate the effects of an illness, it is essential to obtain pertinent data on the mother's condition during pregnancy, genetic factors and a detailed account of the course of labour and delivery.

Genetic factors:

* Early recognition may prevent serious complications of some hereditory diseases.
* Some of these may not be evident on physical examination.

* The history may give a valuable clue leading to diagnostic laboratory tests.
* When there is a possibility of hereditory transmission of a disease, a careful inquiry should be made about the health of siblings, uncles and aunts, grand parents and other immediate relatives.
* It is best to ask specific questions about the occurrence of outstanding symptoms than to question about a definite disease entity.

Maternal History:

Some times diseases can be transmitted directly from the mother to the offspring. More often, prenatal material disturbances lead to nonspecific lesions in the fetus. At times, the mother may never have shown any symptoms of the disease, or symptoms may have occurred prior to onset of pregnancy.

* Chronic diseases known to be transmitted trnsplacentally include syphillis tuberculosis, melaria and Chages disease. Acute infections, such as many contagious diseases, coxsacties virus infections, and genital tract infections may be passed to the fetus.
* Disorders of the maternal circulatory and respiratory systems may lead to fetal hypoxia.
* Various complications affecting placental circulation have a similar effect.
* Immonologic disorders may be the result of passively transmitted antibodies produced in the mother as a response to fetal stimuli or of various other factors.
* Consider maternal endocrine or metabolic disorders.
* Threatened abortion may be associated with malformations. Abnormal implantation of the placenta, manifested by bleeding, often leads to fetal hypoxia or acute anemia.
* Maternal diabetes, toxemia of pregnancy, post maturity leads to degenerative lesions of the plcenta favouring hypoxia.

* Drugs.
* Dietory deficiencies and persistent gastro intestinal disturbances.

Obstetric factors:

* The baby may be profoundly affected by the vicissitudes of labour and delivery essential to establish diagnosis.
* Whether the baby was bom in the hospital, at home or enroute.
* Estimate of the duration of pregnancy.
* The time of rupture of the membranes, possibility of interactive infection significantly high when rupture occurs more than 24 hours before delivery.
* Duration of labour.
* Mother's condition, fever, infection etc.,
* Whether she is primiparous or multiparous.
* Type of delivery spontaneous, induced or operative including cessarian section or use of forceps.
* Fetal presentation.
* Relative intensity of labour
* Whether cephalo pelvic disproportion existed.
* Drugs used for analgesia or anasthesia, doses, routes of administration and timing with respect to delivery.
* Whether labour was induced and managed by an ototoxic agent.
* Whether any untowared event occured (maternal haemorrhage, severe hypotention etc)
* Infant's condition at the moment of birth.

Whether resuscitation was required, if so the methods employed.

All factors which affect the child's life (including environmental factors) are considered and the affect of each is noted down.

In addition, the age of acquisition of skills developmental mile stones are also considered, so that any possible delay in development is easily identified.

Case history taking helps us most is identifying behaviour as delayed or devient.

Case history taking for adults.

The procedure is similar to that in case of children, but the questions asked to the patients or his relatives may differs depending on the type of problem.

Here, generally the premorbid state (ie., state of the patient before the problem occured) is compared to the post morbid state (ie., state of the patient after the onset of the problem) and the changes are noted. Any factor suspected to have caused the onset of the problem is also noted down for detailed testing.

Further information regarding the duration of the problem (whether continuous intermittent or only a single episode etc.); severity of the problem etc., are also considered generally. Case history taking for adults involves a more structured atmosphere.

There are several advantage of case history taking. Since detailed information regarding the medical, social, developmental, educational history is taken a full profile of the client is obtained.

This profile aids in establishing the cause effect relationship. Also, one can arrive at a tentative diagnosis based on which further steps for investigation can be delineated.

Case history taking in the first step in diagnosis formation. It also helps in establishing rapport with the patient and his family members. The subject comes to the clinician for guidance and assurance, most of which is provided by the clinician during case history taking.

Further the information obtained during case history taking case be stored and retrieved later on. it is useful for survey and research purposes.

Caution: The clinician should take care not to let his personal biases reflect on the case history taking, he should not get involved and become overly sympathetic or condemning towards the patient. He should be empathetic. Professionalism has to be maintained.

PAMPHLET NO : 3

Case History:

When we go to doctor, he asks us about our problem and also questions us about past events.

Questions like "Did this happen before?

At what age was it first seen?

What treatment was taken was for how long?, etc., are asked

Why does the doctor ask us questions about past events? There is a very important reason for this.

First let us answer the question "What is CASE HISTORY?"

Case history is a procedure where. In the history of the patients problem is taken up and details about the patients earlier condition is looked into this is done because it gives us important clinical information.

Before diagnosing or labelling the patients problem all the information about his problem has to be collected. There are several methods to do this such as

* Case history taking.
* Observation of the patient
* Reports given by other professionals
* Questionnaire etc.,

Case history taking is conducted in an envronment away from noise. Inside the room, there are no pictures or books which could distract the patient. Other people are not allowed inside the room. The patient is made comfortable so that he feels free to give all the necessary information. There are different ways through which the case history is collected.

- The examiner may directly ask question to patient
- He may ask the patients relatives.
- He may give some questionnaire to gain further information.

Depending on the age and problem of the patien the case history taking would differ. For children, the case history taking would involve obtaining general information and later on taking the pre - natal, perinatal and postnatal history.

prenatal histry : Any disease injury infection etc. which affected the mother during her pregnancy.

Prenatal history : Complications during delivery such as prolonged labour, operation, etc.

Postnatal history : Includes any problem faced by the infant soon afer birth.

In addition, information about anyone else in the family having the same problem, or if the problem was present at birth or acquired later are also taken..

History about the acquisition of different skills such as motor skills, language skills etc. are taken so that any delay in development in easily identfied.

Case history, taking for adults follows the some patterns. But questions asked may differ according to the patient's problem. Hear, the state of the patient before the problem occured is compared to his state after this problem occured, and the chages are noted.

Additional information such as whether the problem is continuous or intermittent, how severe is the problem are, also obtained.

Case history taking helps us to get detailed information regarding the medical, social developmetal educational history and thus a full profile of the patient is obtained. Case history taking helps us to identify the cause of the

problem, and aids in diagnosing/labelling the patients problems. Also, the clinician is able to guide the patient and reassure the ptaient.

Case history taking helps to build a friendly relation between the patient and clincion.

INTRODUCTION TO PAMPHLET NO.4

TINNITUS

People sometimes complain of sound/noise in the ear even though no sound stimulus is present. This complaint is called **'TINNITUS'.**

It can occur with any type and degree of hearing loss or it can occur in individuals without any hearing problems or even without any measurable hearing loss. Usually, these annoying noises are described as ringing, hissing, humming, buzzing, roaring, chirping or like a sea shell sound, heard in the ear of the person with this problem.. Tinnitus may be intermittent, or continuous or it could vary in intensity/quality. Some times it could be pulsatile in nature i.e., sound in the ear pulsates in rhythm with the heart beat.

Various authors have attributed various causes for tinnitus.

Possible causes of tinnitus

External ear	**Middle ear**	**Inner ear**	**Central nervous system**	**Others.**
1. Impacted cerumen- 2.Foreign object 3.-Otitis externa 4.-Perforation 5.-Myringilts Bullosa	l.Otitis Media 2.Middle ear fluid 3.Otosclerosis 4.0ssicular chain-disruption 5.Barotrauma 6.Patulous sustachain tube 7.Vascular-anoraolies 8.Neuro musculartics 9.Middle ear tumour	l.Meniere's disease 2.Labyrithitis 4.Cochlear-Otosclerosis 5 Presbycusis Accoustic -trouma 6.Ototoxicity 7.Circulatory failure 8.Head trauma	1. Acoustic neuroma 2 Cerebello -Pontine tumors 3 Vascular malfor-mations 4 C.N.S. syphillis 5 Epilepsy 6 Mygraine 7 Concussion 8 Tumors.	1 Anemia 2 Carotid arterio-sclerosis 3 Cardiac murmours 4 Allergy. 5Psychogenic 6 Drugs like reserpine 7Furosemide and lithium 8 Agents - erthromycin, lidocaine.

Tinnitus is frequently associated with sensorineural hearing loss,. Since spontaneous activity occurs in the absence of acoustic stimulation, it has been suggested that these patients may have regions of cochlea that produce aberrant patterns of spontaneous activity that give rise to the perception of tinnitus.

Western (94) examined factors of tinnitus and vertigo in a population of 509 subjects with presbycusis. Data showed positive relation between incidence of tinnitus, vertigo and severity of hearing loss. He said approximately.

*49% had tinnitus.

*20% had both tinnitus and vertigo

*32% had vertigo.

Management:

The formation of the American Tinnitus Association (Deweese and Vernon -1975). raised professional consciousness on the subject of tinnitus.

Very little was available until about a decade and a half ago to help these people. Recently, professionals have learned to heed the complaint of tinnitus sufferers Other than the use of masking sounds to overcome tinnitus. Ex: Clock radio or white sound generator at night; a hearing aid during the day etc.

Treatment included drugs such as vitamins and vasodilators. Surgery such as labyrinthine or vestibular nerve destruction; nerve blocks and cognitive therapy have been applied all with mixed success.

Principles of bio feed back have also been applied to relieve tinnitus Biofeed back allows the individual to monitor his own physiological activity by attaching recording electrodes to specific parts of the body. These permit the

subject to observe and to control the activity. Some patients learned to monitor and supress their tinnitus, through such techniques.

The wearable tinnitus unit has enjoyed marginal popularity. They are an inbuilt part of the behind the ear hearing aids. The tinnitus masker is designed as a miniature masking unit, producing a band of noise that surrounds the frequency of the tinnitus. When no specific frequency of noise band is reported as characteristic of the individuals tinnitus, a broad-band signal may be used as the masker. Gradual adjustments are made and a close match to the patient's tinnitus can be obtained. Special devices called tinnitus audiometer have been developed to enable the audiologists to determine patients specific masking spectral needs, along with intensities required to mask their tinnitus.

The tinnitus masker hearing aid has two tone controls and two volume controls. One for adjustment of the hearing aid and the other for the tinnitus masker unit.

It is interesting that despite patients complain of extreme loudness in tinnitus, when matched to the signal of similar accoustic spectra, the sensation level of the heard noises are rarely more than 10 dB.

Few of the patients are reported to be extremely satisfied with the tinnitus maskers. Some claim that not only is tinnitus relieved by what they observe to be external sounds preferrable to their own tinnitus, but also that tinnitus is relieved after the masking device is removed. Although not completely understood, this effect may be explained by some residual inhibition in the auditory system. But others report of disappointing results.

On the whole, the phenomenon of tinnitus continues to be perplexing.

PAMPHLET NO.4

TINNITUS

People sometimes complain of sound/nnoise in the ear/head even though no sound stimulus is present. This is called **TINNITUS**

Tinnitus is very annoying and is described as ringing, hissing, humming, buzzing, roaring chirping or like sea shell sound.

This condition can occur with any type and degree of hearing loss or even without any measurable hearing loss.

Various people have explained tinnitus to have different causes. Some of them are mentioned below:

Tinnitus can occur because of:

l)Wax

2) Foreign body

3) Infection In the external ear.

1) Fluid

2) Injury / trauma

3) Tumors

4) Infection In middle ear

1) Infection

2) Trauma

3) Drugs

4) Reduced blood supply In the inner ear.

In addition, conditions such as anemia, syphillis, presence of tumors; migrain, allergy etc., and some drugs can cause tinnitus. Some times the cause of tinnitus cannot be traced at all.

Very little was done about this condition in the post. But recently various methods to control and overcome tinnitus have been suggested.

Earlier, clock radio or white sound generators were used at night to mask tinnitus and hearing aids were used during the day by the hearing impaired. Some people seemed to find relief from tinnitus after usage of drugs, and surgery has also been tried out, but without much success.

Now a days the wearable tinnitus masker units are being used. Such units produce a band of noise which closely resemble the noise in the ear of the person with tinnitus. The parameters of the band of noise can be adjusted as needed.

Most of the patients who are satisfied with this unit as they report that any other sound is preferrable to their own tinnitus. But there are some who are not satisfied with these maskers.

Our knowledge, about tinnitus is still incomplete. Research is being carried out to find out more about the causes and mechanism of tinnitus and also to find a cure or other methods to overcome t innitus.

INTRODUCTION TO PAMPHLET NO.5:

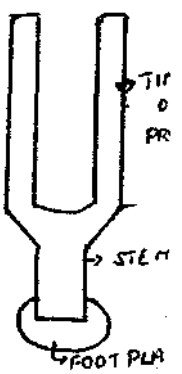
Assessment of Hearing Loss:

Sometimes, we see that some children do not respond to sounds around them to which other children respond to. More likely than not; this is because the child has hearing loss.

Even adults may find it difficult to discern what others are saying. Hearing loss may be suspected, in them.

What is to be done then?

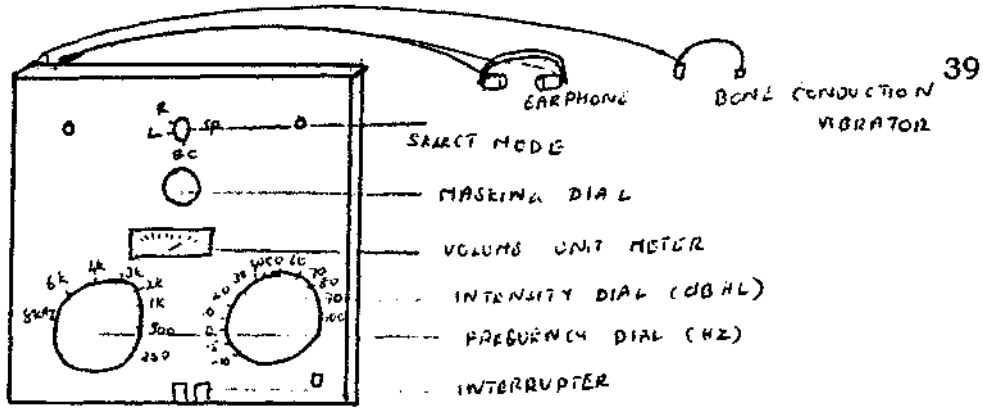
The very next step to be followed would be to consult an audiologist or an audiometrician to confirm the presence or absence of a hearing loss.



In the olden days, tuning forks were used to test the hearing.

Tuning fork produces a tone at a particular pitch when it vibrates. The tuning fork is set into vibration by holding the stem in one hand and striking the fines against a firm but resilent surface.

Various tes ts such as Rinne's test, Weber's test, Schwabach test, King's test etc., were being analysed. But the tuning fork tests gave information only regarding the type of hearing loss. The degree of hearing loss could not be measured accurately. These tests were adopted over a hundred years back. Nowadays audiologists use other sophisticated instruments such as the audiometer, which provide qualitative as well as quantitative information about the patients hearing.



This is the picture of a manual pure tone audiometer. Typically, the sound is presented through the earphones or bone conduction vibrator. Sounds can also be presented using loudspeakers in a sound field.

Air Conduction tests: Clinician presents tones through the ear phones at frequencies 250 Hz. 500 Hz, 1 kHz., 2 kHz., 4 kHz and 8 kHz. At each frequency the lowest level of intensity where the tone is barely heard at least 50% of the times is measured. This is considered to be the **"threshold".** The threshold at different frequencies is measured. The average of threshold at frequencies 500 Hz., 1 kHz and 2 Khz is calculated. If the result exceeds 16 dB HL then we consider that a hearing loss is present. The degree of hearing loss depends on the threshold obtained. If the threshold lies below 15 dB HL hearing is normal.

If the threshold lies between.

16-25 Minimal hearing loss

26 - 40 Mild hearing loss

41-55 Moderate hearing loss

56 - 70 Moderately severe hearing loss

71-90 Severe hearing loss

90 and above - hearing loss is profound:

Air conduction threshold levels give us information regarding the degree of hearing loss.

Bone conduction audiometry.

The bone vibrator is placed on the mastoid and audiotory thresholds for frequencies 250 hz, 500 Hz., 1 kHz, 2 kHz., 4 kHz. are obtained. Bone conduction thresholds along with air conduction thresholds help us in diagnosing the type of hearing loss.

(Care should be taken not to exceed the audiometric limits specified in the manual)

Speech audiometry:

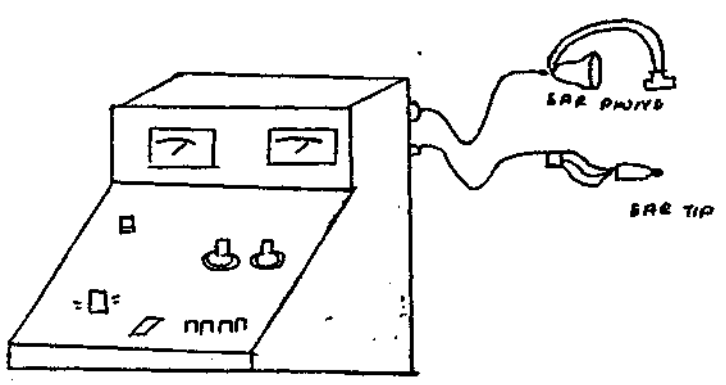
In day-to-day life we come across more of speech stimulus rather than pure tone stimulus. So testing a persons ability to understand speech is a must. Phonetically balanced words or spondees are used and the speech recognition thresholds and speech descrimination scores respectively are obtained.

Facilities for masking and free field testing for both pure tone audiometry and speech audiometry are present in most of the instruments.

Some audiometers may also have facilities for special tests like SISI - Short increment sensitivity index or TDT. Tone Decay test which help us to specify the type of hearing loss (whether cochlear or retro cochlear)

All these instruments have to be caliberated from time to time .

Immittance audiometry.



Immittance audiometry aids mainly in the clinical assessment of the middle ear function. The ear phone is placed on one ear and the ear tip on the other. The impedance test consists of three measurements. Tymponometry, static compliance and the acoustic reflex test.

Tympanometry: Here, the pressure in the outer ear is changed with the help of the instrument, and the changes in compliance of the middle ear is noted. Generally the pressure is changed from + 200 to 200 dapa. A graph is plotted, called the tymponogram and based on the pattern obtained it is classified under type A, Type B, Type C, Type D, Type As or Type Ad. Each type indicates different conditions of the ear.

Static Compliance: This is the term used to express middle ear compliance. Normal values range from 0.3. to 1.6 cm^3.

Acoustic reflex measurements: Stimulating one ear with a high intensity stimulus causes simultaneous contraction of the stapedius muscles (muscles of middle ear) in both ears. The presence of reflex and the reflex thresholds in both ears are checked at frequencies. 500 Hz., 1 kHz., 2 kHz. and 4 kHz. Based on the diffrerent reflex patterns obtained, a diagnosis is arrived at.

Immittance audiometry has various clinical uses. We can correlate the pure tone audiometric values to the values obtained through immittance audiometry. It is a non-invasive objective proceedure and is useful in patients who refuse to co-operate. It aids in the evaluation of middle ear function, differential diagnosis in cochlear and retro cochlear disorders and in localization of brainstem and facial nerve lesions.

Evoked response audiometry: it is a non-invasive objective technique. Here the responses from the auditory nervous system are measured.

Brief stimulus such as clicks or tone pips are introduced at various intensity levels. The response of the auditory nervous system is picked up by surface electrodes placed on the head and scalp.

The instrument contains a display screen where the responses are displayed in the-form of waves.

The latency of response that is the time difference between the presentation of stimulus and onset of response is obtained and compared with the norms established for appropriate population.

This test is helpful in assessing hearing sensitivity in patients, especially children who cannot give a yoluntory response. This test is also used to identify lesions in the auditory nervous system.

Recently even more sophisticated instruments wherein otoacoustic emissions from the ear are obtained and measured are in vogue.

PAMPHLET NO.5

Assessment of hearing loss:

Sometimes, we see that some children do not respond to sounds or even loud noise around them, to which other children respond. More likely than not, this is because the child has hearing loss. Even adults may find it difficult to understand what others are saying. What is to be done in such cases.?

The logical step would be to consult an audiologist. He would tell you if you have a hearing problem or no and also advise you on what to do next.

You must be interested in knowing how the audiologist tests your hearing . This pamplet will help you to answer such doubts.

Now a days, the common instrument being used for assessing the hearing ability is the audiometer. The audiometer is a box like structure. It has earphones The sound is passed through earphones, into the patients ear. The patient is told to indicate whenever he hears the sound. This procedure is carried out for different frequencies, at different intensities. The least intensity level where the sound is barely heard is found. This is threshold of the patient. The obtained results are compared to norms and the patients hearing is classified accordingly as normal or (different degrees of) hearing loss.

Bone conduction audiometry wherein a bone vibrator is placed on the mastoid (bone behind the pinna) of the patient can also be done.

Instead of giving a tone/sound sometimes speech stimulus is given through the ear phone. This procedure is called speech audiometry.

Instead of giving the stimulus through the ear phones, it can be given through a loud speaker also.

Immittance Audiometry:

This procedure helps us to assess the middle ear function. It is a non invasive objective procedure. It does not require the co-operation of the patient and hence is very useful in testing children. It gives important clinical information. Evoked response Audiometry (ERA).

This is also a non invasive objective technique wherein electrodes are used and the activities going on in the auditory nerve are picked up in the form of potentials/spikes. ERA is also used widely in the testing of infants hearing.

As seen, there are various instruments which help to measure the level of hearing of a person. Different clinicians may use some or all of these instruments.

If you suspect that you or your family members have hearing loss, please contact an audiologist immediately. Remember **(prevention is better than cure).**

CONCLUSION AND SUGGESTIONS

These pamphlets help in creating awareness among the laymen who are afflicted and also the non afflicted .

These pamphlets will encourage many among the common public to get their hearing tested for any deficits.

I sincerely hope that these pamphlets serve the purpose for which they have been created.

Many more pamphlets on different topics should be written so that awareness increases, many of the disorders are prevented and also the afflicted individuals become aware of the rehabilitative measures.

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