UNUSUAL COMPLICATIONS OF COCHLEAR IMPLANT

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- CI surgery is a relatively safe procedure in experienced hands
- The rate of complications has decreased because of improvements in devices and the progression of surgical techniques
- Number of the cochlear implantation is exponentially growing
- Intraoperative and postoperative complications have been reported between 2.3% to 12.33%

- Major
- Minor
-

- Intraoperative
- Postoperative
-

- Early
- Late
-

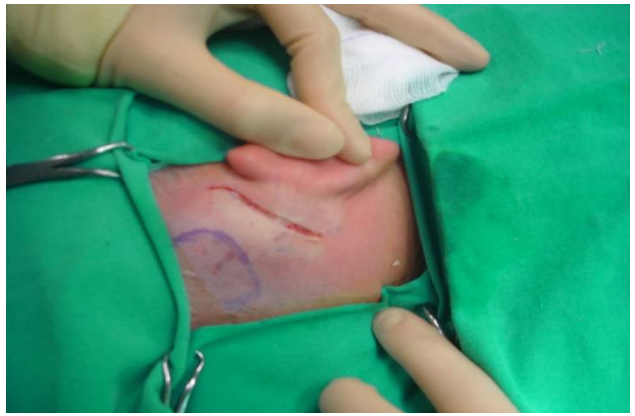
- Major
  - Need surgical intervention (Revision surgery or reimplantation)
  - Need hospital admission
- Minor
  - Outpatient treatment or observation

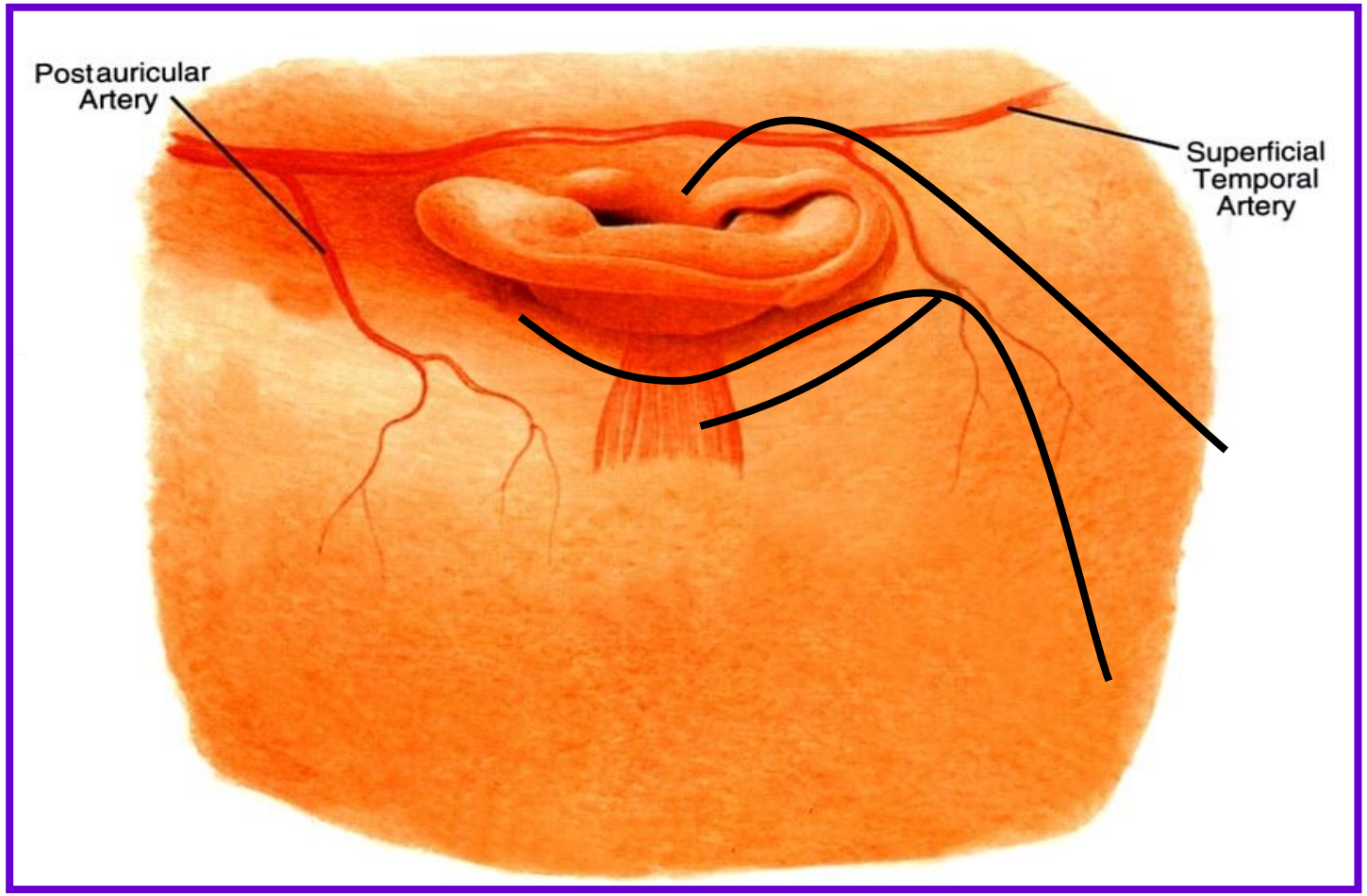
- Patient-related factors
  - Anatomic variations (Facial nerve, inner ear abnormalities, location of RW&Cochlea etc)
  - Skin condition (Wound healing problems, DM…)
  - Preoperative disabilities (vestibular disturbance, tinnitus…)
- Patient-related factors (Late)
  - Strong magnet → Pressure
  - Minor head trauma
  - Biofilm formation

- Surgeon-related/Operation-related factors
  - Surgical experience
  - Type of incision, surgical techniques
  - Failure of sterile technique

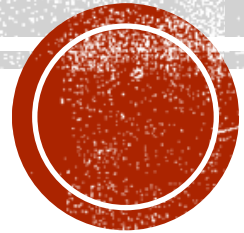
- Device failure
  - Technical improvements of the devices → Less device failure

- Flap problems
  - Surgical changes
    - Type of incision
    - Excessive use of electrocautery
    - Excessive tissue retraction
    - *Subperiostal pocket technique*

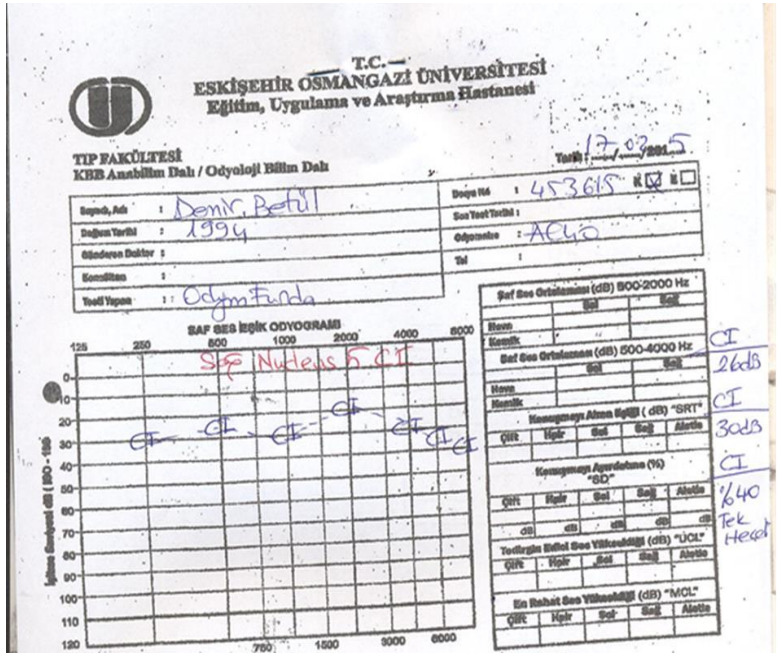



Postauricular
Artery
Superficial
Temporal
Artery

Pain and Shocking Sensation



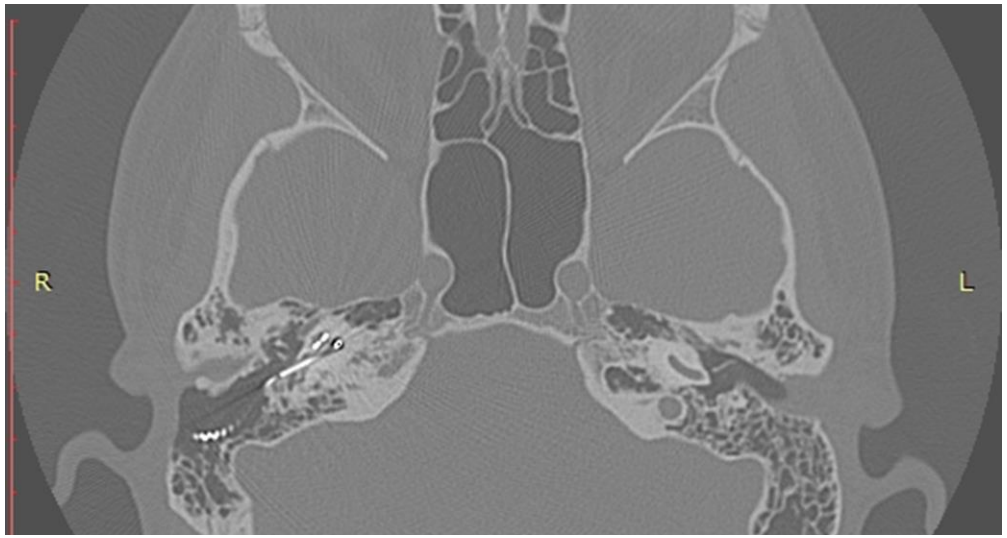
- B.D., 22 y/o, F
- Congenitally profound hearing loss
- She was implanted at the age of 5 years old (2000)
- Her performance was good
- She graduated university
- She works in the Court-House



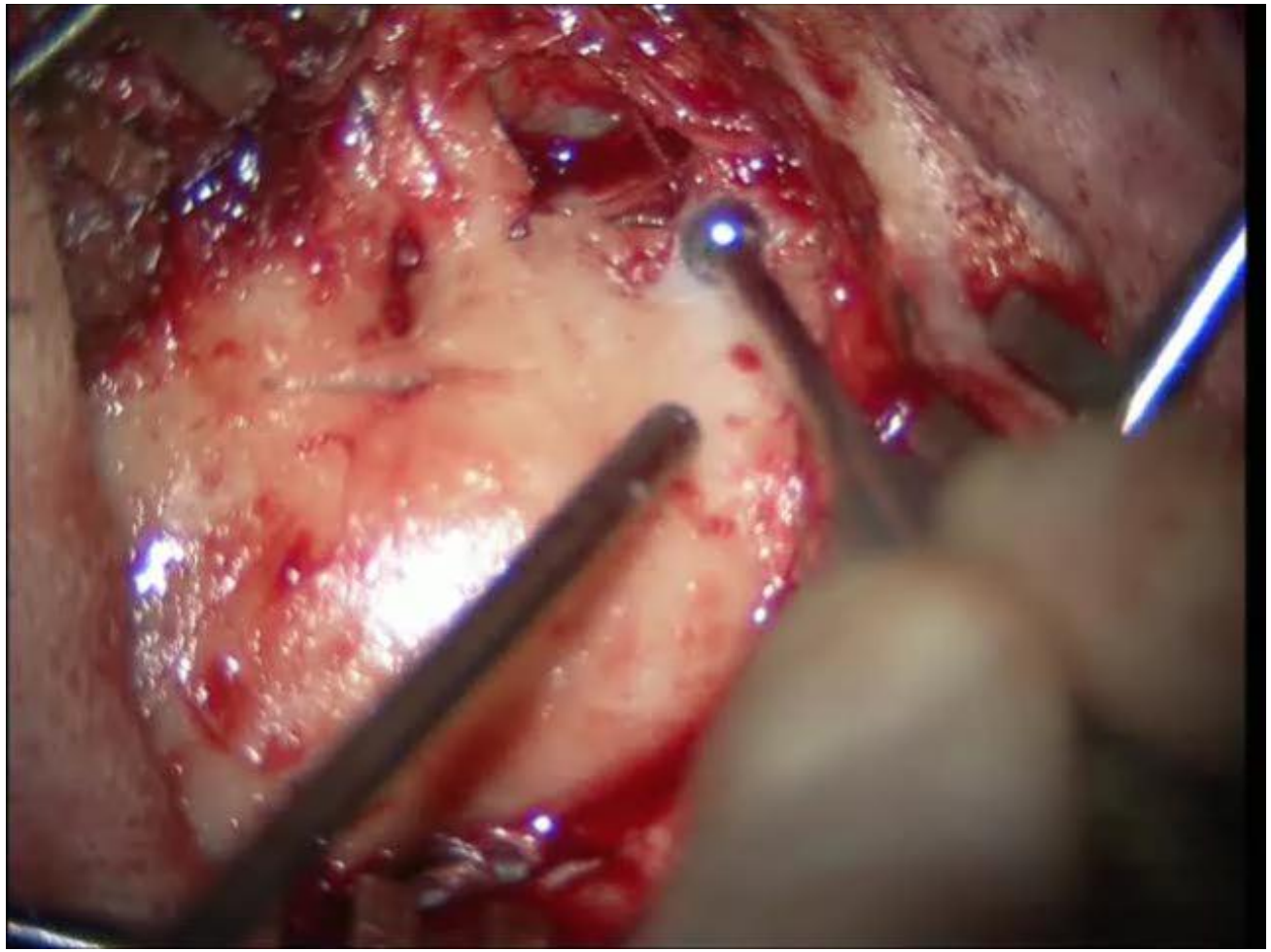
- In 2014, she complained about
  - Headache
  - Sensitivity of head skin (especially over the cochlear implant receiver)
  - Sometimes dizziness

- She has been used CI limited time in a day because of these problems
- ENT exam was normal
- Caloric weakness was found on the non-operated side

- CS19 Intra-Cochlear Impedance Matrix Test (Integrity test) gave the «reduced performance» result
  - Reimbursment was not possible
- CT scan has been reported normal
- Neurological evaluation was normal
- Soft Failure??



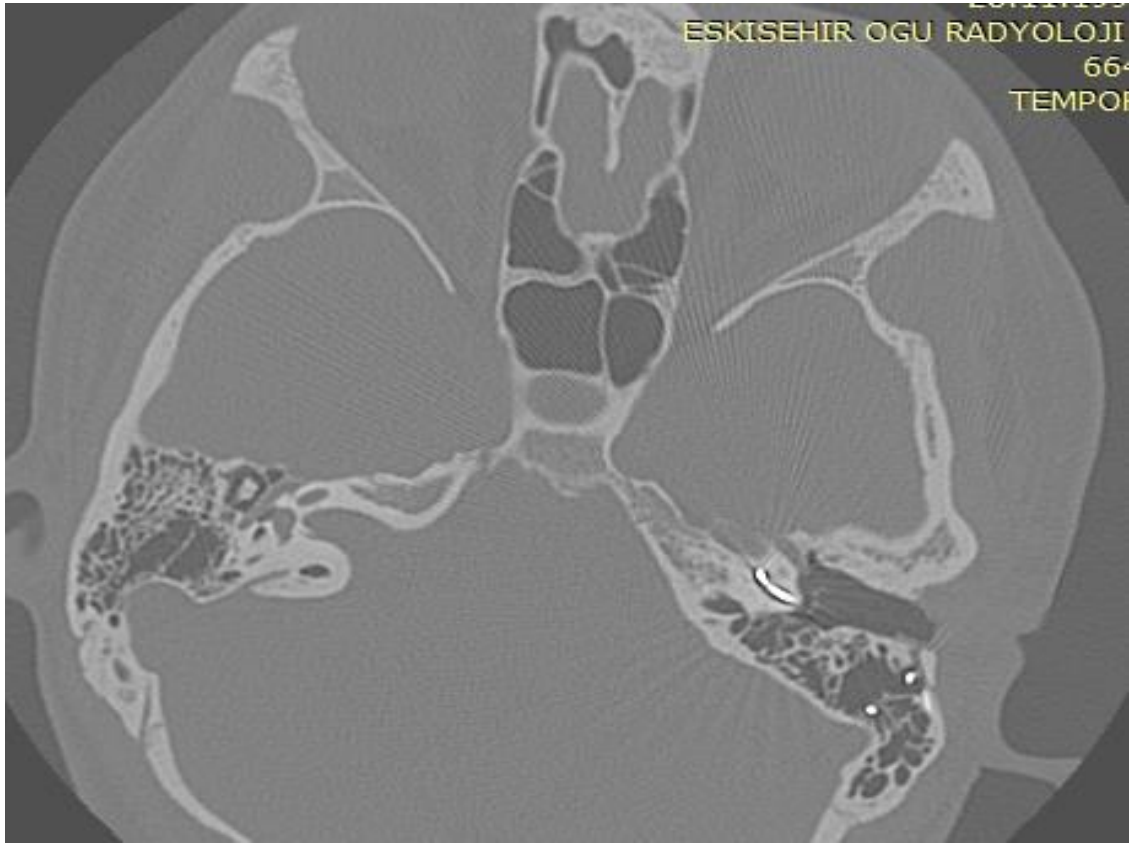
REIMPLANTATION, JUNE 26TH, 2014



- S.I.Y., 21 y/o, female
- She started use hearing aids at the age of 6 months
- She was implanted at the age of 3 years
- She is a student at university

- She complained about sensitivity and pain over over the cochlear implant receiver
- Impaired sound quality
- Dizziness (rare)

- CS19 Intra-Cochlear Impedance Matrix Test (Integrity test)
  - **Electrodes MP1** have Open Circuit(s)
  - The results from the integrity test indicate the receiver-stimulator and electrode are exhibiting normal function. However, as you have provided evidence that this recipient is unable to gain adequate benefit from this device, according to the International Classification of Reliability[1] this cochlear implant is classified as a **PERFORMANCE DECREMENT (B2).**


ESKISEHIR OGU RADYOLOJI
66
TEMPOR

- Sodium Fusidate 2*500 mg
- Dexamethasone 1 mg/kg
- Ciprofloxacin 2*500 mg

- Reimplantation on 25th of May, 2015

- G.A., 21 y/o, female
- Congenitally profound hearing loss
- She was implanted in 2000 at age of 4 years
- She is a student in university

- She complained about sensitivity and pain over over the cochlear implant receiver
- Every touch of head gives her pain, shocking sensation
- Dizziness, Buzzing
- ENT examination was normal

- CS19 Intra-Cochlear Impedance Matrix Test (Integrity test)
  - There is no obvious technical reason for the reported symptoms of buzzing. The CAF does not detail any externals troubleshooting has been performed which would be a required step in cases of poor sound quality. If necessary MAPs can be created with selected electrodes deactivated to see if any one specific electrode is contributing to the reported buzzing.

    Conclusion

    The results from the integrity test show the receiver-stimulator and electrode are operating normally. According to the International Classification of Reliability[1] this cochlear implant is classified as a **FUNCTIONING DEVICE (A)**.

- Sodium Fusidate 2*500 mg
- Dexamethasone 1 mg/kg
- Ciprofloxacin 2*500 mg

- After the treatment, she is fine and using CI

- Same surgical technique
- Bony well
- Receiver-stimulator was secured using tie-down suture
- Transmastoid-facial recess approach
- Cochleostomy
- No dural exposure&soft tissue injury

- Soft failure
  - According to Consensus Development Conference Statement (2005), pain over the impant site was classified as a nonauditory symptom
  - If symptoms are severe and persistent, revision must be considered

- Biofilm formation?
- 1/3 patients responded well to conservative treatment

- **Pain-only complaint about cochlear implant device: A five-patient pediatric experience.**

Todd NW, Fainberg JC, Ukatu CC, Venable CY, Segel P., Cochlear Implants Int. 2015 Jan 7. [Epub ahead of print]

  - The onset of pain ranged from 2 to 16 years post implantation
  - Revision surgery in all five cases, with immediate resolution of the pain in four.

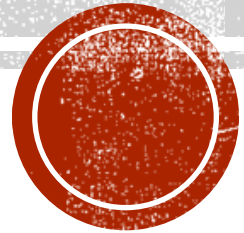
- **Pain in cochlear implant recipients: An uncommon, yet serious, consequence of cochlear implantation.**

Shapira Y, Yaar-Soffer Y, Hildesheimer M, Migirov L, Henkin Y., The Laryngoscope, 2015

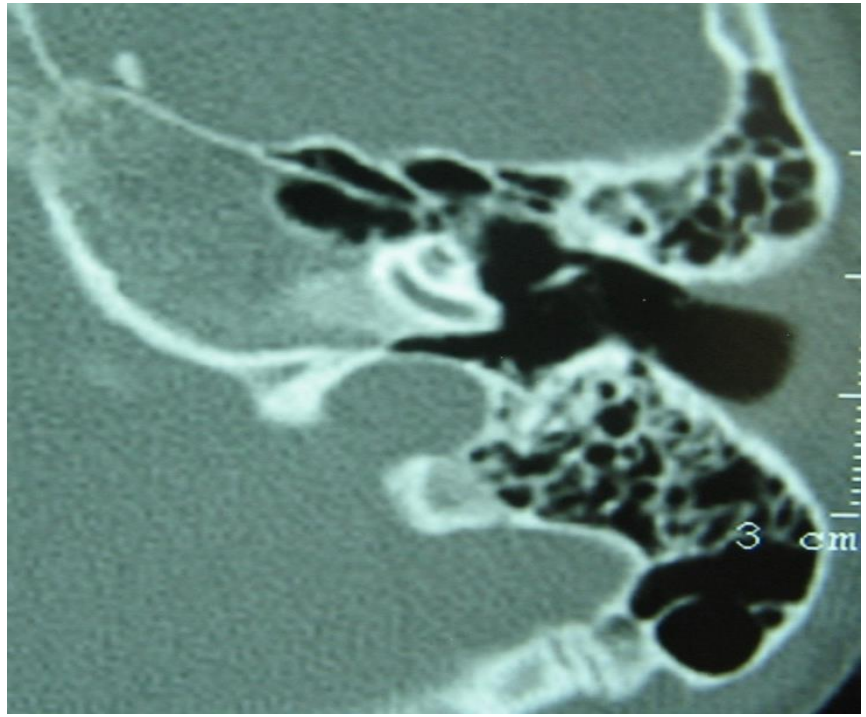
  - 30 patients
  - The onset of pain ranged from 3 months to 12 years post implantation
  - 77% responded conservative treatment with prolonged antibiotic therapy or antiinflammatories
  - Revision surgery in 6 cases, with immediate resolution of the pain in four
  - No sign of the infection, foreign body reaction or device damage in the explanted device

- Pain and shocking sensation may be a new indication for revision
- Assessment of the explanted device should include the evaluation of biofilm formation
- Samples around the receiver stimulator must be taken

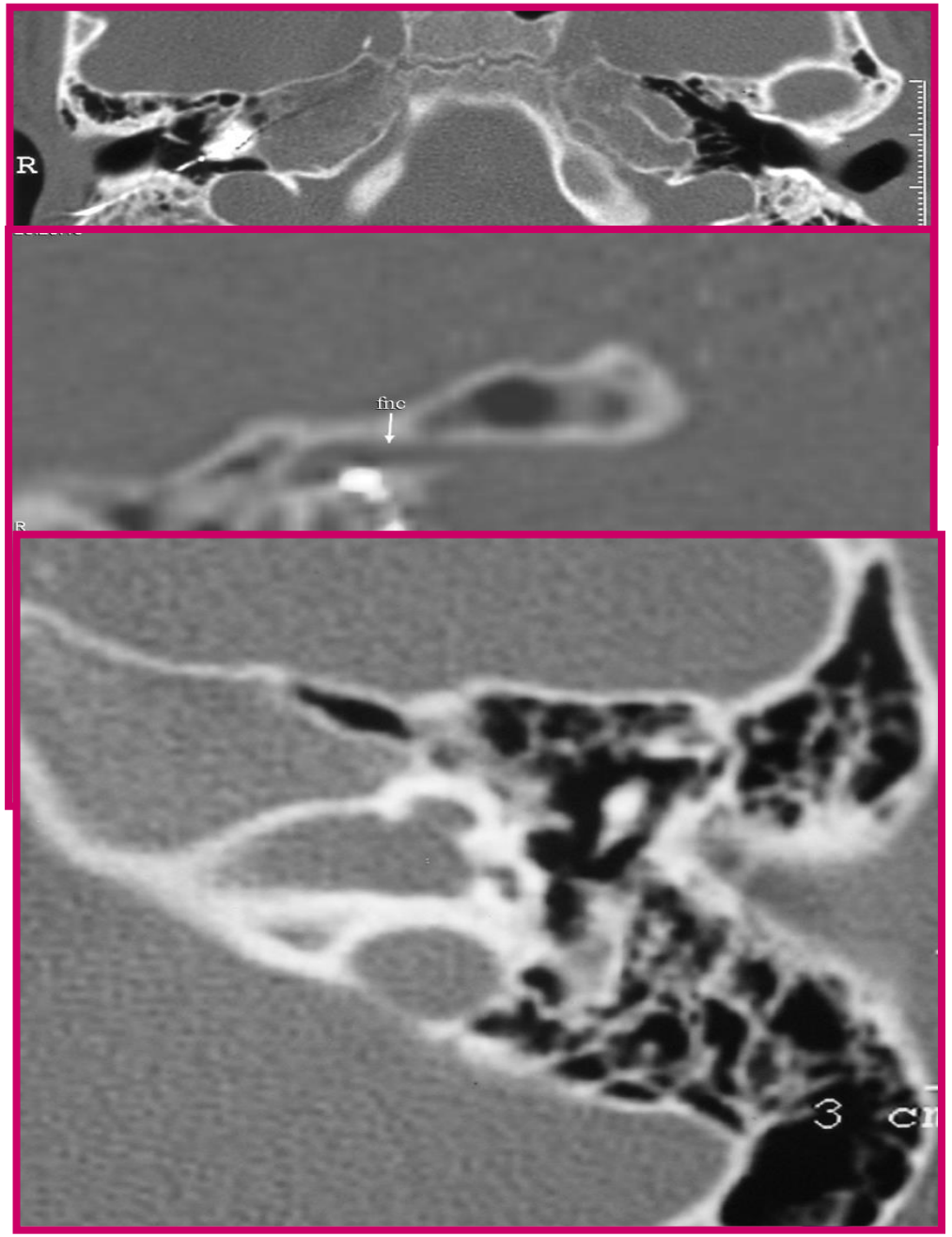
Facial Nerve Stimulation



- 21 years old girl
- Congenital profound SNHL
- Preop CT and MRI were reported <u>normal</u>
- Implanted at the age of $3^{1/2}$ yrs (2000)
- CSF gusher was encountered
- Postop. course was uneventful
- *Her brother has mild mental retardation, paraparesis, agenesis of the corpus callosum and <u>normal hearing</u>*

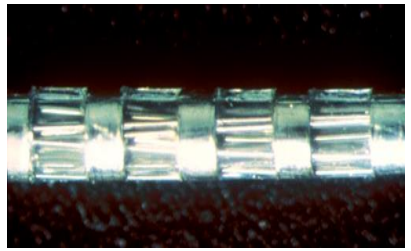


- She had facial nerve stimulation five years after the implantation
- HRCT scan
  - correct electrode placement in the cochlea,
  - electrode array protruded to labyrinthine segment from the second turn of cochlea.
  - IP-type III anomaly (X-linked anomaly) with the bulbous dilatation at the lateral ends of IAC on both sides
- Implanted on left side in 2006



- Facial nerve stimulation can be resolved with minimal changes in speech processor fitting in the most of the cases
- If facial nerve stimulation cannot be solved by reprogramming or deactivation of the offending electrodes,
- Perimodiolar or midscalar electrode arrays that sits farther from the facial nerve and has medially facing electrode contacts may be a solution

- Full banded electrode
  - Better stimulation to SGCs
  - Facial nerve stimulation



- Midscalar electrode
  - Stimulation to SGCs?
  - Less chance to FN stimulation

FACIAL NERVE STIMULATION

- In the pediatric population, 1.89% incidence rate was reported
- Inner ear abnormalities
- Otosclerotic inner ear
- Cochlear ossification
- Temporal bone fracture

- The possible reason of postoperative facial nerve stimulation
  - Inner ear malformations was proximity of the facial nerve to the electrode array
  - A
  - I
  - I

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nerve in

REIMPLANTATION

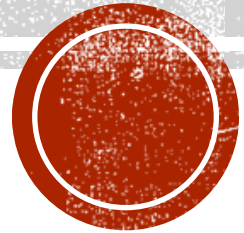
Implantation of the other ear

Possibility of future device failure

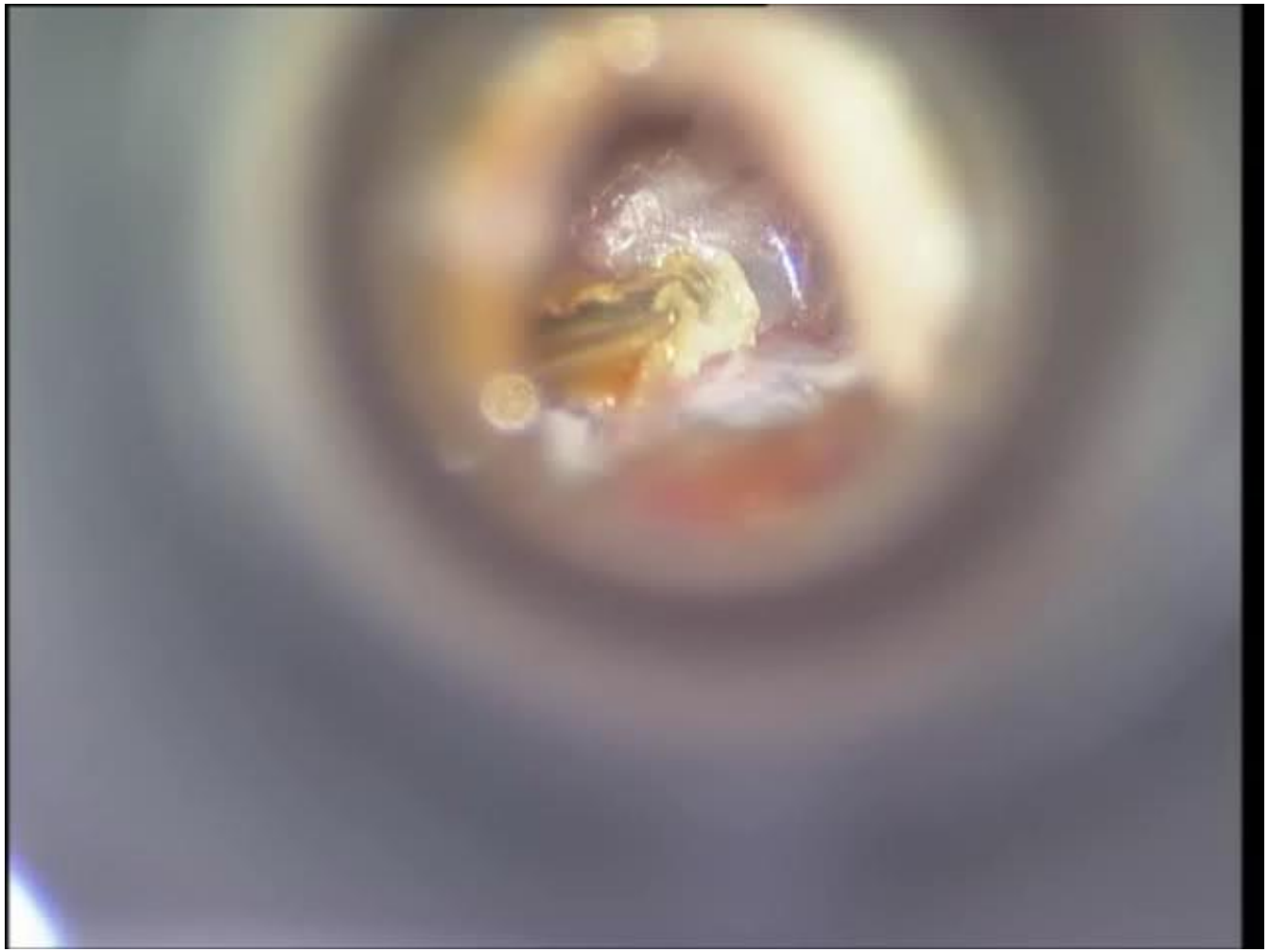
Auditory deprivation due to none of the stimulation

ABI??

Cholesteatoma Formation

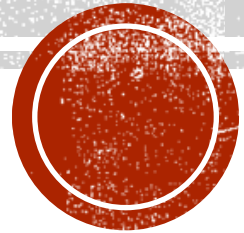


- 12 y/o girl
- She was implanted 6 years ago
- Her performance was fine
- Before the CI, she had tympanoplasty operation



- Follow-up??
  - DW-MRI → Artefacts
  - Baseline CT Scan
  - Clinical evaluation
- Patient/Parents Counseling

Recurrent meningitis due to non-implanted ear in patient with bilateral inner ear abnormality

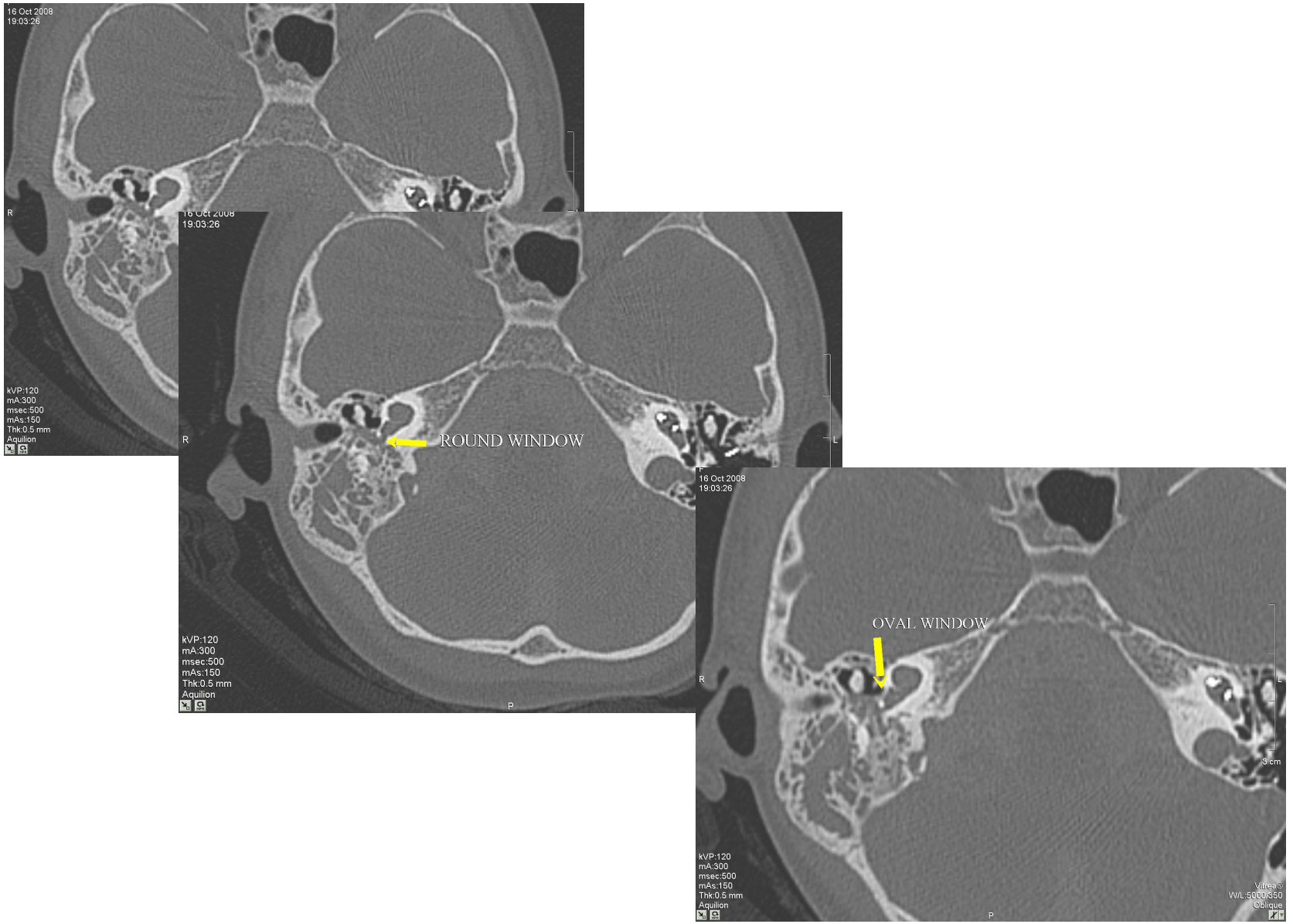


- D.C., 12 y/o girl
- She started use hearing aids at the age of 1 year old
- She has IP Type I anomaly
- She was implanted at the age of 3 years 6 months

She had three bacterial meningitis attacks in 9 months

S. pneumonia was isolated

- CT scan and CT cisternography revealed a defect around the OW in the nonimplanted ear


16 Oct 2008
19:03:26
R
kVP:120
mA:300
msec:500
mAs:150
Thk:0.5 mm
Aquilion
16 Oct 2008
19:03:26
R
ROUND WINDOW
L
kVP:120
mA:300
msec:500
mAs:150
Thk:0.5 mm
Aquilion
P
16 Oct 2008
19:03:26
OVAL WINDOW
R
L
3 cm
kVP:120
mA:300
msec:500
mAs:150
Thk:0.5 mm
Aquilion
P
Vitrea®
W/L:5000/350
Oblique

- Transcanal middle ear exploration
- Defomed stapes with one crura and two fistulas located posterosuperior to OW
- After a minor head trauma 10 months later, she had another attack
- Re-exploration
- Rhinorea after 10 days
- Continious lumbar drenage
- Re-exploration

Reference	Number of case	Age	Age at first attack of meningitidis	Number of attacks of meningitidis	Organism(s) isolated	HRCT of Temporal bone	Operative findings / treatment (surgery)
Claros P et al, (1993)	1	4	2	4	N. meningitidis (2times) S. pneumoniae (once) No microorganism (once)	Extensive dehiscence of the left cibriform plate	Dehiscence with multiple perforations of the left cribriform plate
Stevenson DS et al, (1993)	1	5	17 months	6	No identified (4 times) Actinobacter spp(once) P. aeruginosa (once)	Bilaterally severe cochlear dysplasia	Dehiscence in the oval window niche
Kimitsuki T et al, (1999)	1	4	4	1	Haemophilus Influenzae	Dilated amorphous cochlea in wide communication with a dilated vestibule and wide oval window	The bone of the stapedial footplate is absent and is covered with membranous tissue
Rupa V et al, (2000)	2	Case 1: 12 Case2 : 13	Case 1: no identified Case 2: no identified	Case 1: 4 Case 2: 5	Case 1: no identified Case 2: S. Pneumoniae (once)	Case 1: Mondini's dysplasia Case 2: Normal	Case 1: A small central dehiscence was visible over the footplate of the stapes Case 2: two defects, one at the round window and a another a few milimetres below and anterior to it on the promontory
Teo DTW, et al (2004)	1	5	no identified	3	S. Pneumoniae (2times) No microorganism (once)	Incomplete septation between the apical and middle turns of the cochlea with dilatation of the basal turn in both ears	Defect on the superior region of the anulus of the right oval window
Shoshan MB et al, (2007)	3	Case 1: 21 months Case 2 : No identified Case 3: 9 months	Case 1: 2 year 5 months Case 2: 2 Case 3: 1 year 8 months	Case 1: 3 Case 2: 2 Case 3: 1	Case 1: S. Pneumoniae (3times) Case 2: S. Pneumoniae (once) No microorganism (once) Case 3: S. Pneumoniae	Case 1: fusion of the right cochlea and vestibule with aberrant track of the right facial nerve Case 2: enlarged cavity in cochlea ,abnormal semicircular canals and abnormal location of seventh nevre Case 3: incomplete partition of the cochlea bilaterally and a saccular dilatation of the vestibule	Case 1: A defect in the oval window of the right vside Case 2: right labyrnthectomy with obliteration of the middle ear was performed Case 3: obliteration of the cochlea on the right side was performed

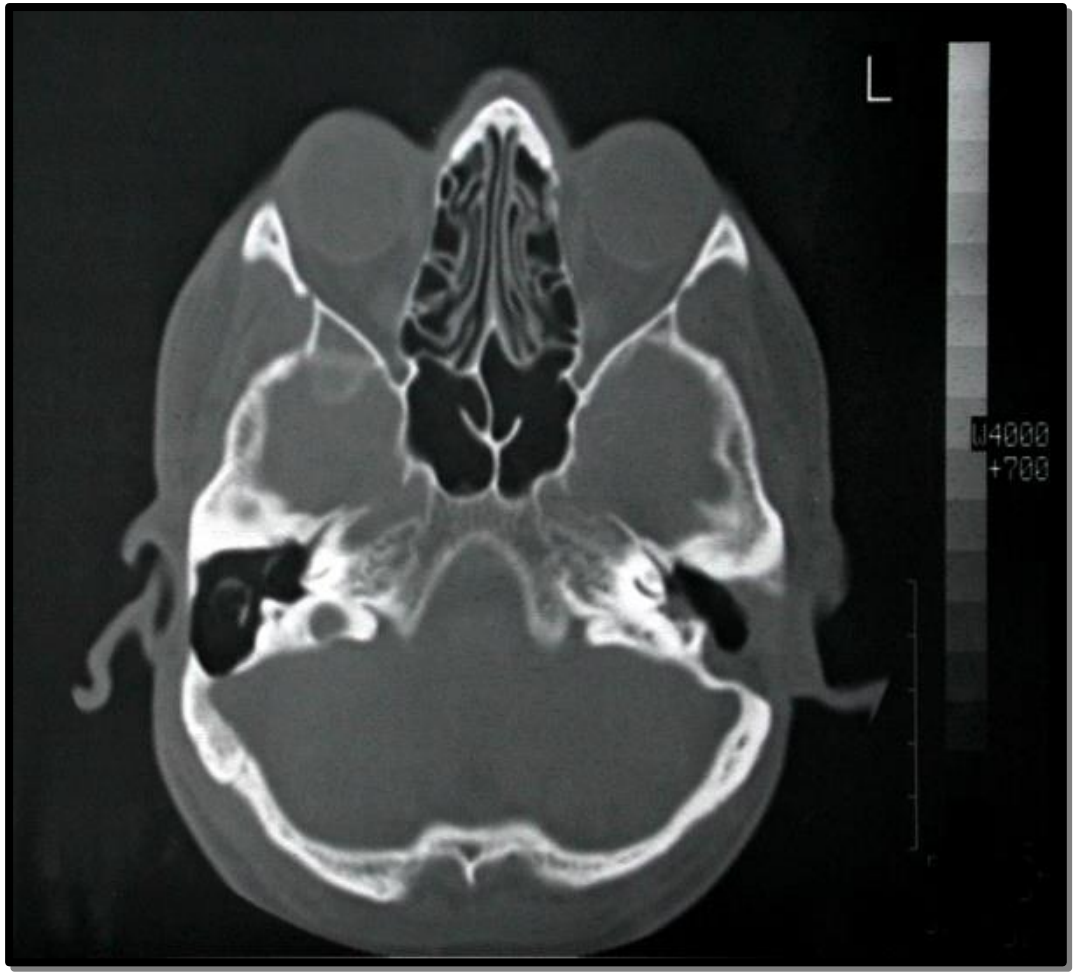
Gürbüz MK,IAO,2012

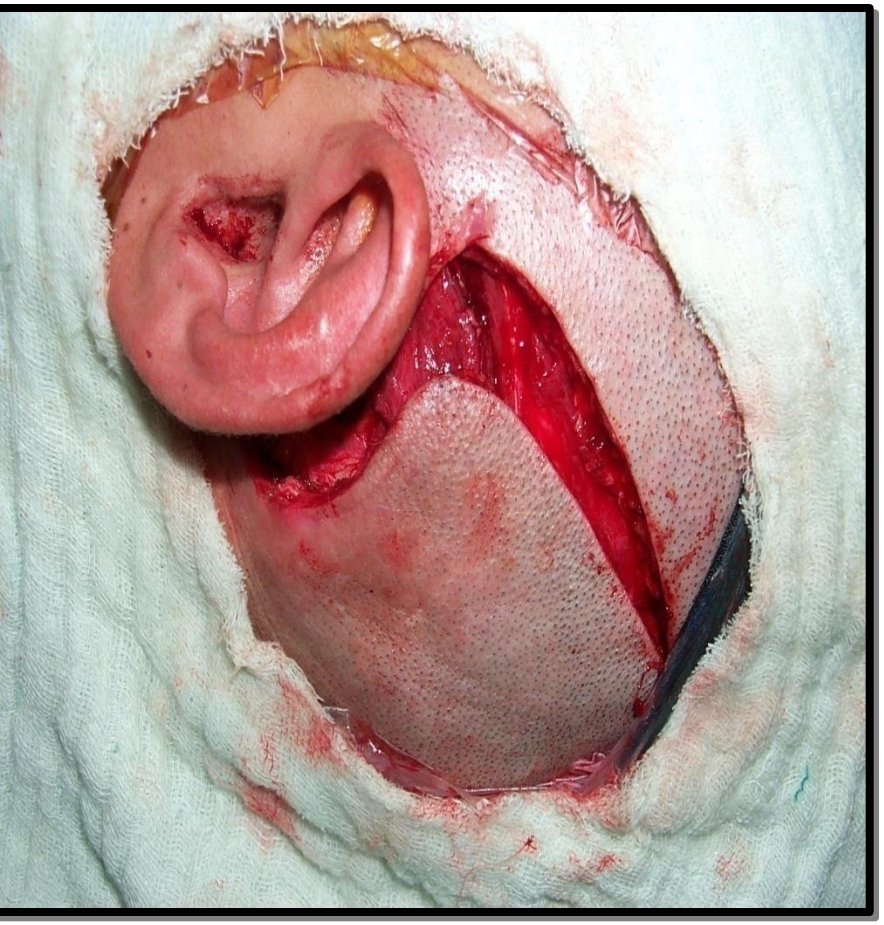
- Meningitis is one of devistating complication after cochlear implantation
- Non-implanted ear may be a source
- Aggressive treatment of AOM and matoiditis is mandatory
- Vaccination is important

Electrode exposure in patient with canal wall down mastoid cavities

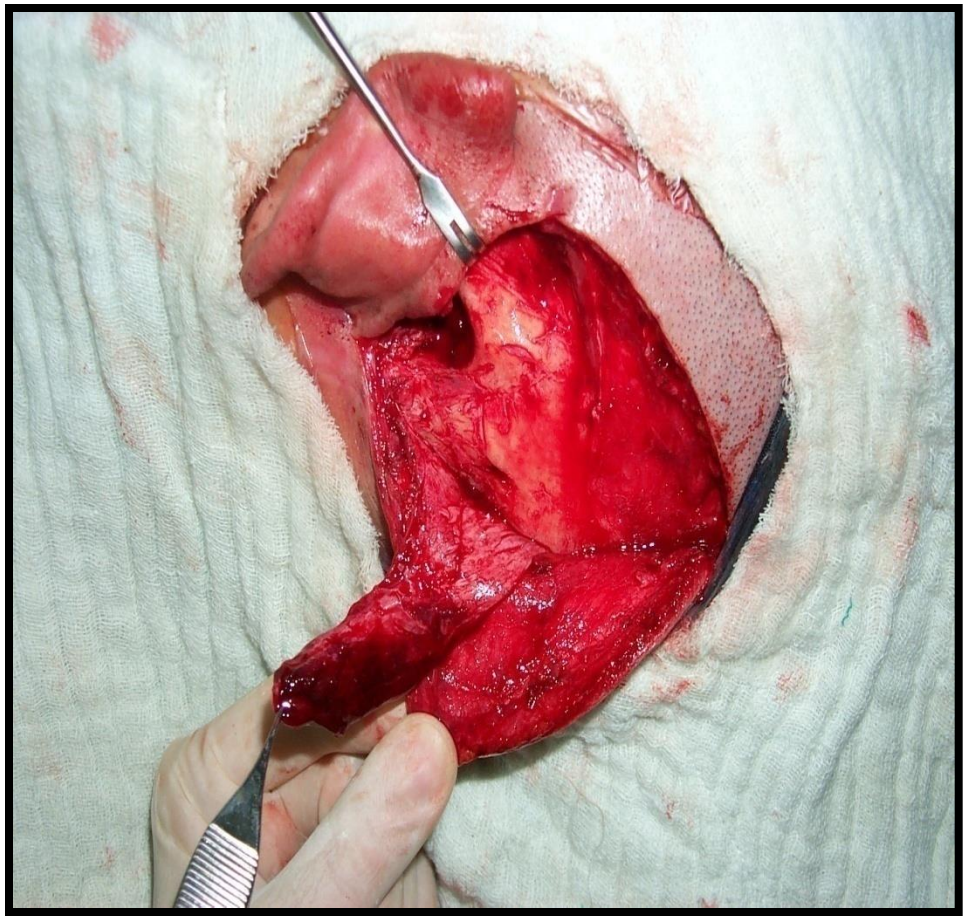
- 48 y/o male
- He had measles resulting in COM at the age of 12
- He had bilateral infected mastoid cavity
- Revision operation+cavity obliteration with abdominal fat+blind sac closure of external auditory canal

CT SCAN AFTER THE OBLITERATION



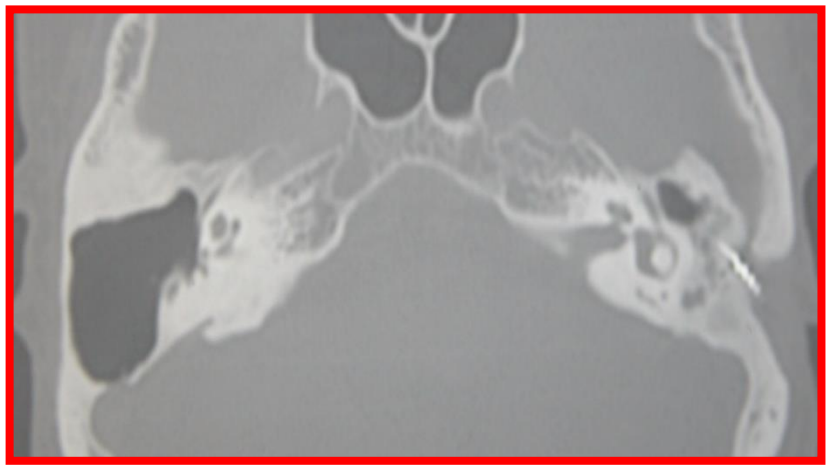


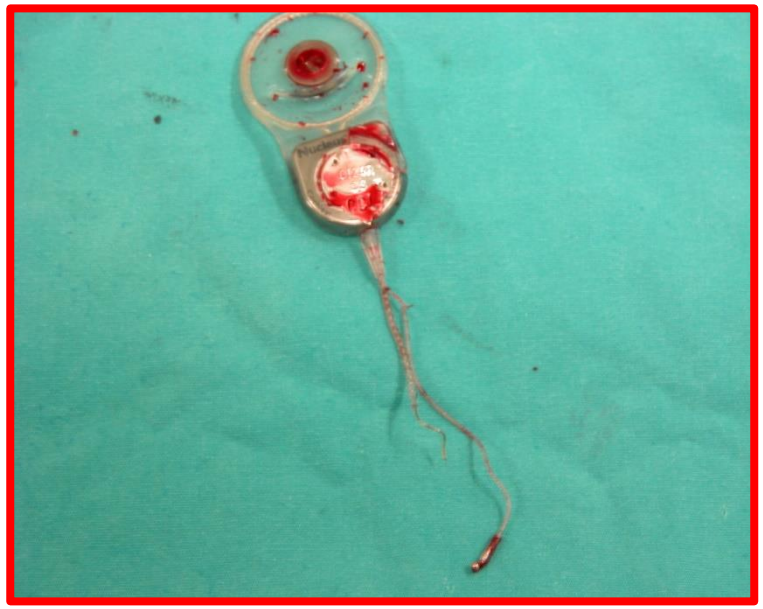
Skin incision

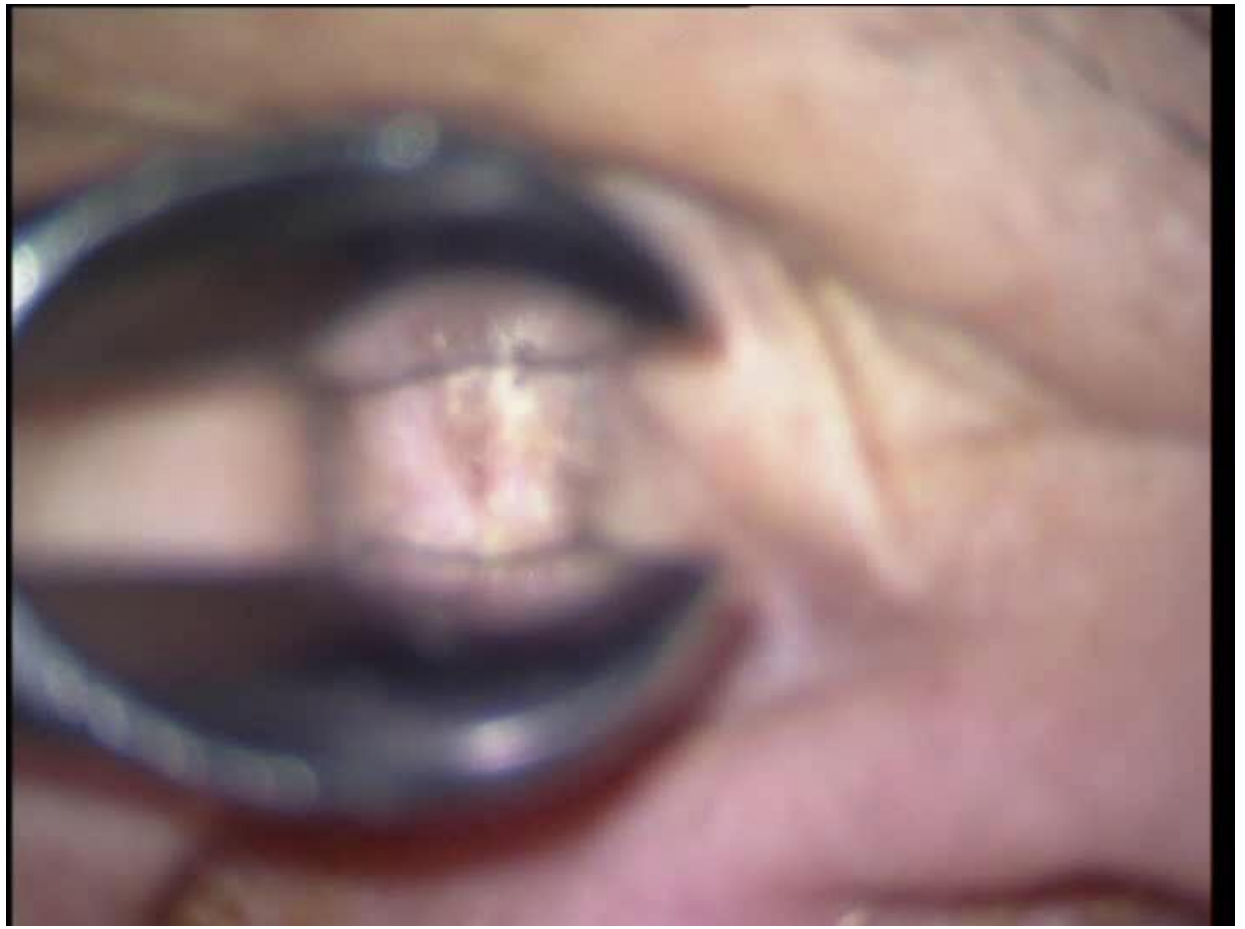


Temporalis muscle flap

- In 2006, he had dizziness and itching in the ear
- A resident found a “foreign material” in the cavity and he removed it!







- Cochlear implantation have some difficulties in cases with radical cavity and large meatoplasty

- Several surgical techniques have been recomended
  - Two stage operation
  - Reconstruction the posterior bony canal
  - Mastoid obliteration
  - EAM closure

Closure of the EAM is not easy in the cases with large meatoplasty

- **Maintenance of the cavity → Good for the follow-up to diagnose recurrence
  - ↓ Electrode extrusion

**Closure of the EAM → Breakdown of the closure

↓ Two staged operation

→ Follow-up: MRI Arterfact; Baseline CT Scan

- The rate of minor complication in the adult population was reported higher than in the pediatric population

- Infectious complications are more common in children, whereas, cochleovestibular complications (tinnitus and vertigo) are more common in adults (Farinetti A. et.al., 2014)

- Children may not report their complaints such as tinnitus or dizziness

- The rate of major complication was almost same in both group