



# Cochlear Implant

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# ? Diagnosis

- Can hear ?
- Dose not speak
- Should we wait (relative experiences)

# Let us Agree

- Good to be careful
- The earlier the better
- Hearing is very important
- Hearing loss is very common

# ورد في القرآن الكريم

لفظي السمع و البصر معاً ( ١٩ ) مرة

ذكر في ( ١٧ ) سبعة عشر لفظة السمع قبل البصر منها

– قوله تعالى: ( و هو الذي أنشأ لكم السمع والأبصار و الأفئدة )المؤمنون : ٧٨

– قوله ( إن السمع و البصر و الفؤاد كل أولئك كان عنه مسؤولاً ) الإسراء : ٣٦ .

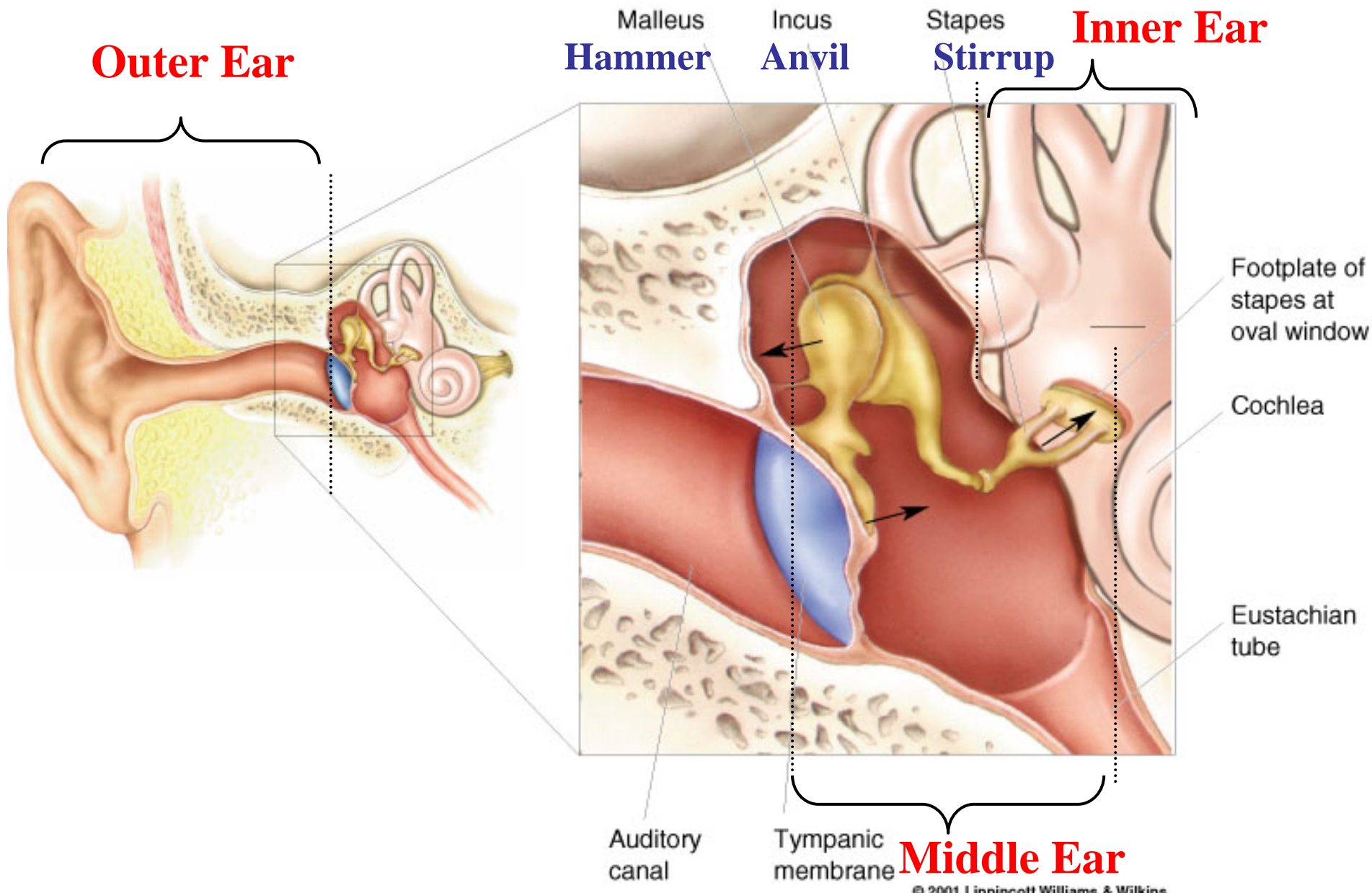
- Foetus can hear
  - cochlea mature at 24 weeks
- Even minor loss is a major loss

# Childhood Deafness

- higher than other childhood disorders
- 0.1% children
- 3 % of intensive care infants

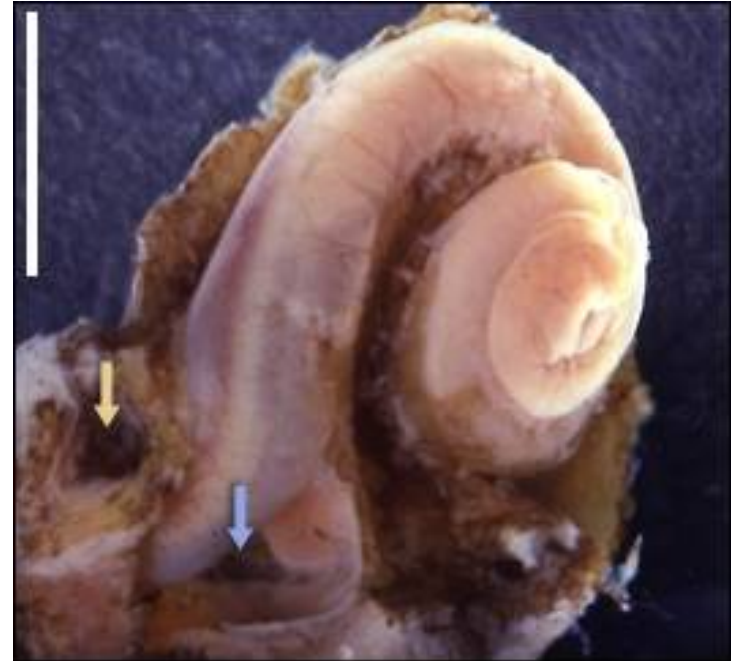
# Childhood Deafness

- Conductive
- Sensorineural
  - Cochlear
  - Retrocochlear



# Cochlea

- Frequency analyzer
- Energy converter
- Some frequencies
- All Freq → Comprehensive speech





# **Make sure**

## **Hearing Tests**

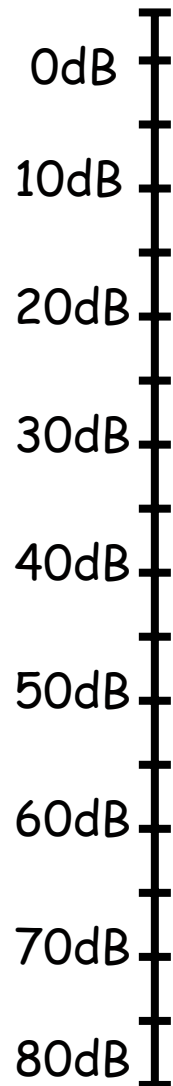
- Audiogram**

- Impedance**

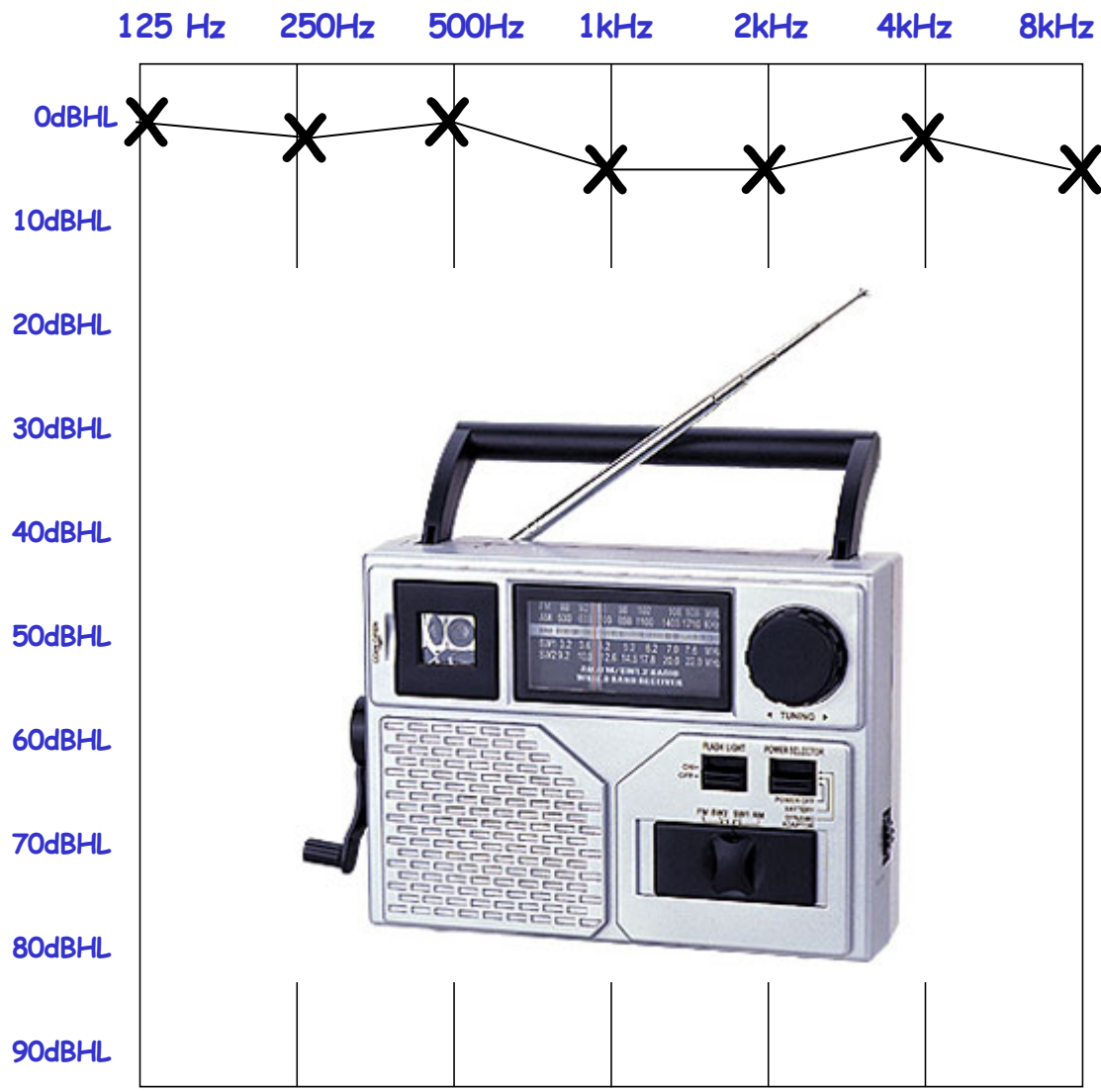
- ABR**

- OAE**

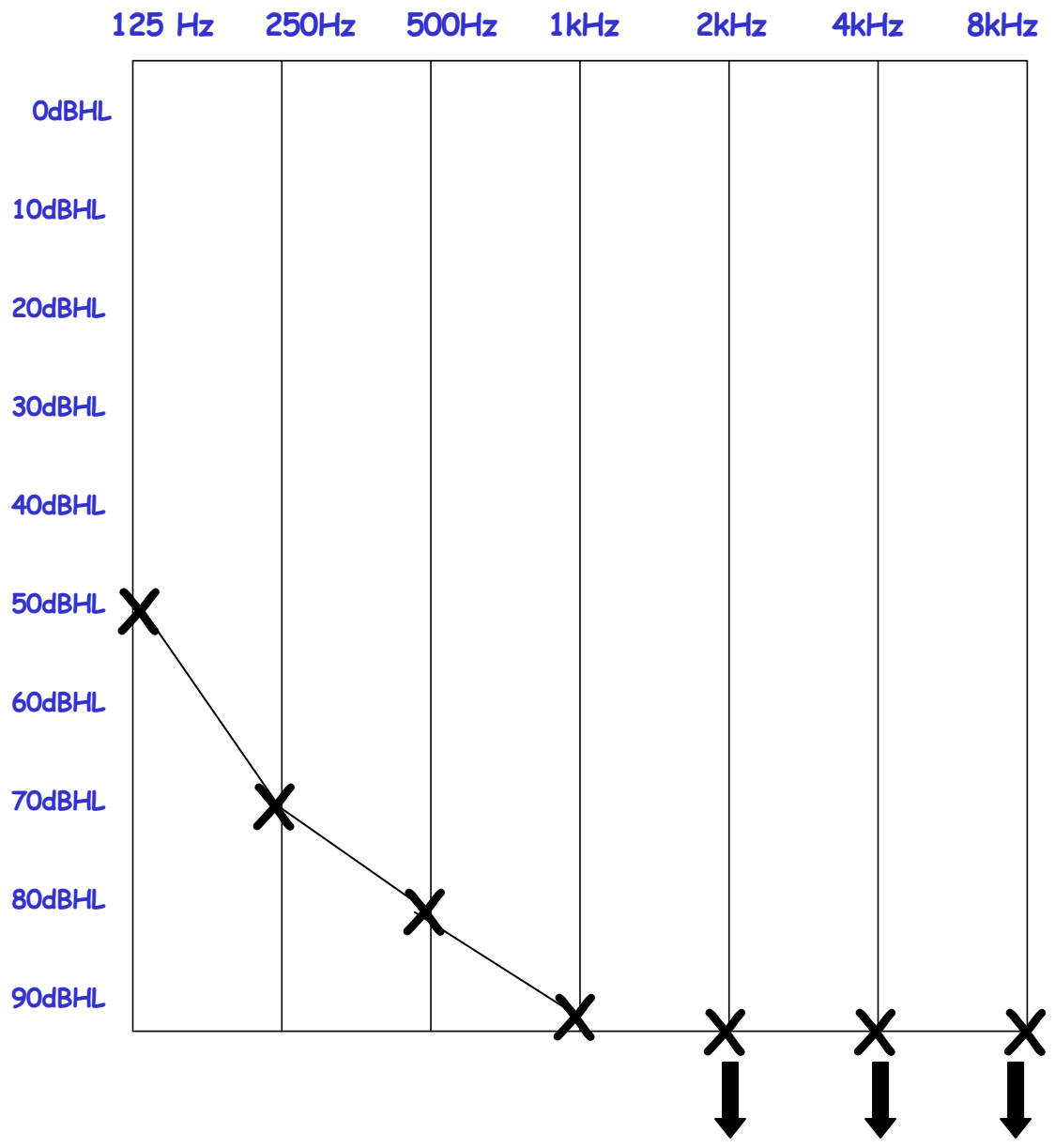
# Loudness/Volume



- **Threshold < 20 db**
- **Hearing threshold Child > adult**
- **Speaking are between 30-70dB**
- **Louder audiogram from top to bottom**



Someone with normal hearing might have an audiogram that looks something like this



Someone who is profoundly deaf might have an audiogram that looks something like this

# Yes

• قال تعالى ( وَلَنَبْلُوَنَّكُمْ بِشَيْءٍ مِّنَ الْخَوْفِ وَالْجُوعِ وَنَقْصٍ مِّنَ الْأَمْوَالِ وَالْأَنْفُسِ وَالثَّمَرَاتِ وَبَشِّرِ الصَّابِرِينَ \* الَّذِينَ إِذَا أَصَابَتْهُمُ مُصِيبَةٌ قَالُوا إِنَّا لِلَّهِ وَإِنَّا إِلَيْهِ رَاجِعُونَ \* أُولَئِكَ عَلَيْهِمْ صَلَوَاتٌ مِّن رَّبِّهِمْ وَرَحْمَةٌ وَأُولَئِكَ هُمُ الْمُهْتَدُونَ ) البقرة ١٥٥

- It must be so hard for you to accept your child's deafness
- Permanent
- Fundamentally life-altering condition

# Etiologies of deafness

- Idiopathic 30%
- Genetic 30% (+ FHx) → counseling
- Others 30%
  - Infectious etiologies (TORCH)
  - Trauma (Hypoxia, Kernicterus, Ototoxic .....
  - Autoimmune conditions

# Non-Genetic and Unknown Causes

## Non-Genetic:

- Trauma before or during birth
- Low birth weight
- Bacterial and viral infections (e.g., meningitis)

## Unknown:

- Research is under way to reduce number of unknown causes
- Scientists think half are genetic and half are non-genetic

# Genetic Causes

- Gene is inherited from a parent
- 400 kinds have been identified!
- Syndromic (Usher's Syndrome)
- non-syndromic (CX26 gene mutation)



# Definitions

- **Prelingual Deafness:** Deafened before developed language
- **Postlingual Deafness:** Deafened after acquired language

Child is not a small adult



# Definitions

- **Oral communication:** Taught to maximize aided hearing, to listen and to develop natural speech and language.
- **Signing:** Use signs, body movements, facial expressions, gesture, mime and finger spelling.

Signing languages:

American Signing Language (ASL),

British Sign Language (BSL)

Australian Sign Language (AUSLAN).

- **Total communication:** Use any combination of signs, finger spelling, listening with amplification, speech, lip-reading, facial expression, body language, reading and writing.

# You need to know

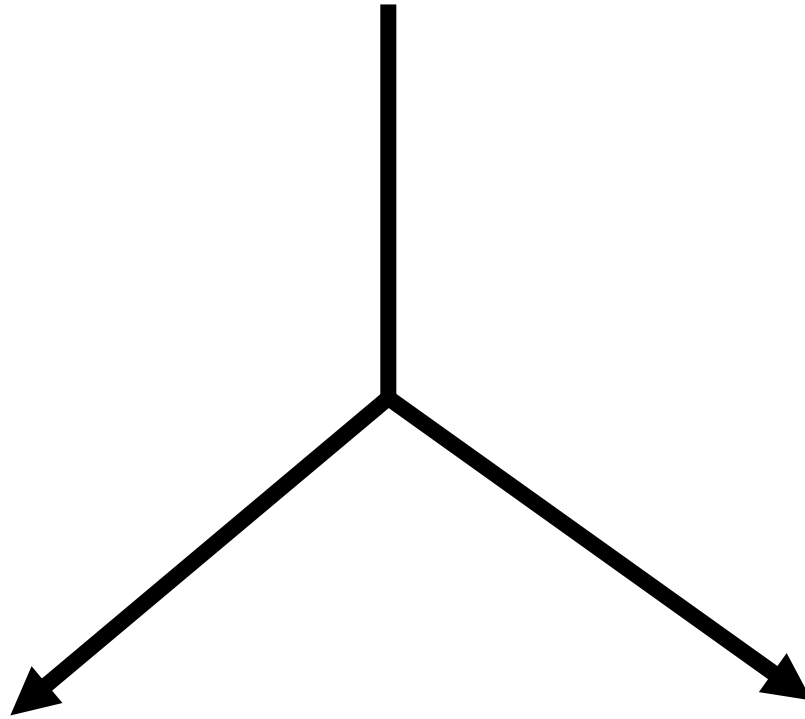
We are not the owner ( responsible )

(إنا عرضنا الأمانة على السماوات والأرض والجبال فأبين أن  
يحملنها وأشفقن منها وحملها الإنسان إنه كان ظلوماً جهولاً)

## Reward from Gad

(ومن أحيائها فكأنما أحيى الناس جميعاً)

# Where to go?



**Deaf mute school**

**Regular School**

# **1<sup>st</sup> decision**

- **Life-and-Death Decisions**
- **Long/ difficult commitments**
- **We are here to help**
- **It is not my decision (CI Committee)**
- **Do not make decisions now**

**Pray Istekarah then come back**

# Next visit

- Soon appointment
- Come with close relatives (Grandparents )
- Family committed
- Sacrify other member in the family

# Family Agreement and Disagreements

- Do parents and child agree on
  - Disability ?
  - Desirability of CI?
  - Active participants ?





# Costs

- Total cost approximately 200,000
  - Cost of implant device is 100.000
  - Rehab 20.000/ year for 4 years
  - Surgical, anesthesia and hospitalization fees 25.000
- Fully sponsored by the government

# Hearing Aid

- **Confirm Dx**
- **3 months (Accepting CI)**
- **Bilateral**
- **BTE**
- **Newer and strong hearing aids**

# Speech

- 2 meeting before CI meeting
- Speech & Language assessments
- I.Q
- Family counseling

# Radiologic Evaluation

- CT Scan of the temporal bones
  - Patency of cochlea
  - Evaluate IAC
  - Mastoid aeration
  - Facial nerve position
  - Middle ear status

# MRI Evaluation

- Cochlear or CN VIII aplasia are contraindications to C.I.
- IAC <1.5mm on CT  
Evaluate presence of cochlear nerve
- Hx of Meningitic Deafness  
Evaluate degree of cochlear ossification

# Primary Assessment

- Audiology → PASS
- Speech → PASS
- Surgeon → PASS
- Neurologist → PASS
- Radiology → PASS

**C.I. Committee**



# **C.I. Committee**

**Speech therapists**

**Audiologists**

**Social workers**

**Psychologists**

**Neurologist**

**ENT surgeon**

# CI Committee

## Yes

- Donation letter
- Member in the program
- Meet implantee
- Pass 1/3

## No

- (لَا تَحْسَبُوهُ شَرًّا لَّكُم بَلْ هُوَ خَيْرٌ لَّكُمْ) (النور/الآية ١١)
- Second opinion
- Still need F/U
- How can we help?



# Families Counseling

- Provide materials in a variety of formats
  - print, video, face-to-face discussion
- Avoid the overuse of jargon
- Explain new terminology
- Repetition of information over time
- Make time for questions at every visit
- Encourage networking with other parents

# Families Counseling

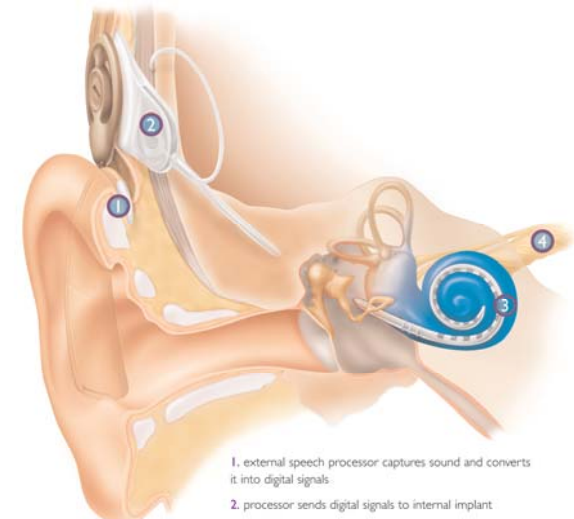
- What is CI?
- Risk/benefit
- Failure
- Limitations
- Surgical/hospital issues
- Post implant habilitation/Mapping
- Precautions

# Introduction

- Not transplant (it is HA)
- House/3M single-channel implant in 1972
- Multichannel devices introduced in 1984
- 2006, nearly 100,000 CI worldwide
- Nucleus, Clarion, MED-EL and MXM.

# What is a cochlear implant?

- ***External parts:***
  - Microphone
  - speech processor
  - Transmitter
  - cords
- ***Internal parts:***
  - Receiver
  - wire capable → the cochlea.







# C.I.

- Single Channel
- Multi-channels CI
- Bilateral C.I.
- Electro-Acoustic stimulation
- Partial Insertion



# **Risk/Benefit**

## **Aspects that contribute to success**

- Age
- duration of deafness
- Support
- wear time
- Therapy



# **Risk/Benefit**

## **Aspects that contribute to failure**

–Lack of commitment by

- Parents
- Teachers
- Therapists
- Recipient

–Limited wear time

# LEVELS OF PERFORMANCE



- Sound Awareness
- Discrimination of sounds
- Voice

# Failure Rate

- **Internal receiver failures**
  - Complete malfunction
  - Partial malfunction
- **Cumulative Survival Rate (CSR)**
  - Percentage that survive
  - 99%

# ***Limitations***

- It doesn't work as well
  - over distance
  - background noise
- Difficult to localise sounds
- Batteries
- 22 channels vs 30,000 ganglions in cochlea
- There will be times when your child can't listen, eg.in the bath

# How can you help?

- Keep background noise to a minimum
- Make sure CI is on & working properly
- Use a natural voice – don't shout
- Remember,  
half the distance → double the volume

# Families Counseling

- What is CI?
- Risk/benefit
- Failure
- Limitations
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- Precautions

# **Surgery**

- **Which side?**
- **GA**
- **Shaving**
- **2 hours**
- **Facial nerve monitoring**
- **Confirmation (NRT & X-ray)**
- **Immunizations**

# Which ear ?

- Anatomy
  - Calcification / Sx
  - malformed/no cochlea
  - Auditory nerve
  - VII too close
- Implant worse ear vs Implant better ear
- Recently deafened ear
- Worst vestibular function
- Patient preference
- Right- speech & hearing centers (left brain)??
- Right- in the car



# Surgery Complications

- Surgical complications - overall <3%
- Flap dehiscence 2.8%
- Implant migration 1.2%
- VII nerve weakness 0.2%
- Partial insertion
- Perilymphatic or CSF gusher
- Seroma
- Facial nerve stimulation
- Device failure



\*Luetje et al. *Otolaryngology-Head and Neck Surgery*. 117(3), 243. 1997

# Speech after CI

- 4 week
- 10 appointments (1-2 / week)
- Re-schedule app
- Extensive rehab 1 year
- Other rehab center + school
- 4 years

# Mapping

- Sets sounds so they are loud enough to hear but not so loud as to be uncomfortable.
- Begin intra-operatively
- Mapping schedule
  - 4 weeks Activation
  - Dynamic range increases
  - # electrodes can be stimulated comfortably

# Mapping/Programming Issues

- Map based (for each electrode)
  - Threshold levels
  - Comfort levels
- Each person has an individual program
- Strategies (SPEAK, CIS, ACE).
- Takes multiple sessions to program
- May initially be uncomfortable (Eye glass)

# Precautions

- Trauma
- Swimming
- Infection
- Skin necrosis
- Surgery (mono-polar)
- MRI

# Conclusion

- **CI is a major decision**
- **Parents require knowledge/Support**
- **Counseling from all CI members**
- **The more information → better outcome**

**Cochlear implant  
in  
Saudi Arabia**

# Statistics

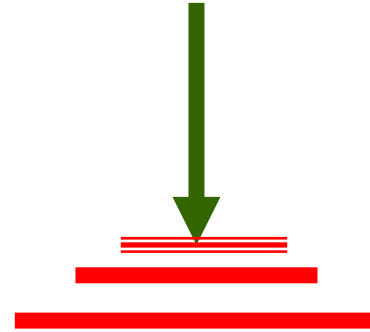
- Germany 80 millions  $\rightarrow$  1200/Y (KSU=300/Y)
- United states
  - S 250 C.I. centers. (KSU=25)
  - Till high school \$420,000 can be saved in special education costs (KSU 1,600,000)

**In 10 years, 1000% interest**



# C.I.

- Single Channel
- Multi-channels CI
- Bilateral C.I.
- Electro-Acoustic stimulation
- Partial Insertion



You are here



**Thank You**

# References

<http://www.nidcd.nih.gov/health/hearing/coch.asp>