The Important Role of Imaging (CT scan and MRI) in Cochlear Implantation

Professor Dr Hassan Wahba
Professor of Otology
Ain Shams University
Ain Shams Cochlear Implantation Center
Egypt

AIN SHAMS UNIVERSITY
COCHLEAR IMPLANTATION CENTER

- Established in 1992
- University based center
- Clinical integrated services (surgery, phoniatrics & audiology) for profoundly deaf patients
- Research activities regarding deafness and cochlear implantation
- **180** patients have been implanted from 1994-2009
Cochlear patency
Cochlear development
Cochlear nerve
Surgical issues
Post-operative evaluation

Cochlear Patency
CT scan bone window axial view

CT scan bone window coronal view
MRI

Labyrinthitis Ossificans (White Cochlea)
Cochlear Ossification

Lateral semicircular canal  Superior semicircular canal

Lateral semicircular canals & left cochlear ossification

MRI
Cochlear ossification with narrow cochlear lumen

MRI T2 showing various signal intensities in normal and ossified cochlea

Ossification
Assessment of the ossified cochlea

Transverse fracture of the temporal bone showing labyrinthine ossification
Otosclerosis

Cochlear Otosclerosis (bracelet)
Cochlear Development

EMBRYOLOGY

Development of the inner ear
Slit VA
Cochlear partition
Apical horns

Signs of a fully developed inner ear

Large Vestibular Aqueduct Syndrome = Enlarged Endolymphatic Sac Syndrome
COMMON CAVITY

a

b
Common Cavities
Dwarf Cochlea
FORAMINA CRIBROSA
Cochlear Nerve

MRI sagittal internal auditory canal

IAC

facial nerve
Deformed IAC

Cochlear nerve aplasia
Bilateral cochlear nerve hypoplasia (Y)

Left cochlear nerve aplasia

Bilateral cochlear nerve hypoplasia (Y)
Bilateral transverse fractures of temporal bones:
Which side to operate on
MRI
Electrical promontory test
History of facial nerve paralysis following trauma
NF2

Surgical Issues
Mastoid

Size
Pneumatisation
Position of sigmoid sinus
Emissary vein

Facial Recess:

Assessment of size
Sentinel air cells
Lateral semicircular canal hump: an indication of the size of the posterior tympanotomy.

The windows area:
- Hook area
- Round window niche
- Oval window
- Stapedial artery
Transverse fracture causing round window niche distortion

Persistent stapedial artery
Facial Nerve (axial CT scan)

CT Scan
Coronal View
Facial Nerve
MRI sagittal
Facial nerve

Transverse fracture of the temporal bone
COCHLEAR OTOSCLEROSIS showing the focus close to the labyrinthine part of the facial nerve.
Dehiscent Jugular Bulb

Danger when drilling the cochleostomy in an ossified cochlea the internal carotid is only 8 mm away.
Cochlear dimensions
The size of the cochlea & predictions of insertion depth angles for cochlear implant electrodes Escudes et al. (2006)

Seat for the receiver stimulator part of the cochlear implant
Post-operative evaluation of the depth of insertion of the electrode array
CI24

CI24 22+10 insertion
Complete insertion through basal turn cochleostomy
Assessment of position of electrode array within the cochlea

Middle turn insertion in severely obliterated cochlea (insertion of 14–16 electrodes)
Intra-cochlear electrode distortions

- overadvancement
- hook
- buckled
- double buckled
- crooked
- kinked

CT CI
An experienced cochlear implant surgical team and peri-operative imaging evaluation are mandatory for preventing complications. Cohen (2000)
Thank you