Audio-Visuals on Audiological Findings in Pathological Conditions

Register No. M 9516

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

C E R T I F I C A T E

This is to certify that the independent project entitled
"Audio-Visuals on Audiological Finding in Pathological Conditions"
is a bonafied work done in part fulfilment for the first year
degree of Master of Science (Speech & Hearing), of the
student with Register No. M 9516.

Mysore
May 1996

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

C E R T I F I C A T E

This is to certify that the independent project entitled

"Audio-Visuals on Audiological Finding in Pathological Conditions"

has been prepared under my supervision and guidance.

Dr. (Miss) S. Nikam
Guide

Mysore
May 1996

DECLARATION

I hereby declare that this independent project entitled **"Audio-Visuals on Audiological Findings in Pathological Conditions"** *is the result of my own study under the guidance of Dr. (Miss) S. Nikam, Project and Head, Department of Audiology, All India 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 9516

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I am thankful to ***Dr. (Miss) S. Nikam,*** *Director, All India Institute of Speech and Hearing, Mysore, for allowing me to take up this project*

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Dear ***Mummy*** *and* ***Papa,*** *you have given me everything I have aspired for and blessed me over the years, no words can express how great I feel about you both.*

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Thanks to ***Rajashree & Nidhi*** *- No road is long with good company. Its been great to have friends like you around.*

Last but not least, I am also grateful to ***"Spaceage"*** *for their creative work and timely help.*

Reg. No. M 9516

CONTENTS

INTRODUCTION

Speech is perhaps the greatest gift of God to the human being and the ability to communicate has empowered the human being to rise to a level far above the other living forms. Man being a social animal, his requirements for communication with others is possibly his greatest need and to accomplish this he largely depends on his ability to hear. The hearing mechanism not only helps him to communicate effectively but also acts as an alert mechanism round the clock, hence it can be considered as a bridging mechanism between the man and his environment.

However, there are many unfortunate and less fortunate members of this human community who are deprived of their ability to hear. A hearing loss not only impedes communication but also has a profound impact on cognitive, speech language and social functioning. (Vernon & Andrews" 1990) This effect is more grave when hearing loss starts right from the birth and severe in nature.

Although hearing impairment is a pervasive problem it is difficult to estimate the impact of hearing loss on a particular individual. This is because of the individual differences that the human being exhibit, the multitude of causative factors that can lead to hearing loss or the combined effect of hearing loss along with other developmental or psycho-social variables.

The various multitudes of causative factors of hearing loss can be broadly divided in terms of a basic dichotomy i.e., congenital or acquired hearing loss. Congenital hearing loss are caused due to genetic conditions, infections, ototoxicity, trauma or Rh incompatibility. Hearing loss acquired at various stages of life could be due to infections, ototoxicity, trauma, systemic diseases etc.

Also important in the classification of an auditory disorder is the location of the lesion. Lesions occuring in the outer ear or middle ear cause conductive hearing loss that is frequently amenable to medical treatment. If damage occurs to the hair cells or the nerve endings the hearing loss is sensorineural. Hearing loss resulting from damage to the auditory nerve after it leaves cochlea on its pathway within auditory central nervous system, resulting condition is known as central auditory-disorder. In functional hearing loss there is no detectable organic damage to the auditory pathway but some underlying psychological or emotional overlay.

Thus it becomes very much important to determine the nature and severity of hearing impairment in order to plan a management strategy. The first step in the management process involves assessing the handicapping effect of hearing impairment. Basic information regarding this effect can be obtained through audiological approach to site of lesion testing.

Audiological approach to site of lesion testing is accomplished by two different methods that includes subjective and objective measures.

Subjective measures requires an overt response from subject with response ranging from observation of an involuntary eye blink to a voluntary response for an audiotry signal presented. Pure tone audiometry is used primarily to determine air conduction and bone conduction thresholds of hearing. These thresholds are necessary for diagnostic evaluation of hearing loss. Speech audiometry is used principally to obtain Speech Reception Threshold (SRT) and Speech Discrimination Scores (SDS) for diagnostic purposes. Besides these there are various special audiometric tests which are useful in the differential diagnosis of pathological conditions. These special tests includes Tone decay test (TDT). Supra threshold Adaptation Test (STAT), Short increment sensitivity index (SISI), Pl-PB function, Synthetic Sentence Identification (SSI), Staggered Spondiac Word(SSW) and Stenger test etc.

Objective measures include response elicitation from a patient without his/her active participation in response to an acoustic stimulus. Objective measures include Immittance measurement, Evoked Brain-Stem Response and Otoacoustic Emission etc.

Acoustic immittance is an integral part of the basic audiological assessment. This test battery includes measures of static compliance, tympanometry and acoustic reflex.

Evoked Brain Stem Response is used to assess functional integrity of the peripheral and brain stem portions of the ascending audiotry central nervous system. More commonly for the assessment of hearing in infants or difficult to test patient.

Oto-acoustic emission is an emerging clinical tool that can be used for hearing sensitivity screening of infants, estimation of severity and differential diagnosis.

The interpretise basis of diagnostic audiometry lies in recognizing pattern of responses that occurs for lesions located at different sites of the auditory system. These pattern result from different symptoms that are attributed to damage to external ear, middle ear, cochlea, auditory nerve or central auditory pathway.

This project is aimed at developing an audio-visual programme on audiological findings in various pathological conditions related to hearing impairment. This audio visual programme consists of pre-recorded audio cassette and visual slides. Audiological findings included are based on patient characteristics, Pure tone audiometry, speech audiometry immittance measure and Special audiological tests for differential diagnosis. This piece of work is intended to help readers in developing an understanding of the rationale for the

audiological approach to the diagnosis and treatment of patients with audiotory problems. It is expected that this work will deliver adequate assistance to various professionals contributing to the habilitation and education of hearing impaired children and rehabilitation for adults.

TYPES OF HEARING LOSS

Hearing loss can occur due to a multitude of causes and the site of lesion may be as variant as the number of anatomical parts of the auditory system. However a broad classificatory system can aptly be employed to classify the types of hearing loss as : Conductive, Sensorineural, Mixed, Central hearing loss and Functional hearing loss.

Conductive Hearing Loss:

A Conductive hearing loss is one in which the effective transmission of sound into the inner ear has met some interference at the external canal, tympanic membrane, ossicular chain or middle ear cavity. In a pure conductive loss, cochlea and auditory nerve, are intact for effective transmission.

Characteristic Features:

* History reveals a discharging ear or previous ear infection with a feeling of fullness or pain in the ear. This is well confirmed by abnormalities in otological findings.
* Better hearing in noisy environment than normals (Percussion willis).
* Soft speaking voice in cases of bilateral hearing impairment.
* Good understanding of speech if it is loud enough.

Audiological Findings:

* Normal bone conduction with air bone gap not greater than 60 dB.
* Flat or ascending (ocassionally descending) air conduction configuration.

* Unimpaired speech discrimination when intensity is great enough.
* Although tests for recruitment and abnormal tone decay rarely performed, but these phenomenon are absent.
* Impedance:

Compliance:	Less than 0.30 cc or more than 1.6 cc
Tympanogram:	AD, AS, B or C depending upon pathology
Acoustic Reflex:	Absent unilaterally or bilateraly depdending upon ear involved

Sensorineural Hearing Loss:

"A pure sensorineural hearing loss is caused due to lesion in the cochlea and/or auditory nerve in presence of functionally normal external and middle ear mechanism".

Characteristic Features:

* Hearing loss may be congential (hereditary or non hereditary) or acquired (inflammatory disease, trauma, toxicity, noise or metabolic abnormalities).
* Hearing impairment may be marked with normal otological findings.
* Patients speaks in loud voice when loss is bilateral.
* Patient reports difficulty in understanding speech; problem becomes worse in noisy environment.
* If tinnitus is present it is usually high pitched hissing or ringing.
* Inability to tolerate loud sounds.

***Audiological Findings**:*

* Both air conduction and bone conduction thresholds are reduced with air-bone gap less than 10 dB.
* Striking disparity between the hearing threshold level and the patient's ability to discriminate speech.

* Generally consistent threshold response.
* Reduced dynamic range in patients with recruitment.
* Recruitment is present which may be partial or complete with normal response pattern on Tone Decay Test and Stapedius Reflex and abnormal response pattern on SISI test. [Sensory Hearing Loss]
* Neural Hearing loss is characterized by abnormal tone decay and absence of stapedius reflex.
* Depending on Cochlear or auditory nerve involvement PI-PB function indicative of presence or absence of roll over phenomenon.
* Impedance measures; Tympanogram and static compliance value within normal limit. Acoustic reflex absent if loss is greater than 40-50 dB HL; acoustic reflexes are present at reduced SLs in cochlear loss of less than 80 dB HL. Positive reflex decay indicative of auditory nerve involvement.

Mixed Hearing Loss

A mixed hearing loss combines elements of both conductive and sensorineural hearing loss and may occur as a result of any combination of pathologies e.g. Otosclerosis and Presbyacusis, Otitis media and Acoustic trauma etc.

Audiological Findings:

* Reduced bone conduction sensitivity in conjunction with air bone gap not greater than 60 dB.
* Configuration may be flat, ascending or descending; bone conduction does not necessarily parallel air conduction.
* Speech discrimination may or may not be reduced depending on the degree and severity of the sensorineural component.
* Special test result are variable depending on the degree and severity of sensorineural component.

* Impedance audiometry results are dependent on nature of pathology.

Compliance: Most commonly low but may be any value.

Tympanogram: Mostly B or As type.

Acoustic reflex: Absent if degree of hearing loss is mild or worse.

Central Hearing Loss:

Central hearing impairment results from any disorder of the auditory pathways of the brainstem or the primary or association areas of the auditory cortex.

Characteristics features:

Patients with Central hearing impairment are clinically heterogeneous group and do not present easily classified symptomatology. Most of these patients have associated neurological symptoms that have priority over their auditory complaints.

Audiological Findings:

* Pure tone audiometry may or may not indicate peripheral hearing impairment.
* Patient has difficulty in interpreting complex information.
* Decreased ability of understanding speech in presence of background noise.
* Pure tone thresholds are relatively good in comparison to ability of the patient to discriminate and especially to interprets what he hears.
* Impedance measures; Tympanogram and static compliance measures are within normal limit. Acoustic reflex measures vary depending on site of lesion. In general reflexes are normal in patients with temporal lobe lesion and abnormal in patients with intraaxial brain stem lesion.

* Special audiolgical test battery for central auditory disorder consists of a large number of test. Several of which require special instrumentation. Few commonly used tests are Synthetic Sentence Identification(SSI) and Staggered Spondise Word (SSW) tests. Depending upon site of lesion to temporal lobe or brain stem, performance on these altered speech tasks is poor.

Functional Hearing Loss:

Functional or Psychogenic hearing loss is the customary diagnosis when there is no organic basis for the patient's apparent deafness. His inability to hear result from emotional or psychological factor, and if there is some slight damage to the peripheral end organ, the observed hearing loss is disproportionate to the organic lesion. So it is also possible for hearing loss of functional origin to be superimposed on true organic deafness, in which case, the term "Functional Overlay" is used.

Audiological Findings:

* Inconsistency in test responses patient's errors are in the form of false positive or false negative response.
* Relatively flat audiogram showing an equal amount of hearing loss across frequencies - Saucer shaped audiogram similar to a Supraliminal equal loudness contour. (Doerfler'51, Carhart'56 .)
* Lack of contralateral response, especially by bone conduction is a very clear symptom of unilateral non organic hearing loss.
* Lack of relationship between the pure tone overage and the speech reception threshold, in the absence of explanation such as slope of the qudiogram or poor word discrimination.
* Objective tests like Impedance confirms the non-organicity of patient's hearing problem.

Special audiological tests like Stenger test, Lobard test etc. rule out any organic involvement for apparent impairment.

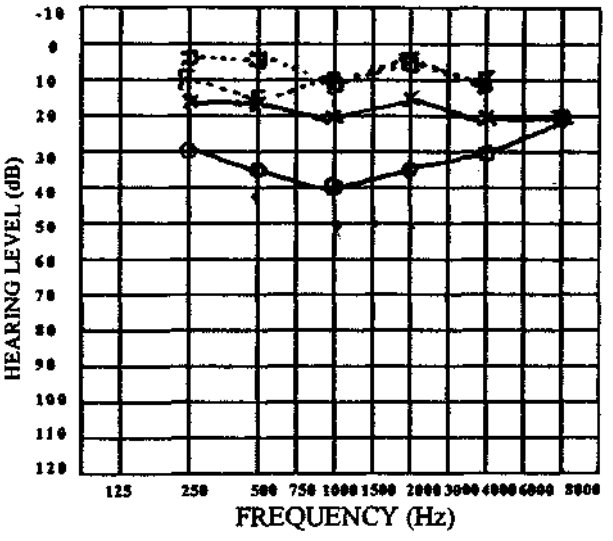
Audiological Findings in Pathological Conditions

Impacted Cerumen.

"Occulsion of external auditory meatus due to excessive formation of wax and its retention by stiff hairs, desqamation, exostoses and other stenosing conditions"

Visual

Slide No. 1



		Right	Left
Speech Audiometry			
SRT	*35dB*		15dB
SDS		100%	95%
Impedance :			
Tympanogram		'B'	'A'
Static Compliance		-	1.1 cc
Acoustic Reflex			
Contralateral		■	▨
Ipsilateral		■	□

Diagnosis : (Rt) Mild conductive hearing loss.
(Lt) Hearing within normal limits.

Audio

Patient Characteristics: Onset of hearing loss is slow or sudden after attempting to clean ear canal. Otoscopic findings shows blocked ear canal and hearing returns to normal after wax removal.

Pure Tone Audiometry: Bone conduction thresholds within normal range while air conduction thresholds will be elevated at all frequencies. Degree of hearing loss usually varies from mild to moderate degree.

Speech Audiometry: Speech reception threshold corresponds to pure tone average. Speech discrimination scores within normal range.

Impedance: Reduced static compliance and 'B' type tympanogram indicative of hypomobility of tympanic membrane. Acoustic reflexes are found to be absent.

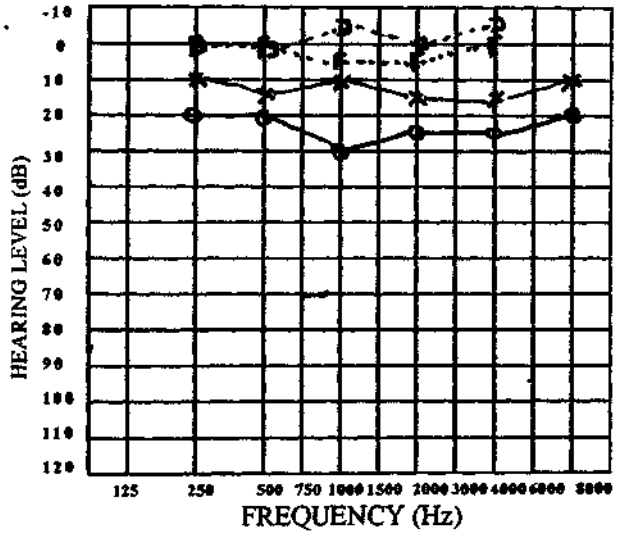
Diagnosis: Conductive hearing loss.

Perforated Eardrum

"Sudden hearing loss, perforation could be because of burn injuries or previous history of infection. "

Visual **Audio**

Slide No. 2



	Right	Left
Speech Audiometry		
SRT	3OdB	15dB
SDS	95%	100%
Impedance :		
Tympanogram	*B'	"A'
Static Compliance	-	1.3cc
Acoustic Reflex		
Contralateral	■	▨
Ipsilateral	■	□

Diagnosis: (Rt) Mild conductive hearing loss
(Lt) Hearing within normal limit

Patient Characteristics: Onset of hearing loss is sudden with marked destruction of drum with history of severe pain.

Pure Tone Audiometry: Bone condction threshold is within normal range. Air conduction threshold is reduced to 15 to 60 dB HL depending upon the size and location of perforation in tympanic membrane.

Speech Audiometry: Speech thresholds and speech discrimation scores are within normal limit.

Impedance: It is not possible to obtain a airtight seal in the ear with perforated eardrum.

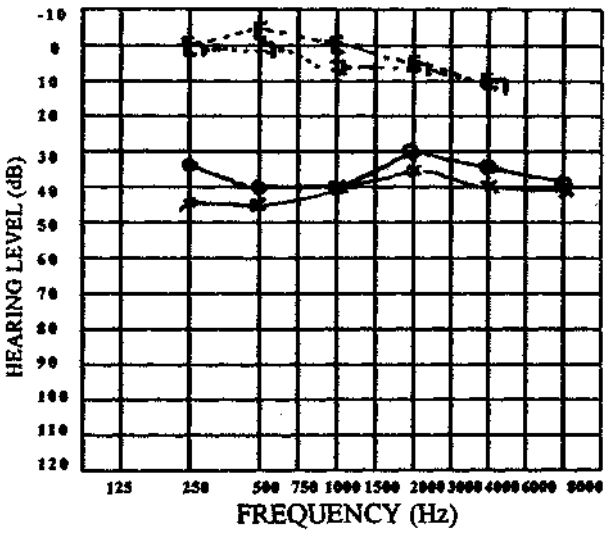
Diagnosis: Conductive hearing loss.

Fluid in the middle ear

It is a condition in which serous fluid accumulates in the middle ear because of obstruction or infection of the eustachion tube or nasopharynx

Visual

Slide No. 3



	Right	Left
Speech Audiometry		
SRT	45dB	50dB
SDS	95%	100%
Impedance :		
Tympanogram	'B'	B'
Static Compliance		
Acoustic Reflex		
Contralateral	[redacted]	[redacted]
Ipsilateral	[redacted]	[redacted]

Dignosis : Bilateral mild conductive heaing loss.

Audio

Patient Characteristics: Otitis media may occur at any age, but it is more common in children. Fluctuating type of hearing loss, feeling of fullness, low pitched pulsating or continuous tinnitus. Patient's own voice may sound unnaturally loud to him/her

Pure Tone Audiometry:Bone conduction threshold remains in normal range. Air conduction thresholds are reduced at all frequencies. Air bone gap is greater at low and mid frequencies. Hearing loss is usually of mild degree and rarely it exceeds 40-45dB of loss.

Speech Audiometry: Speech reception threshold correspo:nds to pure tone sensitivity with normal speech discrimation scores.

impedance: Reduced static compliance wiith type 'B' or 'C' tympanogram. Acoustic reflecxes are absent.

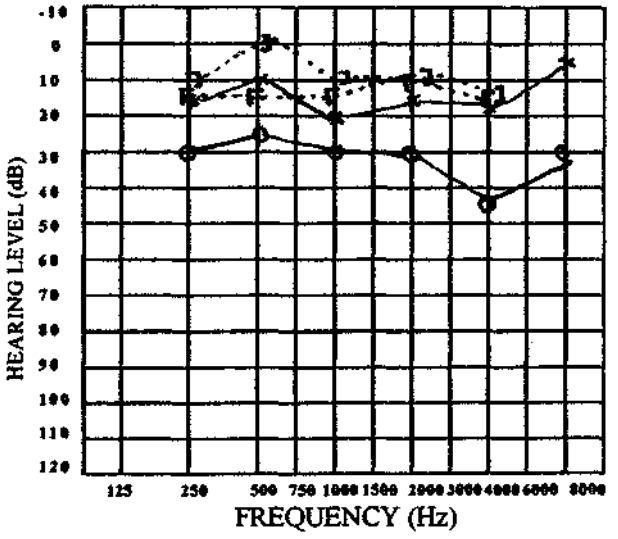
Diagnosis: Conductive hearing loss.

Cholestestoma

"Cholestestoma is a cystic mass that may occur within the middle ear and other pneumatized area of temporal bone leading to conductive type of hearing loss."

Visual

Slide No. 4



	Right	Left
. **Speech Audiometry**		
SRT	35dB	15dB
SDS	100%	100%
Impedance :		
Tympanogram	'As'	"A'
Static Compliance	0.4cc	1.1 cc
Acoustic Reflex		
Contralateral	■	▨
Ipsilateral	■	□

Dignosis : (Rt) Mild conductive heating loss.
(Lt) Hearing within normal limits.

Audio

Patient Characteristics: Cholesteatomas are most commonly acquired. Onset of hearing loss is insidious and can occur at any age. Patient may complain of earache, tinnitus and foul smelling ear discharge. It may be unilateral or bilateral type.

Pure Tone Audiometry: Bone conuction thresholds are within normal limits. Air conduction thresholds are elevated to mild to moderate degree depending on the size and location of the cholesteatoma. Most commonly leads to conductive hearing loss but sometimes cochlear or facial nerve involvement is also seen depending upon extent of lesion.

Speech Audiometry: Speech reception threshold corresopnd to pure tone sensitivity with speech discrimation scores within normal limit. Speech discrimation scores may be poor in conditions with cochlear involvement.

Impedance: Impedance measures reflect alteration in the middle ear physics caused by a particular.disease process rather than the disease itself.

Reduced static compliance and A or B type tympanogram is indicative of hypomobility of tympanic membrane. Acoustic reflexes are found to be absent.

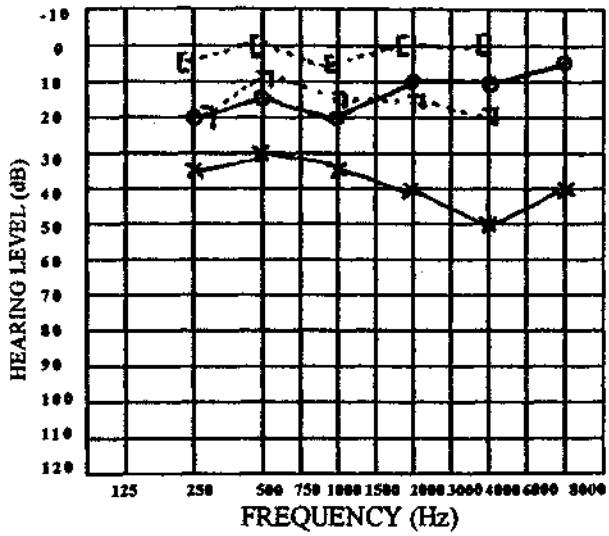
Diagnosis: Conductive hearing loss.

Glomus jugular Tumour

"This peculiar neoplasm arises from cells around the Jugular bulb and expands to involve neighbouring structure causing conductive hearing loss and pulsating tinnitus"

Visual **Audio**

Slide No. 5



	Right	Left
Speech Audiometry		
SRT	20dB	50dB
SDS	100%	95%
Impedance :		
Tympanogram	'A'	"As'
Static Compliance	0.7cc	0.2cc
Acoustic Reflex		
Contralateral	■	■
Ipsilateral	□	■

Diagnosis : (Rt) Hearing within normal limit.
(Lt) Moderate conductive hearing loss.

Patient Characteristics: Glomusjugulare tumours are most commonly seen in patients between 40 and 60 years of age. Tumours is unilateral in 90% of patients. It is characterized by pulsatile tinnitus, hearing loss, facial nerve paralysis.

Pure Tone Audiometry:Pure tone sensitivity resuslts commonly show conductive type of hearing loss. All the frequencies are equally affected. Hearing loss mild in initial stages and later goes upto 60-70dB HL.

Some times invovement of cochlea or auditory nerve leads to sensorineural hearing loss.

Speech Audiometry: Speech intelligibility result may be normal or abnormal depencing on the extent of middle ear, cochlear or auditory nerve involvement.

Impedance: Tympanogram and static compliance normal or indicative of hypomobility of the ear drum.

Unique finding is of periodic pulsating baseline measures synchronous with patient's heart beat. Acoustic reflexes are absent.

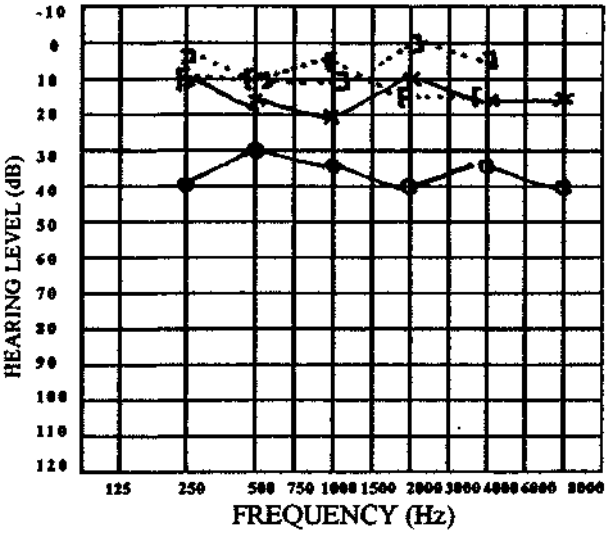
Diagnosis: Conductive hearing loss

Discontinuity of the Ossicular Chain

"Discontinuity of the Ossicular chain refers to disruption of normal articulation between ossicular as a consequence of congenital defect, skull trauma or middle ear disease"

Visual **Audio**

Slide No. 6



	Right	Left
Speech Audiometry		
SRT	45dB	20dB
SDS	100%	100%
Impedance :		
Tympanogram	AD	'A'
Static Compliance	2.0cc	1.1 cc
Acoustic Reflex Contralaterai	■	■
Ipsilateral	■	□

Diagnosis : (Rt) Mild conductive hearing loss.
(Lt) Hearing within normal limit.

Patient Characteristics: Hearing loss usually stable and unilateral. Patient complaints tinnitus. If ossicular chain discontinuity is associated with longitudinal skull fracture, it may be accomapanied by external canal collopase or tympanic membrane rupture.

Pure Tone Audiometry: Air conduction threshold reduced to 40 to 60 dB HL. While bone conduction thresholds remain unaffected. Audiometric configuration is generally flat.

Speech Audiometry: Speech reception threshold agrees with pure tone average. Speech discrimination scores with in normal limit.

Impedance: Impedance results characteristically show an abnormally deep (A_D) tympanogram, static compliance well above the normal range.

Reflex pattern is usually charecterised by an inverted L shaped configuration. A diogonal reflex pattern indicates a residual connection between the tympanic membrane and stapedial tendon inspite of ossicular disruption.

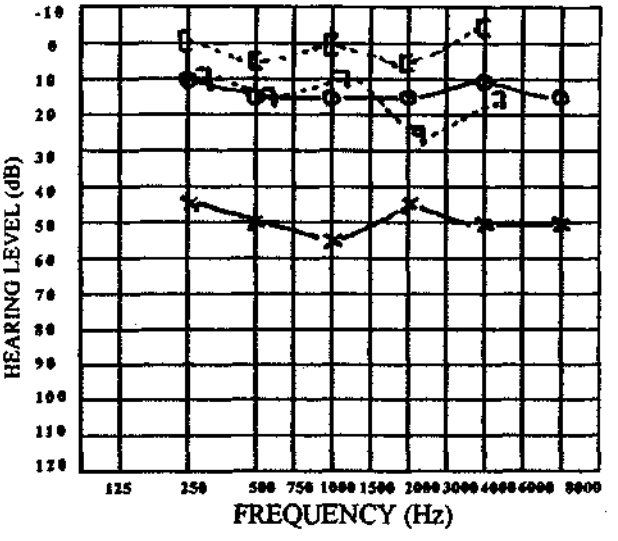
Diagnosis: Conductive hearing loss.

Malleus Fixation

"Fixation of the malleus characteristically refers to an unusually firm attachment between malleus and incus or malleus and roof or walls of epitympanum as a consequence of abnormal developement, bony growth or calcification of ligaments"

Visual **Audio**

Slide No. 7



t	Right	Left
Speech Audiometry		
SRT	15dB	55dB
SDS	100%	100%
Impedance :		
Tympanogram	'A'	As
Static Compliance	0.8cc	0.2cc
Acoustic Reflex		
Contraiateral	■	■
Ipsilateral	□	■

Diagnosis : (Rt) Hearing within normal limit.
(Lt) Moderate conductive hearing loss.

Patient Characteristics: Onset of hearing loss usually between 10 and 40 years of age. Slow and gradually progressive hearing loss accomapnied by tinnitus.

Pure Tone Audiometry:Pure tone sesntivity resuslts characteristically show greater loss usually between 40 to 60dB HL.

As a general rule, pure tone sesnitivity results are similar to auditory findings in patients with fixation of stapes due to otosclerosis.

Speech Audiometry : Speech discrimantion and speech reception thresholds within normal limits.

Impedance: Impedence results characteristically show an abnormal tympanogram consistent with extreme restriction of mobility of middle ear system. Static compliance measures are reduced.

Acoustic reflexes are inverted L pattern in cases with unilateral involvemet and absent in bilateral hearing loss cases.

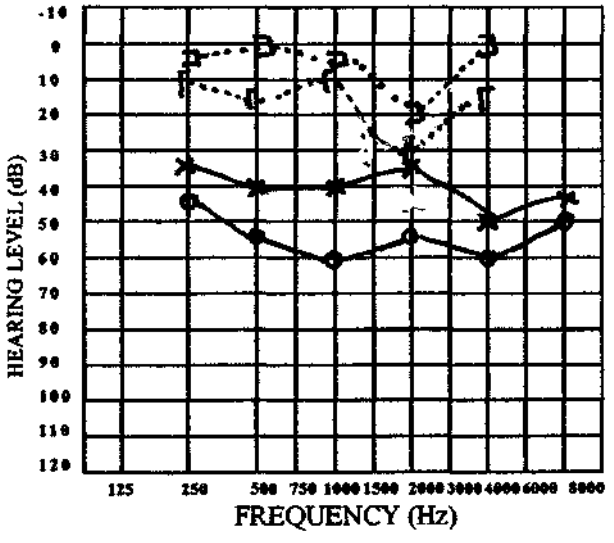
Diagnosis: Conductive loss.

Otosclerosis

"Localized disease of the otic capsule in which new spongy bone causes ankylosis of the footplate of the stapes"

Visual **Audio**

Slide No. 8



t	Right	Left
Speech Audiometry		
SRT	65B	55dB
SDS	95%	95%
Impedance :		
Tympanogram	As	As
Static Compliance	0.3cc	0.2cc
Acoustic Reflex		
Contraiateral	[redacted]	[redacted]
Ipsilateral	[redacted]	[redacted]

Diagnosis : (Rt) Moderate conductive hearing loss.
(Lt) Mild conductive hearing loss.

Patient Characteristics: Onset of hearing loss is between 15 to 45 years of age and usually bilateral. Gradually progressive hearing loss accompanied with tinnitus. Patient reports better hearing in noisy environment than in quiet.

Pure Tone Audiometry:Pure tone sesitivity shows bilateral conductive hearing loss. Maximum, air bone gap rarely exceeds 50dB. One feature of reduced bone conduction associated with clinical otosclerosis is called "Carhart's Notch", there is 15-20 dB reduction in bone condution threshold at 2000Hz. Degree of loss varies from mild to moderate degree.

In the initial stages of otosclerosis, the audiometric contour is generally rising with greater loss in low frequency region, as footplate becomes severely, fixed audiometric contour gradually flattens. In few cases otosclerosis progresses into sensorineural hearing loss.

Speech Audiometry: Speech discrimation and speech thresholds are within normal limit.

Impedance: Impedance measures reflects As type tympanogram and low static compliance.

Acoustic reflex pattern is charecterized by an inverted L shaped configuration. Reflex time course is generally characterized by an unusual negative deflections of the offset of reflex eleiciting signal

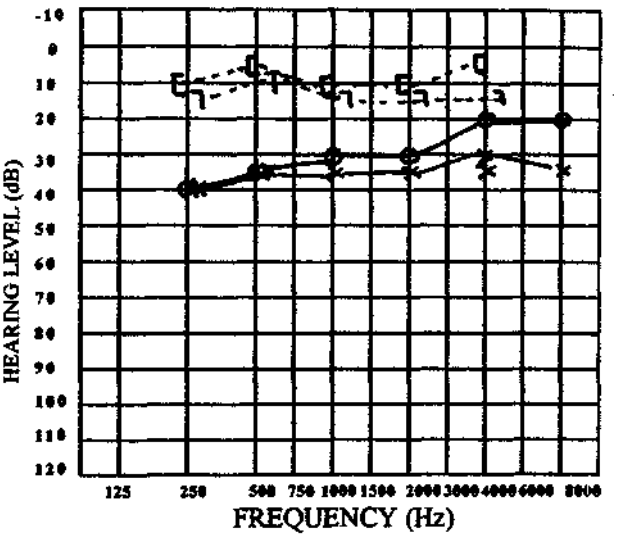
Diagnosis: Conductive hearing loss

Cleft palate

"A congenital condition in which there is a failure of the palatal plate to unite together and with the nasal septum which sometimes leads to middle ear complication also."

Visual **Audio**

Slide No. 9



		Right	Left
Speech Audiometry			
SRT		40dB	40dB
SDS		100%	95%
Impedance :			
Tympanogram	'B'		'B'
Static Compliance			
Acoustic Reflex			
Contralateral		[redacted]	[redacted]
Ipsilateral		[redacted]	[redacted]

Diagnosis : Bilateral mild conductive hearing loss.

Patient Characteristics: Usually seen in children. Patient reports of fluctuating hearing loss in both ears with recurrent otitis media.

Pure Tone Audiometry: Bone conduction thresholds within normal limit. Air conduction thresholds reduced to 40-50 dB HL. High frequencies are affected more commonly.

Speech Audiometry: Speech reception thresholds and speech dicrimination scores within normal limit.

Impedance: Impedence audiometry yields abnormal type A or type C, tympanogram, and reduced static compliance measures.

Acoustic reflexes are absent in both ears.

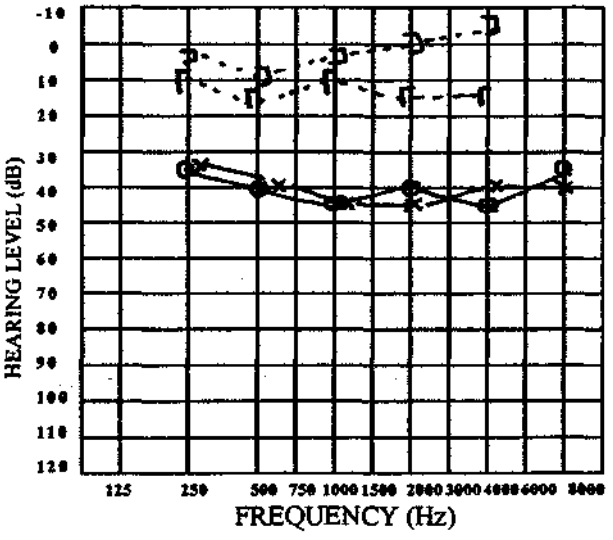
Diagnosis: Conductive hearing loss.

Treacher Collins Syndrome

"Congenital deformity of both auricles, complete absence of both external auditory canals and ear drums; deformity of ossicles along with occular structure abnormalities."

Visual **Audio**

Slide No. 10



	Right	Left
Speech Audiometry		
SRT	45dB	45dB
SDS	95%	100%
Impedance :		
Tympanogram	CNE	
Static Compliance		
Acoustic Reflex		
Contralateral	☐	☐
Ipsilateral	☐	☐

Diagnosis : Bilateral moderate conductive hearing loss.

Patient Characteristics: Autosomal dominent hereditary condition which is characterized by external ear, middle ear and other multiple anomalies. Other features are micrognathia and occular abnormalities. Hearing loss is congenital and usually bilateral.

Pure Tone Audiometry: Bone conduction thresholds within normal limit. Air conduction thresholds elevated to moderate to severe degree. All the frequencies are equally affected. Hearing loss usually bilateral and symmetrical.

Speech Audiometry: Speech reception thresholds correspond to pure tone sensitivity with normal speech discrimination scores.

impedance: In conditions with external audioty canal absence information on measures of acoustic immittance is unobtainable because the probe tip can not be inserted.

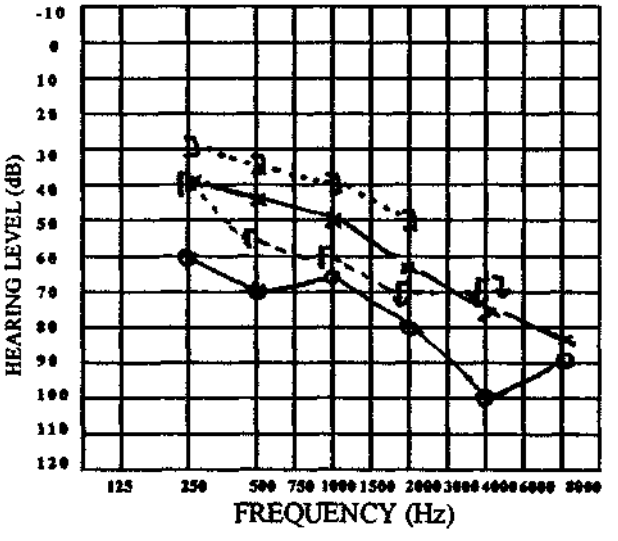
Diagnosis: Conductive Hearing loss.

Congenital Non Genetic Sensorineural loss

"Congenital sensorineural hearing loss caused due to non genetic condition like Rh in compatibility, Hypoxia, neonatal jaundice, rubella or syphillis."

Visual **Audio**

Slide No. ll.a. **Rh incompatibility**



	Right	Left
Speech Audiometry		
SDT	70dB	50dB
Impedance :		
Tympanogram	"A'	'A[1]
Static Compliance	1.0cc	1.0cc
Acoustic Reflex		
Contralateral	[redacted]	[redacted]
Ipsilateral	[redacted]	[redacted]

Diagnosis : (Rt) Severe Sensorineural hearing loss.
(Lt) Moderate sensorineural hearing loss.

Patient Characteristics: Congenital bilateral hearing loss caused by pre natal or perinatal complication. This includes infectious conditions (syphillis, rubella), hypoxia, blood group disease etc. Hearing loss is accompanied by other sensory, motor or mental deficits.

Pure Tone Audiometry: Pure tone sensitivity characterized by bilateral symmerrical sensorineuaral hearing loss. Various audiometric configurations are seen in different pathological conditions; In conditions like Rh incompatibility and jaundice hearing loss is characterized by high frequency hearing loss. Flat type of hearing loss is quite common in conditions like congenital rubella. High frequency hearing loss (Rh incompatibility, Jaundice) or flat type hearing loss (rubella)

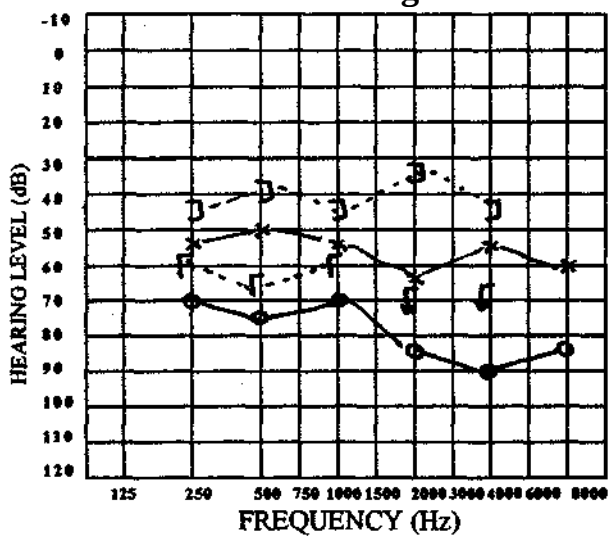
Speech Audiometry: Speech detection threshold corresponds to pure tone average while speech discrimination scores are poor.

impedance: Normal type 'A' tympanogram, normal static compliance measure indicative of normal middle ear funcion. Acousitic reflexes found to be at normal HLs and reduced SLs in cochlear pathology and absent or elevated in auditory nerve involvement and severity of hearing loss.

Diagnosis: Sensorineural hearing loss.

Visual **Audio**

Slide No. 11.b. **Congenital Rubella.**



		Right	Left
Speech Audiometry			
SDT		80dB	60dB
Impedance :			
Tympanogram	'A'		'A'
Static Compliance		0.75cc	1.2cc
Acoustic Reflex			
Contralateral			
Ipsilateral		[redacted]	[redacted]
		[redacted]	[redacted]

Diagnosis : (Rt) Severe Sensorineural hearing loss.
(Lt) Moderately severe sensorineural hearing loss.

Heriditary Sensorineural hearing loss

Hereditary hearing loss may occur when one gene (dominant trait) or a pair of genes(recessive trait) is abnormal for hearing.

In dominantly transmitted hereditary hearing loss one parent is affected and passes the abnormality to about one half of his children while in recessively transmitted loss, both patents are usually unaffeced carriers and passes the hearing defect to one fourth of their children. In conditions when abnormal gene is located on the sex chromosome (X chromosome) condition is termed as sex linked hereditary characteristics.

Classification of hereditary sensorineural hereing loss is based on either etiologies, genetic or histopathologic features. But there is no clinical pattern that consistanctly identifies different types of hereditary hearing disorder. (Ibrahim and Linthicum79).

Hereditary hearing loss occurs in isolation with no associated abnormalities in about 2/3 of patients and in remaining 1/3 patients, it is part of an identifiable symdrome of abnormalities.

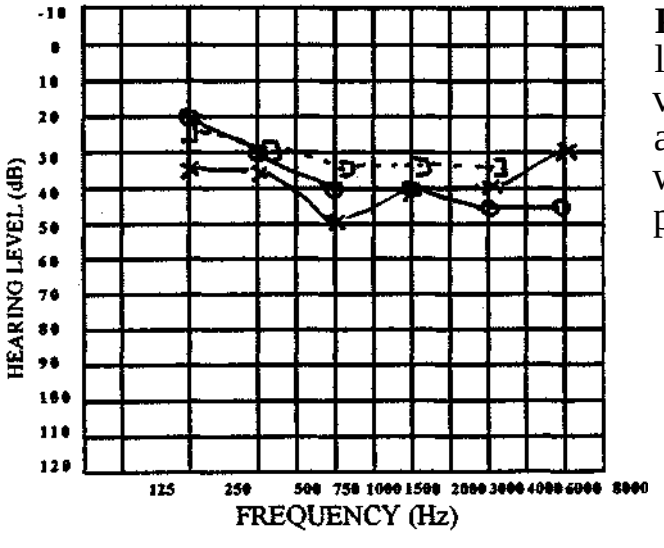
Visual	Audio
	Patient Characteristics: Hereditary sensorineural hearing loss usually becomes manifested during childhood or early adulthood. If the hearing loss is congenital degree of loss is usually stable. If loss develops subsequent to birth, degree of loss may progress in severity over time.
	Pure Tone Audiometry: Pure tone sensitivity characteristically show bilateral, symmetric sensorineural hearing loss. Degree of loss varies from mild to severe.
	Audiometric configuration may be flat, sloping, rising or basin shaped. In cases with progressive hearing loss audiometric configuration changes over time.
	Speech Audiometry:Speech development is found to be delayed and/or deviant in condtions of congenital hearing loss. Speech reception threshold corresponds to pure tone sensitivity.

Visual **Audio**

Speech discrimination scores found to be consistent or dispropotionate to pure tone average depending upon site of lesion.

Impedance: Impedance results characteristically show normal tympanogram and normal static compliance measures. Acoustic reflexes are found to be present at normal HLs and reduced SLs (in cochlear pathology) or at higher SLs (in retrocochlear pathologies)

Slide No. 12.a. **Autosomal Dominant gene (Wardenberg Syndrome)**



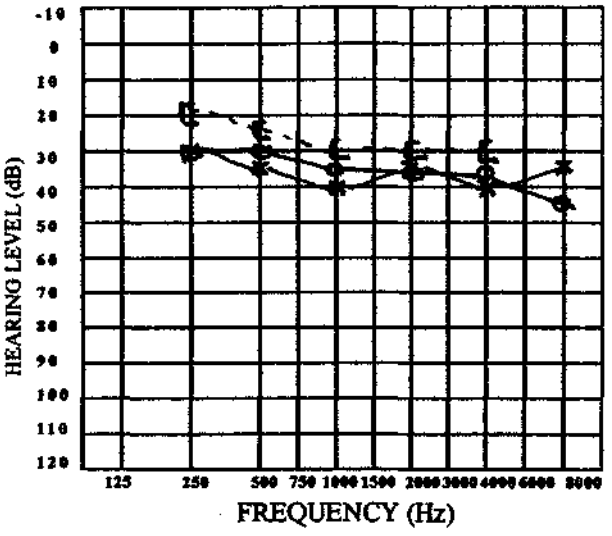
	Right	Left
Speech Audiometry		
SDT	45dB	45dB
Impedance :		
Tympanogram	'A'	"A[1]
Static Compliance	1.0cc	1.2cc
Acoustic Reflex		
Contralateral		
Ipsilateral		

Patient Characteristics: Onset of hearing loss is congenital. Degree of hearing loss varies from mild to severe. Features associated with syndrome includes white forelock, prominent root of nose, pigmentary changes in the skin.

Diagnosis : Bilateral moderate Sensorineural hearing loss.

Visual **Audio**

Slide No. 12.b. **Autosomal Recessive Gene (Hunter's Syndrome)**



	Right	Left
Speech Audiometry		
SDT	50dB	50dB
Impedance :		
Tympanogram	'A'	'A'
Static Compliance	1.0cc	1.2cc
Acoustic Reflex Contralateral		
Ipsilateral		

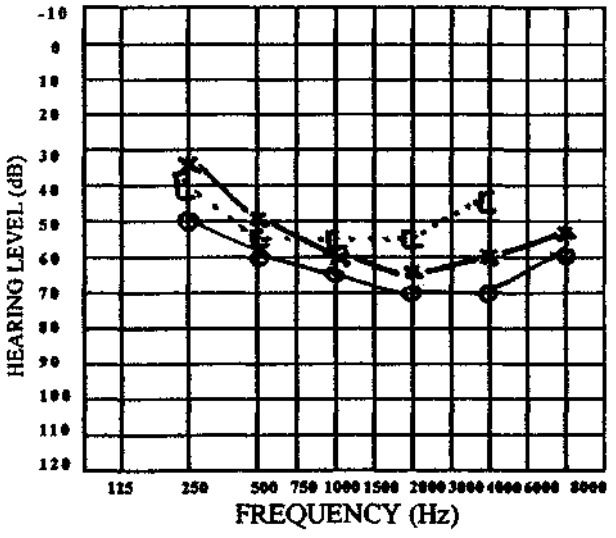
Diagnosis : Bilateral moderate Sensorineural hearing loss.

Patient Characteristics: Onset of hearing loss in childhood. Degree of hearing loss varies from mild to moderate in degree. Other associated features of syndrome are mental retardation, dwarfism and other metabolic dysfunctions.

Diagnosis : Sensorineural Hearing loss.

Visual **Audio**

Slide No. 12 c Chromosomal Abnormality (Down's Syndrome)



Patient Characteristics: Onset of hearing loss in childhood with mild to moderate degree of mixed hearing loss.

Hearing loss is associated with facial and other structural anomalies. Mental functions are also impaired.

Diagnosis : Mixed Hearing loss.

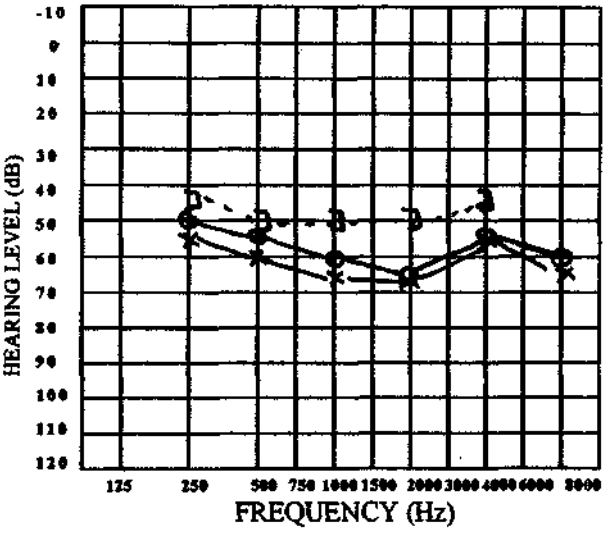
t		Right	Left
Speech Audiometry			
SDT		65dB	55dB
Impedance :			
Tympanogram	'A'		'As'
Static Compliance		80cc	0.75cc
Acoustic Reflex			
Contralateral		[redacted]	[redacted]
Ipsilateral		[redacted]	[redacted]

Diagnosis :

Bilateral moderately severe mixed hearing loss.

Visual **Audio**

Slide No. 12.d. X linked resessive gene (Usher syndrome)



	Right	Left
Speech Audiometry		
SDT	**70dB**	**60dB**
SDS	**45%**	**55%**
Impedance :		
Tympanogram	'A'	'A'
Static Compliance	1.2cc	1.0cc
Acoustic Reflex		
Contralateral	[redacted]	[redacted]
Ipsilateral	[redacted]	[redacted]

Diagnosis :

Bilateral moderately severe sensorineural hearing loss.

Patient Characteristics: Onset of hearing loss is congenital. Usually moderate to severe degree of bilateral hearing loss.

Hearing loss is accompanied by progressive visual impairment.

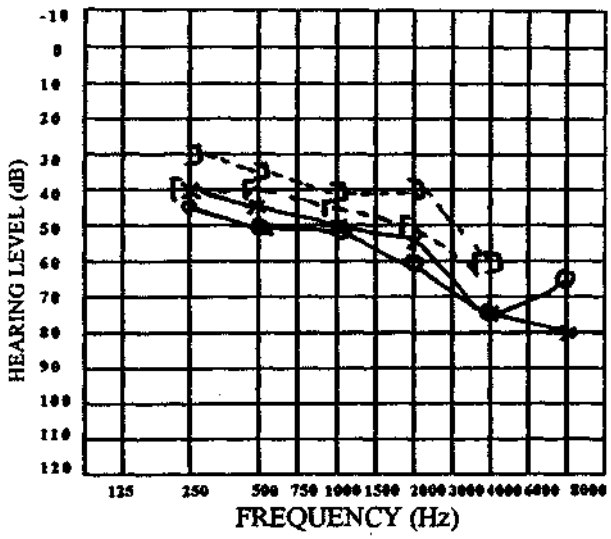
Diagnosis : Sensorineural hearing loss.

Presbyacusis

"Presbyacusis refers to hearing disorders due to senescent changes in the auditory system."

Visual

Slide No. (13.a.) SensorijPresbyacusis.



	Right	Left
Speech Audiometry		
SRT	50dB	50dB
SDS	70%	60%
Impedance :		
Tympanogram	'A'	'A'
Static Compliance	1.1 cc	0.7cc
Acoustic Reflex		
Contralateral		
Ipsilateral		
Special Tests:		
STAT	**-ve**	**-ve**
SISI	**80%**	**75%**
PI-PB	**0.20**	0.15

Diagnosis : Bilateral sensorineurai hearing loss.

Audio

Patient Characteristic: The age of onset of presbyacusis varies among individuals. Presbyacusis may be observed in males after the age of 32 years and in females after the age of 37years(Corso'1977). Gradually progressive, bilateral hearing loss accompanied with high pitched ringing tinnitus.

Pure Tone Audiometry: Pure tone senstivity results show bilateral, symmetrical sensorineural hearing loss.

Audiometric confiuration is characterised by sloping pattern. However the affected frequency region usually increases over time. In the initial stages, the hearing loss is typically confined to frequencies regions above 2000Hz, with increasing age hearing loss eventually involves lower frequencies also.

The pattern of hearing loss due to presbyacusis frequently differs between the sexes. Eg. Hearing loss is greater in high frequency region in males than in females while in females low frequencies are more affected.

Dynamic range is usually reduced.

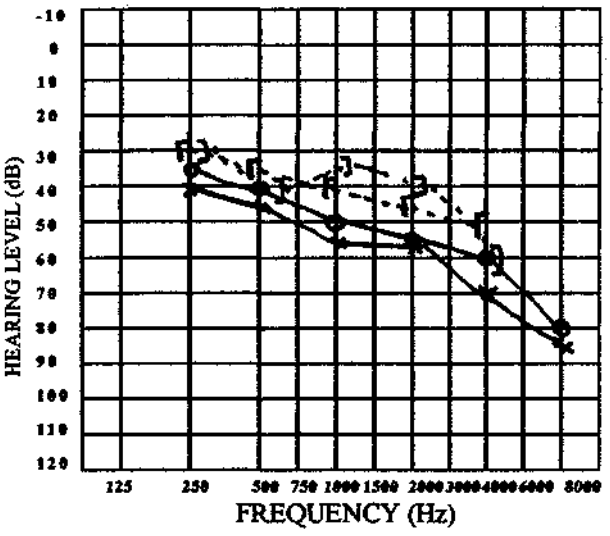
Speech Audiometry: Speech reception threshold corresponds to pure tone average.

Speech discrimination scores consistant with degree of sensitivity loss(in cochlear pathlogy) or unusually poor with degree of severity loss(as in retrocochlear pathology)

Depending upon the involvement of auditory nerve P1-PB function shows roll over.

Visual **Audio**

Slide No. 13.b. Neural Presbyacusis



	Right	Left
Speech Audiometry		
SRT	45dB	55dB
SDS	55%	50%
Impedance :		
Tympanogram	A'	'A'
Static Compliance	1.3cc	0.8cc
Acoustic Reflex		
Contralateral	▨	▨
Ipsilateral	▨	▨
Special Tests:		
STAT	**+ ve**	**+ ve**
SISI	**15%**	**15%**
PI-PB	0.45	0.50

Diagnosis: Bilateral moderate sensorineural hearing loss

Impedance: Normal tympanogram and static compliance measures. Depending on the site of disorder and degree of sensistivity loss accoustic reflex are present at normal HLs and reduced SLs (Sensory presbyocusis) or elevated or absent threshold,with abnormal reflex decay (as in neural presbyacusis)

Special tests: Tests based on phenomenon of adaption (STAT, TDT) helps in confirmation of retrocochlear pathology, where the tests are positive and recruitment tests (like — SISI) shows Kkjh scores indicating cochlear pathology.

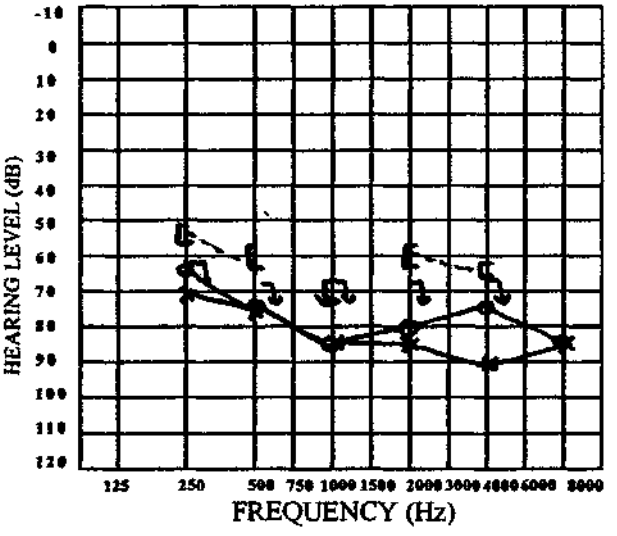
Diagnosis : Sensorineural hearing loss.

Ototoxicity

"Ototoxicity refers to the occurence of an undesired toxic reaction in the auditory or vestibular system consequent to drug intake. Factors responsible for it are potential toxicity, absolute dosage, duration and kidney function."

Visual **Audio**

Slide No. 14



	Right	Left
Speech Audiometry		
SRT	45dB	60dB
SDS	80%	50%
impedance :		
Tympanogram	'A'	'A'
Static Compliance	1.00cc	1.2cc
Acoustic Reflex		
Contralateral		
Ipsilateral		
Special Tests:		
STAT	**- ve**	**- ve**
SISI	**75%**	**90%**
PI-PB Index	0.20	0.15

Diagnosis : Biiatera, severe sensorineural hearing loss.

Patient Characteristics: Hearing loss due to ototoxic agents may be congenital or acquired. Onset of hearing loss is rapid or insidious with bilateral type. Ototxic reactions may be caused by a great variety of substances e.g.aminoglycoside anti biotics, diuretics, aspirin, CO or alcohol.

Pure Tone Audiometry: Pure tone sensitivity results characteristically show an unstable, bilateral sensorineural hearing loss. In the initial stages slope in audiometric configurartion is present which subsequently changes to relatively flatter contour with sensitivity loss at all frequencies.

Speech Audiometry: Speech reception threshold corresponds to pure tone average with poor speech dicriminatioh scores. No roll over seen in Pl-PB function.

Impedance: Impedance results usually show normal, type A, tympanogram and normal static compliance measures.

Acoustic reflexes are present at normal HLs and reduced SLs.

Special tests : Cochlear involvement is confirmed by reduced dynamic range and high scores on SISI.

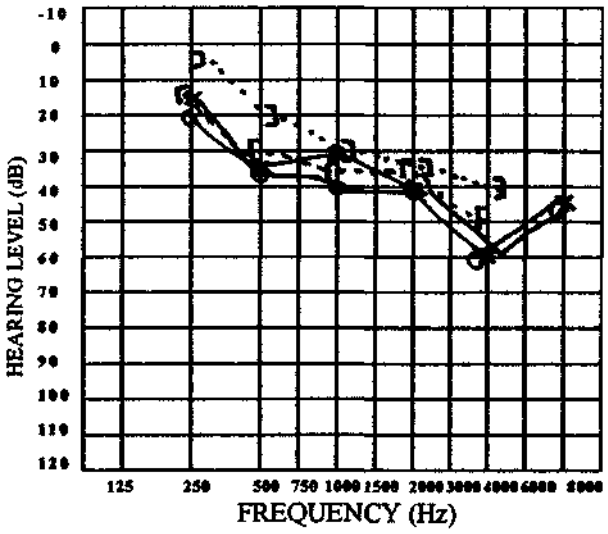
Diagnosis: Sensorineural Hearing loss.

Noise induced hearing loss

"Temporary or permanent loss of hearing either from long term exposure to hazardous noise environment or from short term exposure to single blast of intense noise"

Visual

Slide No. 15.a Prolonged noise exposure



	Right	Left
Speech Audiometry		
SRT	**45dB**	**55dB**
SDS	**30%**	**70%**
Impedance :		
Tympanogram	'A'	"A'
Static Compliance	1.5cc	1.2cc
Acoustic Reflex		
Contralateral		
Ipsilateral		
Special Tests:		
STAT	**- ve**	**- ve**
SISI	**80%**	**85%**

Dignosis : Bilateral moderate sensorineural hearing loss

Audio

Patient Characteristics: A person's susceptibility to hearing loss from noise is influenced by age, illness, exposure to drugs and preexisting hearing loss. Hearing loss from acoustic trauma may be unilateral or bialteral while consequent to prolonged exposure is characteristically bilateral.

Patient also complaints of high pitched, ringing tinnitus and fullness of the ear.

Pure Tone Audiometry: Pure tone sensitivity show a bilateral and symmetric sensorineural hearing loss. Audiometric configuration is downwardly sloping with greater loss in high frequency region than in low frequency region. Maximum threshold sensitivity loss occurs at 4000Hz notch becomes more deeper and wider, (Boilmaker's Notch)

In cases with acoustic trauma middle ear may be involved involving rupture of tympanic membrane.

Speech Audiometry: Speech discrimination scores depends upon the frequencies affected, discrimination remains normal if loss is confined to above 3000Hz.

Impedance: Normal type 'A' tympanogram and normal static compliance measures when middle ear is intact.

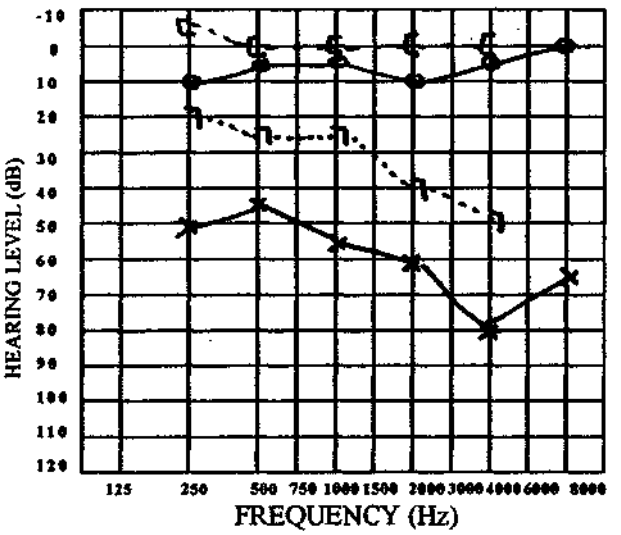
Depending upon the frequency region involved acoustic reflex found to be present or absent.

Special test: SISI test is indicative of cochlear pathology. Findings on STAT and reflex decay tests are usually negative.

Diagnosis : Sensorineural Hearing loss.

Visual Audio

Slide No. 15.b Acoustic Trauma (ruptured ear drum)



	Right	Left
Speech Audiometry		
SRT	15dB	45dB
SDS	100%	90%
Impedance :		
Tympanogram	'A'	'B'
Static Compliance	1.2cc -	
Acoustic Reflex		
Contralateral	■	■
Ipsilateral	□	■
Special Tests:		
STAT	**- ve**	**- ve**
SISI	**20%**	**15%**

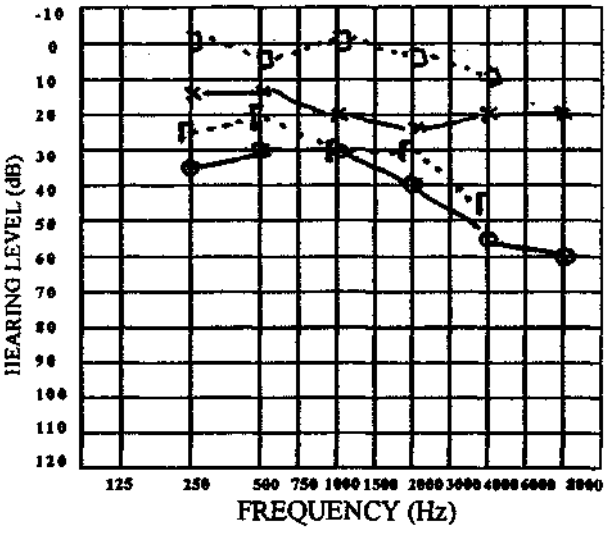
Dignosis : (Rt) Hearing within normal limit
(Lt) Moderate mixed Hearing loss.

Auditory nerve Tumour

"Acoustic neuromas are benign lesions that arise from the neurilemmal sheath of the eight. Cranial nerve within the internal auditory canal"

Visual

Slide No. 16



		Right	Left
Speech Audiometry			
SRT		40dB	15dB
SDS		50%	100%
Impedance :			
Tympanogram	'A'		'A'
Static Compliance		1.0cc	1.1 cc
Acoustic Reflex			
Contralateral		☐	■
Ipsilateral		■	☐
Special Tests:			
STAT		+ve	**-ve**
PI- PB index		0.50	0.20
Acoustic Reflex decay		**+ ve**	

Diagnosis : (Rt) Mild Senson neural hearing loss.
(Lt) Hearing with normal limit.

Audio

Patient Characteristics: Onset of symptom is usually between 30 and 50 years of age. Onset of hearing loss is insidious, progesssive and unilateral type. Hearing loss is accompanied by symptoms like tinnitus, dizziness, inco-ordination and other cranial nerve involvement.

Pure Tone Audiometry: Both bone conduction and air conduction thresholds reduced to similar degree. Greater loss is present in the high frequency region. Degree of loss varies from moderate to severe degree.

Speech Audiometry: Speech reception threshold corresponds to pure tone average. Speech discrimination scores are disproportionality poor to pure tone sensitivity. Pl-PB function indicates rollover phenomenon.

lmpedance:Tympanogram and static compliance are normal. Reflex pattern is characterised by diagonal pattern. Reflex decay test is positive.

Special Test: Positive response on STAT confirms auditory nerve involvement.

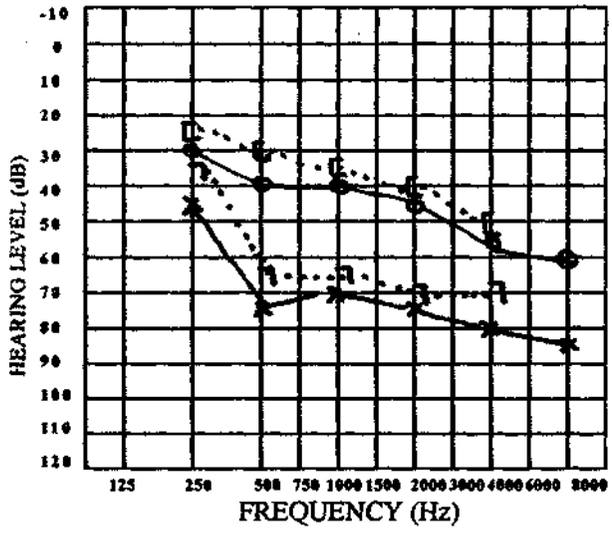
Diagnosis: Neural hearing loss.

Neuritis of the Auditory Nerve.

"Auditory neuritis is an inflammatory condition of the auditory division of the eigth nerve causing hearing loss without dizziness although tinnitus may be present."

Visual **Audio**

Slide No. 17



	Right	Left
Speech Audiometry		
SRT	45dB	70dB
SDS	70%	55%
Impedance :		
Tympanogram	'A[1]	"A'
Static Compliance	0.8cc	1.0cc
Acoustic Reflex		
Contralateral	[redacted]	[redacted]
Ipsilateral	[redacted]	[redacted]
Special Tests:		
STAT	**+ve**	**+ve**
PI-PB	**0.40**	**0.50**
Acoustic Reflex decay	**+ ve**	**+ ve**

Diagnosis : (Rt) Moderate sensorineural hearing loss.
(Lt) Severe sensorineural hearing loss.

Patient Characteristics: Auditory neuritis may follow systemic infectious diseases that produce high fever, eg. scarlet fever, influenza fever, typhoid fever etc. hearing loss is noticed immediately in conjunction with infection. Unilateral or bilateral asymmetric type is very common.

Pure Tone Audiometry: Both air conduction and bone conduction threshold are reduced to similar degree. Higher frequencies are affected more than low frequencies. Degree of loss varies from mild to profound.

Speech Audiometry: Speech reception thresholds correspond to pure tone sensitivity.

Speech discrimination scores disproportional to degree of hearing loss. Pl-PB funcion indicative of retrocochlear pathology.

Impedance: Normal type 'A' tympanogram and normal static compliance, Acoustic reflex absent or elevated. Acoustic reflex decay is positive.

Special test : STAT test indicative of abnormal adaptation confirming auditory nerve involvement

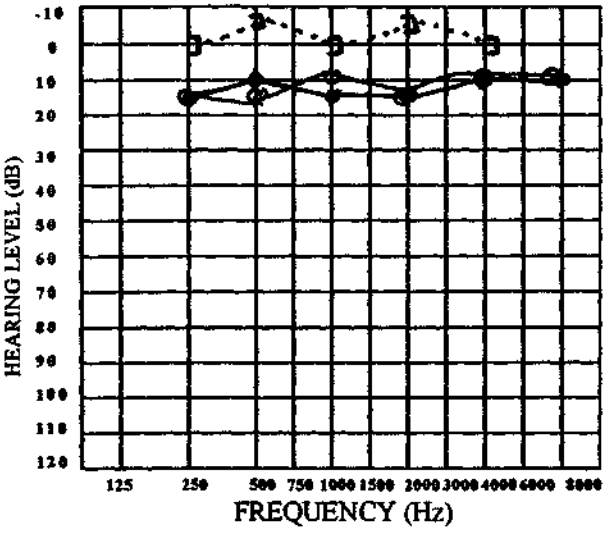
Diagnosis: Sensorineural hearing loss.

Facial nerve lesion

"Facial paralysis effects voluntary and emotional facial expression, speech and mechanism of mastication. It may or may not be associated with hearing loss depeding upon site of lesion.

Visual

Slide No. 18.



		Right	Left
Speech Audiometry			
SRT		15dB	15dB
SDS		100%	100%
Impedance :			
Tympanogram	'A'		'A'
Static Compliance		0.5cc	1.1cc
Acoustic Reflex			
Contralateral		■	□
Ipsilateral		■	□
Special Tests:			
SISI		**20%**	**20%**
STAT		**-ve**	**-ve**

Audio

Patient Characteristics: Onset of facial paralysis may be acute, slowly progressive and usually between the age of 20 years and 50 years. It may be accompanied by complaint of hearing loss, tinnitus and/or pain. Other symptoms are facial paralysis, loss of tase sense, eye muscle movement etc. Symptoms of facial paralysis may be chronic or may show complete recovery.

Pure Tone Audiometry: Pure tone sensitivity for both air conduction and bone conduction lies within normal linit at all the frequencies.
STAT and SISI tests confirms normal functioning of cochlea and auditory nerve.

Speech Audiometry: Speech reception threshold and speech discrimination scores within normal limit.

Pl-PB function scores within normal limit.

Impedance: The distinguishing audiologic characteristics of patient with facial paralysis are realted to stapedial muscle reflex.

Acoustic reflex pattern is characterized by absence of contralateral and ipsilateral reflexes on the affected side (Vertical pattern)

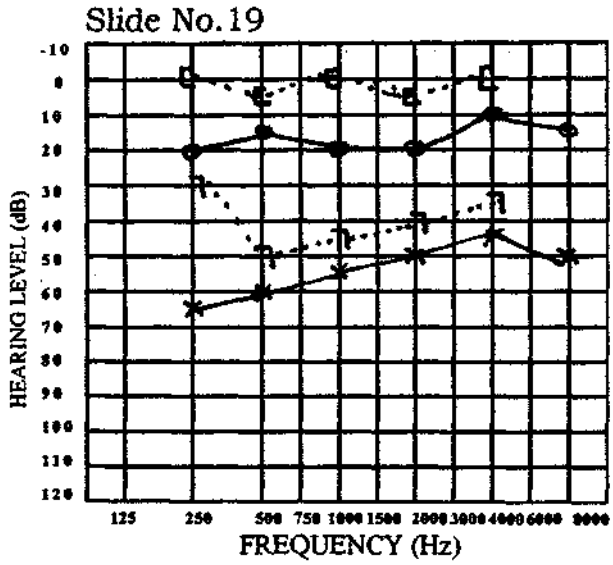
Other measures like tympanogram and static compliance are normal.

Diagnosis: Facial Nerve lesion.

Meniere's Disease

"Disease of the endolymphatic labyrinth characterized by fluctuating hearing loss, episodes of vertiga and tinnitus"

Visual **Audio**



		Right	Left
Speech Audiometry			
SRT		25dB	60dB
SDS		90%	60%
Impedance :			
Tympanogram	'A'		'A'
Static Compliance		0.80cc	1.1 cc
Acoustic Reflex			
Contralateral		■	□
Ipsilateral		□	■
Special Tests:			
UCL		120dB	95dB
PI-PB index		0.20	0.30
SISI		**20%**	**80%**

Patient Characteristics: Initial onset of symptom is between 40 and 60 years of age. Onset is typically characterized by sudden episode of vertigo accompanied by nausea and vomiting. Over time, symptoms of vertigo nausea and vomiting become less severe while hearing loss and tinnitus become more worse. Unilateral type is most common.

Pure Tone Audiometry: Pure tone sensitivity shows unilateral and fluctuating type of hearing loss. Audiometric configuration vary with time course. In the inital stages pattern may of rising with greater loss in low frequency regions. Subsequently may change to a relatively flat contour. During later age may present a downwardly sloping configuration.

Speech AudiometryrSpeech audiometry scores are usually reduced in manner consistent with the degree and configuration of sensitivity loss.

Impedance: Normal tympanogram and static compliance measures.

Acoustic reflexes are characteristically present at normal HLs and redced sensation levels. No reflex decay at 500 or 1 KHz.

Special Test : Cochlear involvement is confirmed by high scores on SISI and low score Pl-PB. Dynamic range is reduced.

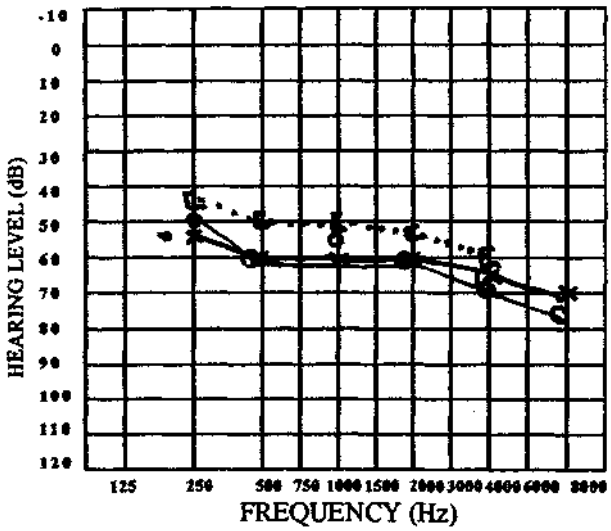
Diagnosis: Sensorineural hearing loss.

Diabetes Mellitus

"Diabetes mellitus is a chronic systamatic disease related to a relative or absolute deficiency of insulin. Complications of diabetes mellitusmay include disorder of ear, eye, kidney or cronial nerves."

Visual **Audio**

Slide No.20



	Right	Left
Speech Audiometry		
SRT	60dB	65dB
SDS	80%	75%
Impedance :		
Tympanogram	'A'	'A'
Static Compliance	1.2cc	1.0cc
Acoustic Reflex		
Contralateral	[redacted]	[redacted]
Ipsilateral	[redacted]	[redacted]
Special Tests:		
STAT	**-ve**	**-ve**
SISI	**80%**	**85%**

Diagnosis : Bilateral moderately severe sensorineural hearing loss

Patient Characteristics: Onset of diabetes is common after the age of 40 years. Onset of hearing loss is insidious but may be instantaneous also. Progressive bilateral hearing loss along with the complaint of dizziness.

Pure Tone Audiometry: Both bone conduction and air conduction thresholds are elevated. Degree of loss varies from mild to profound degree.

Audiometric configuration shows greater loss in the high frequency region than in the mid or low frequency.

Speech Audiometry: Speech reception threshold agrees with pure tone average. Speech discrimination scores may be proportionate or disproportionate to degree of pure tone sesitivity depending on the site of disorder.

Impedance: Normal type 'A' tympanogram and static compliance measures.

Acoustic reflex results may vary dependig on site of disorder and degree of loss. As a general rule, reflexs are present at normal HLs and SLs in cochlear pathalogy and elevated or absent in conditions with auditory nerve or facial nerve involvement

Special Tests : Response on SISI test is suggestive of cochlear involvement while usually negative response on STAT.

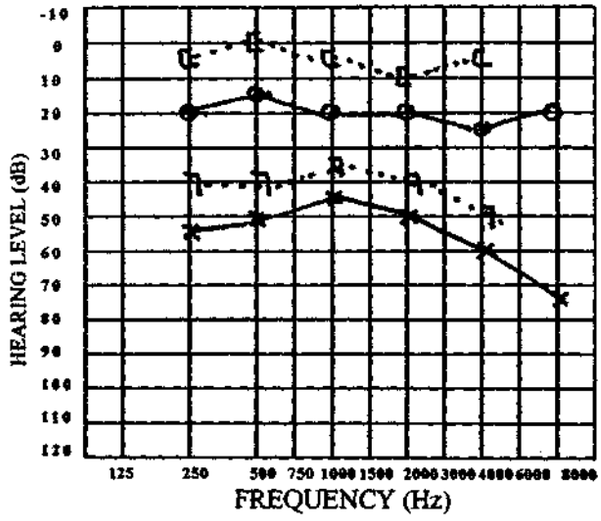
Diagnosis: Sensorineural hearing loss.

Hearing loss associated with Mumps

"Sudden unilateral hearing loss during or following mumps without affecting vestibular system."

Visual **Audio**

Slide No. 21



	Right	Left
Speech Audiometry		
SRT	20dB	55dB
SDS	100%	65%
Impedance :		
Tympanogram	'A'	'A'
Static Compliance	0.70	1.0cc
Acoustic Reflex		
Contralateral		
Ipsilateral		
Special Tests:		
STAT	-ve	-ve
UCL	120dB	95dB
SISI	20%	90%

Diagnosis : (Rt) Hearing within normal linits.

(Lt) Moderate sensorineural hearing loss

Patient Characteristics: Mumps is probably most frequent cause of unilateral severe cochlear loss, in children; older children and adults may also have the disease. Due to its unilaterality and absence of vestibular symptoms quite commonly remains unnoticed for long period.

Pure Tone Audiometry: Both air conduction and bone conduction thresholds are reduced to same degree. High frequencies are affected more than low frequencies. Hearing loss varies from severe to profound degree.

Speech Audiometry:Speech reception threshold corresponds to pure tone sensitivity response.

Speech discrimination scores found to be reduced in affected ear.

Impedance: Normal type 'A' tympanogram and reduced static compliance measures.

Acoustic reflex are present at normal HLs but at reduced SLs (Cochlear pathology)

Special Tests : Reduced dynamic range and response on SISI test suggests ccchlear involvement.

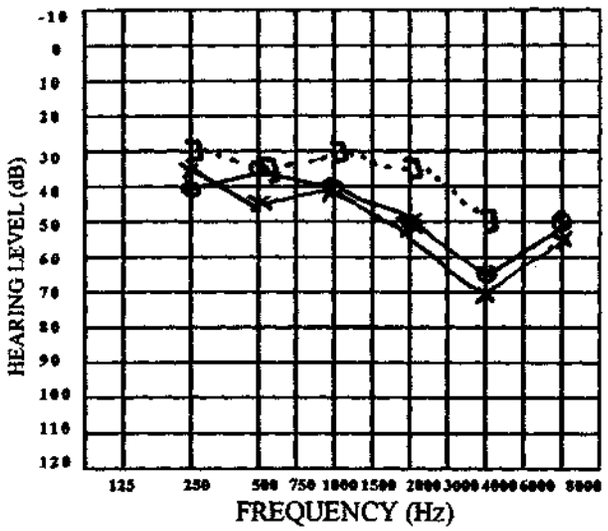
Diagnosis: Sensorineural Hearing loss.

Multiple Sclerosis

"Multiple sclerosis is a chronic, basically progressive disease of the central nervous system characterized by destruction of the myelin sheath of nerve fibers."

Visual

Slide No.22



	Right	Left
Speech Audiometry		
SRT	35dB	50dB
SDS	70%	60%
Impedance :		
Tympanogram	A'	"A'
Static Compliance	1.5cc	1.5cc
Acoustic Reflex		
Contralateral		
Ipsilateral		
Special Tests:		
STAT	+ve	+ve
PI-PB	0.40	**0.45**

Diagnosis : Bilateral moderate sensorineural hearing loss.

Audio

Patient Characteristics: Initial onset of symptoms betweeen 20 and 40 years of age with more prevalent in females than males.

Onset acute with classical symptomatolgy of visual problem, nystagmus, hearing loss, dysarthia and vertigo.

Pure Tone Audiometry:Pure tone sensitivity vary widely in patients with multiple sclerosis. Characterized by bilateral, sensorineural hearing loss for atleast one frequency. High frequencies are affected more commonly than low and mid frequencies. Dip at 4000Hz.

Speech Audiometry:Speech reception threshold agree with pure tone sensitivity measures.

Patients with lesion at the level of eigth nerve or brain stem show greater performance deficits on speech tasks.

Impedance: Normal tympanograms and static compliance measures. Reflex abnormalities may include reduced amplitudes, abnormal temporal patterns, elevated or absent threshold.

The diagonal pattern is consistant with an inter axial brain stem diagnosis.

Special Tests: Positive response on STAT test indicative of auditory nerve involvement.

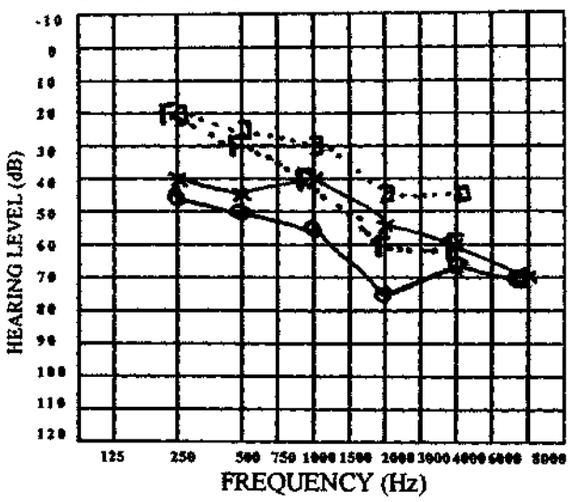
Diagnosis: Neural hearing loss

Paget's Disease

Paget's disease is a chronic bone disease particularly involving areas of spine, skull, pelvis, femur and tibi and onset of disease is insidious."

Visual **Audio**

Slide No.23



		Right	Left
Speech Audiometry			
SRT		65dB	55dB
SDS		60%	60%
Impedance :			
Tympanogram	'As'		'As'
Static Compliance		0.2cc	0.2cc
Acoustic Reflex			
Contralateral		[redacted]	[redacted]
Ipsilateral		[redacted]	[redacted]

Diagnosis : (Rt) Moderately severe mixed hearing loss.
(Lt) Moderate mixed hearing loss.

Patient Characteristics: Most commonly occur after the age of 40 years Physical findings include a markedly enlarged skull, a sunken chest, curved back and weddling gait. Clinical symptoms includes headache, facial pain, visual impairment, tinnitus, dizziness and progressive bilateral hearing loss.

Pure Tone Audiometry: Both air conduction and bone conduction thresholds are reduced usually a downwardly sloping configuration with greater loss in the high frequency region than in low frequency. Air bone gap greater at low frequency region. Degree of conductive component in the low frequency region may be 20 to 30 dB. The mixed hearing loss may progress to a pure sensorineural loss.

Speech Audiometry: Speech discrim nation scores are within normal range or consistant with degree of peripheral sensorineural involvement.

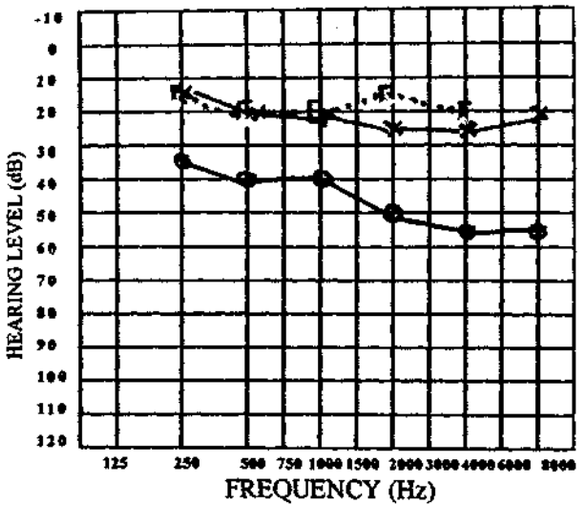
Impedance: Impedence usually shows abnormal tympanogram, abnormal static compliance measures and absent acoustic reflexes.

Diagnosis: Mixed hearing loss.

"Trauma to auditory system may result from direct blows to the head, penetrating wounds to the head or sudden pressure change in the atmosphere.

Visual **Audio**

Slide No.24 a. **Post traumatic haemotympanum**



		Right	Left
Speech Audiometry			
SRT		45dB	20dB
SDS		95%	100%
Impedance :			
Tympanogram	'B'		'"A'
Static Compliance			1.2cc
Acoustic Reflex			
Contralateral		■	■
Ipsilateral		■	□

Diagnosis : (Rt) Moderate conductive hearing loss.

(Lt) Hearing within normal limit.

Patient Characteristics: Onset of hearing loss is characteristically acute. Occassionaly onset may be delayed. Fluctuation, recovery or deterioration of pure tone sensitivity may occur. Other associated symptoms are facial nerve injury, tinnitus and dizziness.

Pure Tone Audiometry:Degree and type of hearing loss depends upon site and extent of injury.

In general unilateral conductive or mixed hearing loss is present in longitudinal temporal bone fracture while sensorineural loss is observed with transverse temporal bone fracture leading to unilateral or bilateral hearing loss.

Degree of loss ranges from mild to profound.

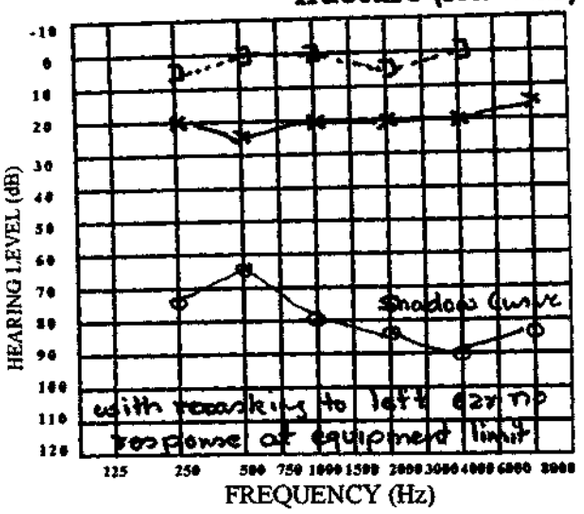
Speech Audiometry: Speech reception threshold corresponds to pure tone sensitivity.

Speech dicrinination scores are found to be poor depending upon cochlear, retrocochlear or auditory pathway involvement.

lmpedance:Acoustic reflex pattern vary depending on both site of the damage and degree of sensitivity loss. The possible site of damage affecting acoustic reflex results are middle ear, cochlea, auditory nerve, facial nerve or brain stem.

Visual **Audio**

Slide No.24 b. **Temporal bone fracture (Rt. side)**



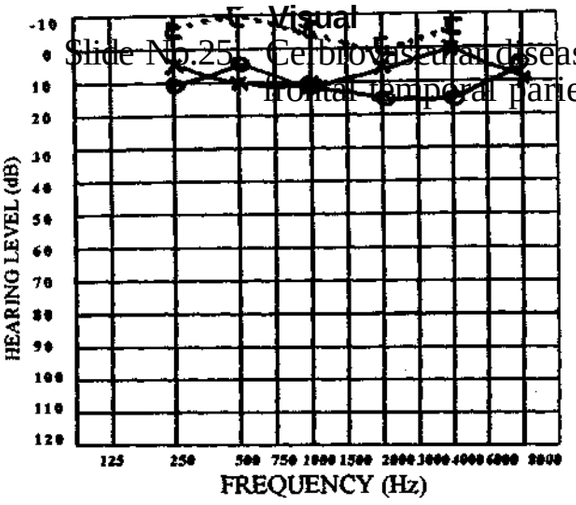
		Right	Left
Speech Audiometry			
SRT		NA	15dB
SDS		NR	100%
Impedance :			
Tympanogram	'A'		'A'
Static Compliance		1.8cc	1.0cc
Acoustic Reflex			
Contralateral		■	■
Ipsilateral		■	□

Diagnosis : (Rt)Profound mixed hearing loss.

(Lt) Hearing within normal limit.

Vascular dysfuction leading Hearing hearing loss.

"Sudden hearin loss, particularly in patients with otherosclerosis or maocardial infraction, characterized by high frequency sensorineural or central auditory hearing loss.



Slide No.25. Cerbiovsedtar disease of right frontal temporal parietal area.

		Right	Left
Speech Audiometry			
SRT		20dB	15dB
SDS		90%	95%
Impedance :			
Tympanogram	'A'		'A'
Static Compliance		1.2cc	1.0cc
Acoustic Reflex			
Contralateral		☐	☐
Ipsilateral		☐	☐
Special Tests:			
STAT		**-ve**	**-ve**
SSW		**85%**	**20%**
SSI-ICM		**53%**	**40%**
SSI-CCM		100%	**70%**

Diagnosis : Central Auditory disorder.

Patient Characteristics: Onset of symptoms may be insidious or instantaneous. Most of the patients arc 60 years of age or older. In patients with cerebrorascular disease characteristic symptoms are hemiplegia, vertigo, tinnitus, motor and sensory deficits and language disturbances. In patients with internal auditory artery and vertebral basilar disease sudden sensorneural loss may occur.

Pure Tone Audiometry: Pure tone sensitivity results ususlly show normal hearing or sensorineural hearing loss. High frequencies are affected more than low frequency.

Speech Audiometry: Speech reception threshold and speech discrimination scores usually are with in normal limit. Roll over of the Pl-PB function indicates central auditory disorder or auditory nerve involvement.

lmpedance:Type A tympanogram and normal static compliance measures indicative of normal middle ear functioning. Accostic reflex may be normal(temporal lobe lesion) or horizontal reflex pattern(brain stem lesion)

Special Test: Pronounced performence deficits are seen in SSW and SSI tests.

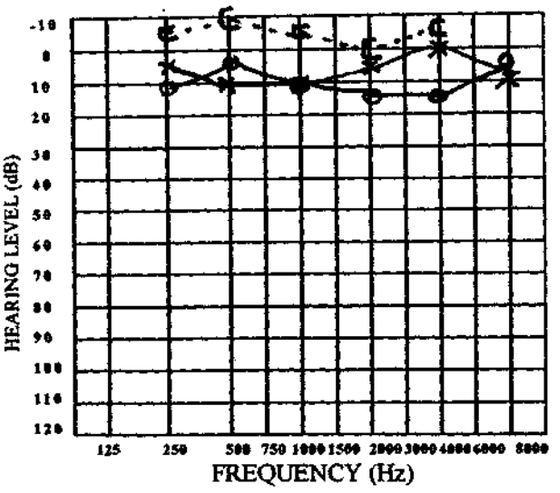
Diagnosis: Central auditory disorders.

Intracranial Tumours

"Intracranial tumors may arise from the skull, the meninges, the bload vessels, the pituitary gland, the chroid plexus, cranial nerves and neuroglia of the brain.

Visual

Slide No.26.a. Temporal lobe lesion (Rt. side)



	Right	Left
Speech Audiometry		
SRT	20dB	15dB
SDS	90%	90%
Impedance :		
Tympanogram	"A^1	"A^1
Static Compliance	1.2cc	1.0cc
Acoustic Reflex		
Contralateral	☐	☐
Ipsilateral	☐	☐
Special Tests:		
STAT	**-ve**	**-ve**
SSW	100%	**48%**
SSI - ICM	**43%**	**37%**
SSI CCM	100%	**67%**

Diagnosis: Central auditory disorder.

Audio

Patient Characteristics:Brain tumors may occur at any age. Tumors are responsible for hearing dysfunction usually originated at the level of brain stem or temporal lobe. In patients with intracranial tumors affecting central auditory system, the laterality of the disorder varies depending upon the site of involvement. In patients with temporal lobe site auditory disorder is unilateral(contralateral side) while in brain stem lesion it is bilateral.

Pure Tone Audiometry: Pure tone sesnitivity normal for both ears. In few patients a mild, bilateral, high frequency loss may be observed. In general pure tone sensitivity results are symmetric (intra axial brain stem lesion) and asymmetric (Eigth nerve lesion).(Neely'1977)

Speech Audiometry: Speech reception threshold within normal limit. Speech discrimination scores normal or may be poor.

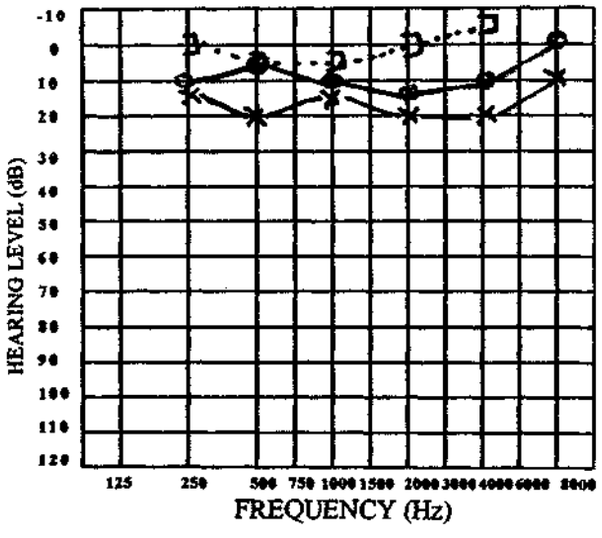
Roll over of the Pl-PB function in the absence of sensitivity loss indicative of central auditory disorder.

In addition to the SSI and SSW, unsuual performance deficits may be observed for speech tests degraded by filtering compression or temporal interruption.

Visual

Audio

Slide No.26.b. **Brain Stem lesion (Rt. ecentric)**



		Right	Left
Speech Audiometry			
SRT		15dB	25dB
SDS		80%	85%
Impedance :			
Tympanogram	'A'		'A'
Static Compliance		1.0cc	0.75cc
Acoustic Reflex			
Contralateral		■	▨
Ipsilateral		□	□
Special Tests:			
STAT		**-ve**	**-ve**
SSI - ICM		**77%**	**10%**
SSI - CCM		100%	100%

Diagnosis : Central auditory disorder.

Impedance: Impedence audiometry characteristically shows normal tympanogram and normal static compliance measures. Acoustic reflex results vary, however, depending on the site of the disorder. In general, reflexes are normal in patients with temporal lobe site and abnormal in patients with intra axial brain stem site(Horizontal pattern). Reflex thresholds on both ears are characterized by elevated threshold in crossed condition and normal in uncrossed condtion.

Special Tests : Response on SSI and SSW helps in differentiating lesions between brain stem involvement or temporal lobe involvement. In addition to SSI and SSW unusual performance deficits may be observed for speech tastes degraded by filtering, compression or temporal interruption.

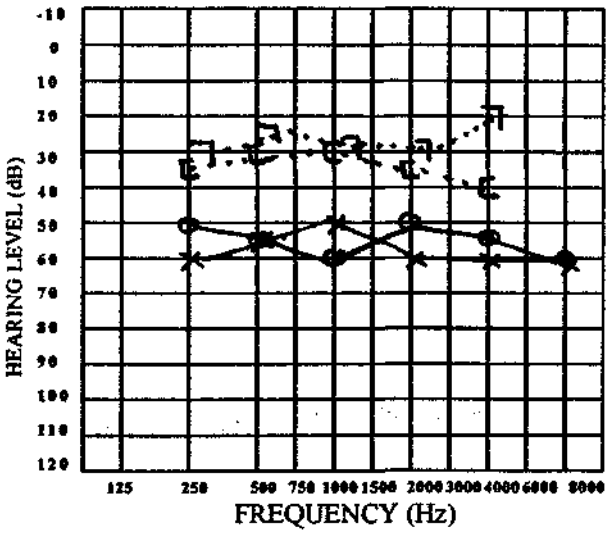
Diagnosis: Central auditory disorder.

Functional Hearing loss

"Functional hearing disorders are apparent losses that cannot be attributed to an organic etiology or a structural change."

Visual **Audio**

Slide No. 27



	Right	Left
Speech Audiometry		
SRT	30dB	30dB
SDS	80%	75%
Impedance :		
Tympanogram	'A'	'A'
Static Compliance	1.0cc	1.2cc
Acoustic Reflex		
Contralateral	☐	☐
Ipsiiateral	☐	☐
Special Tests:		
STAT	**-ve**	**+ve**

Patient Characteristics: Functional Hearing loss may occur in patients of any age. Psychological assesment reveals a greater degree of emotional immaturity, instability, neurotic anxiety then the general population. Onset of hearing loss may be vague and uncertain or may be sudden and referred to a specific incident, hearing loss may be unilateral or bilateral.

Pure Tone Audiometry:Pure tone sensitivity is characterized by a moderate to severe air conduction and bone conduction loss. Audiometric configuration usually shows an inverted saucer shaped audiogram and some times the bone conduction threshold may be poorer than the air concuction threshold. A primary characteristic may be unusual variability in ascending and descending threshold seeking procedure.

Speech Audiometry: Speech reception threshold and speech discrimination scores are dispropotionately good relative to the apparent pure tone sensitvity loss.

Impedance: Impedance results characteristically show normal tympanogram normal static compliance and acoustic reflex.

Special Test: Speech Stenger test is positive.

Diagnosis: Functional hearing loss.

SUMMARY AND CONCLUSION

The audiological investigation aims at determining the degree and type of hearing loss and at the same time gives a directions towards determining the exact site of lesion. To achieve this any single test is not adequate and audiologists have relied upon the test battery approach. From the point of view of this project only pure tone audiogram, Speech audiometry immittance measures and conditions specific special tests have been taken into consideration. However, this is not the exhaustive list and other tests can also be administered on those cases,

Further more any single disorder of the auditory system might manifest itself in different patterns of audiogram depending upon the severity, chronicity and the associated conditions. The slides prepared in this project represent the most common findings in a particular disorder. However the pattern may be slight different depending upon the factors just discussed.

This piece of work is intended to help readers in developing an understanding of the rationale for the audiological approach to the diagnosis and treatment of patients with audibtory problems. It is expected that this work will deliver adequate assistance to various professionals contributing to the habilitation and education of hearing impaired children and rehabilitation for adults.

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Appendix 1. a

Key to Symbols

	Right	Left
Air Conduction		
Unmasked		
Masked		
No response		
Bone Conduction		
Unmasked		
Masked		
No response		
Sound Field		
No response		

Appendix 1. b

Classification of Severity of Hearing Loss

Hearing level (dB)	**Classification**
< 26	Normal hearing
26-40	Mild
41-55	Moderate
56-70	Moderately Severe
71-90	Severe
> 90	Profound

APPENDIX-II

Acoustic Reflex: Acoustic reflex threshold measure is one part of impedance audiometry. It is routinely measured at octave intervals between 500 Hz and 4000 Hz.

Reflex threshold is defined as the lowest HL in dB that produces reliable changes in acoustic immittance time-locked to the reflex eliciting signal.

Acoustic reflex threshold is interpreted as normal if the HL is 100 dB or less. Threshold is considered abnormally elevated if the HL is 105 HL or more. The reflex sensation level (SL), defined by the difference between reflex threshold HL and the behavioural threshold HL, normally ranges from about 70 dB to 100 dB. SLS of less than about 55 dB are indicative of cochlear pathology and SLs more than 100 dB are indicative of auditory nerve lesion.

Speech Reception Threshold (SRT): The SRT is an index of the lowest level of speech a patient can hear and understand. It is the threshold of speech intelligibility defined as lowest level at which the client can respond correctly to 50% of speech stimuli presented.

Pure tone Average (PTA): is an index for quantifying degree of pure tone sensitivity loss. It is usually obtained by averaging thresholds level at 500, 1000 and 2000 Hz.

PI-PB Index: PI-PB Index or Roll over Index is computed by equation: (PB Max-PB min) PB max.

A PI-PB index of more than .40 is considered positive for eighth nerve disorder. A while an index of less than or equal to .40 is negative for eight nerve disorder.

Speech Discrimination Score: Percentage of correctly identified items on a speech discrimination to task when items are presented at a given suprathreshold level.

Speech Detection threshold: The hearing level at which a defined speech sample is detected 50% of the time.

Static Compliance: Static compliance is a measure of middle ear mobility.

It is measured in terms of equivalent volume in cc's based on two volume measurements.

a) C1 is made with the tympanic membrane in a position of poor compliance with + 200 mm H_2O in the ear canal.

b) C2 is made with tympanic membrane at maximal compliance. Static compliance is Cl - C2 by cancelling the column of air in ear canal. Normal values ranges from .5cc to 1.75 cc.

Short increment sensitivity index (SISI): A test for localizing the site of damage to the cochlea. It measures the patient's ability to detect small, short changes of sound intensity.

Test is done monoaurally by fixing the level of a steady tone at 20 dB above the patient's threshold at each frequency and superimpose 1 dB increments of 200 ms duration, at 5 sec. interval on steady tone.

SISI scores between 70% to 100% are considered positive for cochlear pathology and 0-20% negative for cochlear pathology.

Supra threshold Adaptation Test (STAT) : it measures the presence or absence of abnormal decay for continuous tones presented for 60 seconds at 100 dBHL in one ear and white band noise in other ear. Patient is asked to respond as long as he hears the tone.

If he hears the tone for full 60-sec. period result is negative and if he fails to respond for 60 sec. period test is positive and indicative of auditory nerve involvement.

SSI-ICM (Synthetic test sentence identification in presence of ipsilateral competing message).

SSI materials are presented at 50 dB SPL (30 dBHL) and the sentence to competing message ratio is varied from 10 dB to - 20 dB. SSI - ICM score is obtained by averaging performance at 0, - 10 and -20 dB.

Average normal performance 75%. This score measure is sensitive to especially brain-stem lesions.

SSI-CCM (Synthetic sentence identification in presence of contra-lateral competing message)

Sentences are presented at 50 dB SPL (30 dBHL). Sentence to competing message ratio is varied from 0 to -40 dB. Average performance at 0, - 20 and -40 dB is calculated.

Normal performance at all ratio is 100%. This measure is sensitive in identification of central auditory dysfunction at the level of temporal lobe.

SSW (Staggered spondaic word) test: SSW test requires the listener to repeat spondee words. Spondee words are presented to both ears in dichotic and not competing conditions.

Test sequence includes first syllable presentation to (Right) ear in isolation, second syllable to (right ear) simultaneously with first syllable to (left ear) and finally 2nd syllable to (left ear) in isolation.

SSW test is sensitive for temporal lobe lesion.

Tympanometry: It is the graphic representation of the change in impedance of middle ear mechanism as air pressure is varied in the external canal.

Stenger Test: Test for evaluating the possibility of a functional unilateral hearing loss. Voluntary threshold for spondee (ST) are first determined for each ear. Spondee words are then presented to both ears at about

10 dB above voluntary ST on uninvolved ear. Level of bad ear is increased in dB steps until the speech intensity equals patients voluntary ST.

If the patient ceases to respond before his voluntary ST level is reached, stenger test is considered positive confirming functional component in apparent hearing loss of bad ear.

If patient continues to respond as speech intensity on bad ear increased to voluntary, ST level stenger test is considered negative for functional component.

Uncomfortable Loudness Level: The decibel level which the client reports as uncomfortably loud is recorded as the uncomfortable loudness level. UCL is used to measure dynamic range which is found to be reduced in patients with cochlear pathology.