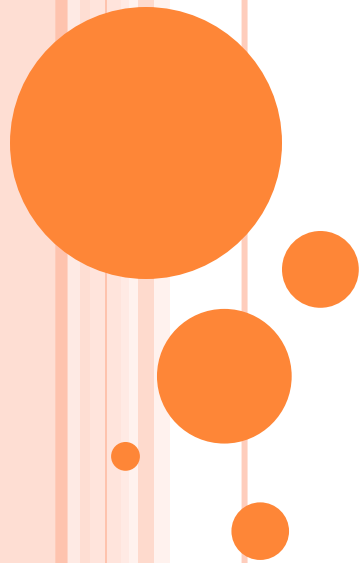


# TRADITIONAL AUDIOLOGICAL SITE OF LESION TEST

“Cochlear and  
Retrocochlear  
behavioral tests “



# INTRODUCTION

- The audiologic test battery was developed to differentiate between cochlear and Retro-cochlear ( **8<sup>th</sup> nerve and extra-axial brain stem**) etiologies
- It was used with unilateral or asymmetrical SNHL



- The traditional tests include: ABLB, SISI, tone decay, speech recognition, Bekesy, ART and reflex decay test
- Electro-nystagmo-graphy (ENG) and brain stem auditory-evoked potentials (BEAPs) were added later



# LOUDNESS BALANCE PROCEDURES

- **Recruitment:**

Abnormal growth of loudness for signals at supra-threshold intensity levels.



## ○ Example:

- Person with 5 dB HL in one ear and 45 dB HL in the other ear, the tones are perceived equally like ( 5 is heard the same as the 45 dB HL in the other ear )
- If the level increased to 70 dB HL in the better ear (65 dB SL) and this will be equal to 70 dB HL in the poorer ear ( 25 dB SL ), that means that 25 dB SL in the poorer ear was enough to make the sound equally like the 65 dB SL in the better ear



- The given example illustrating the most common loudness balance procedures ABLB and MLB
- **ABLB** compares loudness growth for the same frequency between different ears
- **MLB** compares loudness growth for the same ear at different frequencies



# ALTERNATIVE BINAURAL LOUDNESS BALANCE (ABLB)

- The examiner will present and control the stimuli
- The patient should judge about the loudness of the stimulus
- Good ear used as a (**reference ear**) and the poorer ear used as (**variable ear**)



- **For MLB**, good frequency used as reference while, poorer frequency used as variable and the procedure is the same
- Test should be applied at different intensity levels
- Patient instructed that he will hear to tones, one constant in loudness and the other one variable





- ✓ The patient should state whether the variable one is softer than, louder than or equal to the reference ear.
- The signal in the reference ear should be presented at every sensation level for few seconds



# PLOTTING THE RESULTS AND INTERPRETATION

- The results plotted using what we call as **ladder-gram**
- **Interpreted as**
  - Complete or partial recruitment ( cochlear pathology)
  - No recruitment
  - Decruitment ( Retro-cochlear pathology)



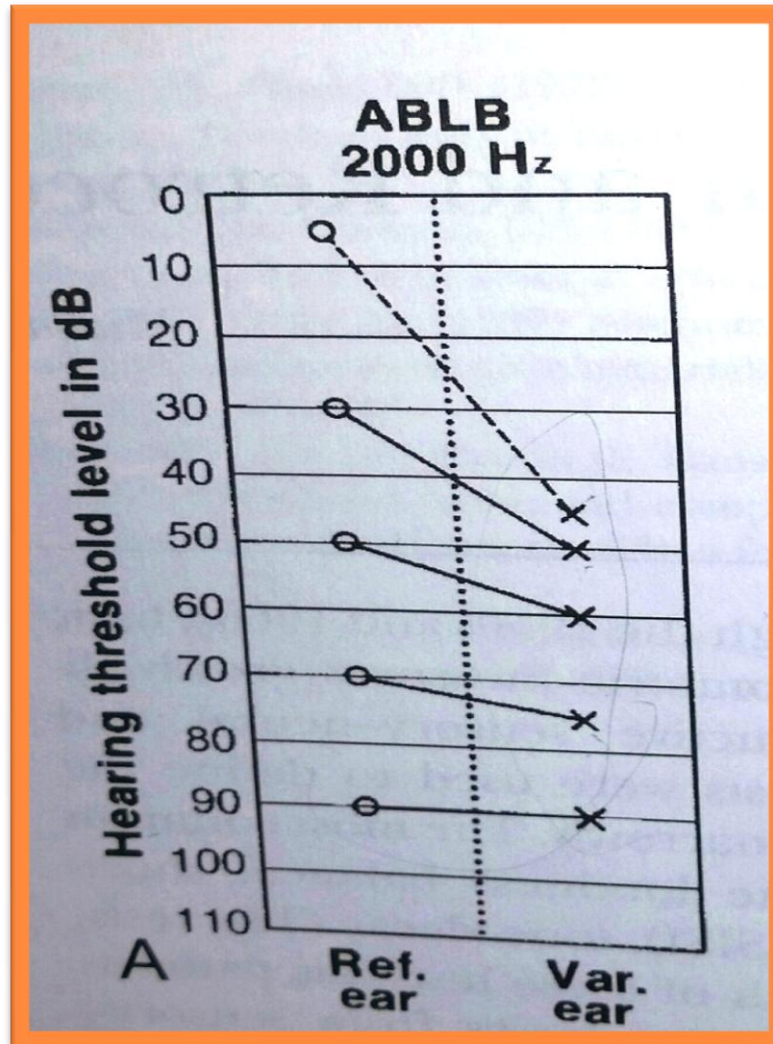
- However, **attention should be paid** as the previous research cited **no recruitment** in 15 to 27 % of patients with **cochlear pathology**
- **Eighth nerve tumor** is considered as **retro-cochlear pathology**. However, **some patients** with such **tumors** showed **recruitment** ..
- This possibly due to interference with cochlear blood supply and the size of the tumor



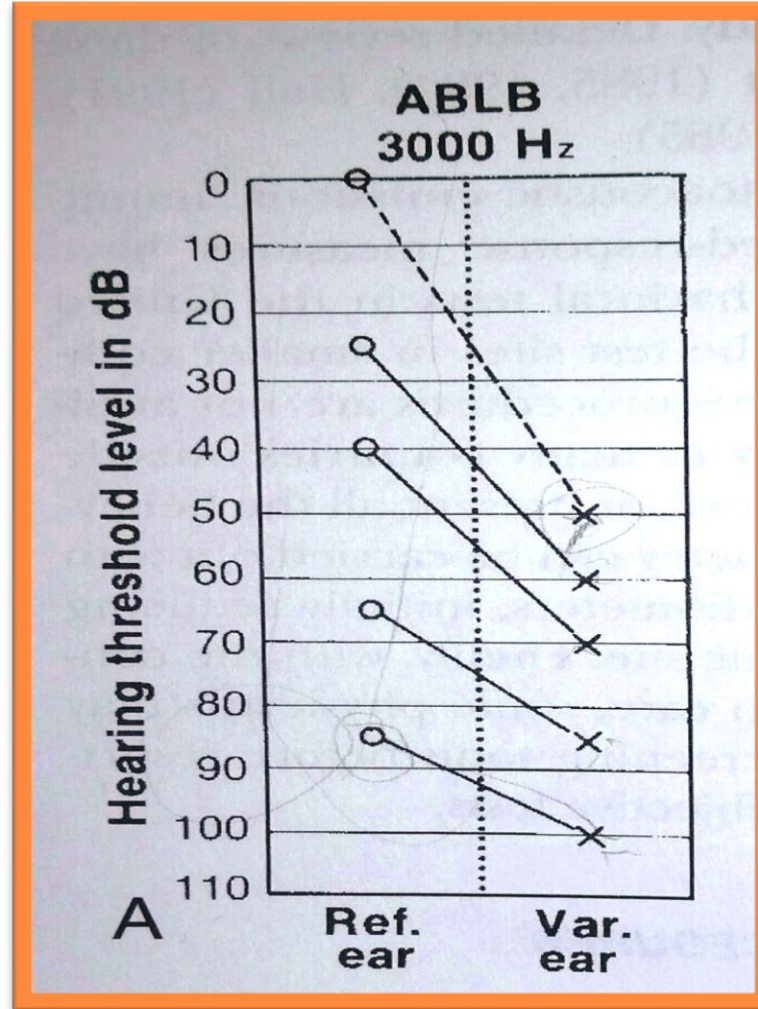
- Absence of recruitment or decruitment is seen in most patients with large tumors
- Loudness balancing procedures are effective in detecting CP but less so in ruling out RCP



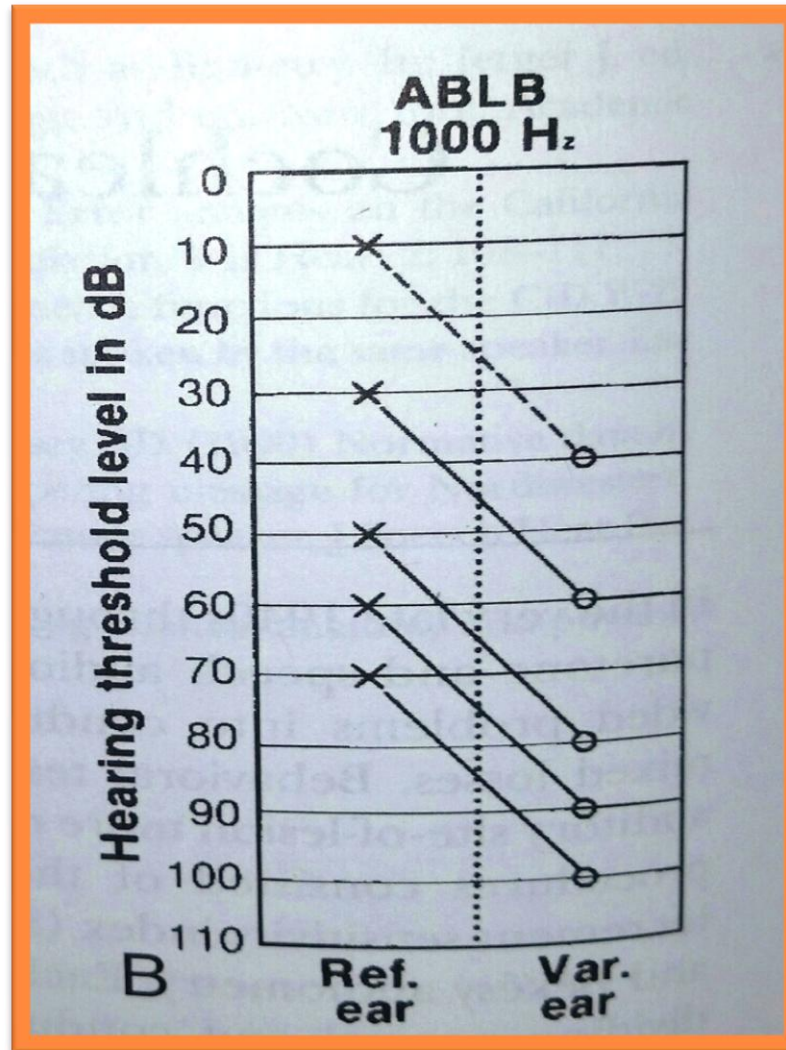
# COMPLETE RECRUITMENT



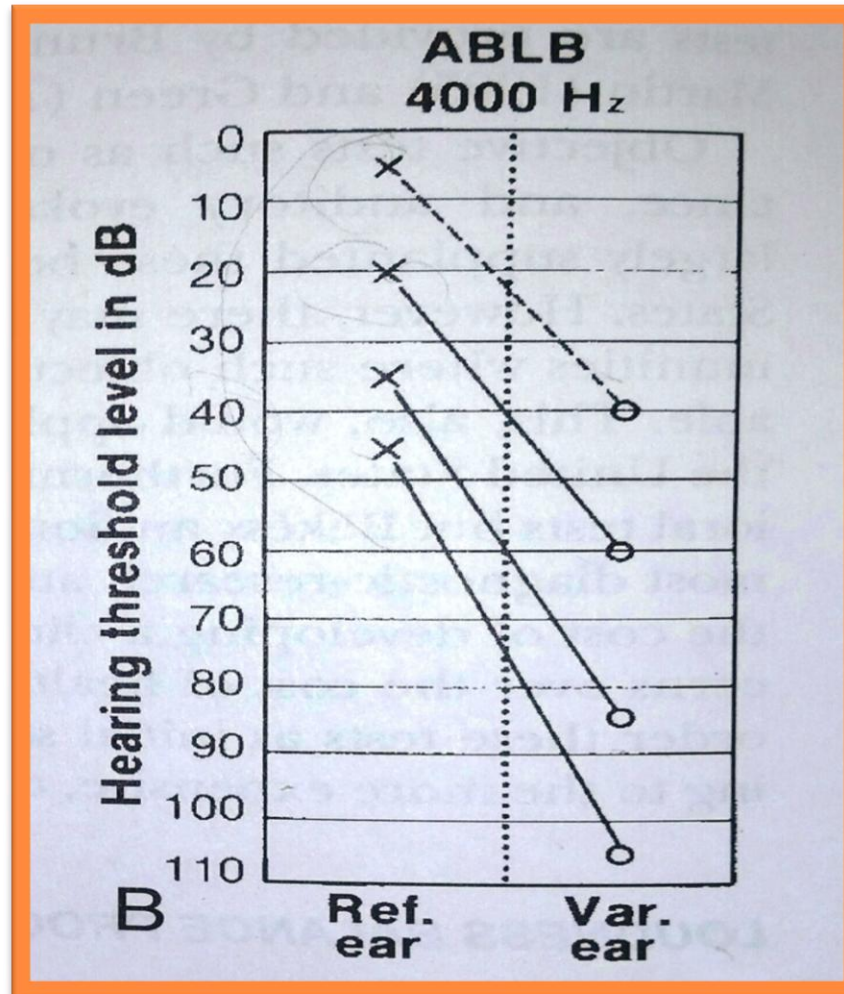
# PARTIAL RECRUITMENT



# NO RECRUITMENT



# DERUITMENT





# MONAURAL LOUDNESS BALANCE (MLB) TEST

- It's developed to assess recruitment in patient with bilateral hearing loss
- The test done for each ear separately between two frequencies (one normal hearing and one with hearing loss )
- Procedure is the same as ABLB except that two tones of different frequencies will be presented for balancing



- One problem with MLB, that the balancing for different frequencies with the intensity are not necessarily perceived as equally loud
- ✓ Many patients find it difficult to do balance between tow tones heard in the same ear



# SHORT INCREMENT SENSITIVITY INDEX (SISI)

- SISI test was first developed by Jerger et al (1952,1953)
- It is a simple test where the patient should indicate when a steady tone increased in loudness



- Jerger has suggested that the SISI test should not be viewed as a test for recruitment rather it is a site of lesion test
- It's results are complement to loudness balance testing. However, they are different tests



# CONVENTIONAL SISI TEST

- The test is administered by presenting carrier tone or steady tone at 20 dB SL (based on the pure tone threshold)
- There will be increment in loudness about every 5 seconds
- The patient task is to indicate whenever s/he notices the increments



- 5- dB increments will be presented for several trails, typically heard by most patients
- Then, 20 of 1- dB increments will be played ( this is the real test )
- Each correct response worth 5 %



## RESULTS

- Patients with cochlear hearing loss detect most of 1- dB increments (**high or positive scores**)
- Normal hearing people, patients with CHL or non-cochlear lesions got (**low or negative SISI scores**)



- Jerger has divided the scores as follow;
- **0-20 % >>> Negative or low SISI scores (normal hearers, CHL or RCP ( eight nerve lesions )**
- **25 – 65 % >>> questionable**
- **70- 100 % >>> High or positive SISI scores ( cochlear loss)**





# PROCEDURAL VARIATION IN SISI

- Several researches have been done it to shorten the test and improve its specificity and sensitivity
- To reduce false positive responses, some increments deleted
- To reduce false negative responses, increments of greater than 1 dB will be introduced



- As patients typically either hear most of increments or hearing just few or non of the increments, reduce the number of 1-dB increments to 10 times rather than 20 is saving the clinical time
- 10 times increments suggested if for the first 10 ( 1 or non of the increments detected ( 0 to 10 %) or if 9 to 10 increments detected ( 90 to 100 %)



- Other than that, 20 times should be completed
- For 10 times increments, each correct response worth 10 %



# PRESENTATION LEVEL OF SISI AND D.D

- **At the low presentation level (20 dB SL),**
- ✓ Most normal hearers show negative or low SISI scores



- ✓ Many patients with mild to moderate cochlear loss at this usual level , show low or negative SISI scores (0-20 %) or questionable scores ( 25- 65 %)
- ✓ Those with greater cochlear loss show positive or high SISI scores (70-100 %) at this usual level



- However, with high presentation level (greater than 20 dB SL),
  - ✓ All of normal hearers and those with mild to moderate or greater cochlear loss showing high or positive scores ...
- Always patients with RCP showing low or negative SISI scores ( below 25 %) at usual level (20 dB SL)
- Some researchers suggested that SISI test is not sensitive in detecting RCP



# CLINICAL PROCEDURE

- Most of researchers suggests use of high level of SISI testing ( above 20 dB SL), 75 dB HL has been suggested
- With this high level, normal people and those with cochlear loss will show high scores ( 70 to 100 %) and those with retro-cochlear loss will show low scores ( 0-20 %)



- However, usual level ( 20 dB SL) is recommended whenever questionable scores seen ( 25 – 65 %)





# TONE DECAY TEST

- It's a test involves presenting a constant pure tone at threshold or supra-threshold level as a starting level
- the patient task is to indicates when the tone is present and when it disappears
- usually the hand is raised as long as the tone is there and lowered when the tone dies



- Test done at 500, 1000, 2000 and 4000 Hz
- **Tone decay** is defines as the reduction in ability to hear a sustained tone
- Numerically, it's the difference between the threshold and the level at which the test terminated



- **For example**, Patient with 35 dB HL threshold at 2000 Hz, TD test started at 35 dB HL and the intensity increases at 5 dB steps each time the perception of the tone is lost.
- When the test terminated at 1 mint at 65 dB HL, TD is  $65 - 35 = 30$  dB



# CLINICAL SIGNIFICANCE OF TONE DECAY

- The important aspects of TD is the amount and the rate of decay

## 1. Amount of decay

- For **normal hearers**, the amount of decay is usually from 0-10 dB across all frequencies



- For **cochlear loss**, the amount of decay is usually from 0-15 and it might reach 25 dB at higher frequencies and it's rarely reaching 30 dB
- Maximum decay seen in **retro-cochlear loss** (8<sup>th</sup> nerve lesion), it is about 30 to 35 dB up to the audiometer limits across the frequencies (more at high frequencies)
- 500 and 2000 Hz should be tested as there is difference between both cochlear and retro-cochlear



## 2. RATE OF DECAY ( TIME )

- The rate of decay differs between CP and RCP
- For **cochlear loss**, at successive 5- dB increments, tone **audibility is longer** and longer
- For **RCP**, the **rate** is quiet rapid but **does not significantly change** with intensity increments



# CARHART PROCEDURE

- Test starts at 0 dB SL and the stopwatch started too
- If the tone is heard for the whole one minute, the test is done at that frequency and there is no decay
- If the patient lowered his hand before the end of one minute, the heard time is recorded, the intensity raised by 5 dB and the time is reset ...



- The previous step will be repeated until either,
  - The patient hears the tone for the whole one minute
  - The audiometer limit reached
  - The amount of decay significant to judge





- All of these steps will be repeated for all frequencies and for both ears ( this is clinic time consuming)
- That's why other procedures have been developed



# ROSENBERG'S PROCEDURE

- Like Carhart one, except that is **the whole test for 1 minute per test frequency**
- Sustained tone presented at threshold level and the stopwatch is started



- Each time the patient lower his hand, the intensity increases in 5 dBs until the end of the 1 minute
- Then, the amount of decay will be calculated



# ADDITIONAL TESTS

- Bekesy Testing: performed by special audiometer
- Speech discrimination Scores (SDS)
- Acoustic Reflexes
- Reflex decay test

