

# Contribution of Imaging in Middle Ear Pathologies

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Paris, France

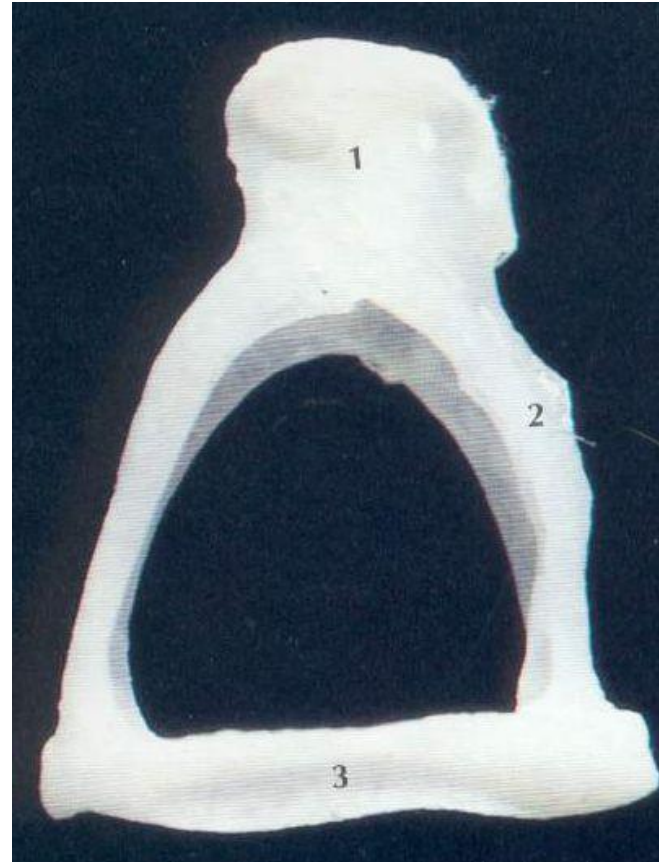
*IFOS, HCMville December 2024*

# OTOSCLEROSIS

- **Advantages**

- Diagnostic confirmation
- Functional prognosis
- Technical difficulties
- Failure or complications
- Forensic protection

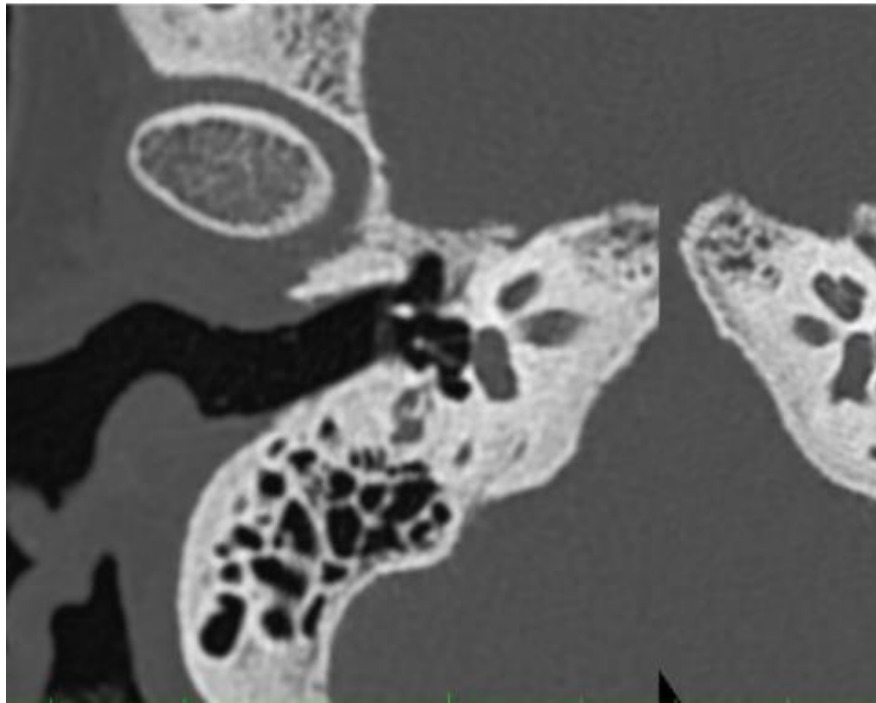
→ CTscan or Cone BeamCT > MRI



- **Disadvantages**

- Irradiation
- Cost

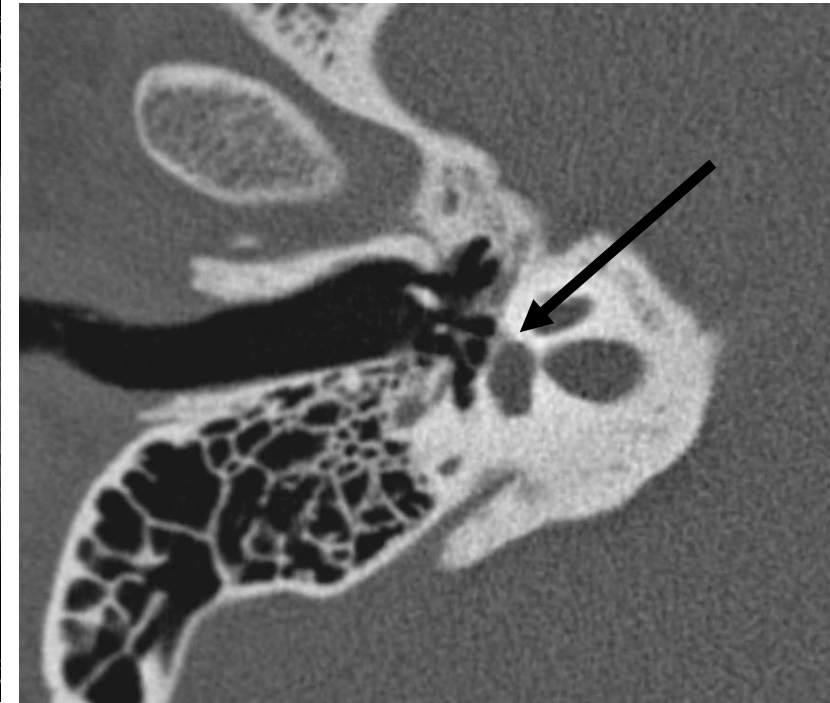
# Diagnostic confirmation



Normal footplate

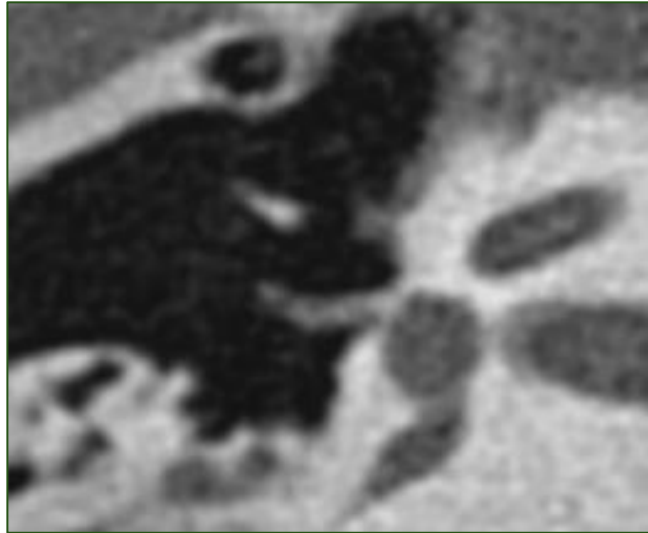


Thickened footplate

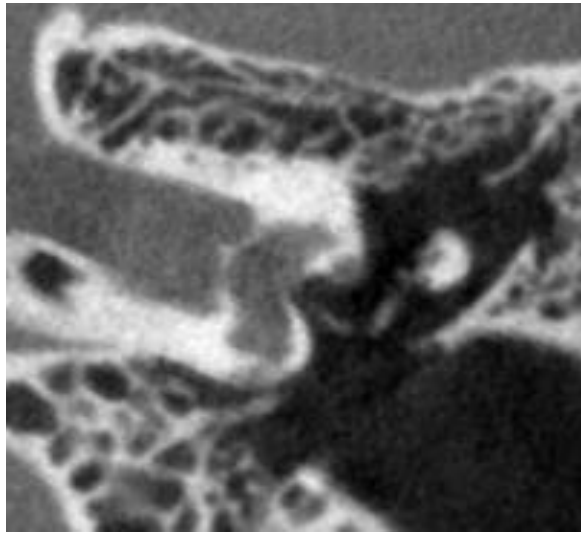


Anterior focus

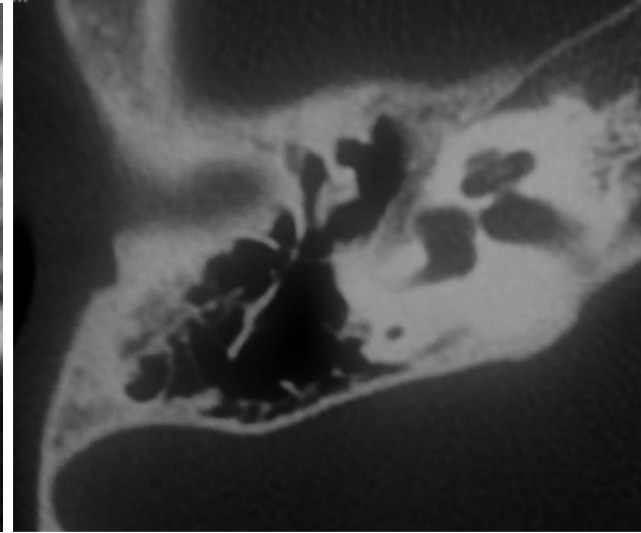
# Eliminating other causes of conductive HL



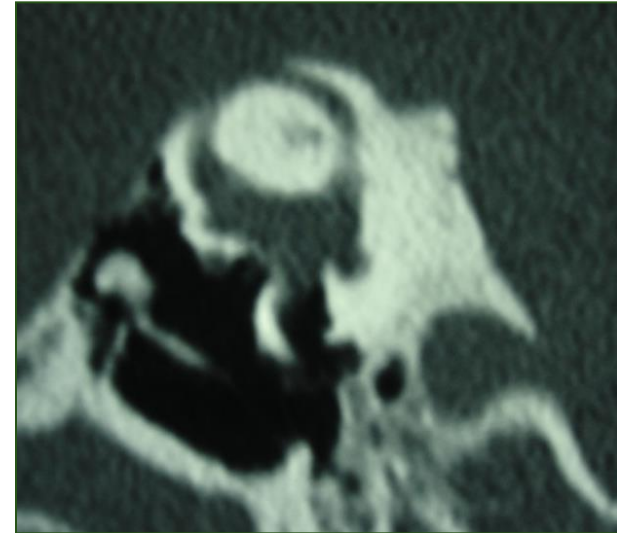
Absent crus



Incus lysis

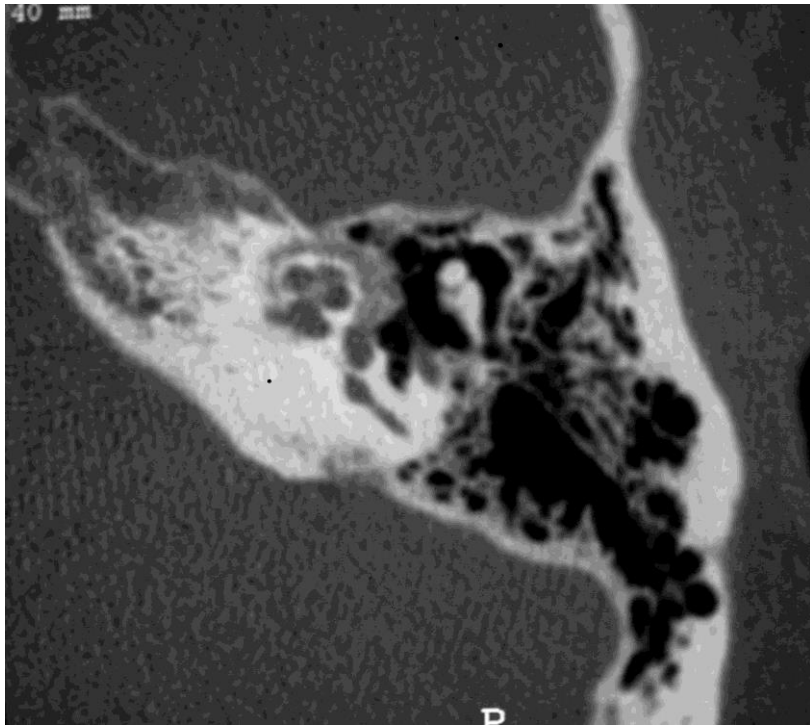


Epitympanic fixation

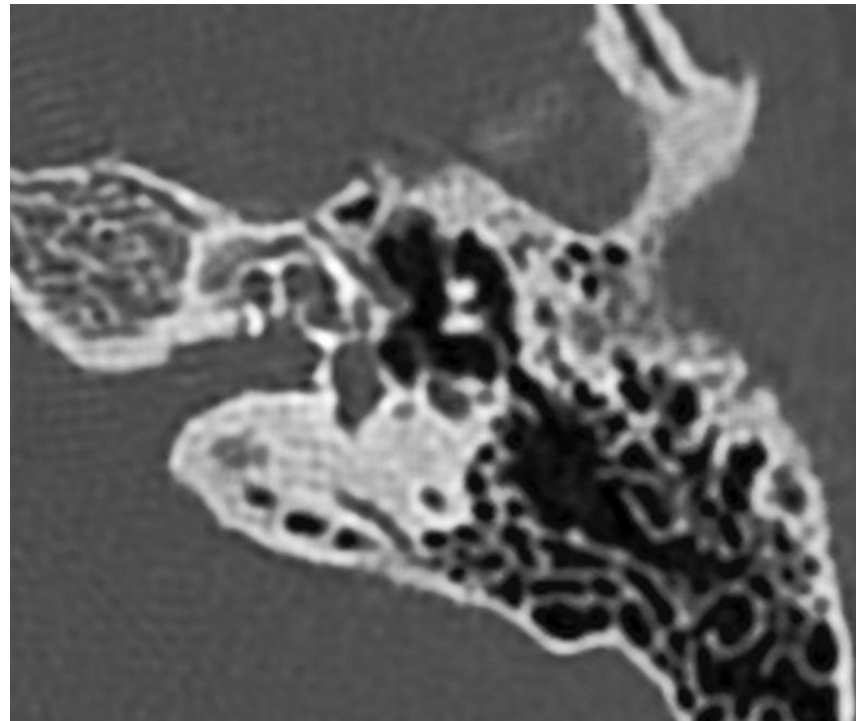


1/2 SC dehiscence

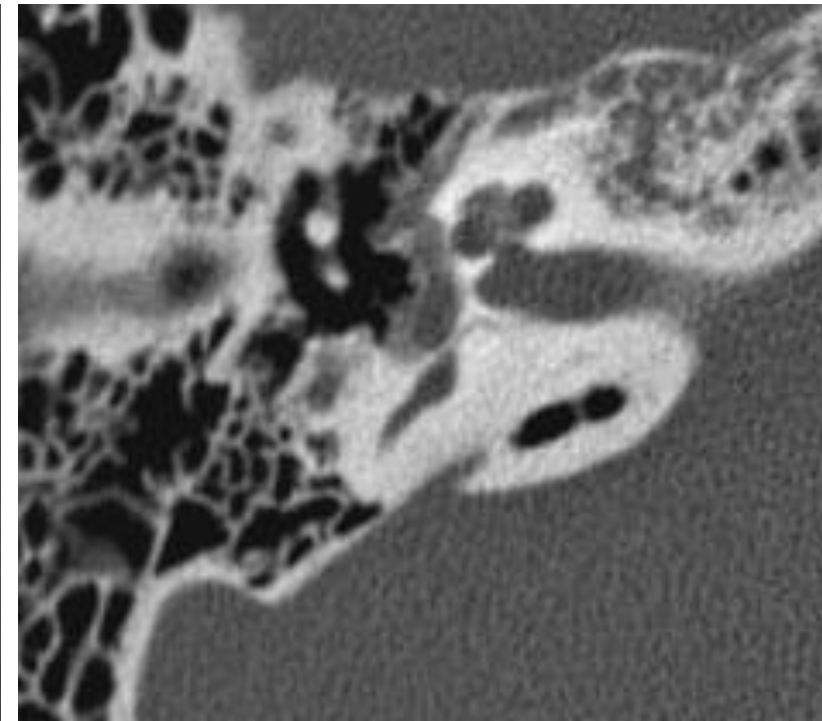
# Functional prognosis : cochlear otosclerosis



Cochlear foci

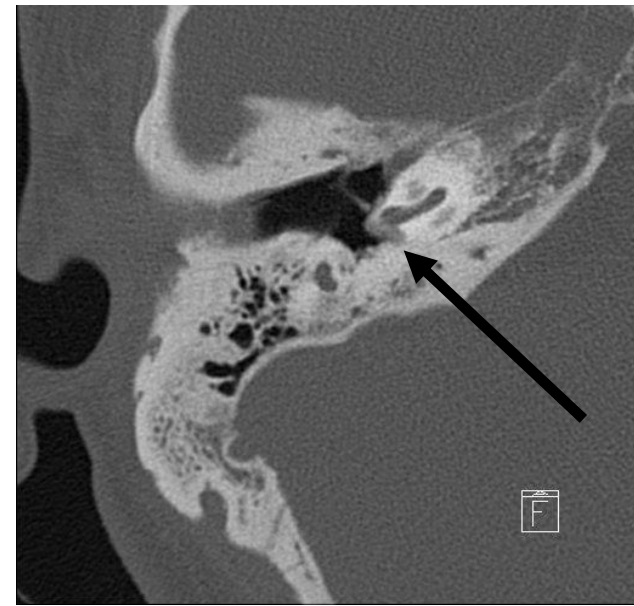


Notch IAC

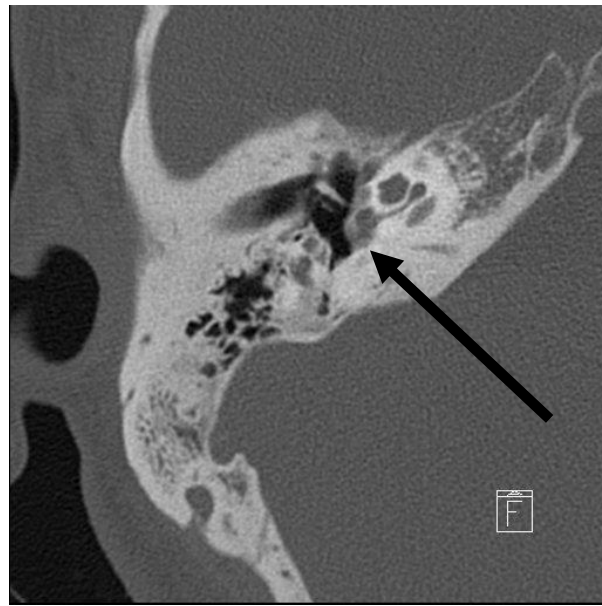


Vestibular extension

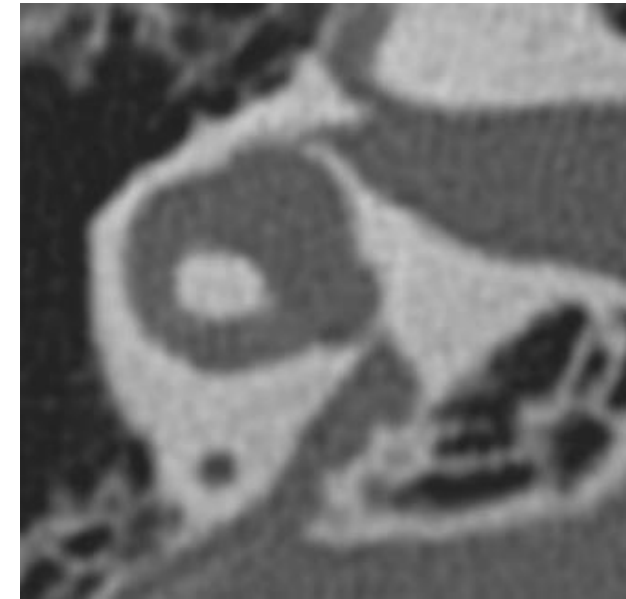
# Anticipating technical difficulties



Obliteration of the RW

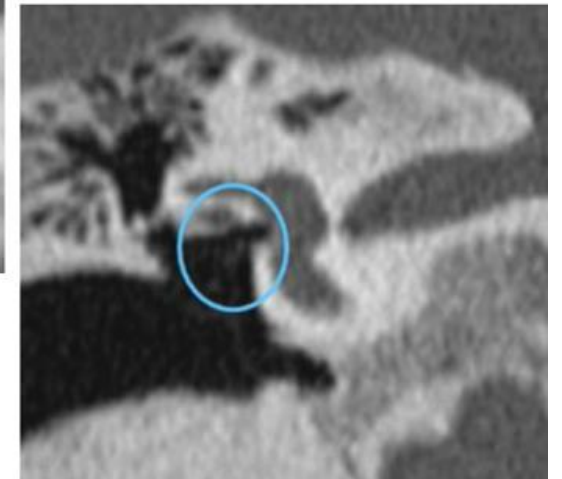
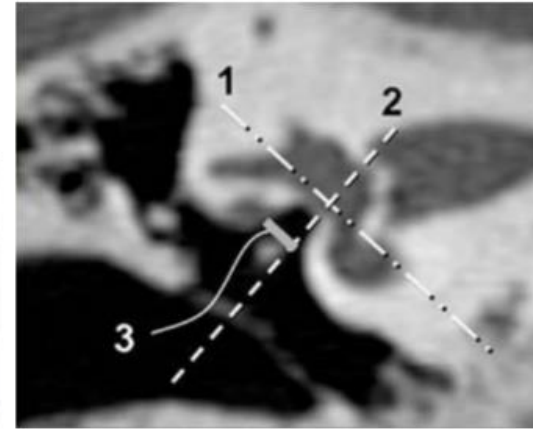
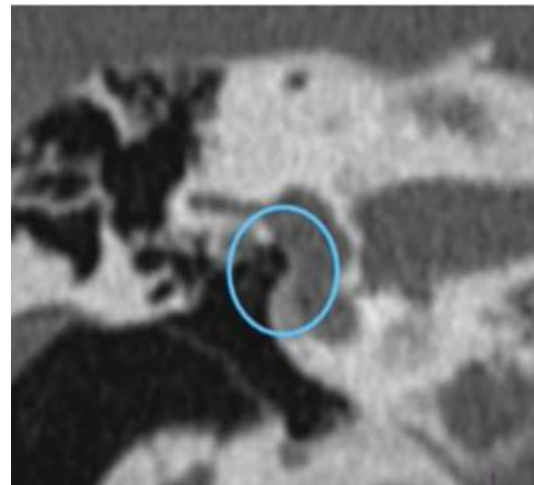
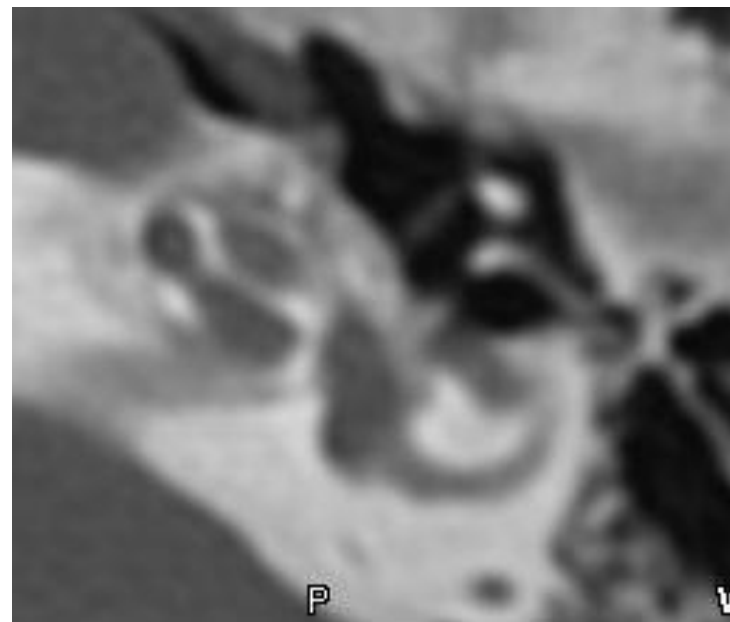


Gusher



Dilation of the VA

# Anticipating technical difficulties

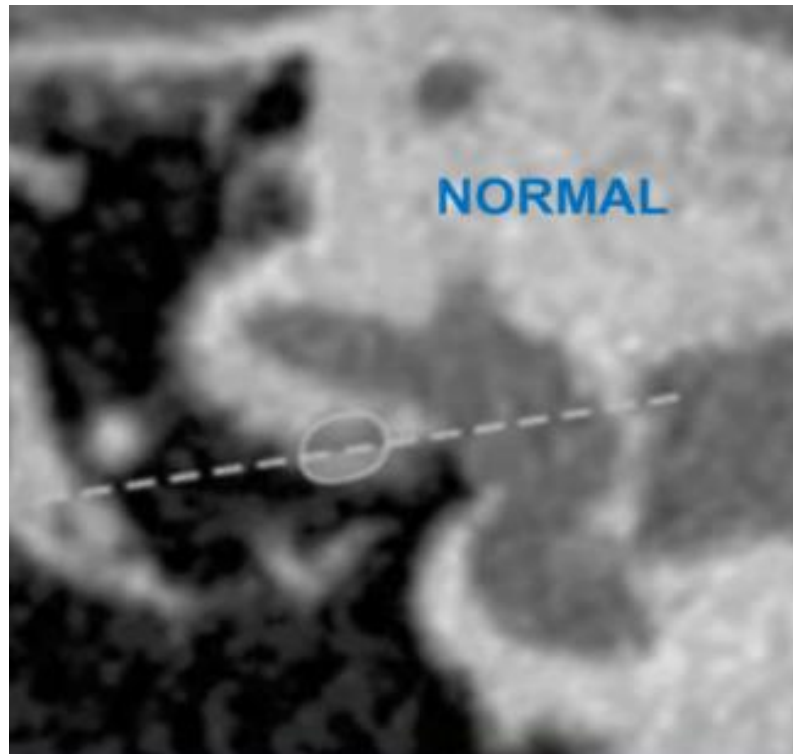


Obliterating otosclerosis

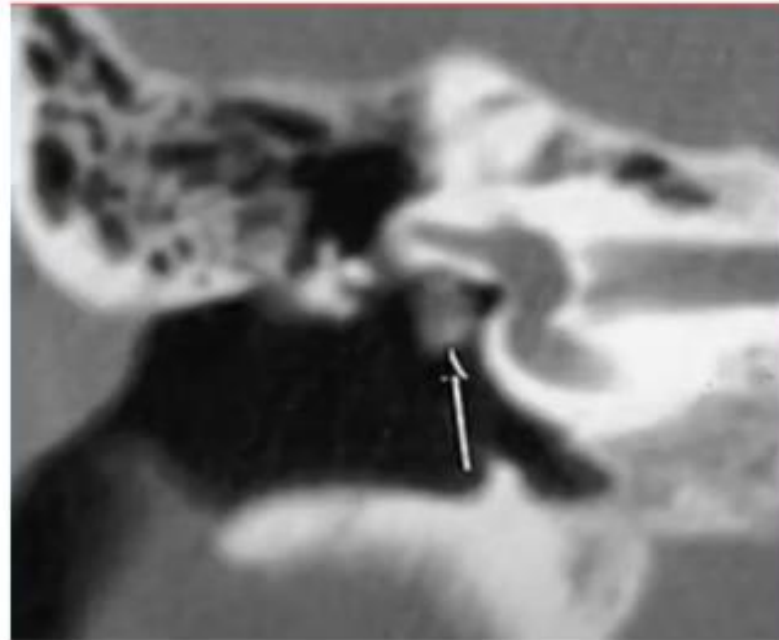
Normal RW >1,5mm

Narrow RW <1,4mm

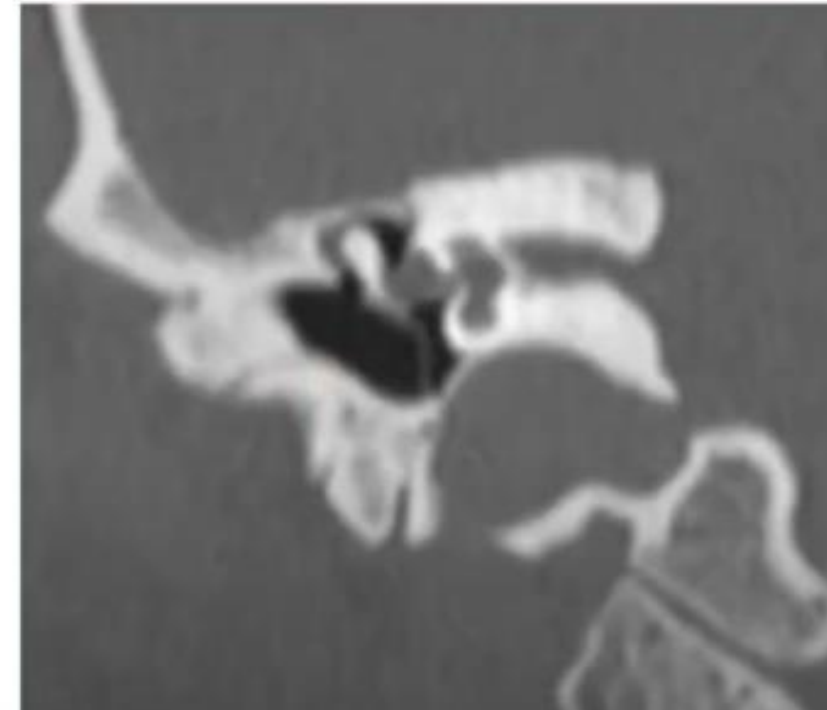
# Anticipating technical difficulties



VII in normal position

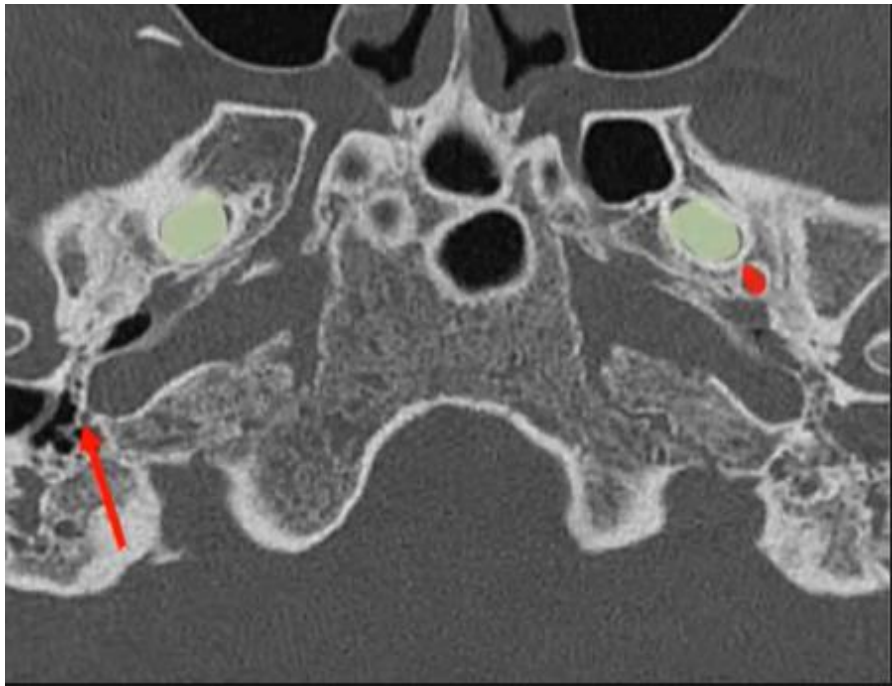


Procident VII



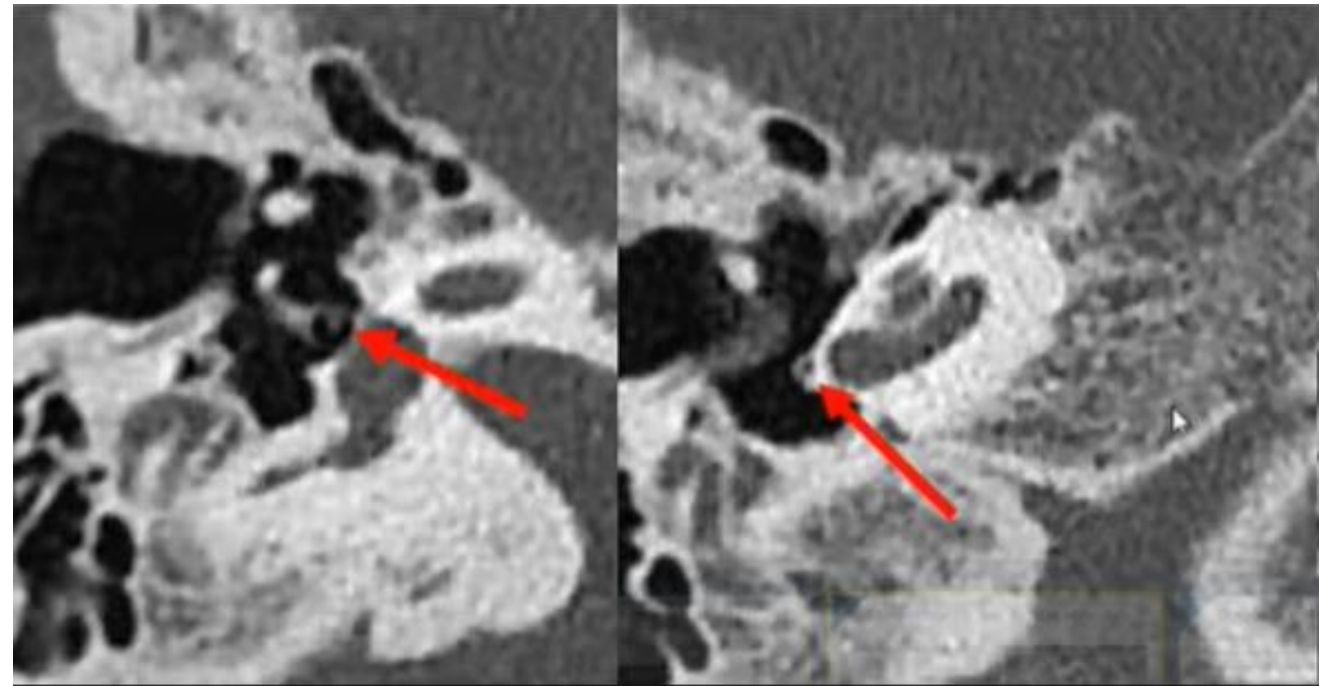
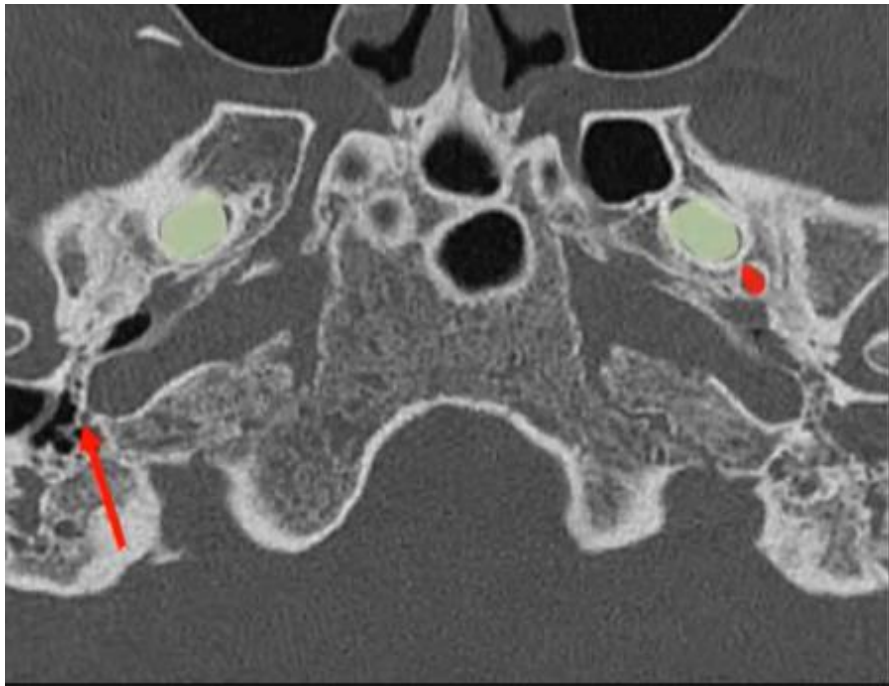


# Anticipating technical difficulties



Absence of Foramen spinosum

# Anticipating technical difficulties



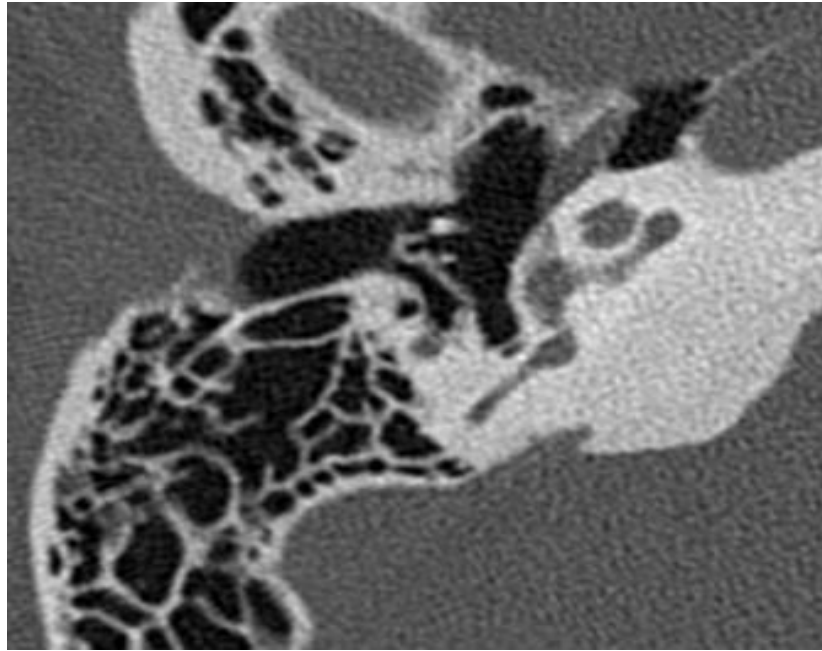
Absence of Foramen spinosum



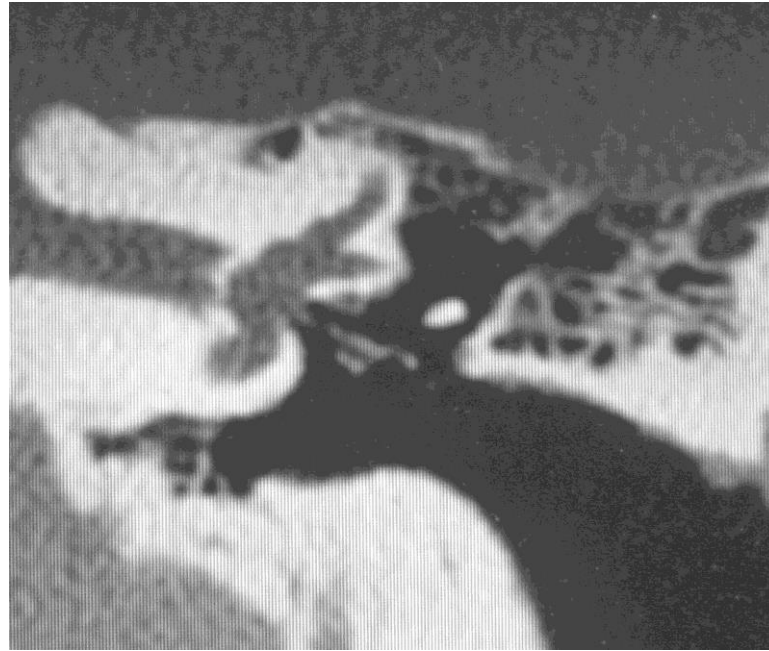
Stapedial artery

# Failure or complications

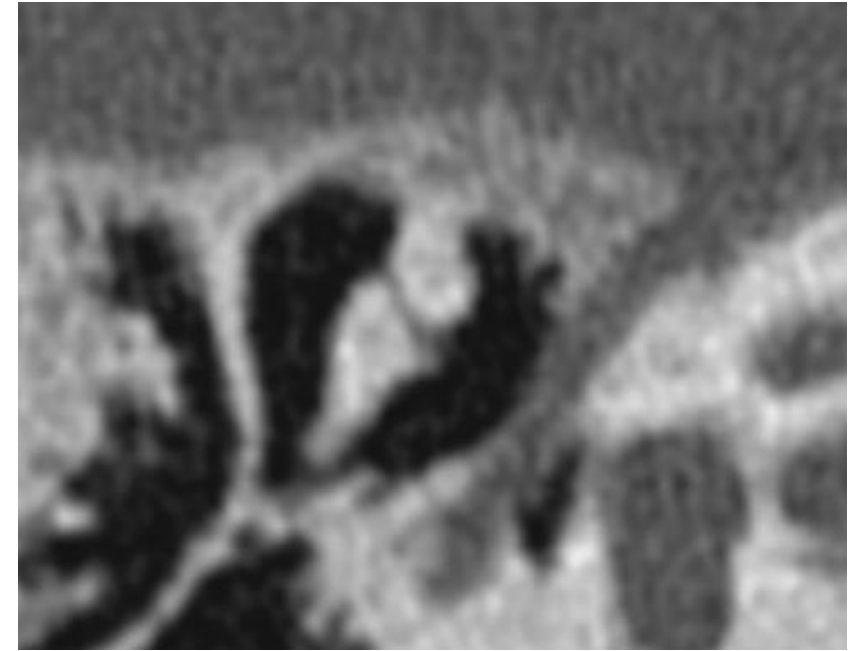
1. Persistence or Reappearance of an Air-Bone Gap → CT scan



Dislocation of the piston



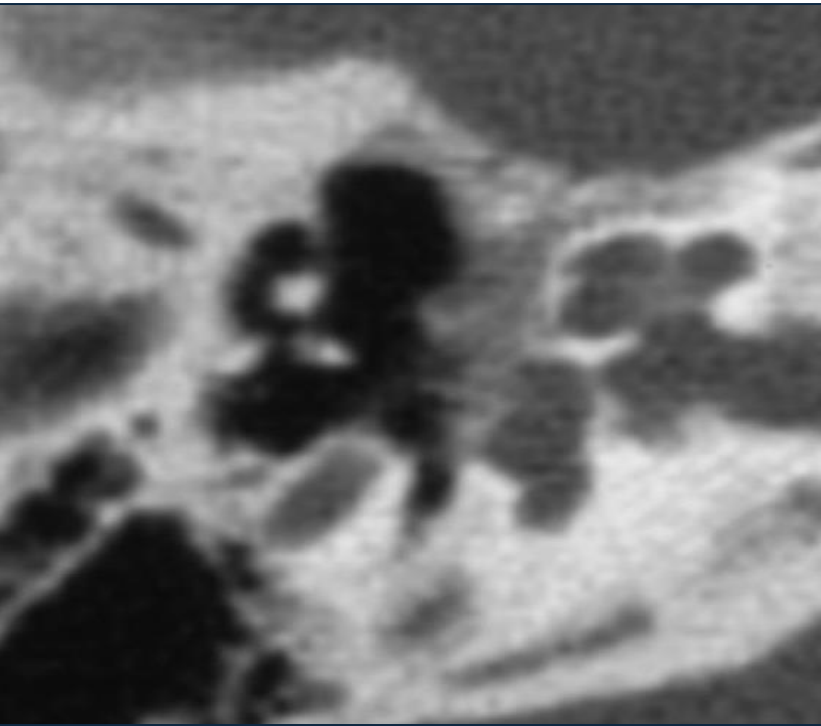
Lysis of long process



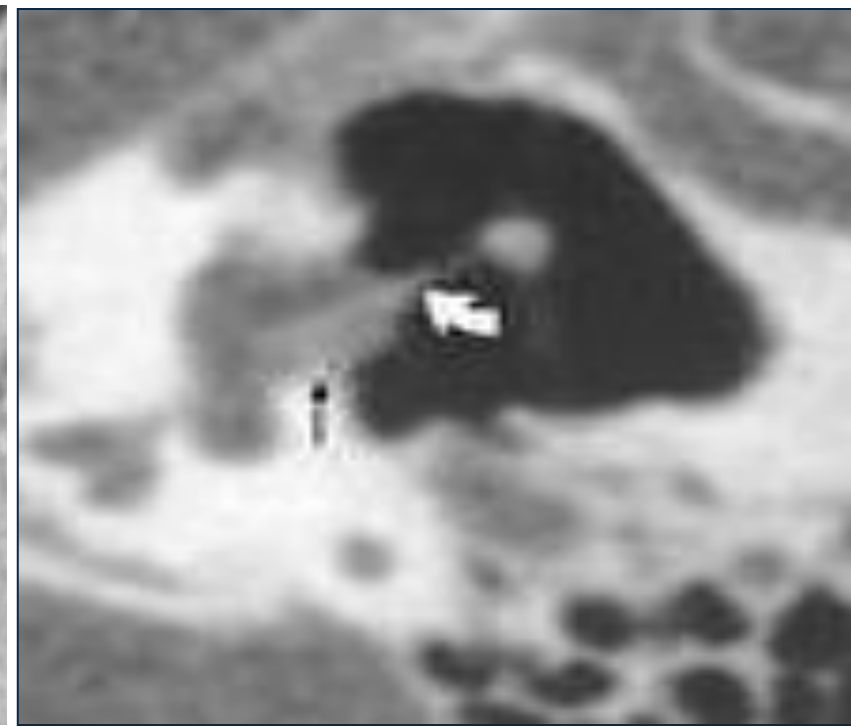
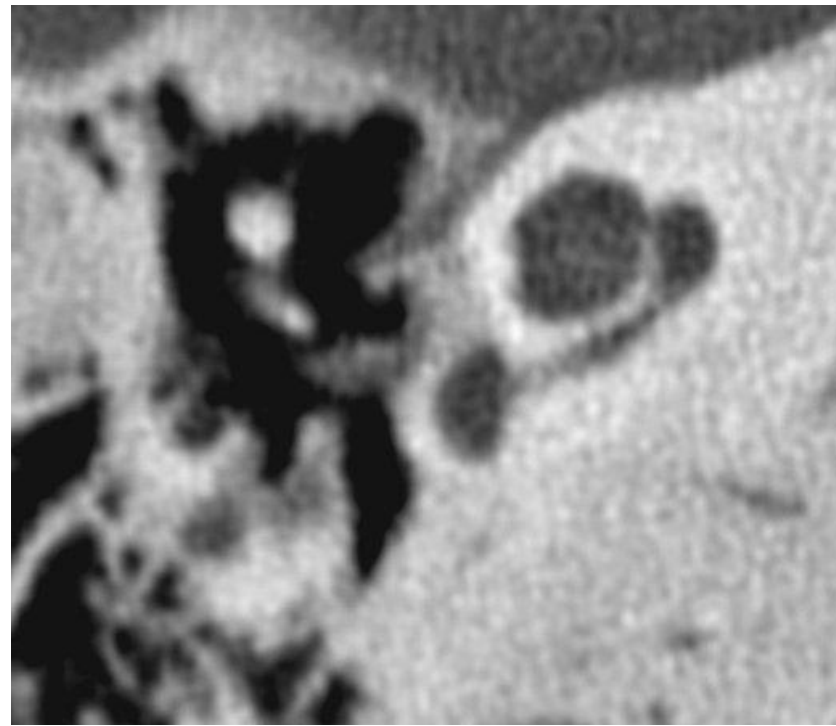
Ankylosis of the malleus head

# Failure or complications

1. Persistence or Reappearance of an Air-Bone Gap → CT scan

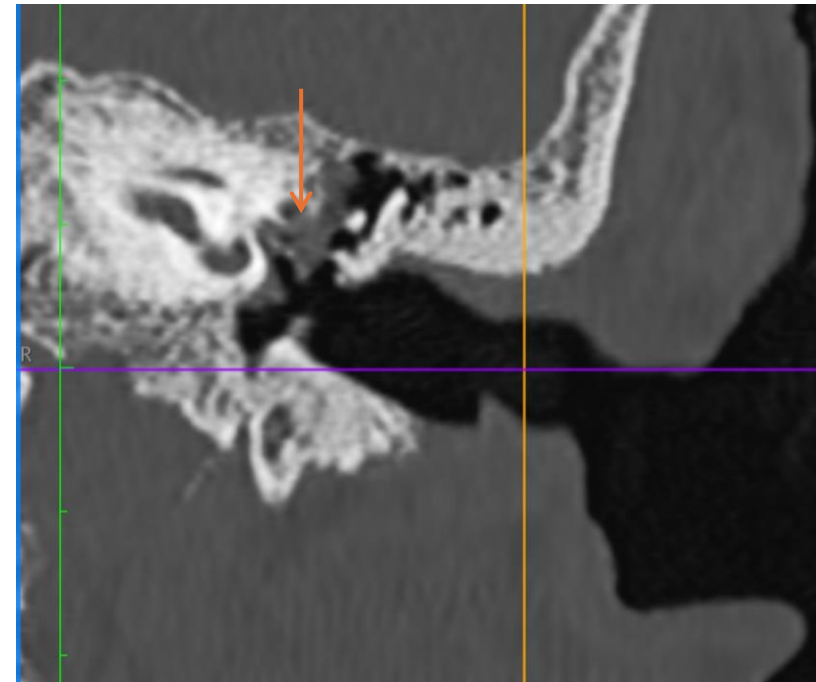


Reepithelialization

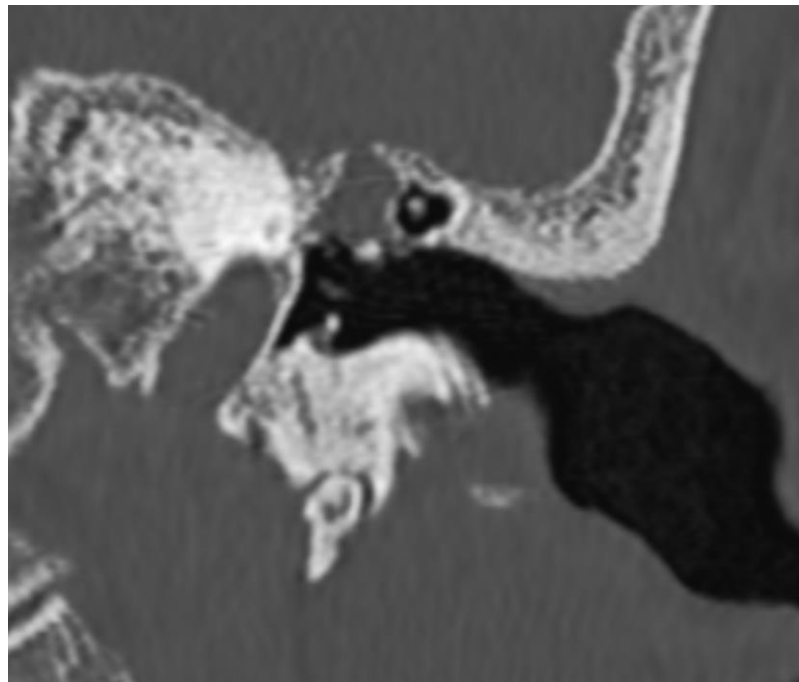


Fibrosis

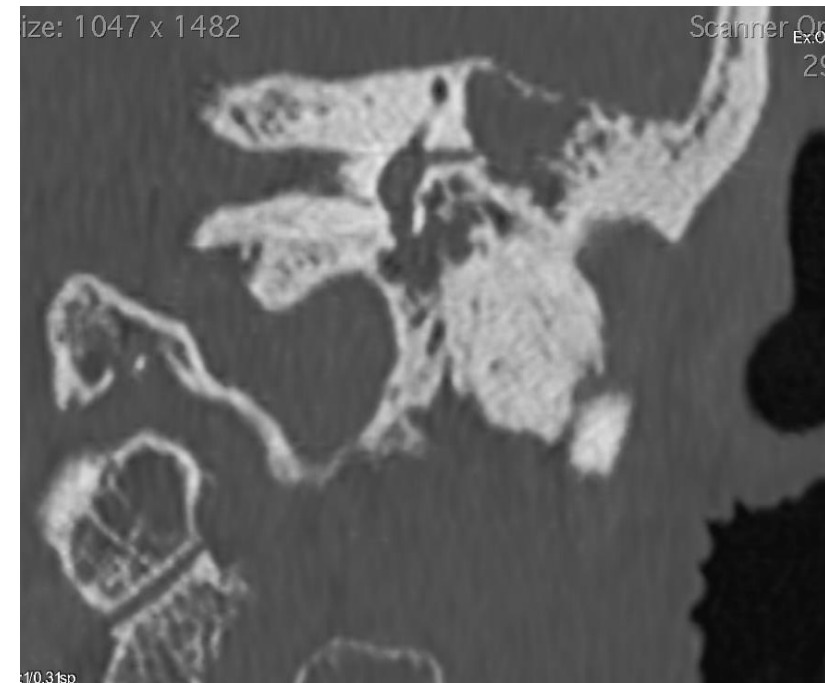
# Detecting complications



- 2<sup>nd</sup> portion of the VII



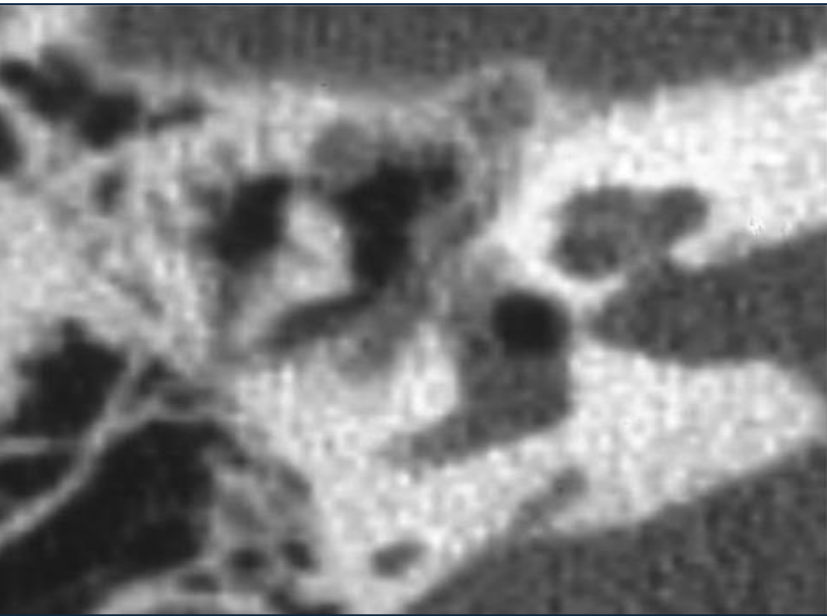
Tegmen



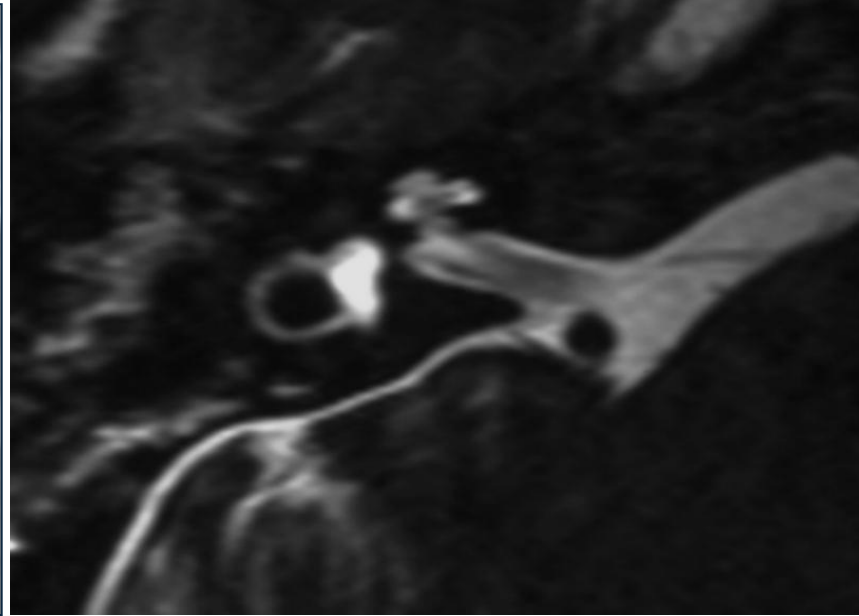
1/2 lateral canal

# Failure or complications

2. Sensorineural hearing loss → CT scan + MRI

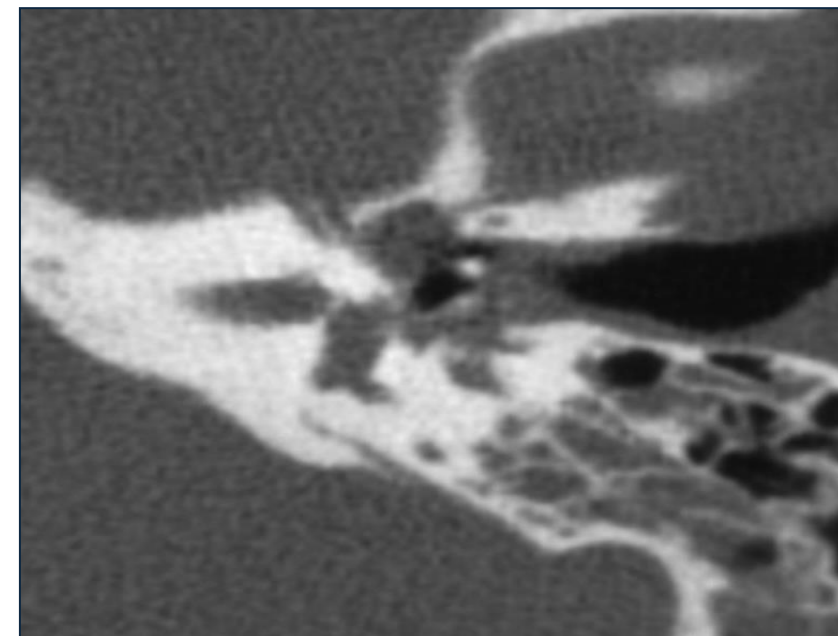


Pneumolabyrinth



Labyrinthine hemorrhage

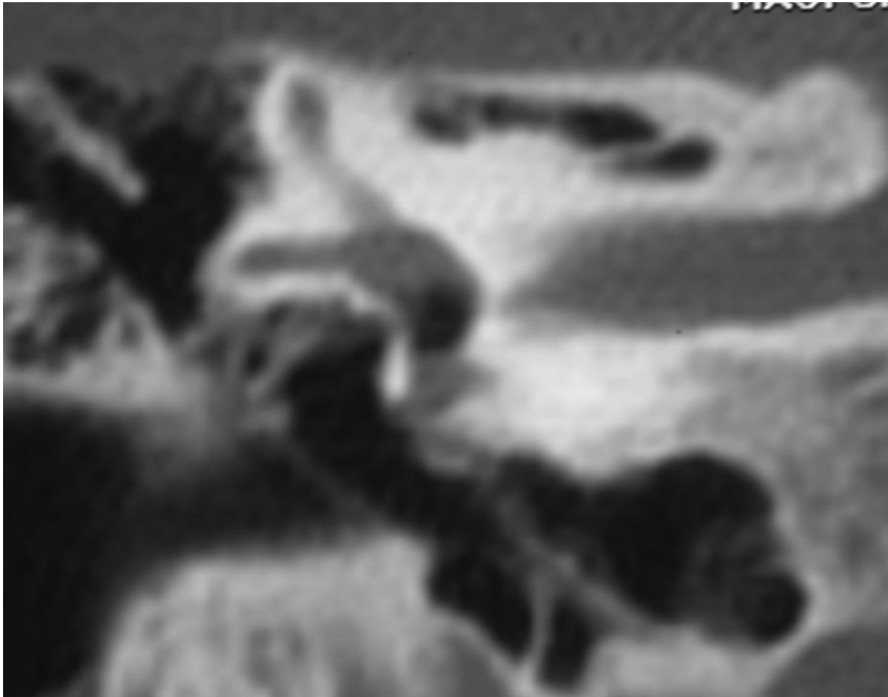
low intensity signal of ½ canals + anterior part of the vestibule + hypersignal in T2



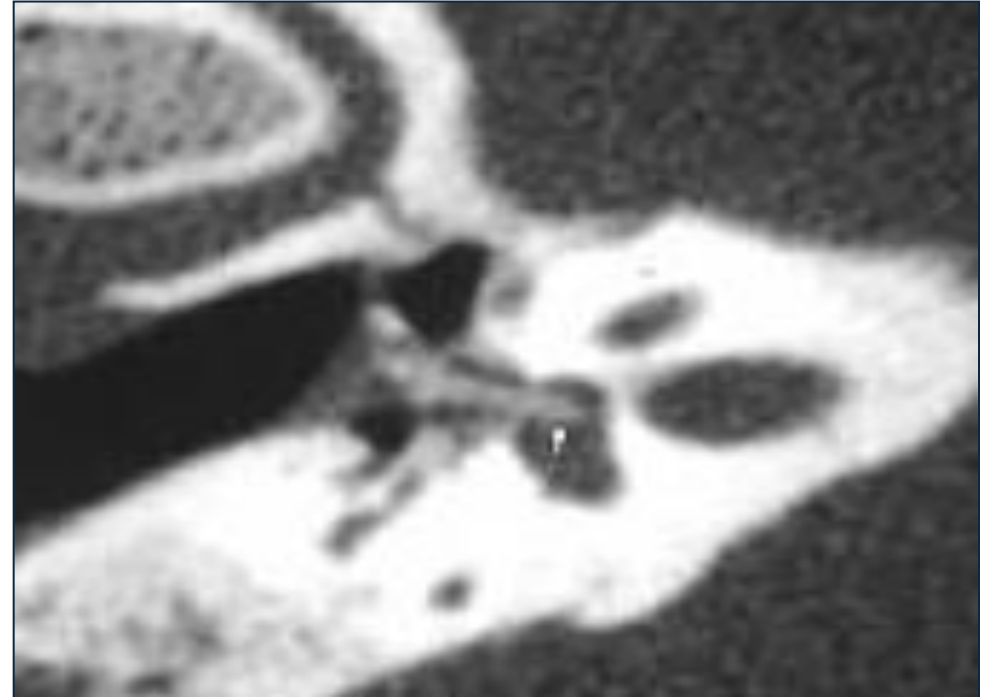
Granuloma

# Failure or complications

## 2. Sensorineural hearing loss - vertigo



Perilymphatic fistula ???



Intravestibular piston

# Imaging in Cholesteatoma

- Of major interest
  - Before surgery
  - Postoperative surveillance





# Cholesteatoma

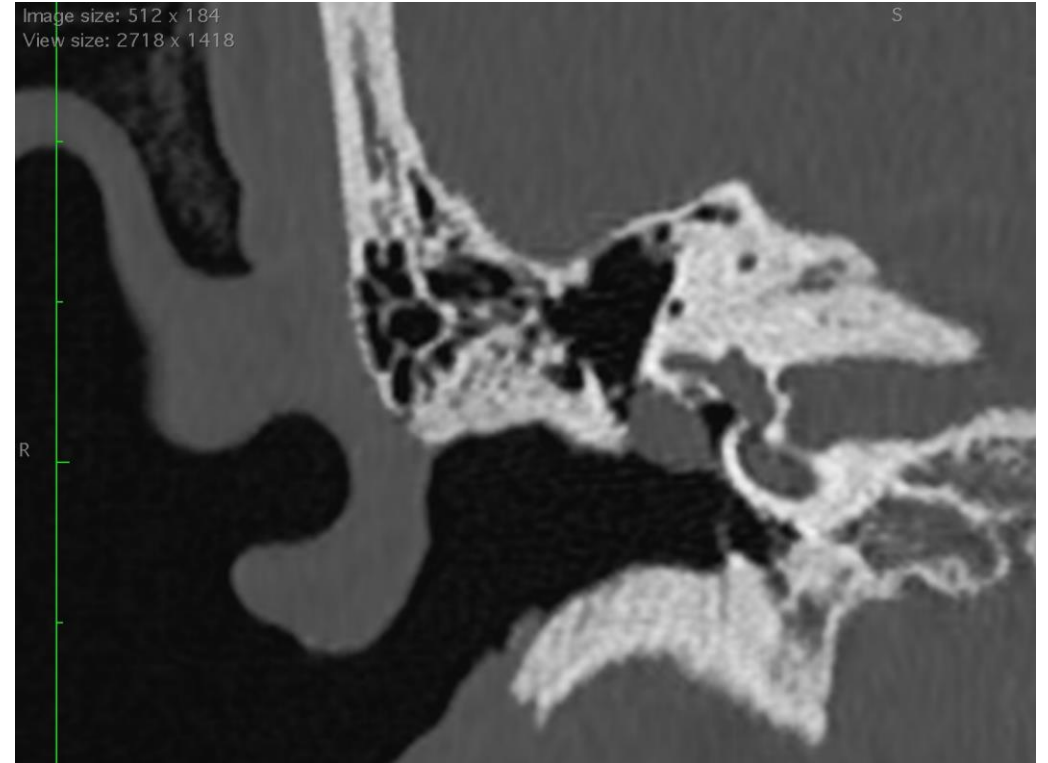
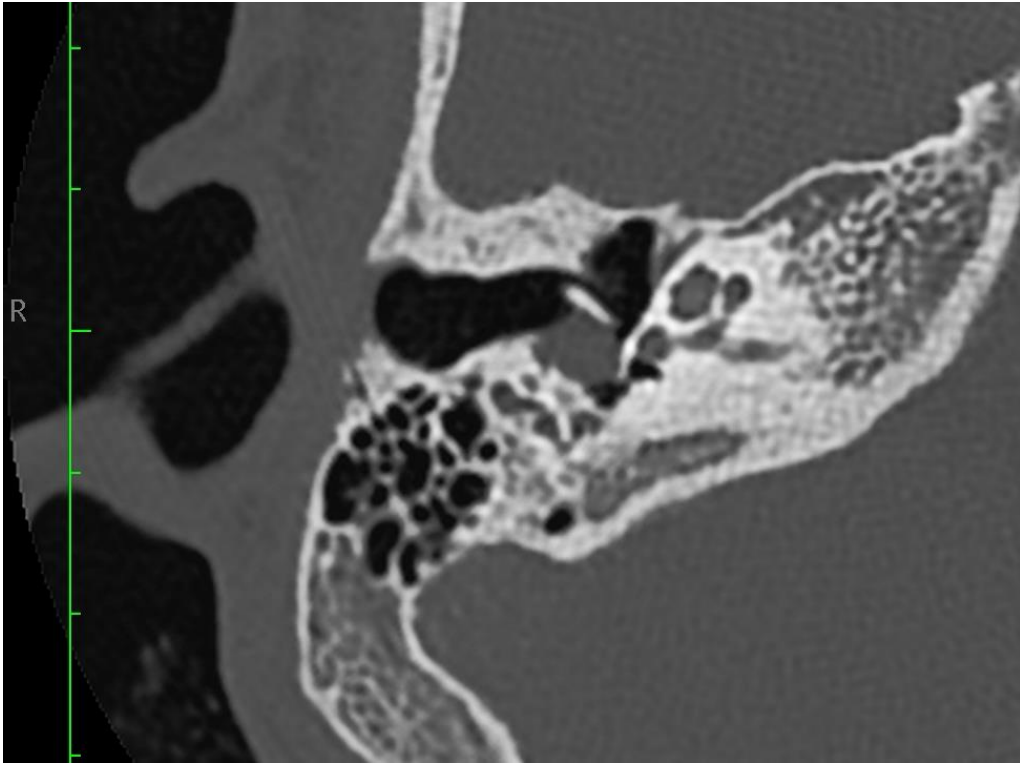
- **CT scan or CB CT**

- Often typical
- Anatomico-surgical clues
- Ossicular status
- Irradiation

- **MRI**

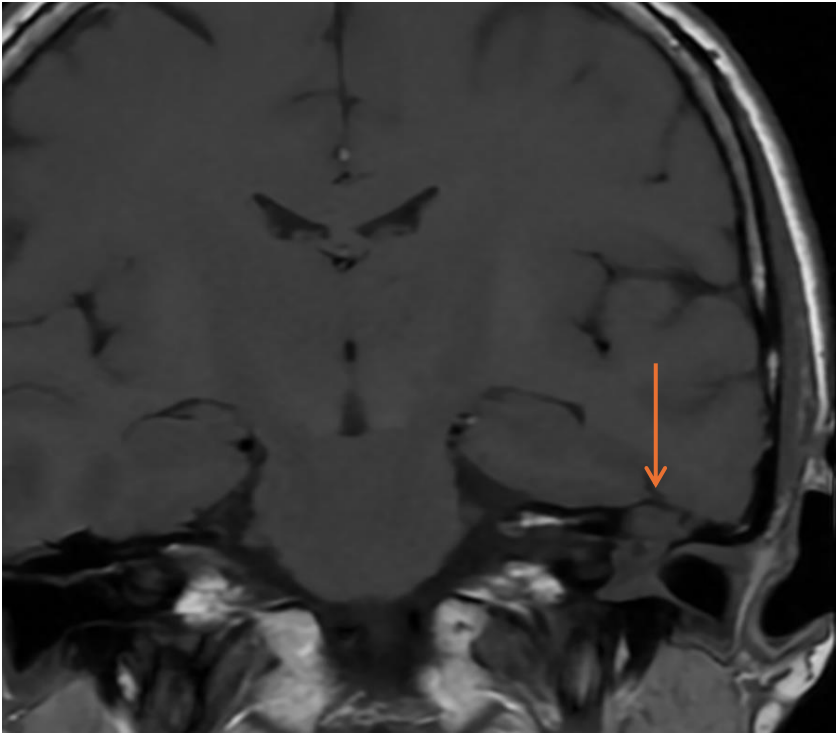
- Diagnostic confirmation (diffusion or T1R)
- Recurrences ++
- No irradiation

# Cholesteatoma

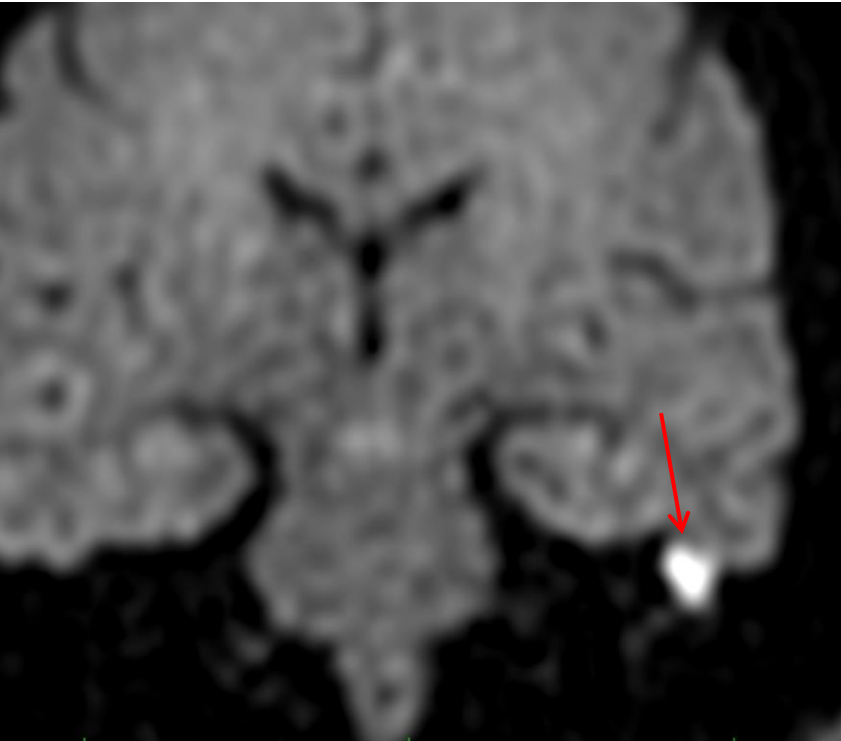


Typical aspect

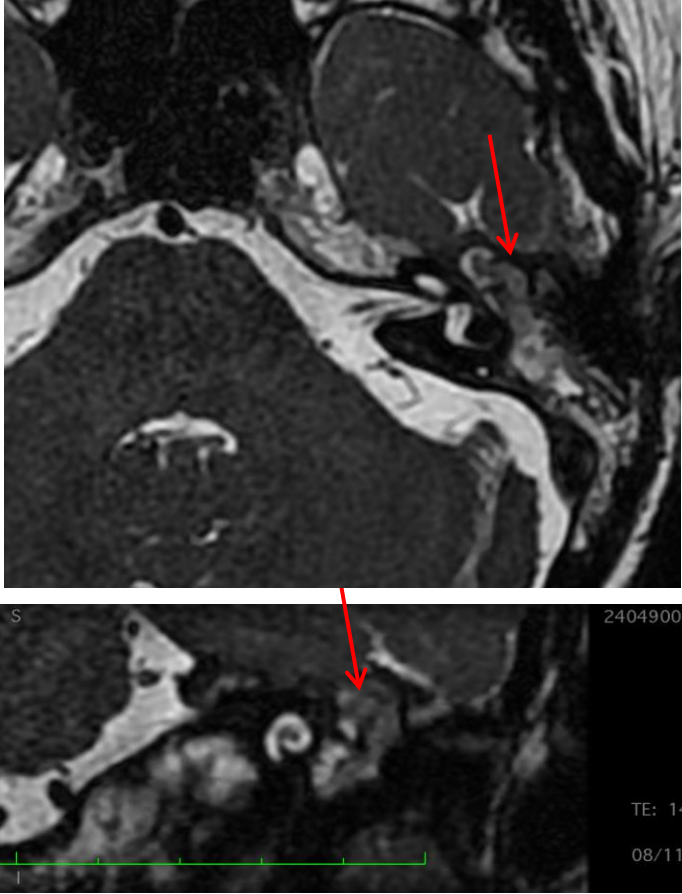
# Cholesteatoma



T1 hyposignal

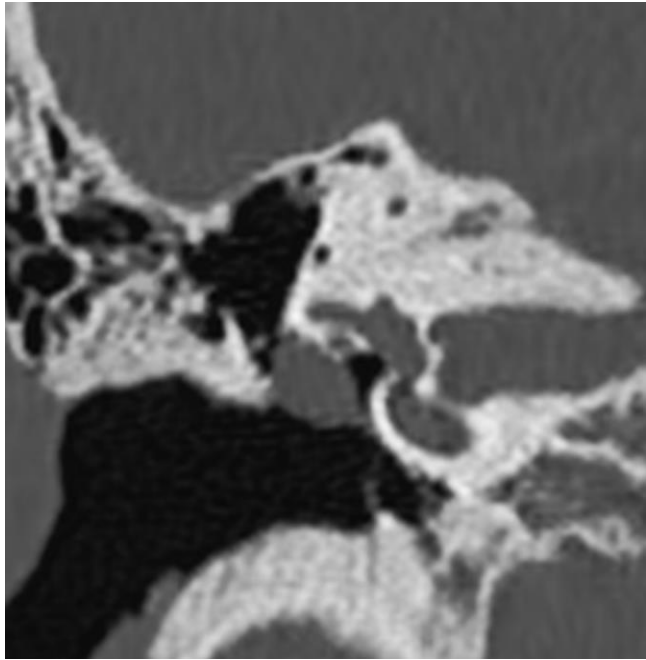


Diffusion Hypersignal



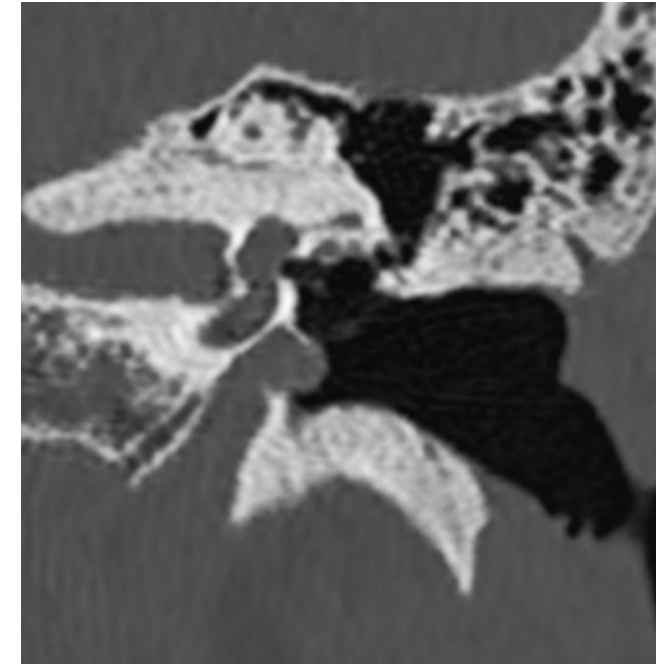
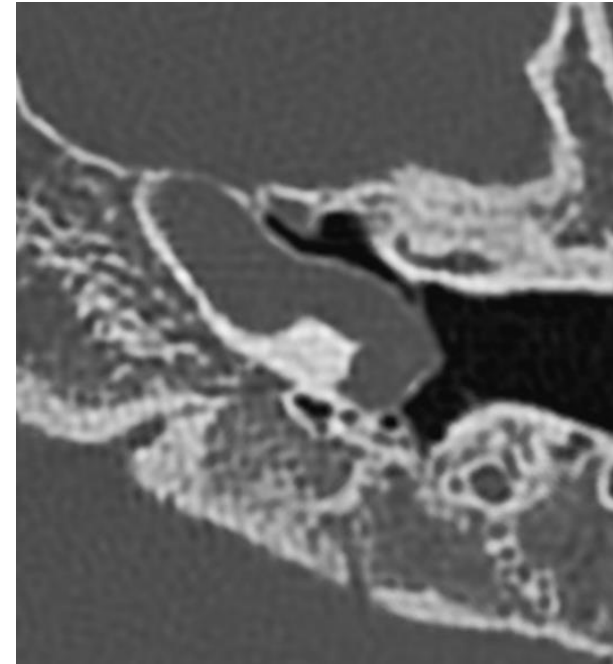
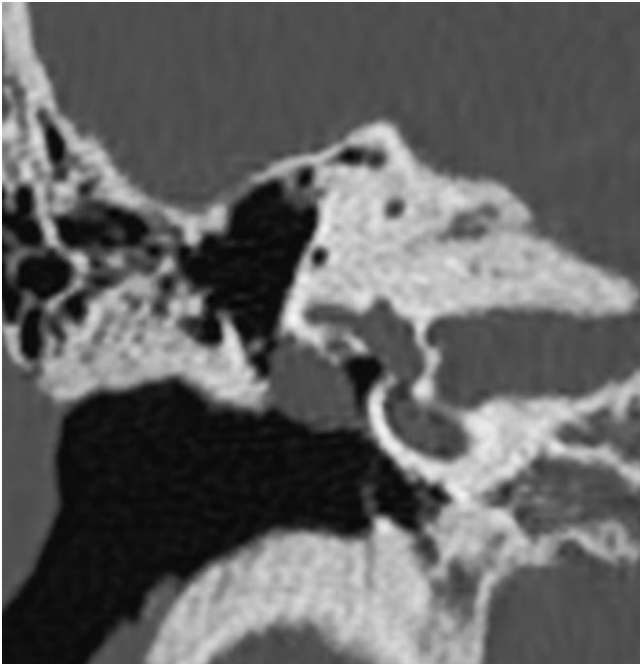
Liquid en hyper T2  
surrounding opacity

# Avoiding a disaster



Right Ear

# Avoiding a disaster

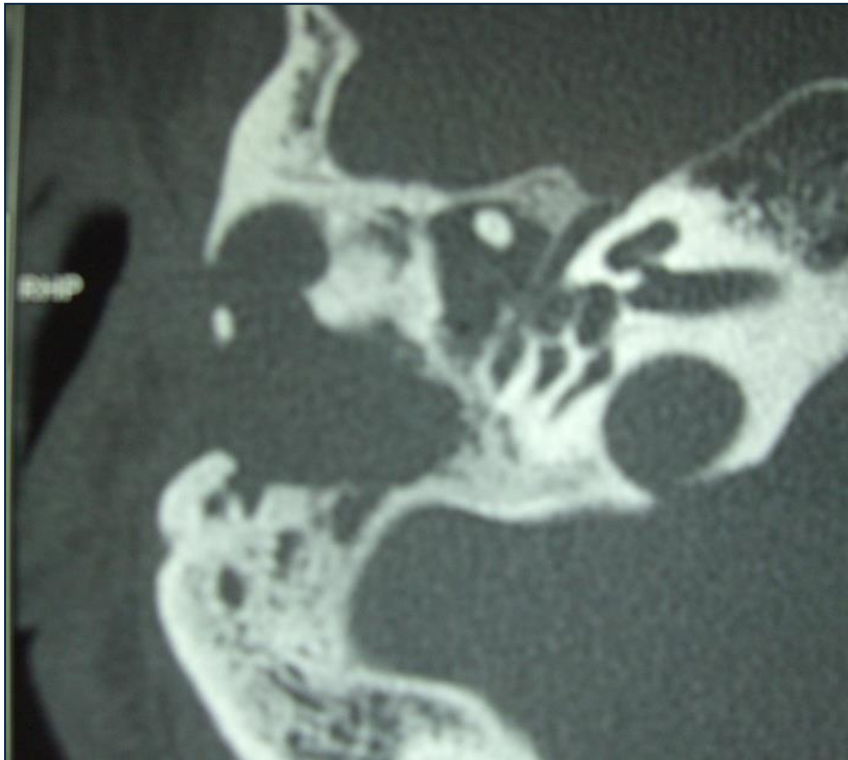


Right Ear

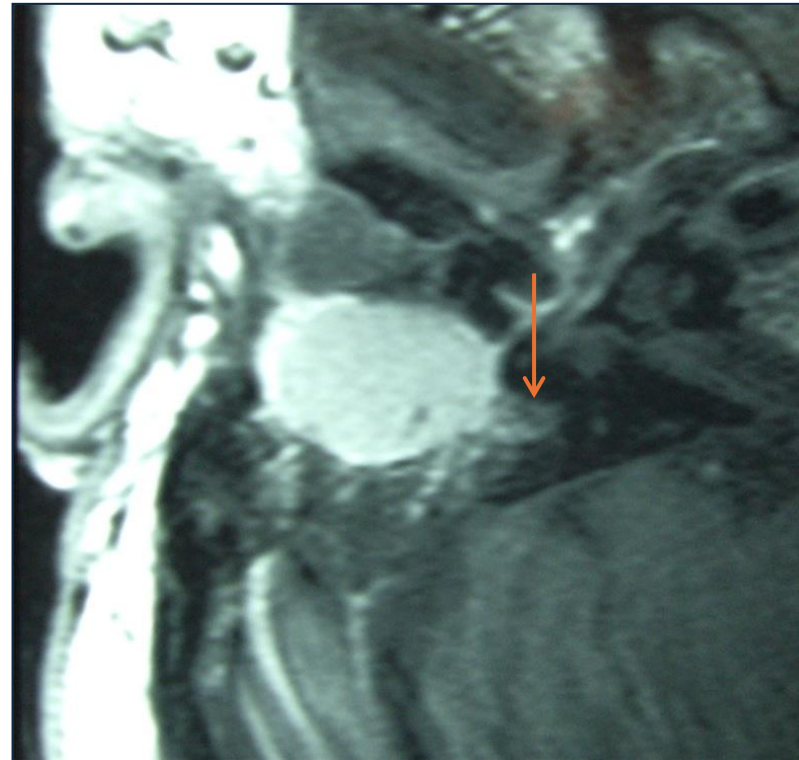
Left Ear

!!!!!!

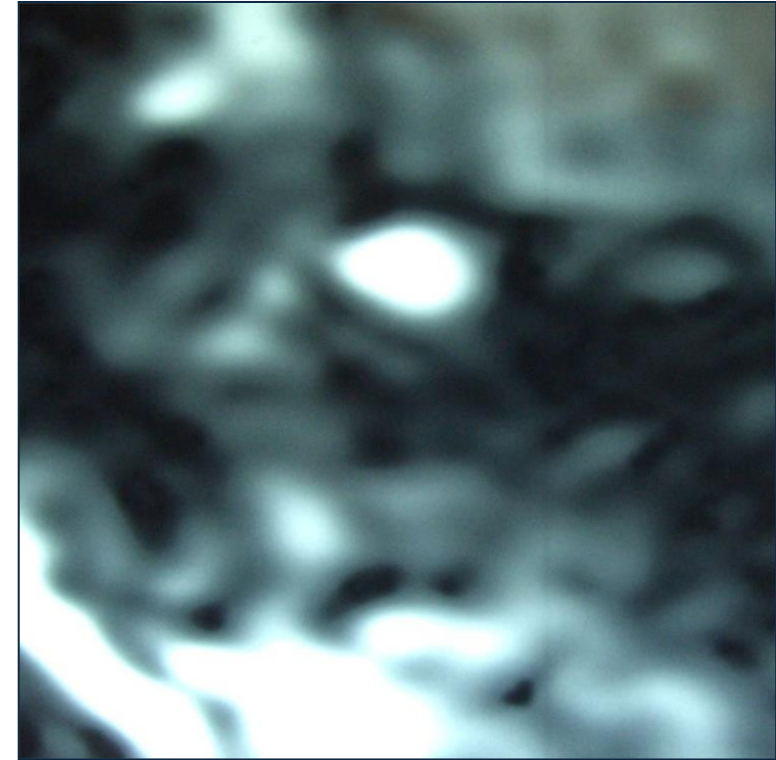
# Postoperative surveillance



Scanner

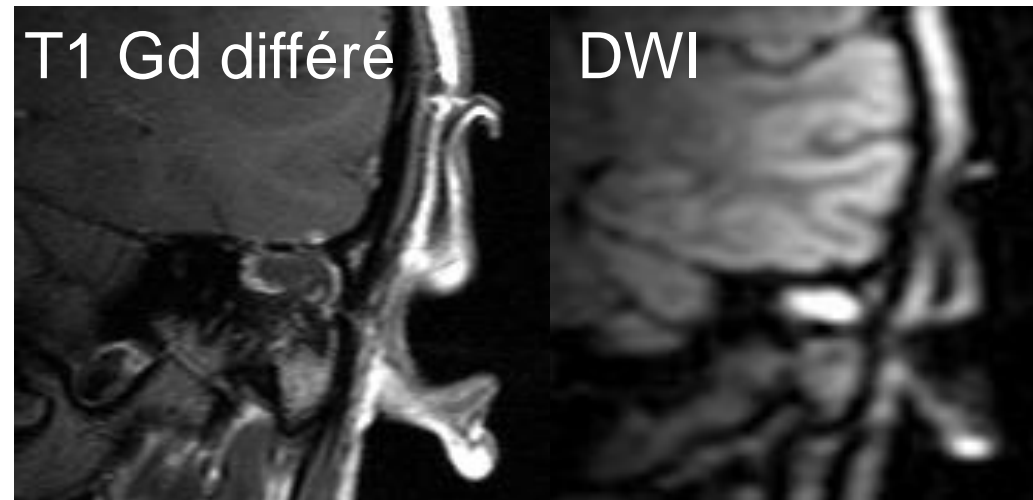
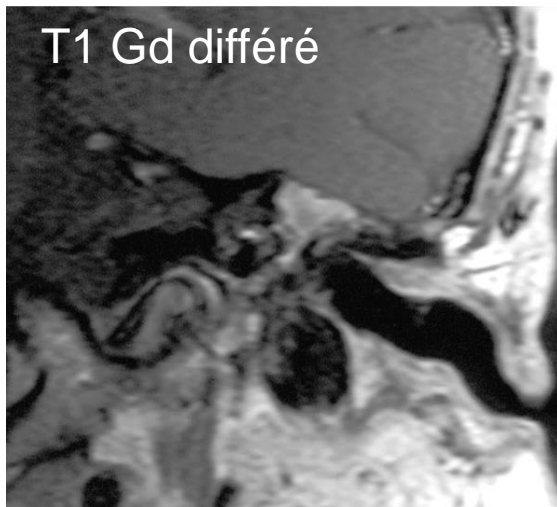
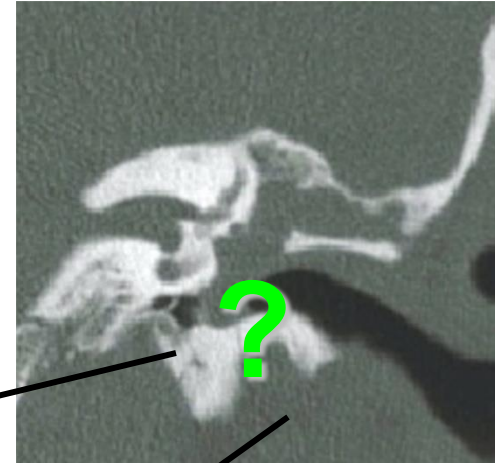
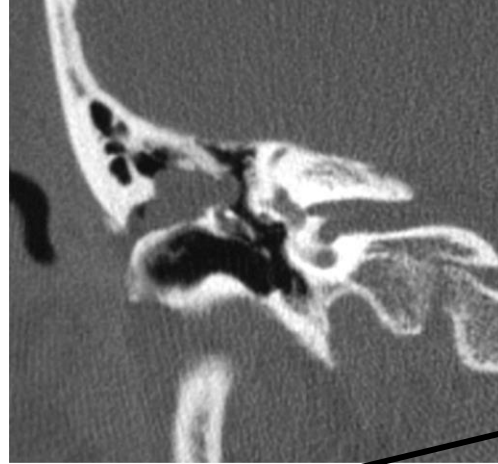
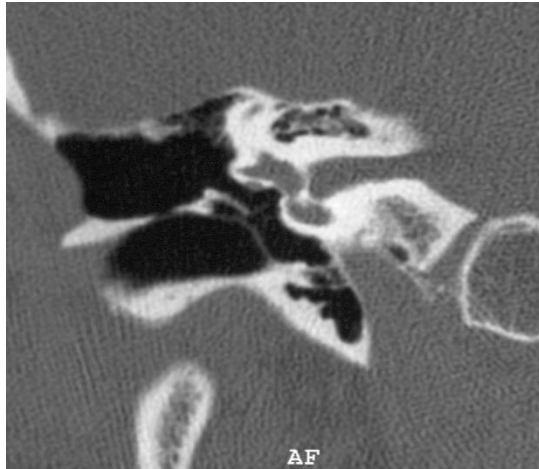


T1 Delayed

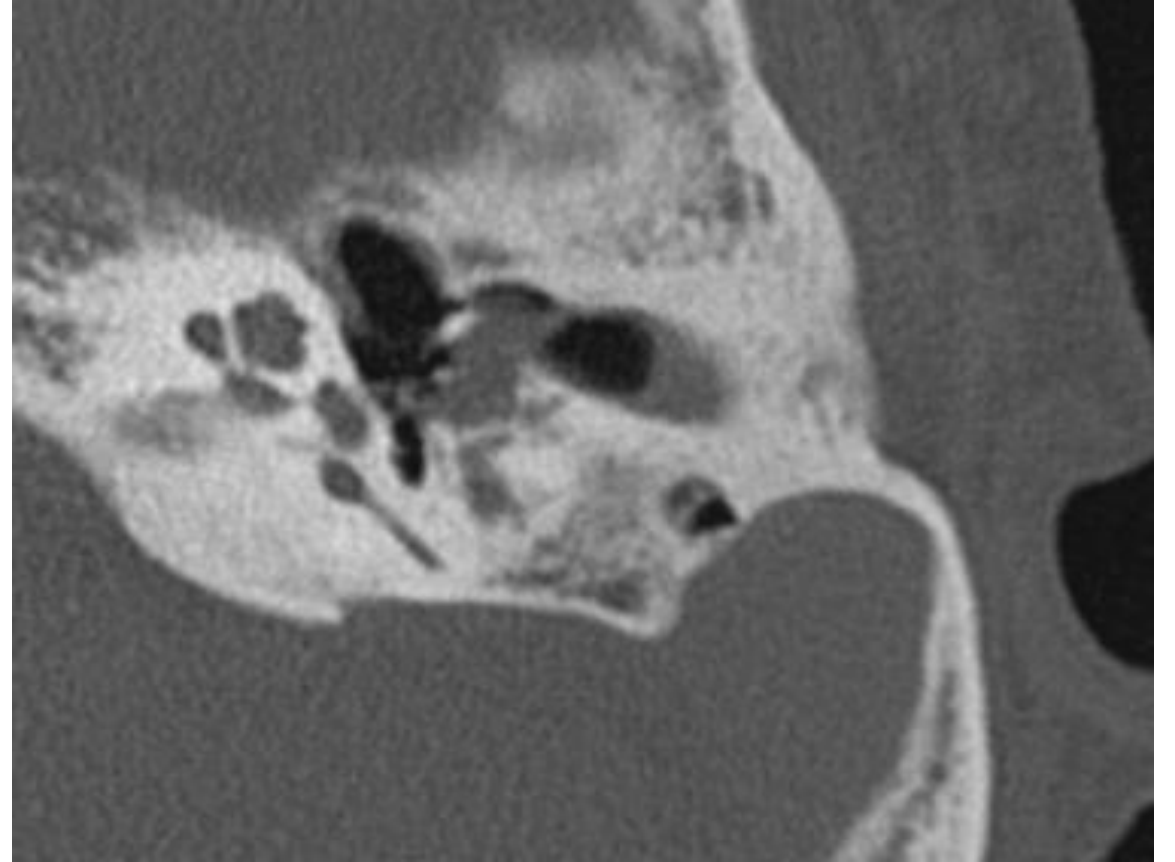
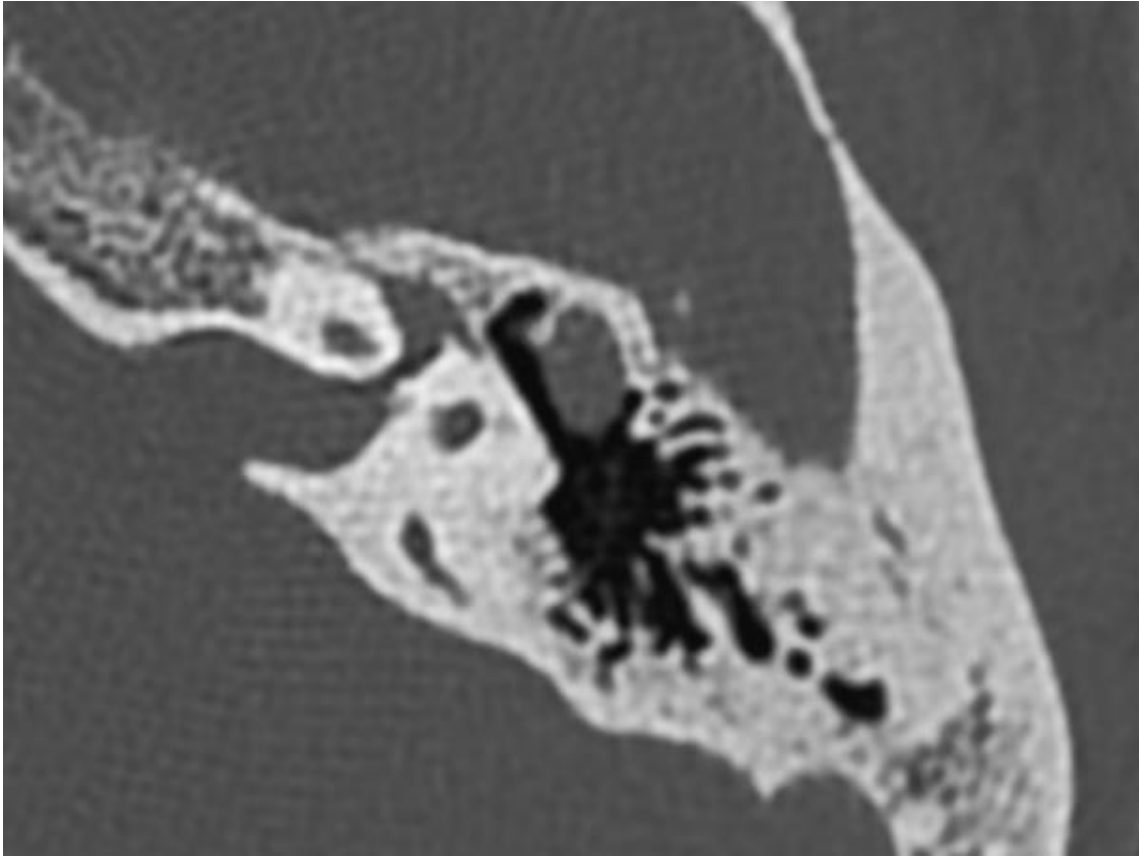


Diffusion

# Postoperative evaluation



# Surgical strategy





Thank you for your attention !



# Apport de chaque modalité

## TDM/CBCT

- Surveillance cholé
  - Parfois d'emblée contributif (aération complète ou opacité nodulaire)
  - Non informatif si comblement complet ou opacité non spécifique
- Infos supplémentaires / IRM :
  - Anatomie
  - Aération
  - Position d'une ossiculoplastie
- Problème de l'irradiation (TDM>CBCT)

## IRM

- Caractérisation tissulaire: 2 possibilités
  - IRM de diffusion (non-EPI, B800 ou 1000)  
++
  - IRM avec injection et séquences T1 retardées
- Technique non irradiante (et non invasive pour diff)
- Réponse binaire
  - Cholestéatome + ou –
  - Peu ou pas d'autre information
- Risque de faux-négatif si < 3 mm

# Apport de chaque modalité

## TDM/CBCT

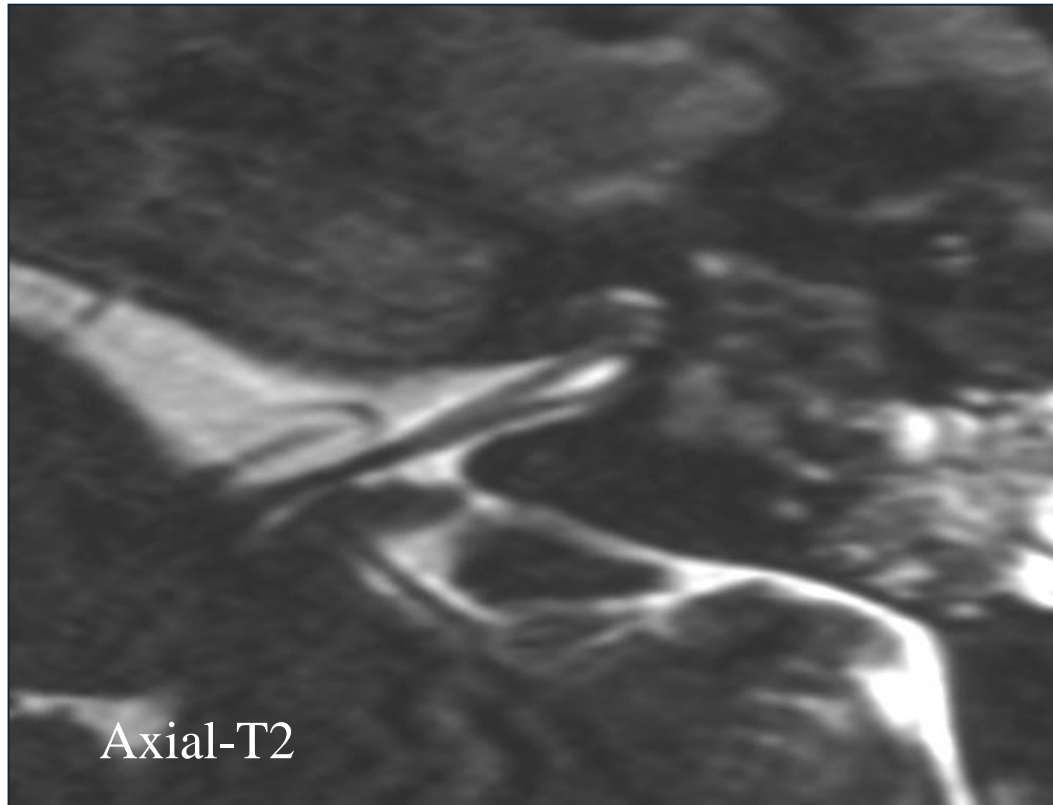
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## IRM

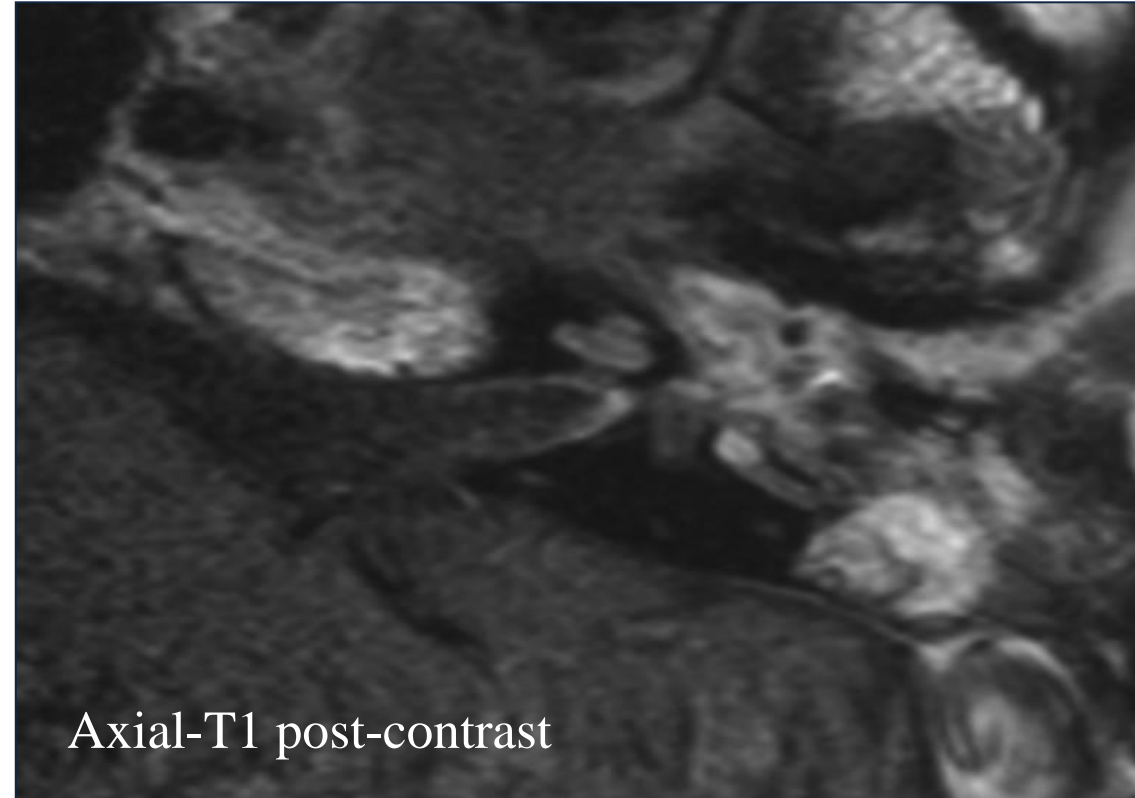
- Caractérisation tissulaire: 2 possibilités
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- Réponse binaire
  - Cholestéatome + ou –
  - Peu ou pas d'autre information
- Risque de faux-négatif si < 3 mm

# Labyrinthite

Cophose et suppuration du site opératoire, J7

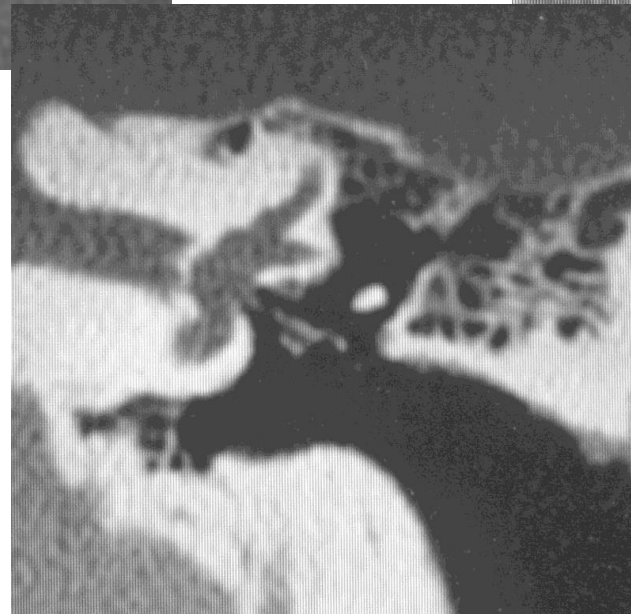
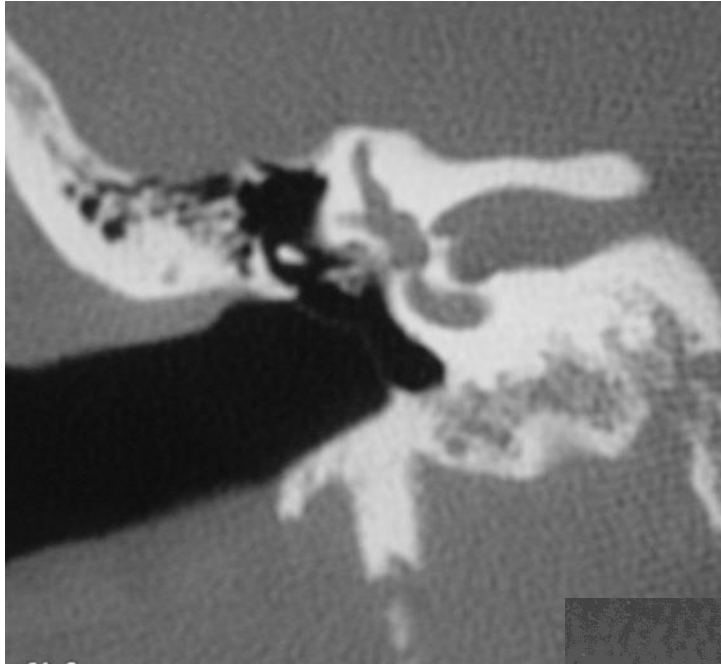


Oblitération partielle des cavités labyrinthiques

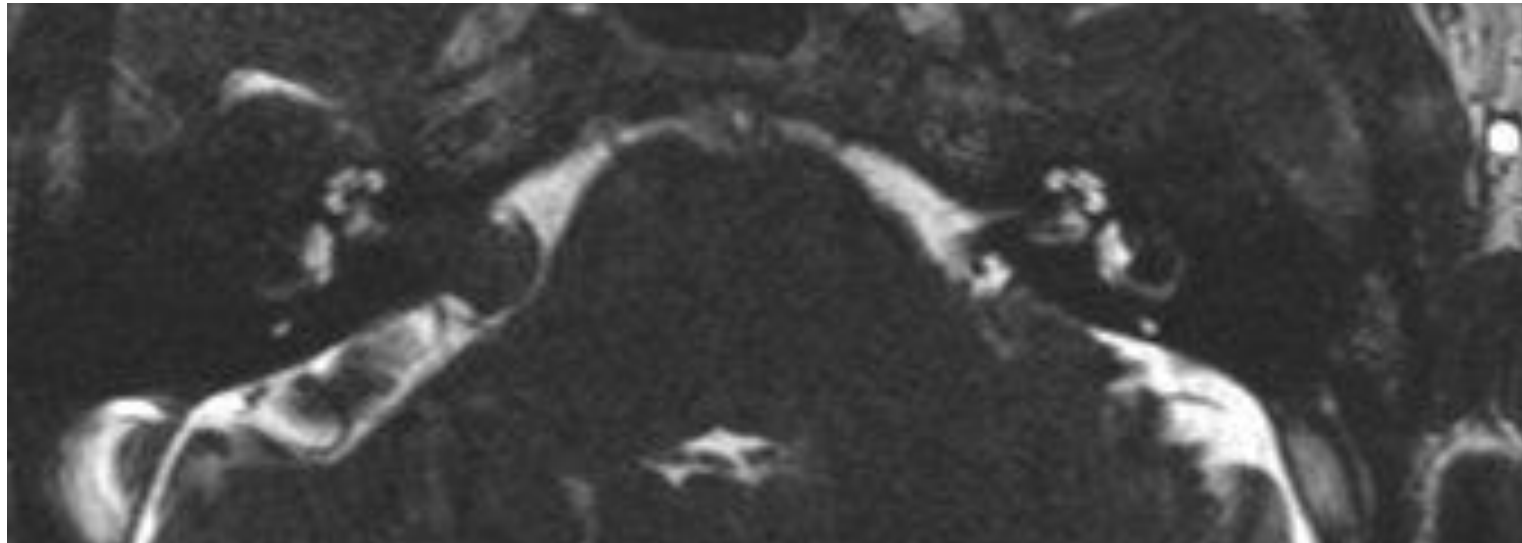
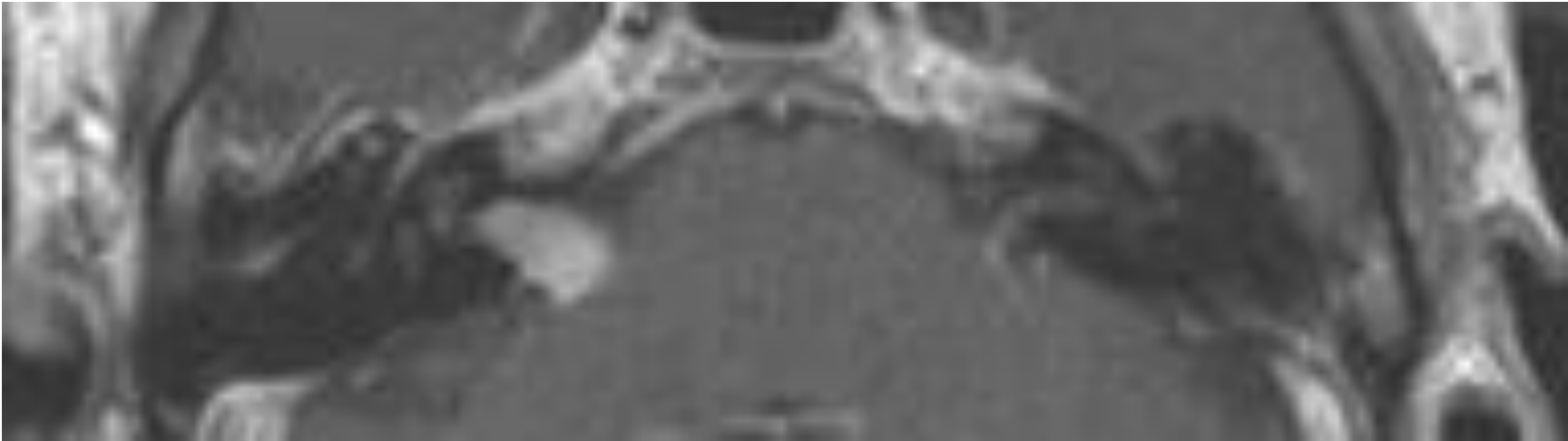


Prise de contraste de la cochlée, du vestibule et du fond du CAI

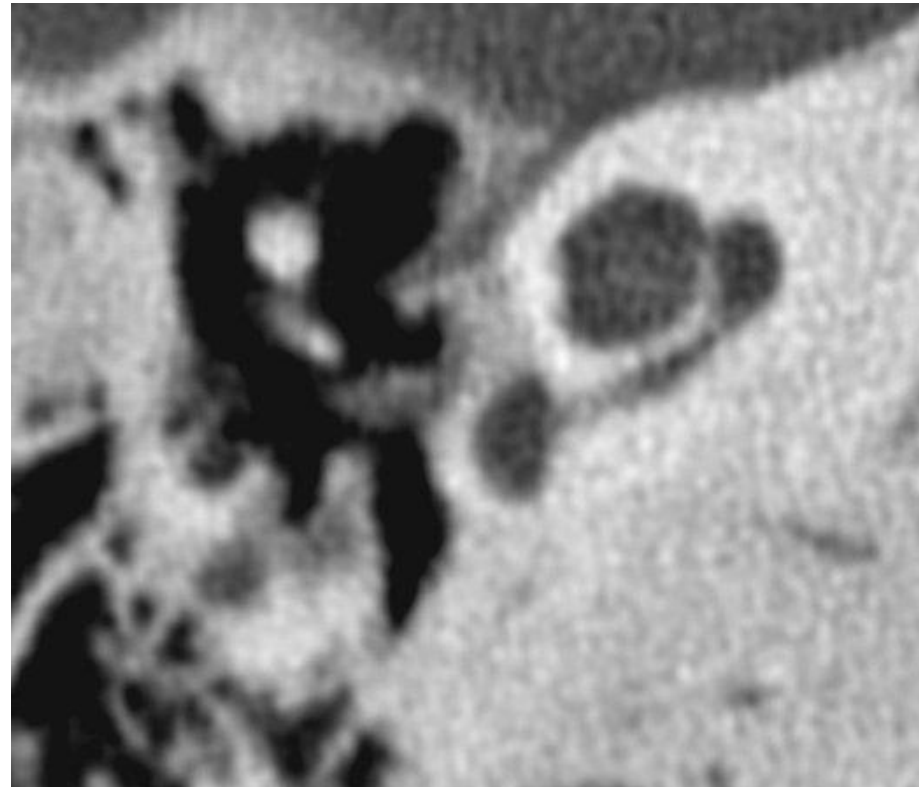
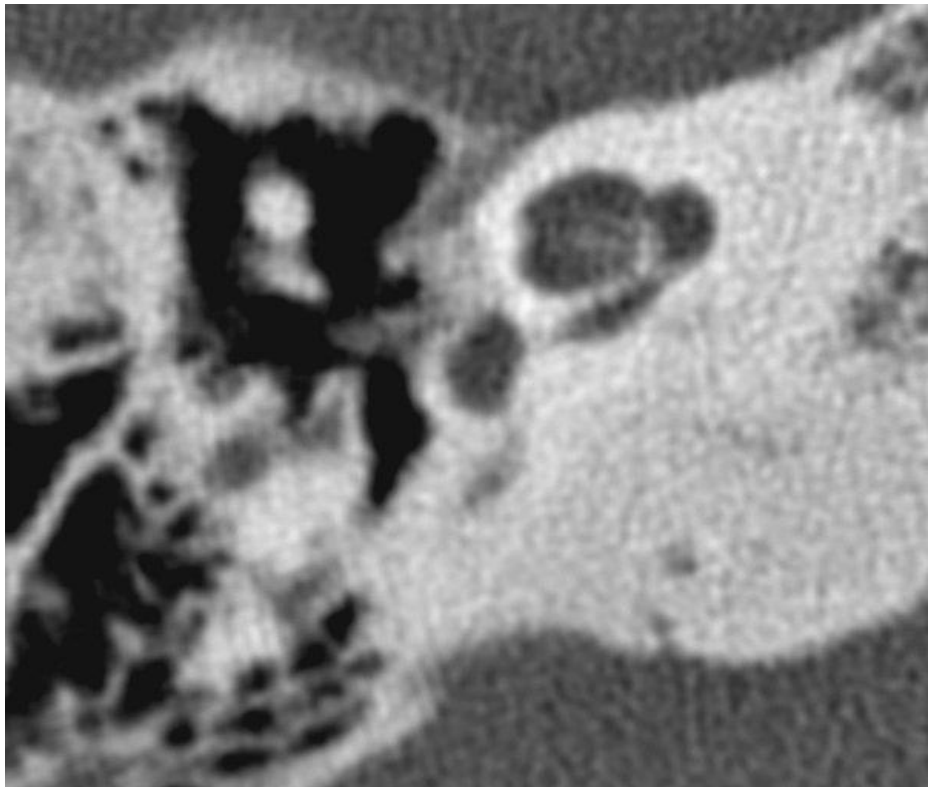
# Érosion de longue apophyse de l'enclume



# Otospongiose et schwannome

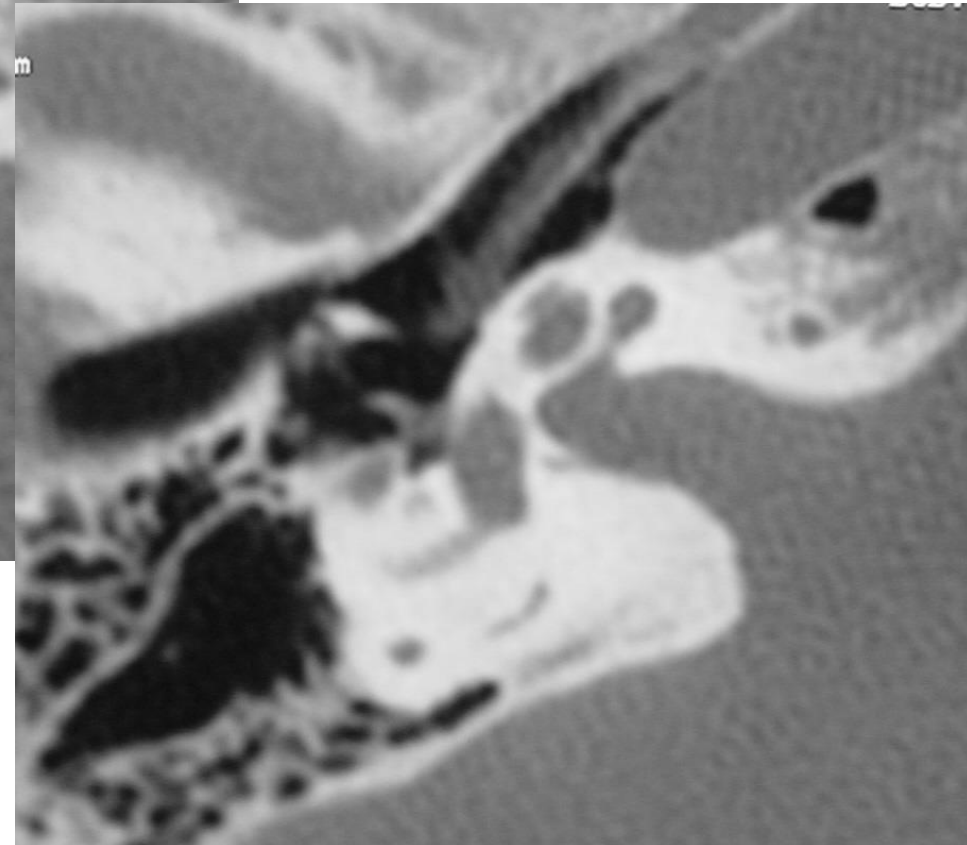
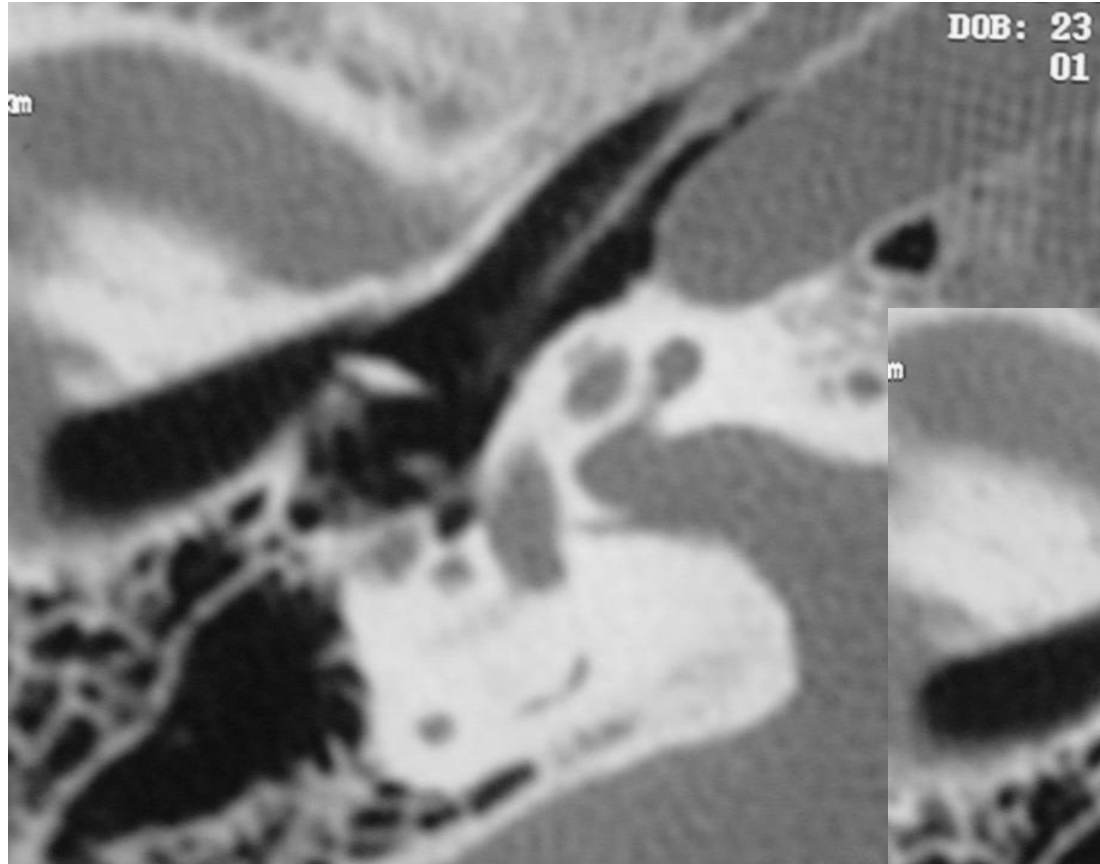


Piston secondairement bloqué  
par foyer évolutif

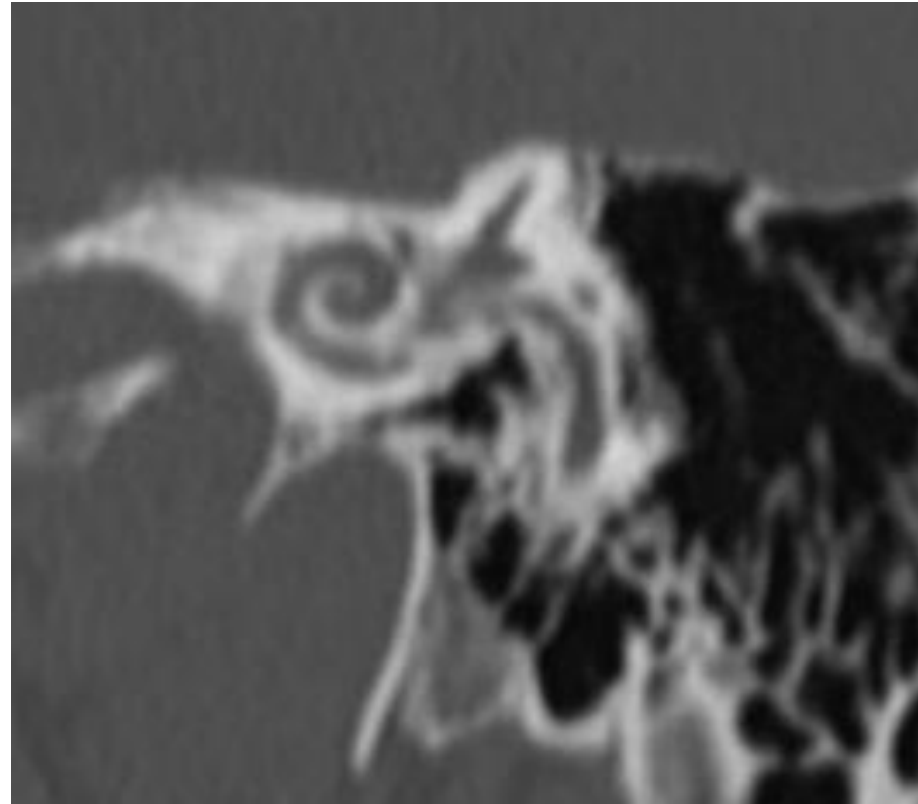
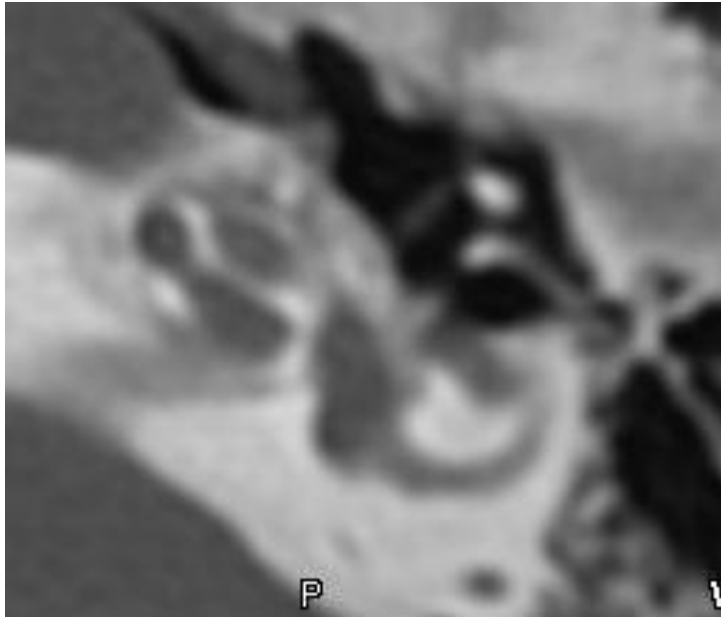




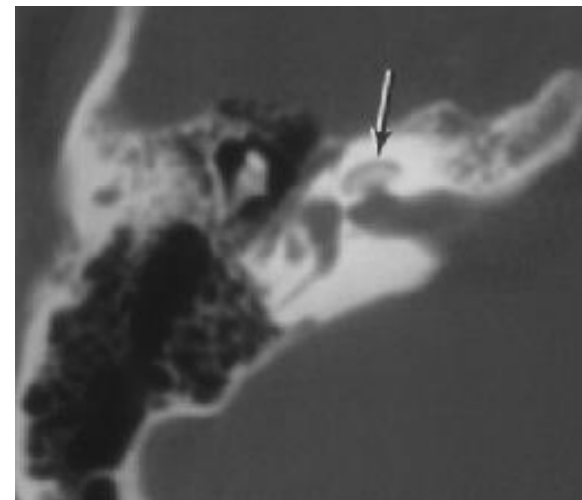
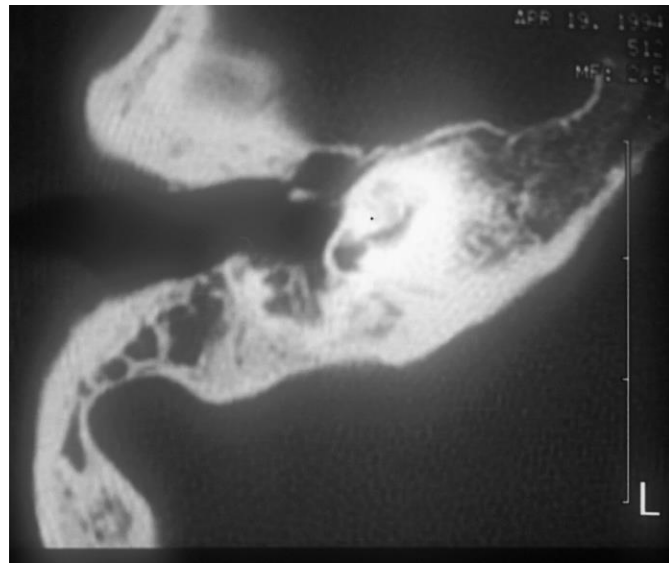
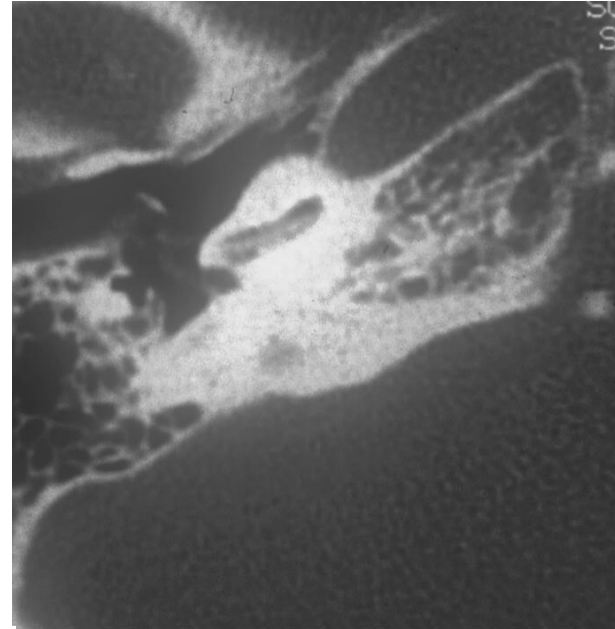
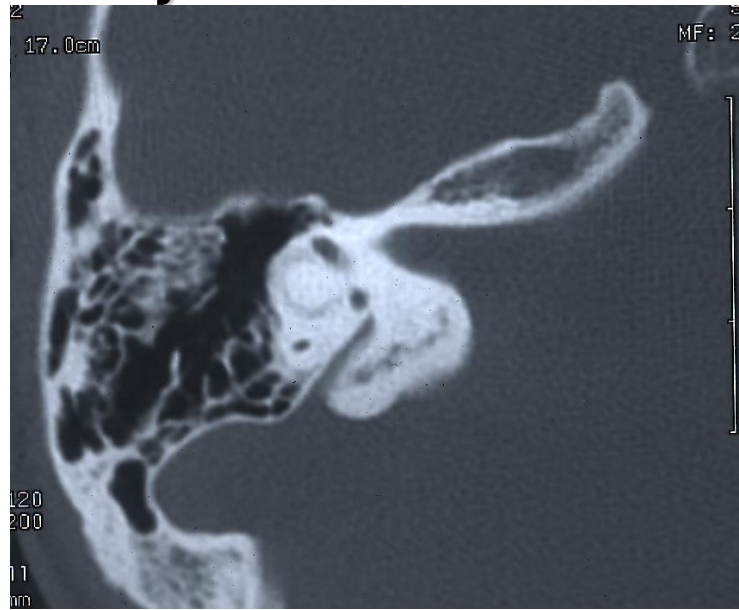
# Fracture d'un piston composite



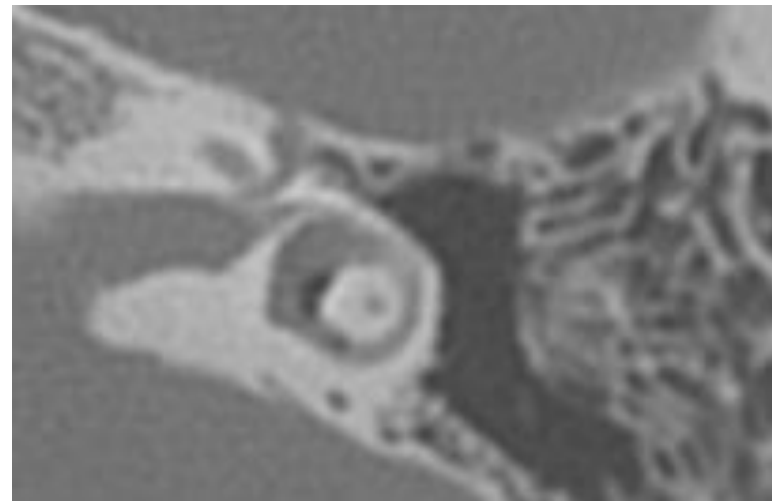
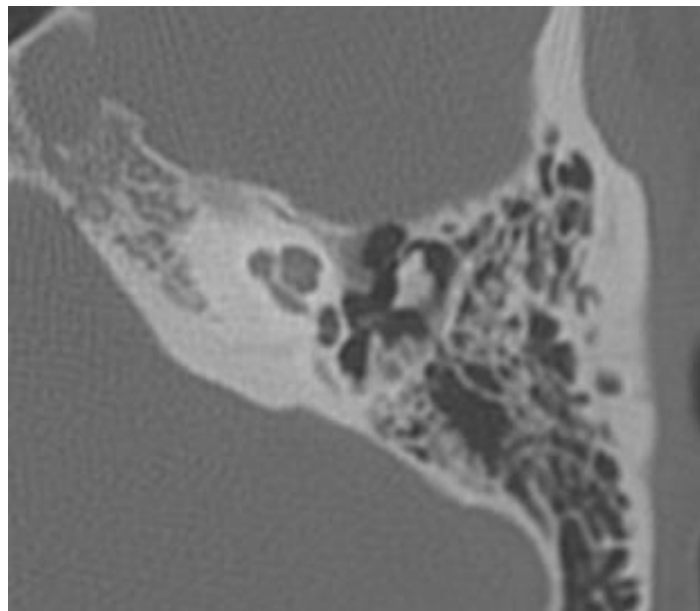
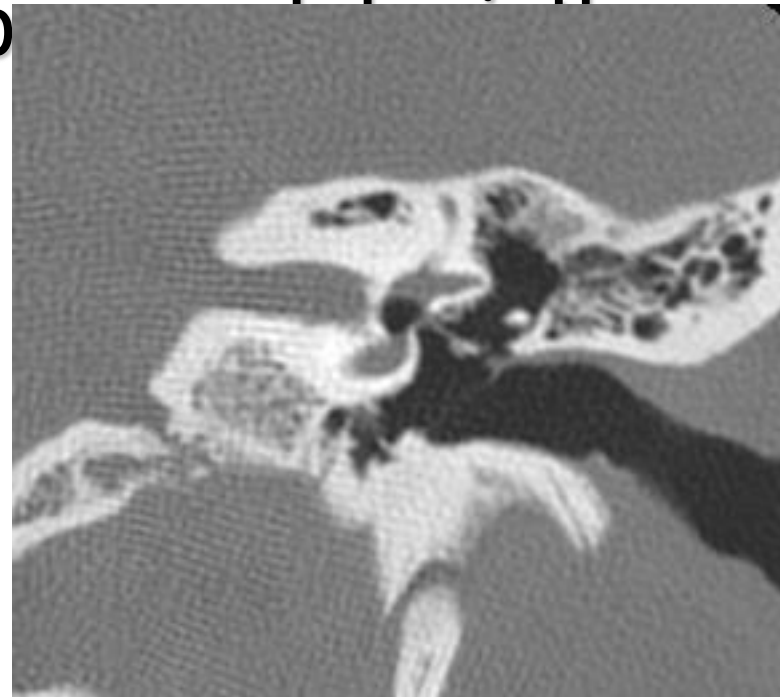
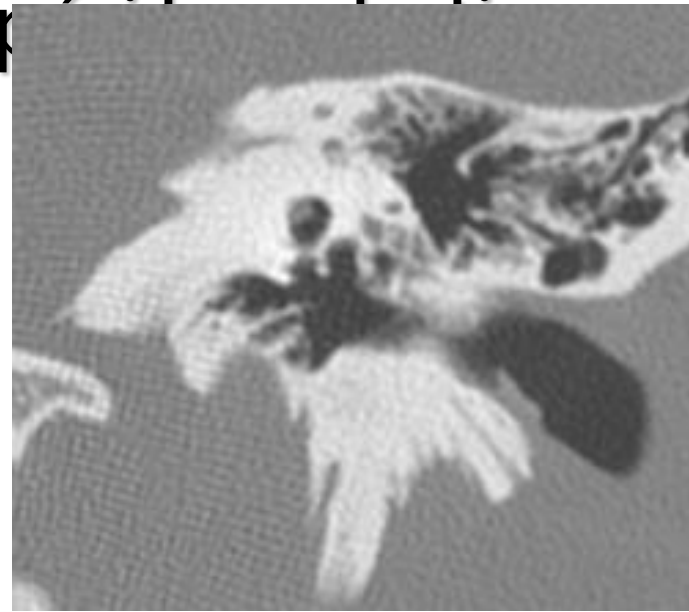
# Foyer d'otospongiose oblitérante



# labyrinthite ossifiante

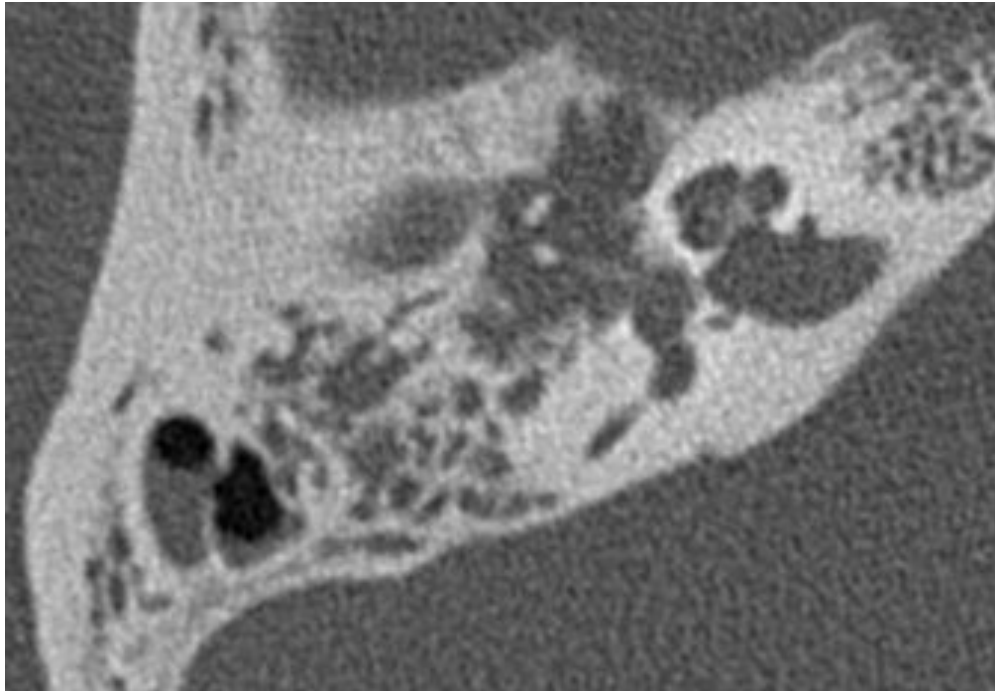


Fistule p / i t h e r i e t p

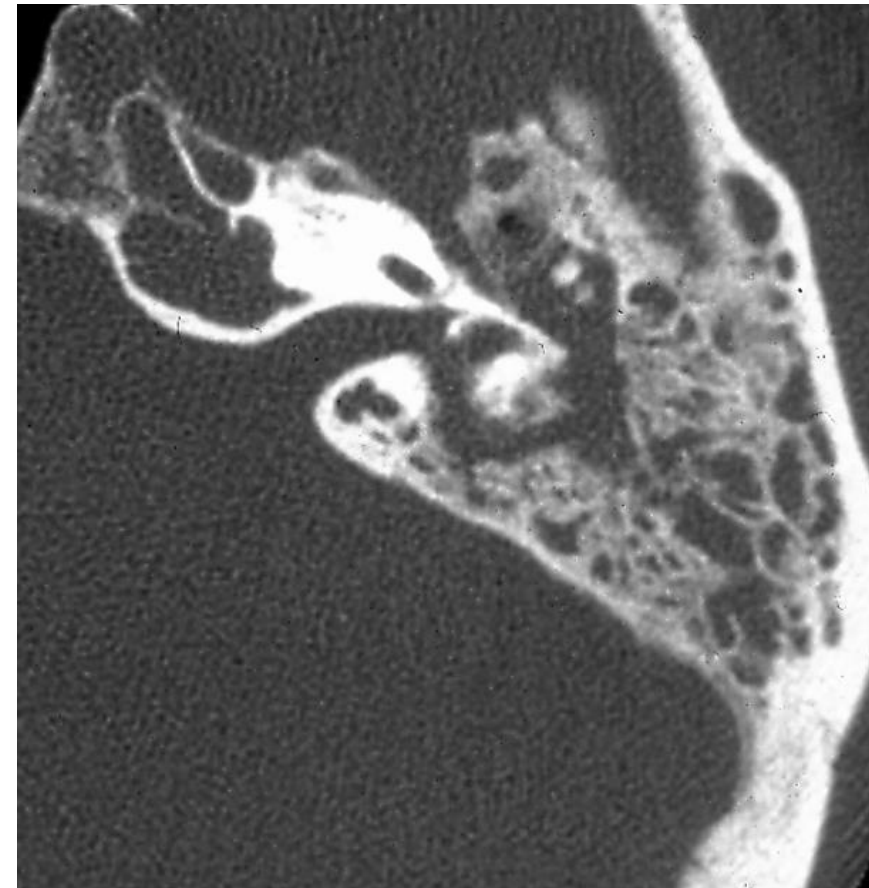


# Risques et complications

- Labyrinthisation par infection post-opératoire, granulomes et labyrinthite ossifiante

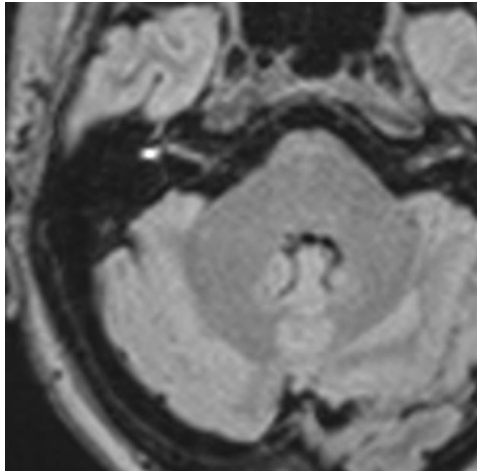


Labyrinthite aiguë

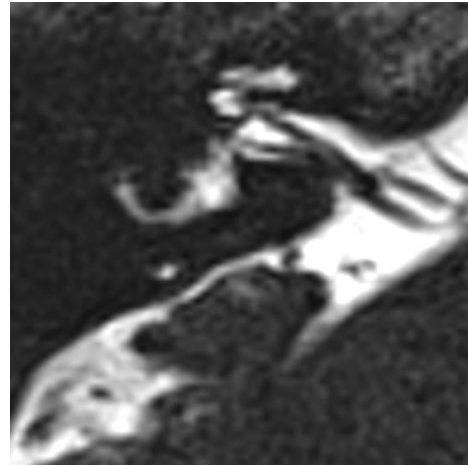


# Risques et complications

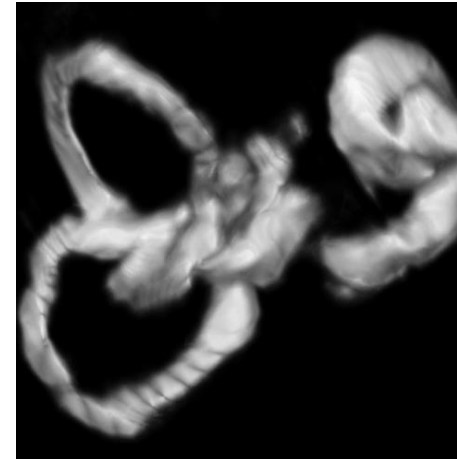
- Labyrinthisation par infection post-opératoire, granulomes et labyrinthite ossifiante



Axial FLAIR coupes fines  
Important hypersignal du  
vestibule



T2 CISS mauvaise  
visualisation du  
vestibule

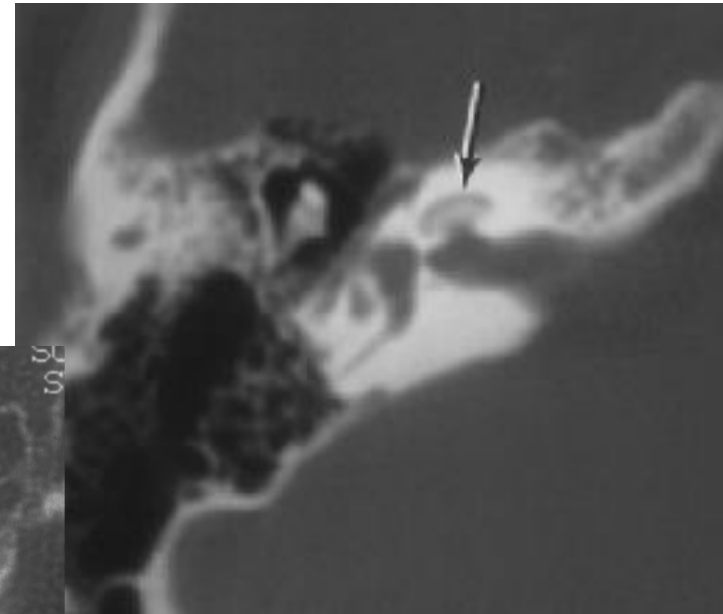
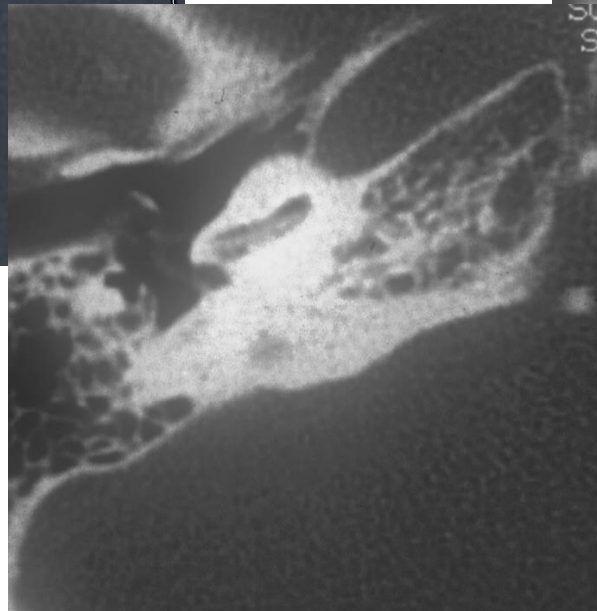
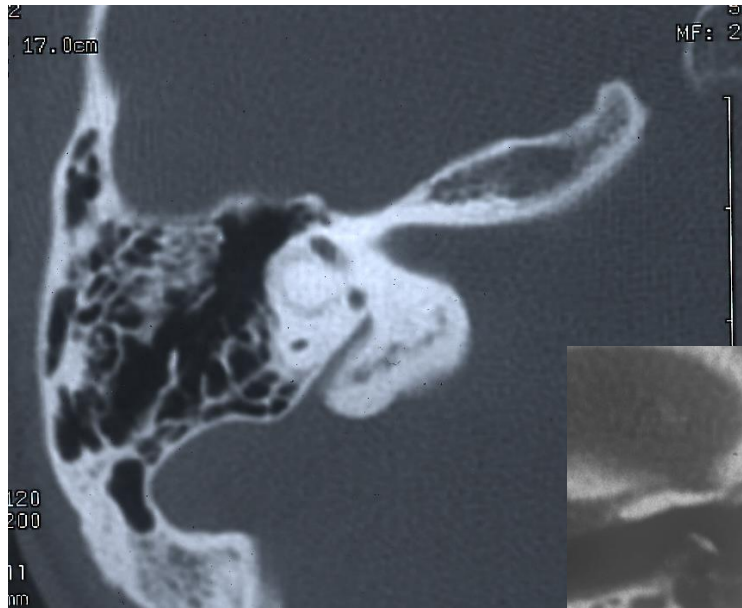


T2 CISS en volume  
rendering : vide de  
signal vestibulaire

Défect vestibulaire en hypersignal FLAIR ne se rehaussant pas  
après Gadolinium → **Granulome vestibulaire**

# Risques et complications

- Labyrinthisation par infection post-opératoire, granulomes et labyrinthite ossifiante



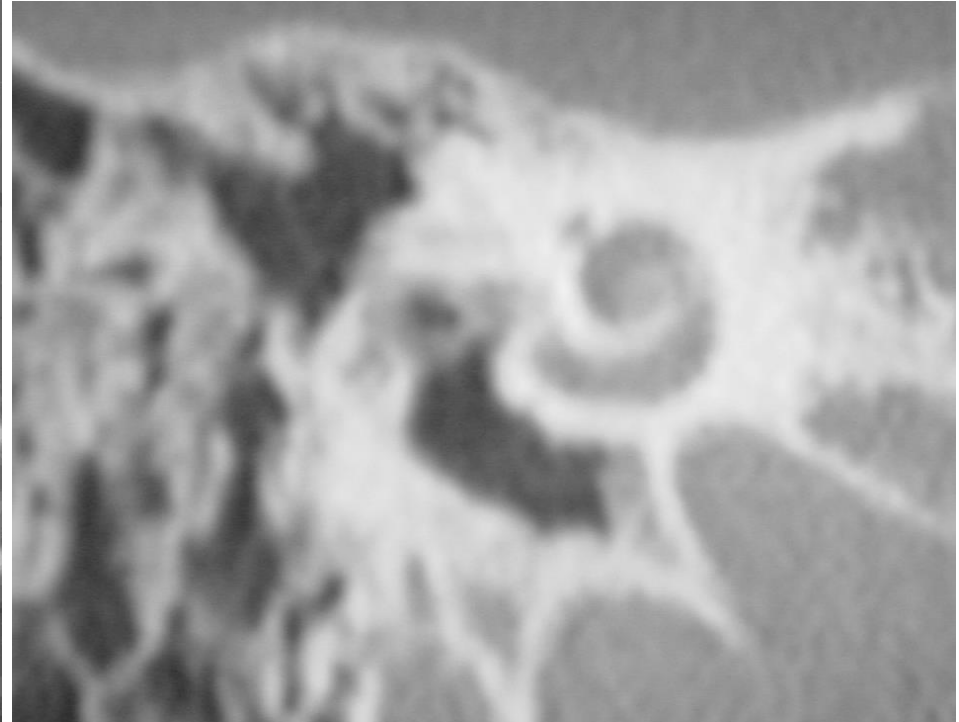
# Risques et complications

- Acouphènes ???
- Paralysie faciale (très rare)
- Perforation tympanique (rare)





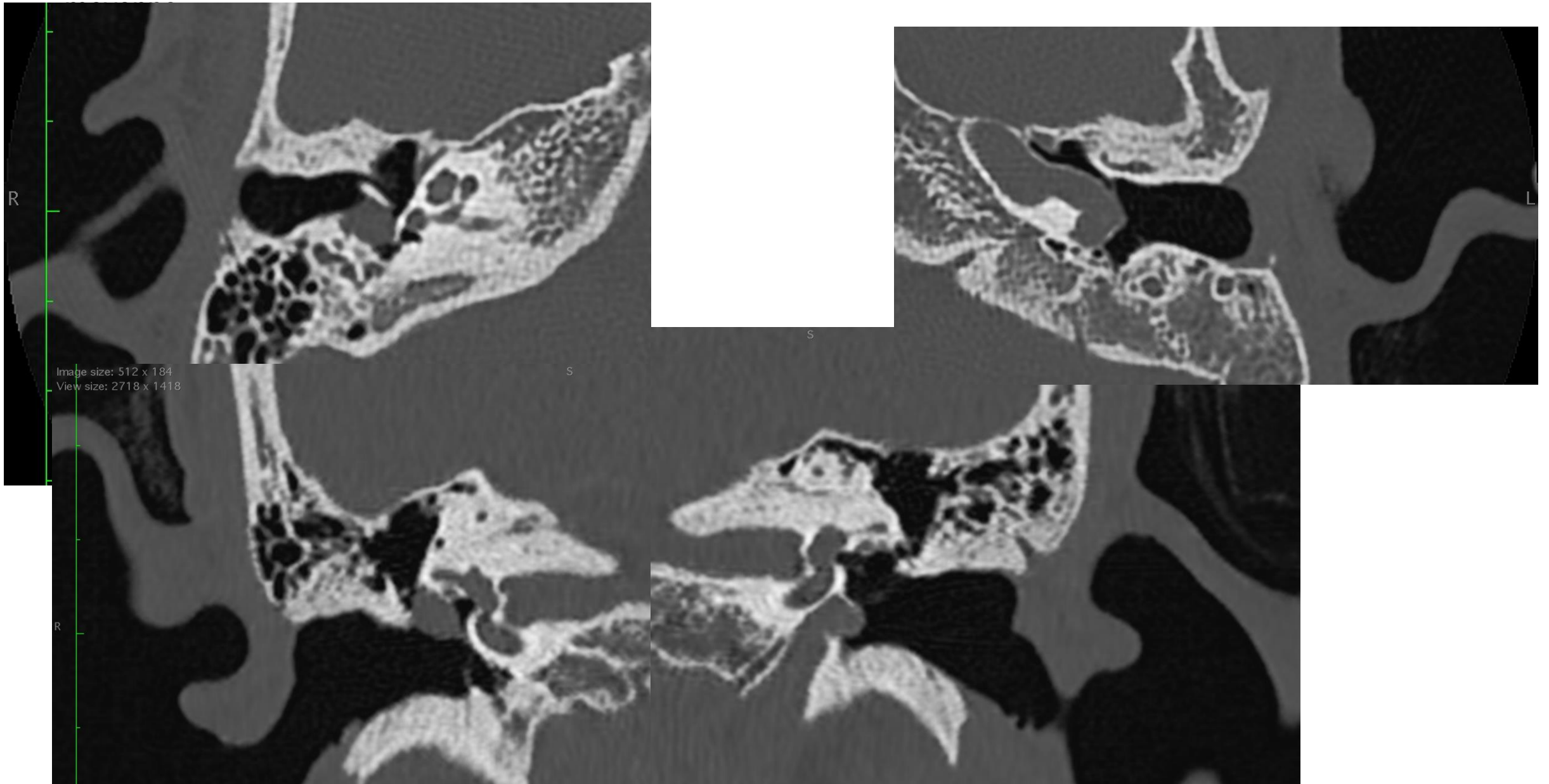
paralysie faciale post opératoire



Patient 5: enfant agé de 15 ans, suspicion de cholestéatome bilatéral

Rocher droit : opacité ronde bien limitée en rapport avec un cholestéatome lysant la pointe du mur de la logette

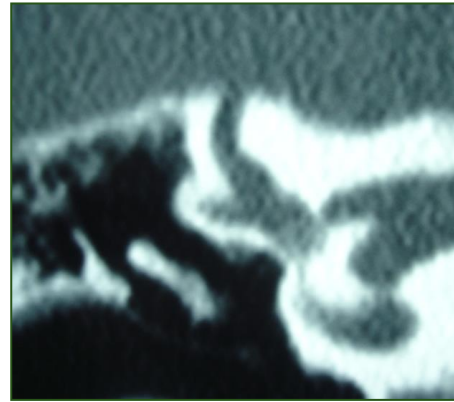
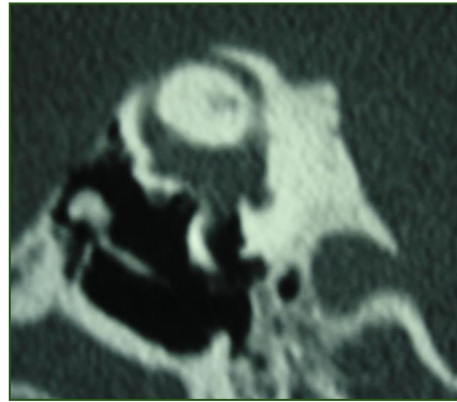
Rocher Gauche: opacité de l'oreille moyenne en rapport avec un canal carotidien ectopique au sein de l'oreille







# Diagnostic différentiel/ Affection associée



Annales d'Otologie et de chirurgie cervico-faciale 124 (2007) 330-332

## CAS CLINIQUE RADIOLOGIQUE

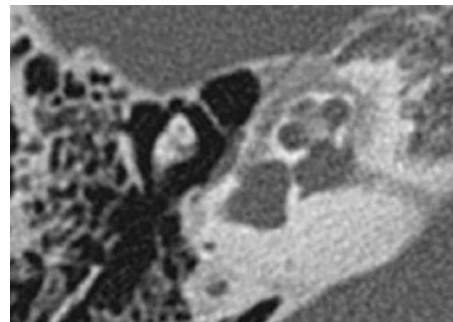
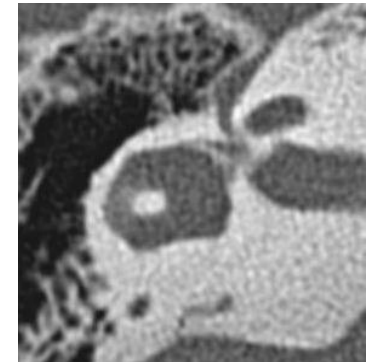
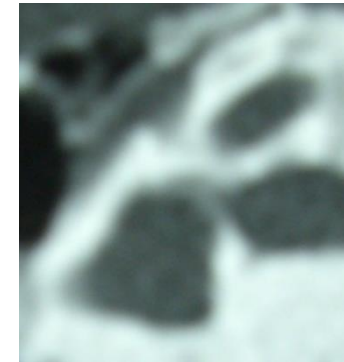
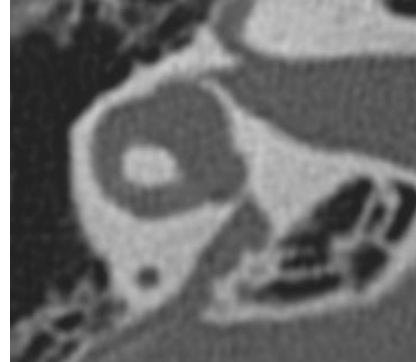
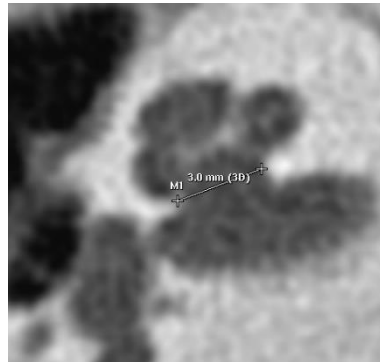
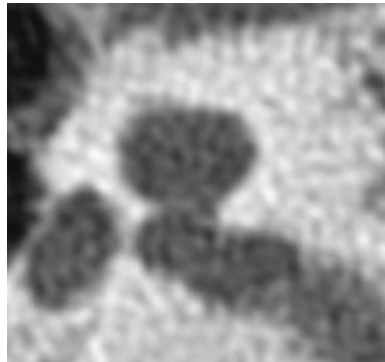
**Déhiscence du canal semi-circulaire antérieur mimant une otospongiose : intérêt de l'imagerie**

**Superior semicircular canal dehiscence mimicking otosclerosis: usefulness of imaging**

A. El Kohen<sup>a</sup>, C.-B. Tetzler<sup>a</sup>, M.-T. Williams<sup>b</sup>, D. Ayache<sup>a,\*</sup>

<sup>a</sup> Service d'ORL et de chirurgie cervicofaciale, Fondation Adolphe-de-Rothschild, 25-29, rue Manin, 75019 Paris, France

<sup>b</sup> Service d'imagerie médicale, Fondation Adolphe-de-Rothschild, Paris, France



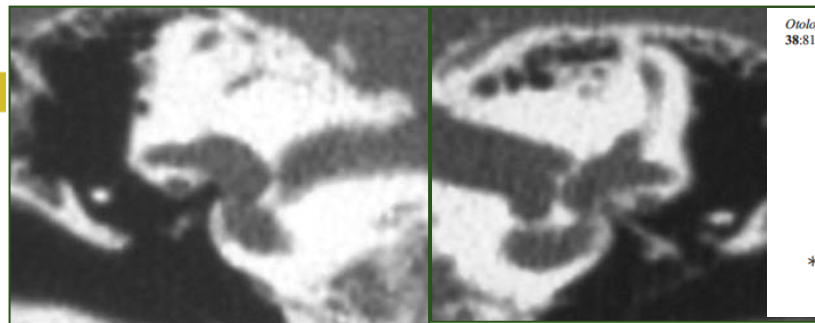
# Prévoir difficultés techniques

Published November 22, 2012 as 10.3174/ajnr.A3354

ORIGINAL RESEARCH  
HEAD & NECK

## Oval Window Niche Height: Quantitative Evaluation with CT before Stapes Surgery for Otosclerosis

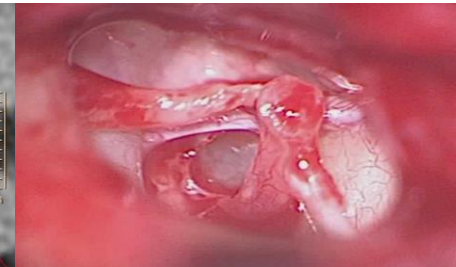
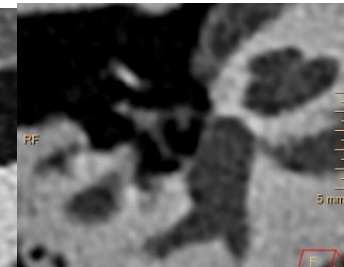
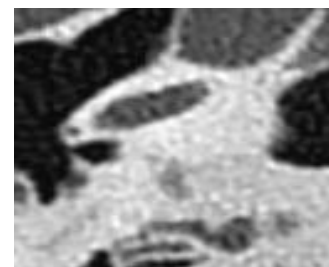
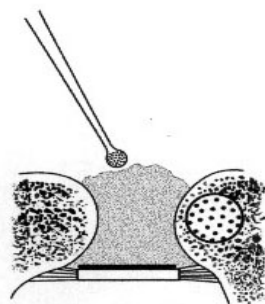
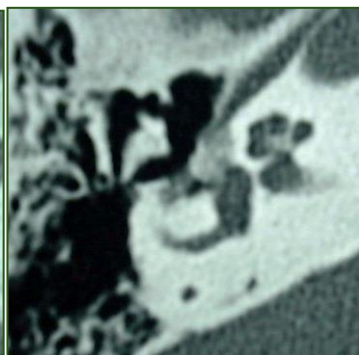
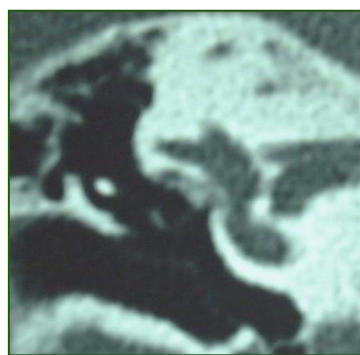
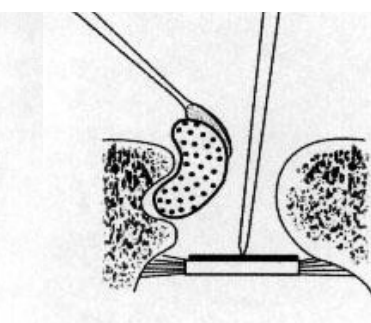
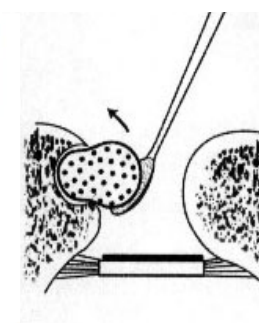
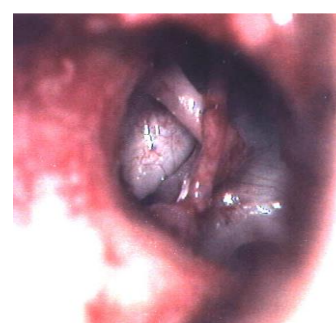
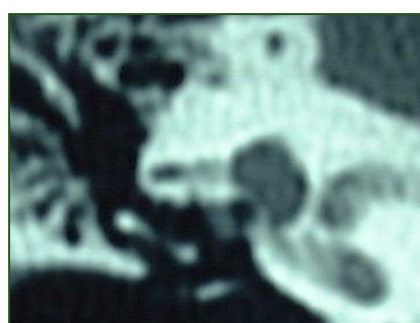
E. Ukkola-Pons, D. Ayache, Y. Pons, M. Ratajczak, C. Nioche, and M. Williams



Otology & Neurology  
38:815–821 © 2017, Otology & Neurology, Inc.

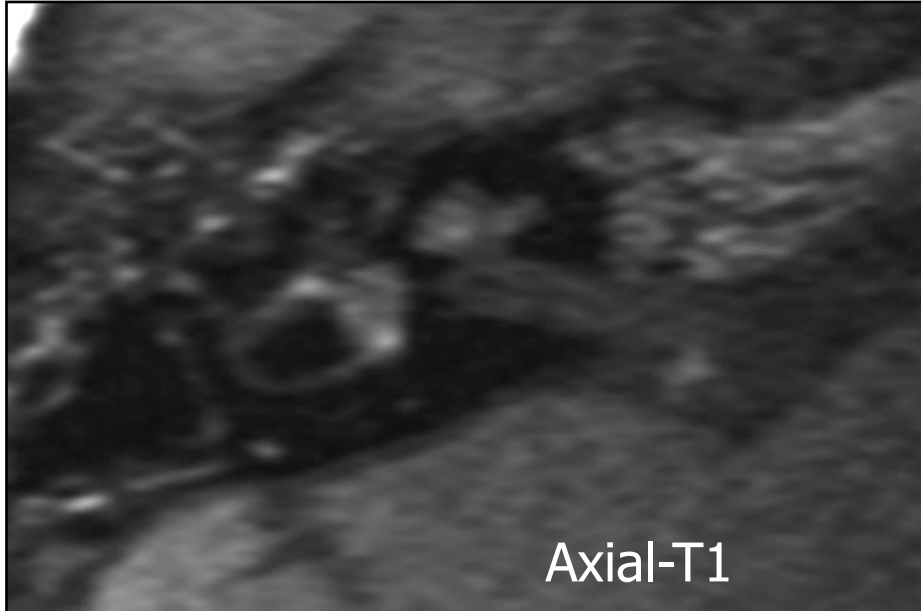
## Imaging Criteria to Predict Surgical Difficulties During Stapes Surgery

\*Claire Parra, †Stéphanie Trunet, ‡Benjamin Granger, §¶Yann Nguyen, §||Georges Lamas, §||¶Daniele Bernardeschi, §#Rémi Hervocho, and §#Frédéric Tankere

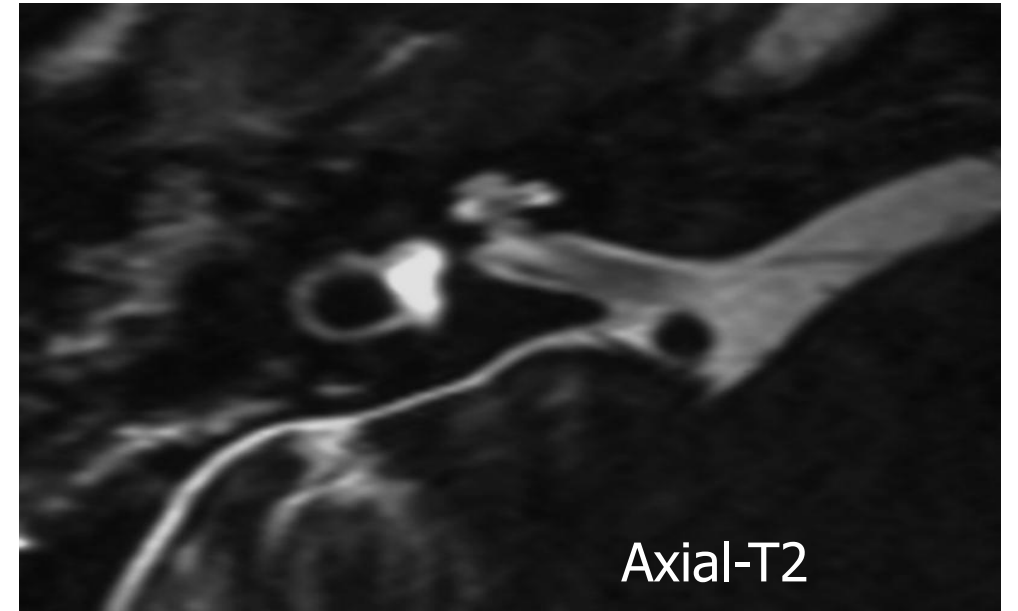


# Hémorragie intralabyrinthique

SP et vertiges 8 jours après une platinotomie ; TDM non contributif



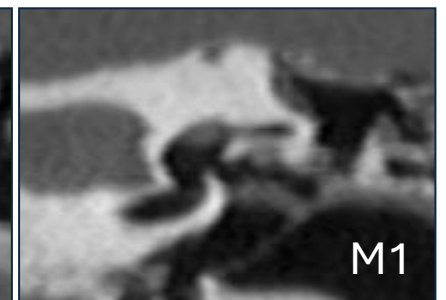
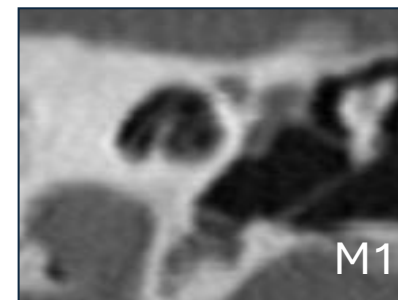
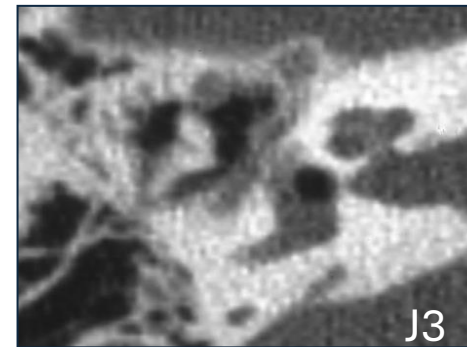
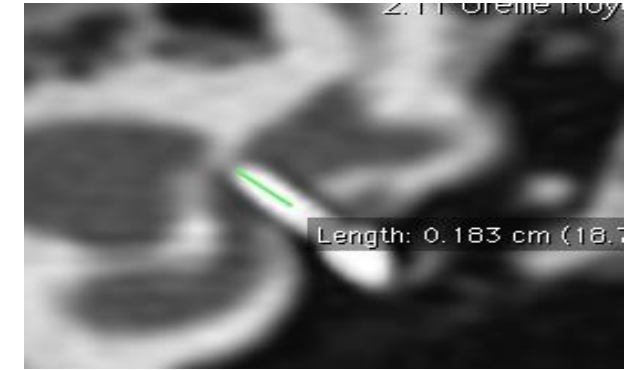
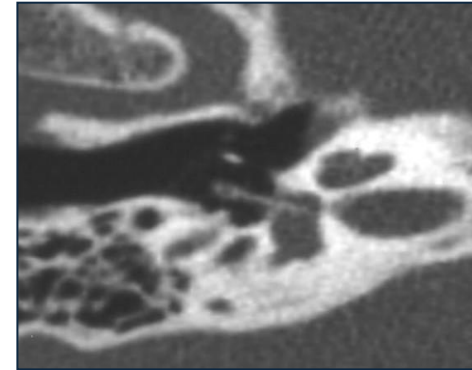
Hypersignal spontané du vestibule et du tour basal de la cochlée



Hypersignal du vestibule. Rehaussement plus intense que l'hypersignal du LCR au niveau des espaces sous-arachnoïdiens de l'APC

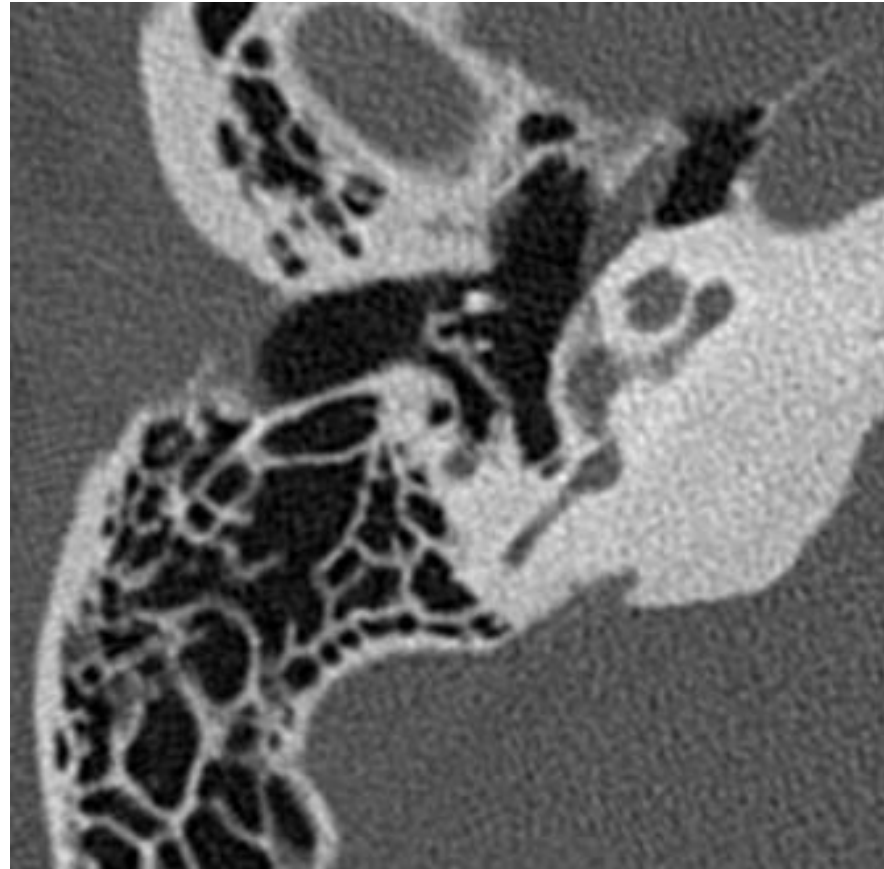
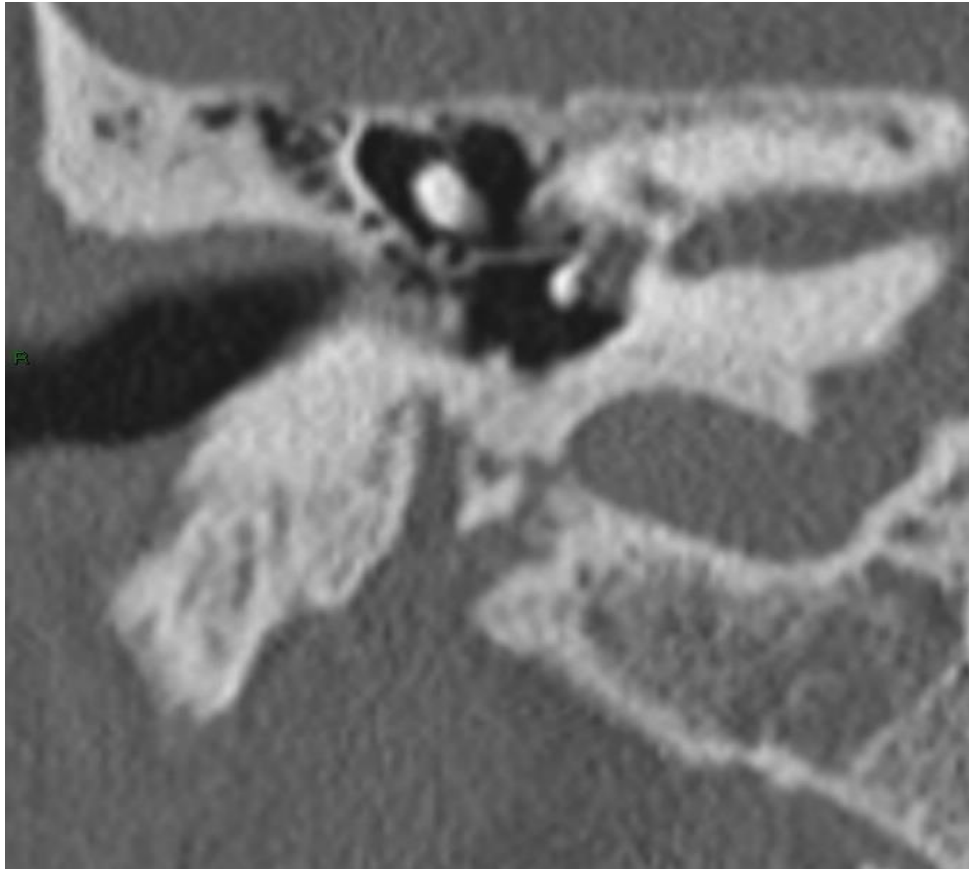
# TDM/CBCT en première intention

- Piston intravestibulaire
  - Pas de définition consensuelle
  - Pistons longs chez patients asympto
  - Pénétration piston  $> 1,5$  mm **AVEC** symptomatologie labyrinthique
- Pneumolabyrinthe
  - Fréquent postop immédiat sans valeur péjorative
  - Forte suspicion FPL si  $> 1$  semaine

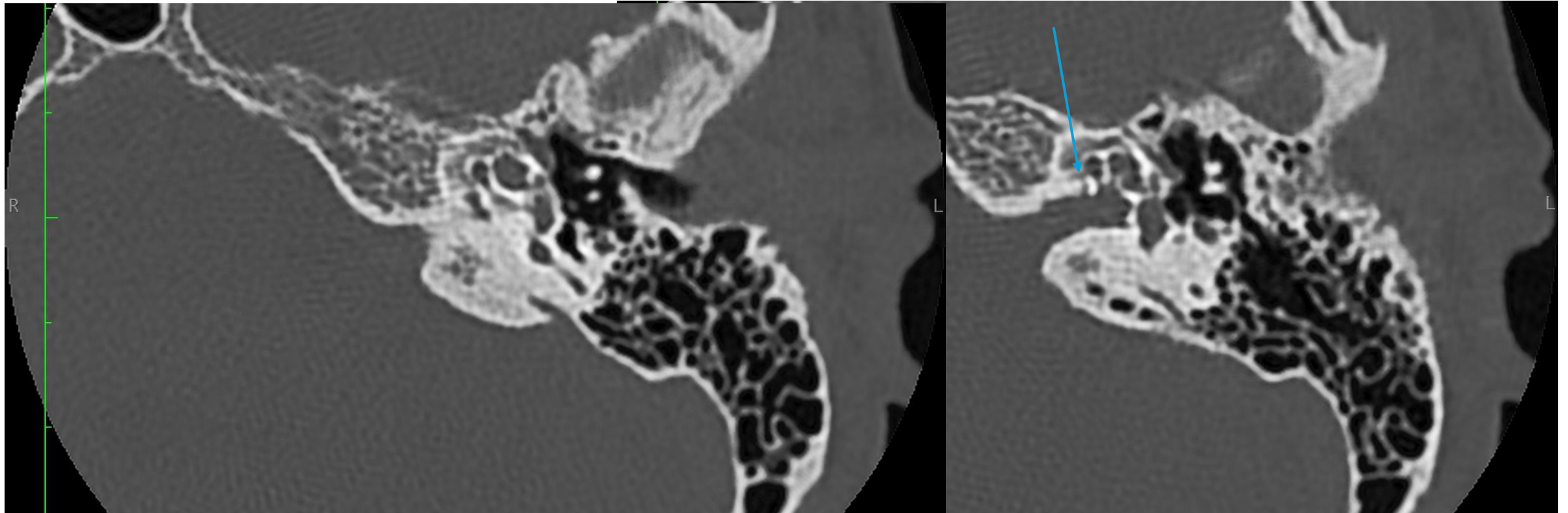




# Luxation du piston

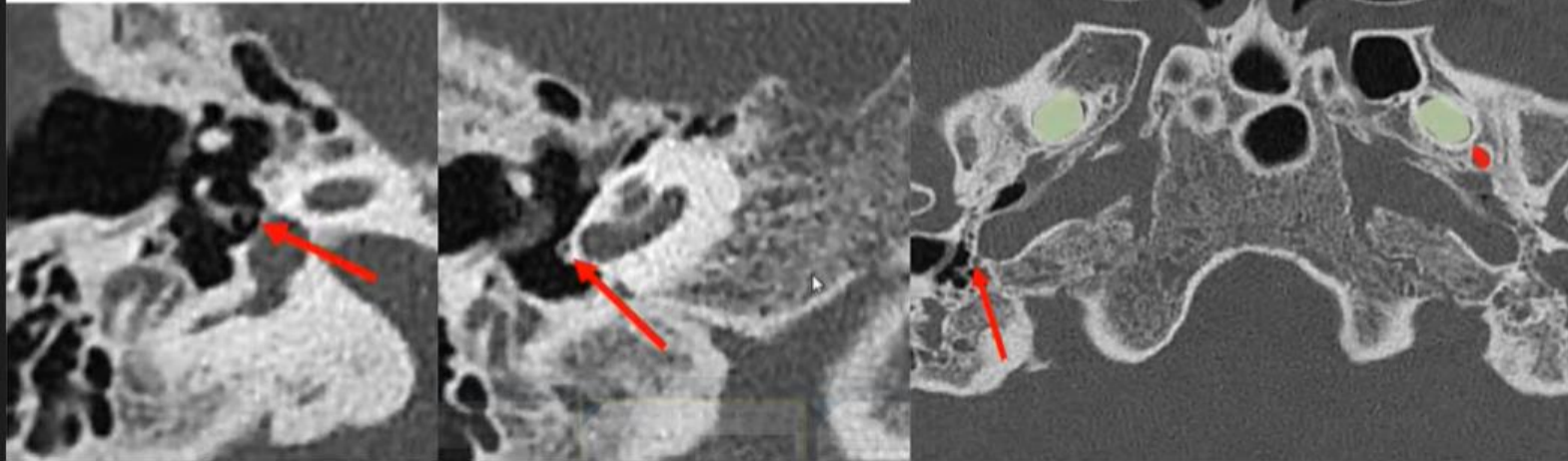


Otospongiose avec atteinte bilatérale étendue avec image de »notch« de la paroi antérieure du CAI

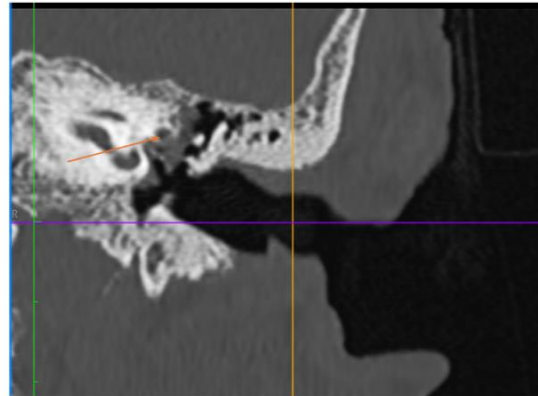


# **PERSISTANCE de l'artère STAPEDIENNE**

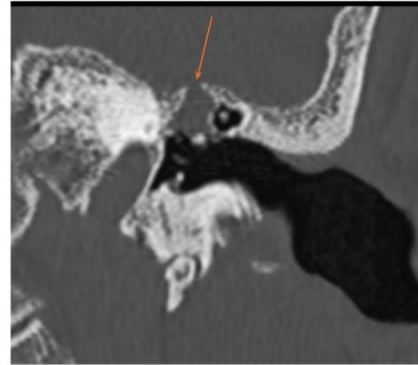
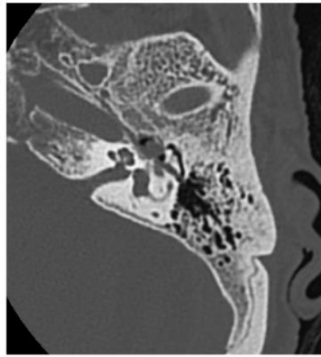
## **FORAMEN SPINOSUM ABSENT**



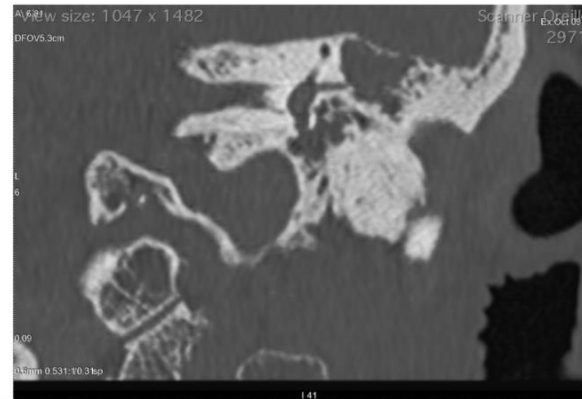
Patiente 1 Vue coronale Cholestéatome atrial avec atteinte de la coque osseuse de la 2<sup>nd</sup> portion du nerf facial: lyse de la coque du facial



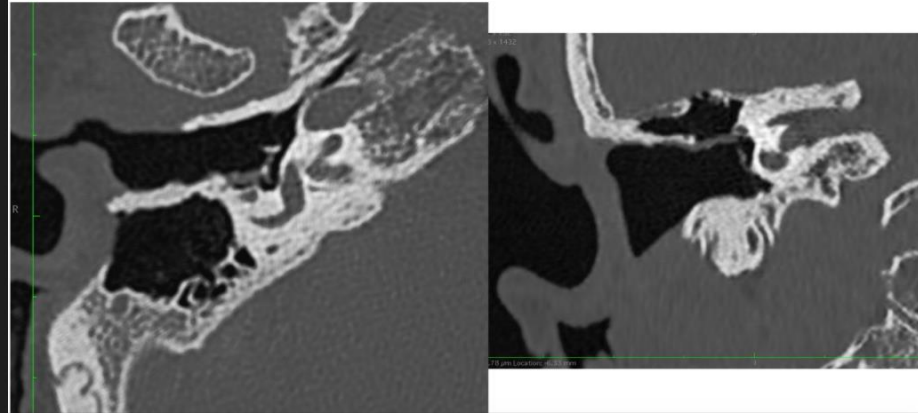
Patiente 1 Coupe axiale scanner : Opacité ronde de la caisse, aspect d'otite chronique avec des cellules mastoïdiennes condensées et ostéolyse focale du tegmen tympani en rapport avec le cholestéatome



Patiente 2 Vue coronale: opacité complète de la caisse responsable d'une ostéolyse de la coque osseuse du canal semi circulaire latérale gauche



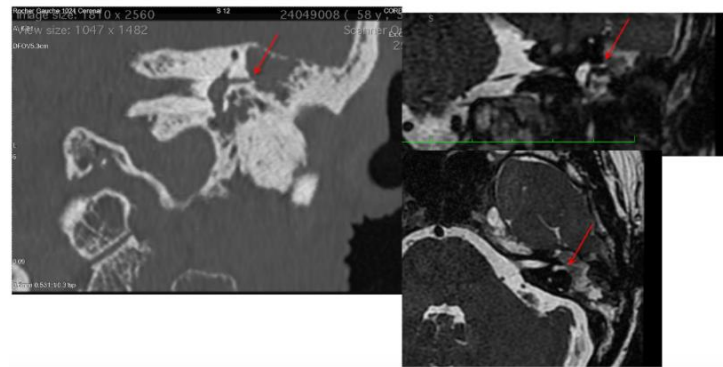
Patiente 2 oreille controlatérale Cavité d'évidement normalement aérée avec tympanoplastie par plateaux cartilagineux à droite



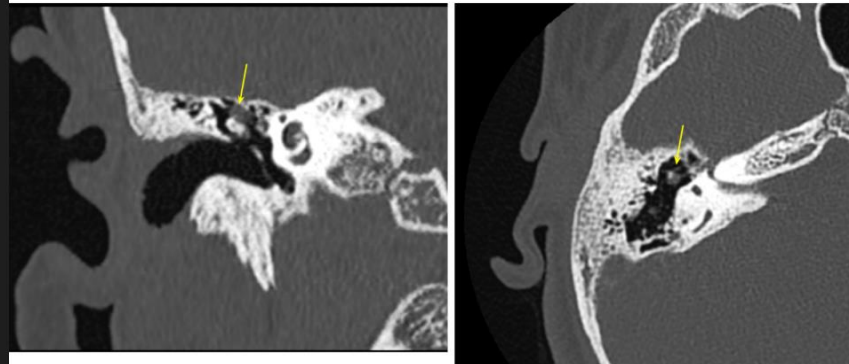




Coupes coronales avec concordance scanner du rocher gauche et IRM volumique T2 dans le plan coronal



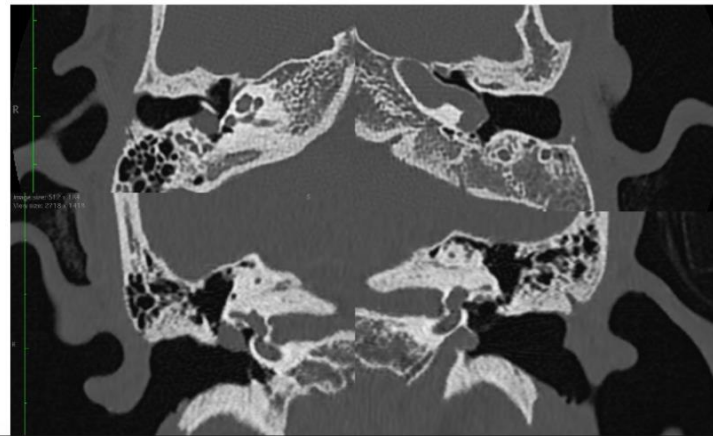
Patient 4: enfant agé de 15 ans, passé otitique, absence de perforation tympanique, opacité centrale de la caisse, sa localisation évoque un cholestéatome congénital



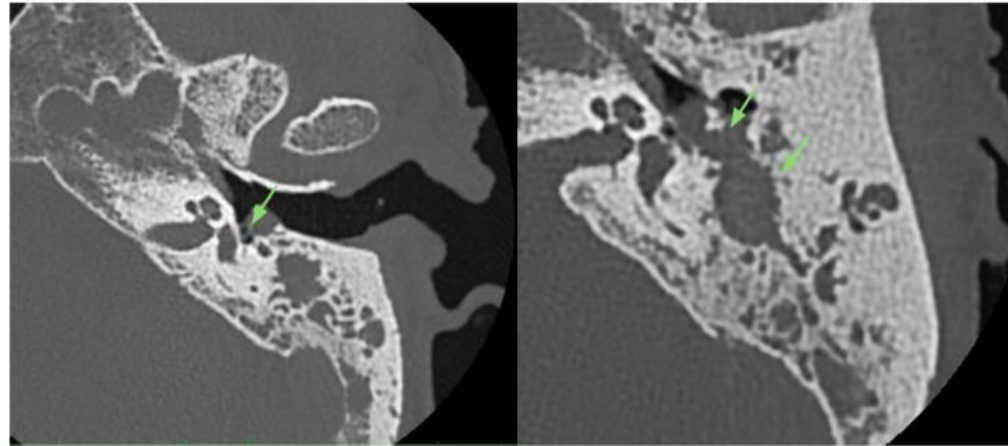
Patient 5: enfant agé de 15 ans, suspicion de cholestéatome bilatéral

Rocher droit : opacité ronde bien limitée en rapport avec un cholestéatome lysant la pointe du mur de la logette

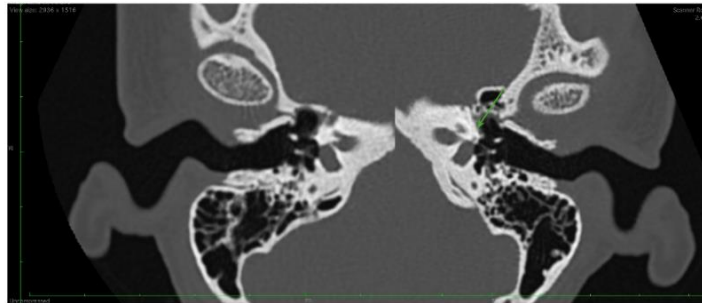
Rocher Gauche: opacité de l'oreille moyenne en rapport avec un canal carotidien ectopique au sein de l'oreille moyenne



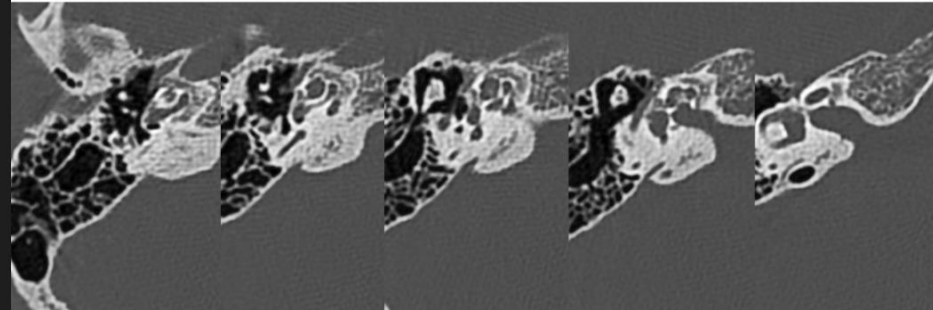
Patient 6: homme âgé de 66 ans, suspicion de cholestéatome, écoulement et image blanchâtre rétro tympanique, Opacité occupant l'oreille moyenne associée à un comblement de l'aditus add antrum et de la mastoïde, ostéolyse du bouton de l'étrier, du corps de l'enclume et de la BDE, signe du petit « LU » ou du timbre poste ( aspect crenelé des contours de l'opacité)



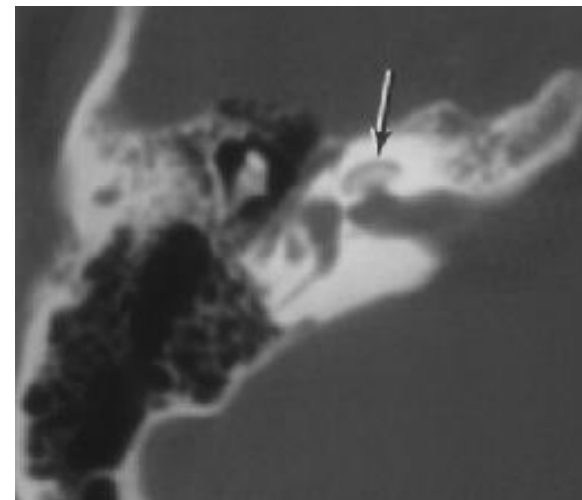
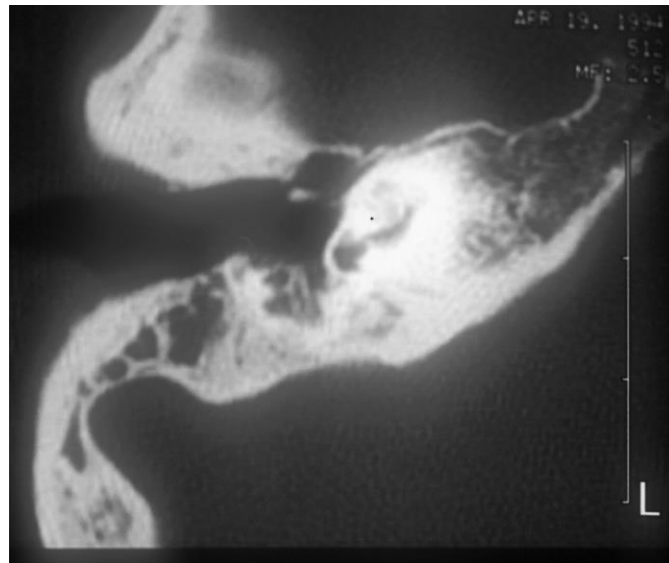
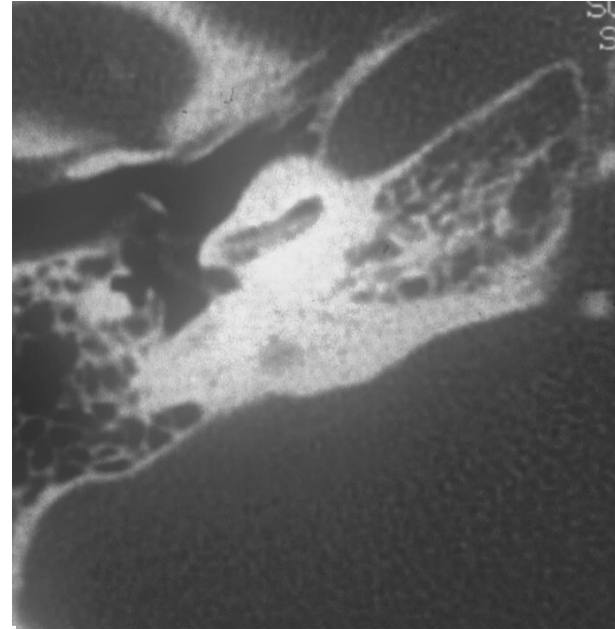
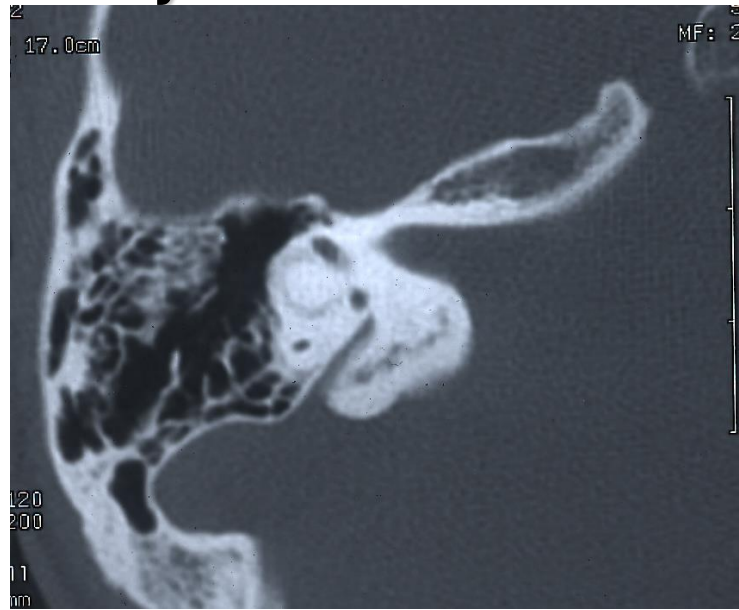
Patiente 8 : Femme âgée de 41 ans, surdité de transmission unilatérale gauche, absence de reflexe stapédien  
Analyse bilatérale comparative du plan platinaire



Patient 9: jeune homme âgé de 19 ans , surdit  bilat rale, otospongiose bilat rale chez la m re

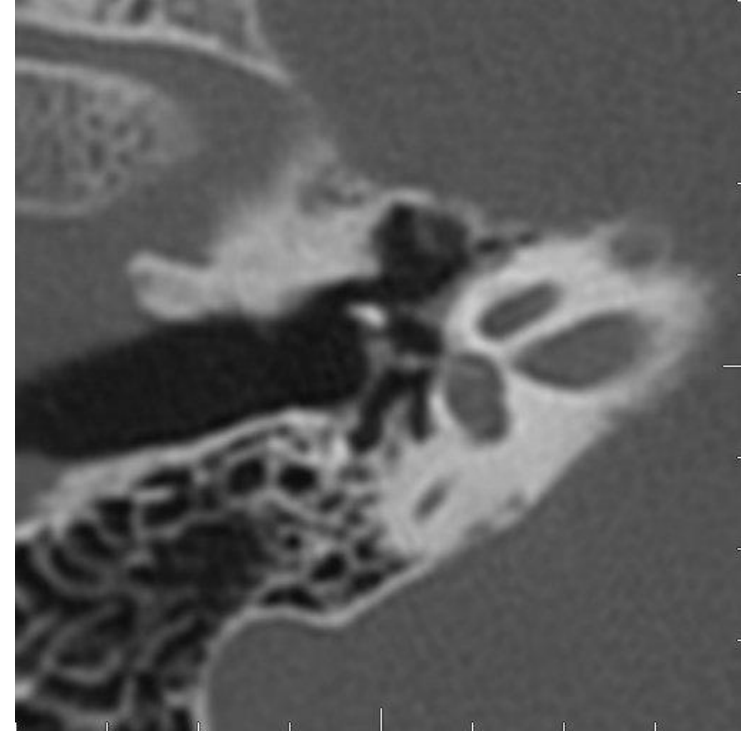
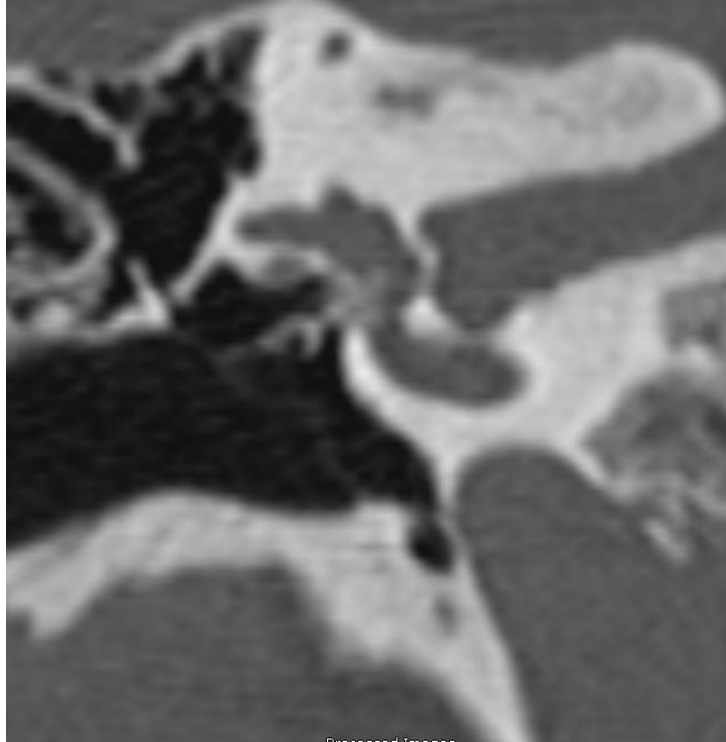


# labyrinthite ossifiante



# Risques et complications

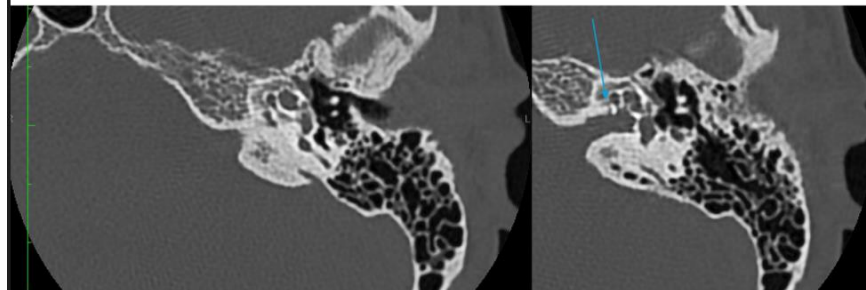
- Vertiges et surdité post-opératoires



Protrusion intravestibulaire du piston

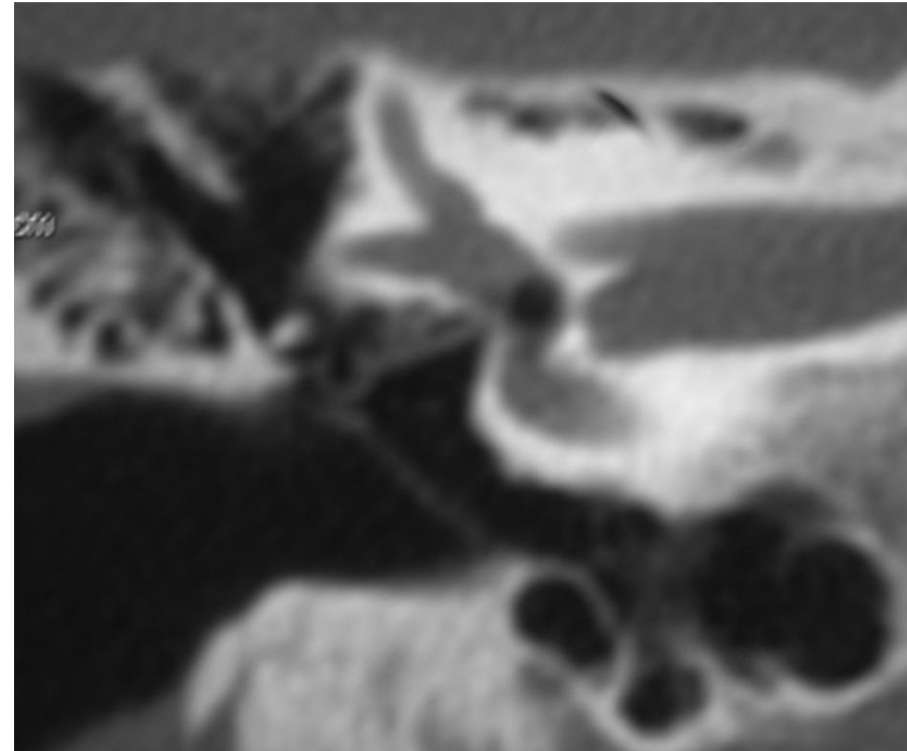
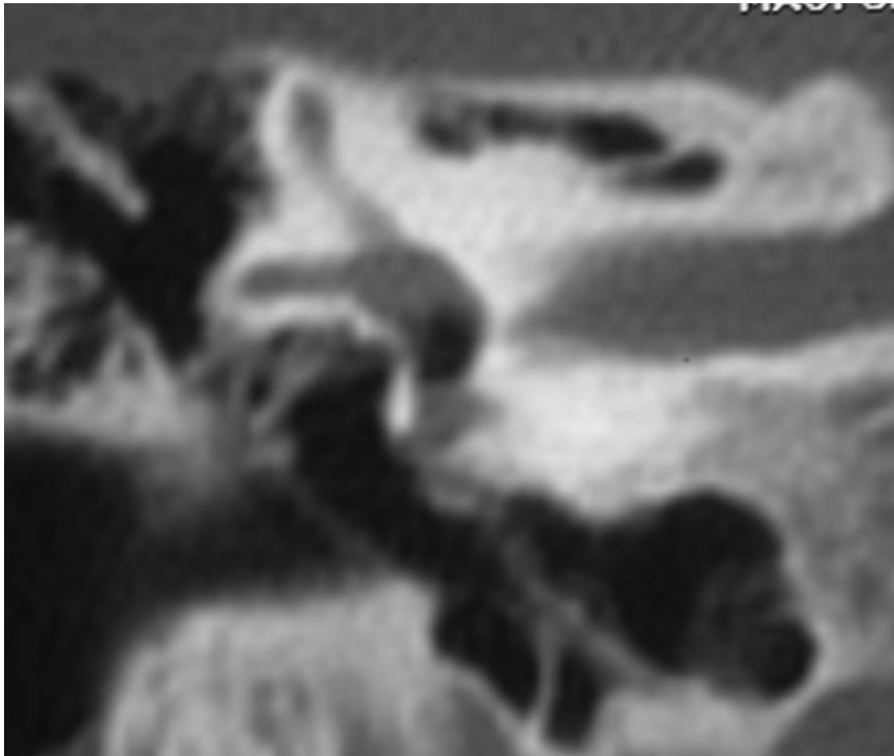


Otospongiose avec atteinte bilatérale étendue avec image de «notch» de la paroi antérieure du CAI



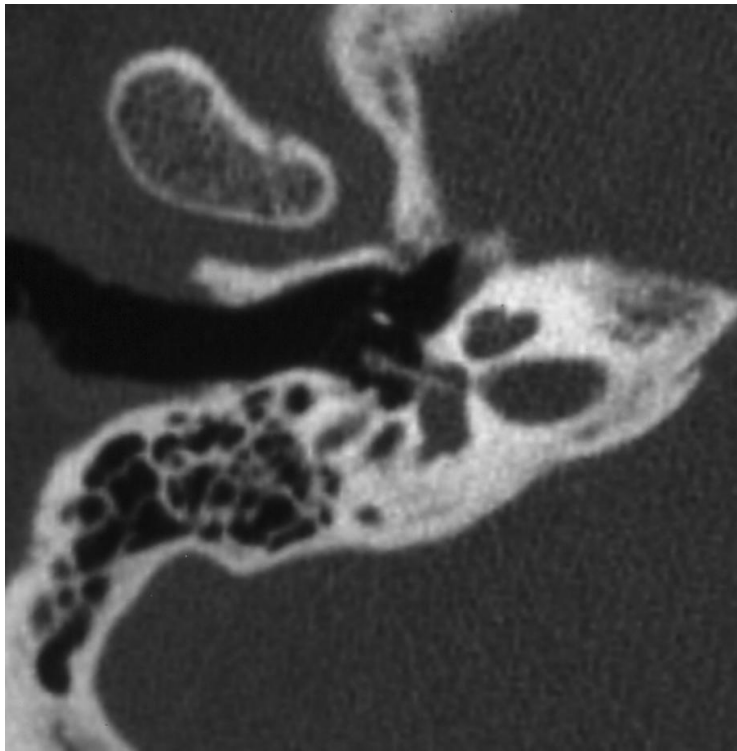
# Risques et complications

- Vertiges et surdité post-opératoires

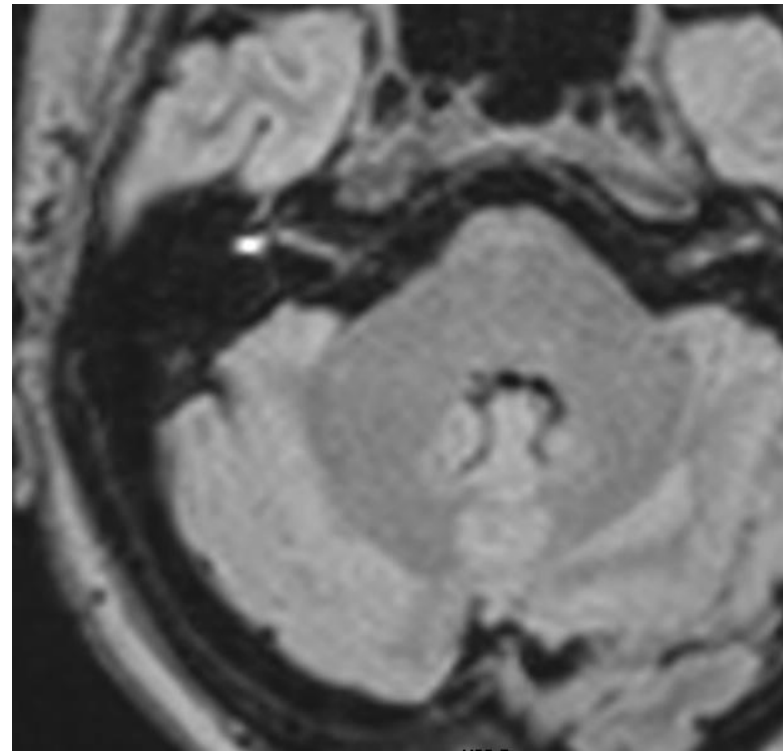


Fistule périlymphatique

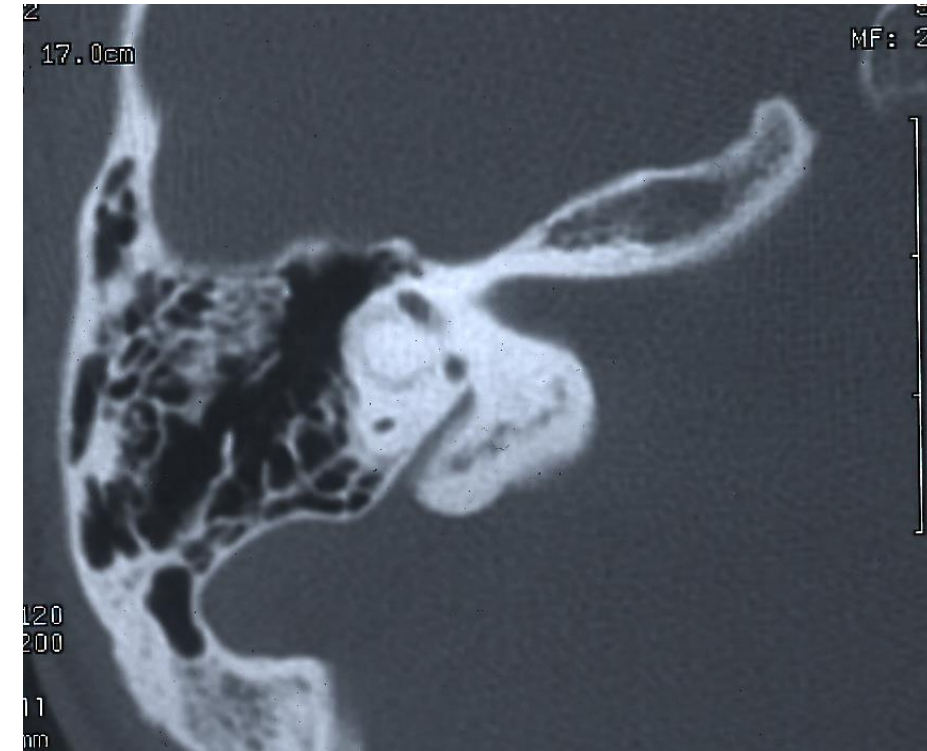
# Failure or complications



Intravestibular piston



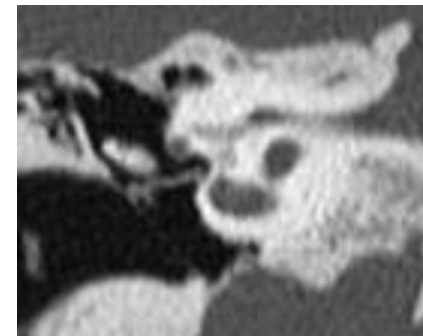
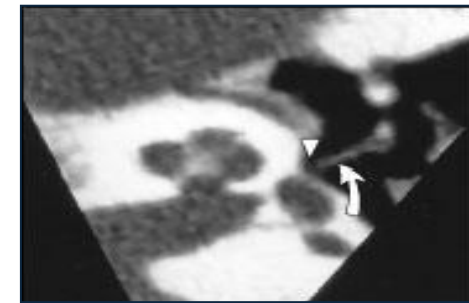
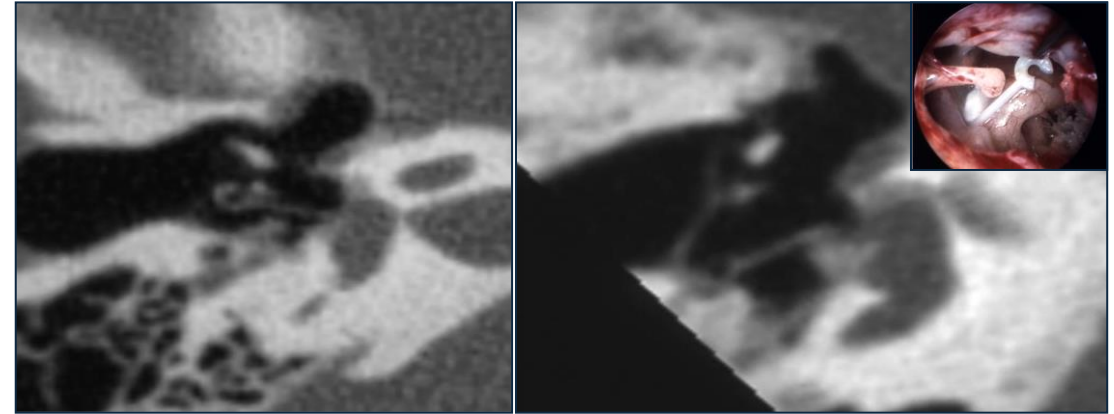
Labyrinthitis



Ossifying labyrinthitis

# Mauvaise position du piston

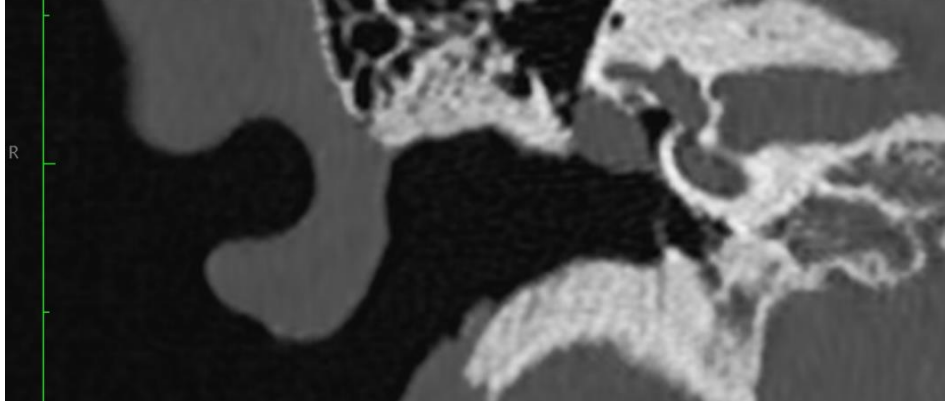
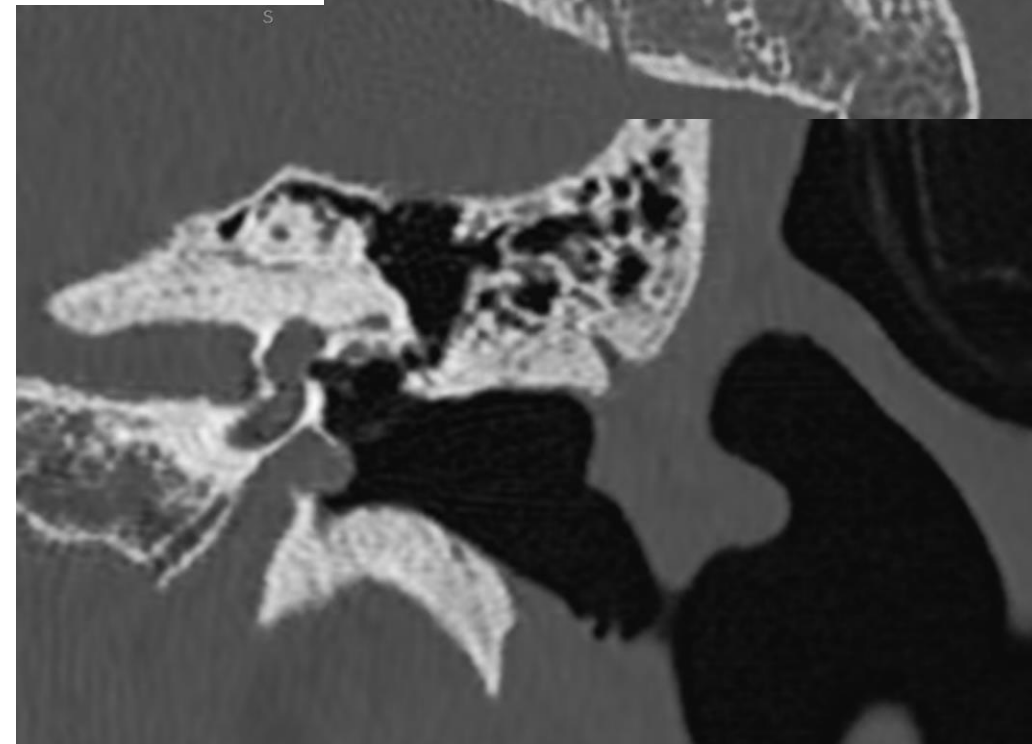
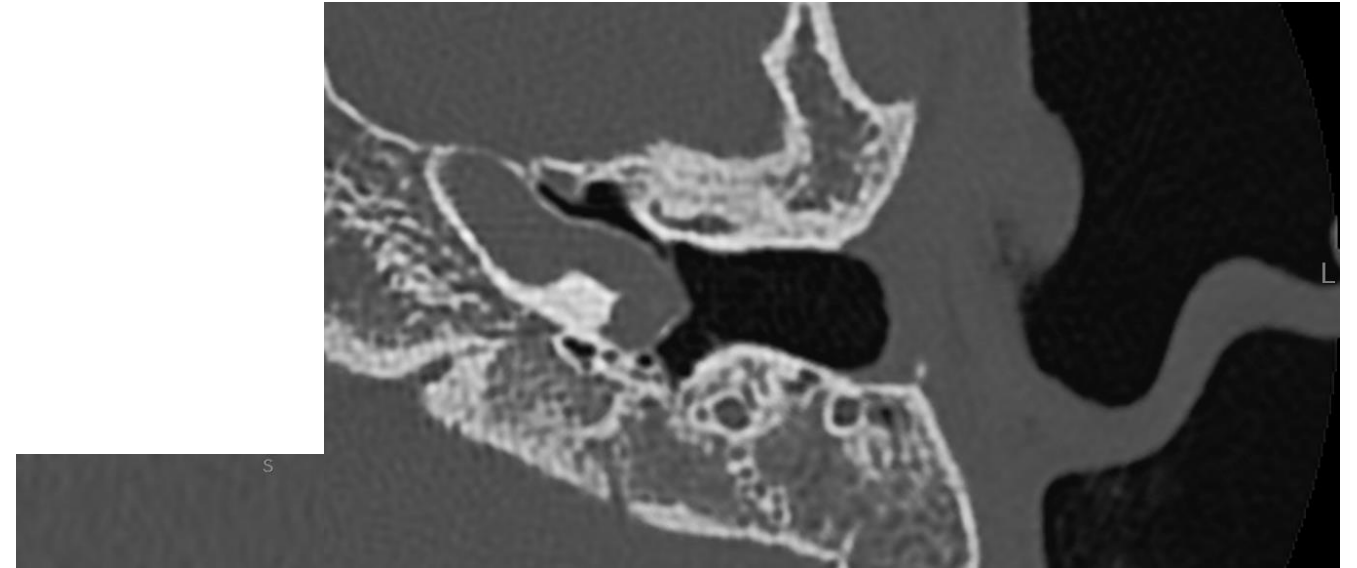
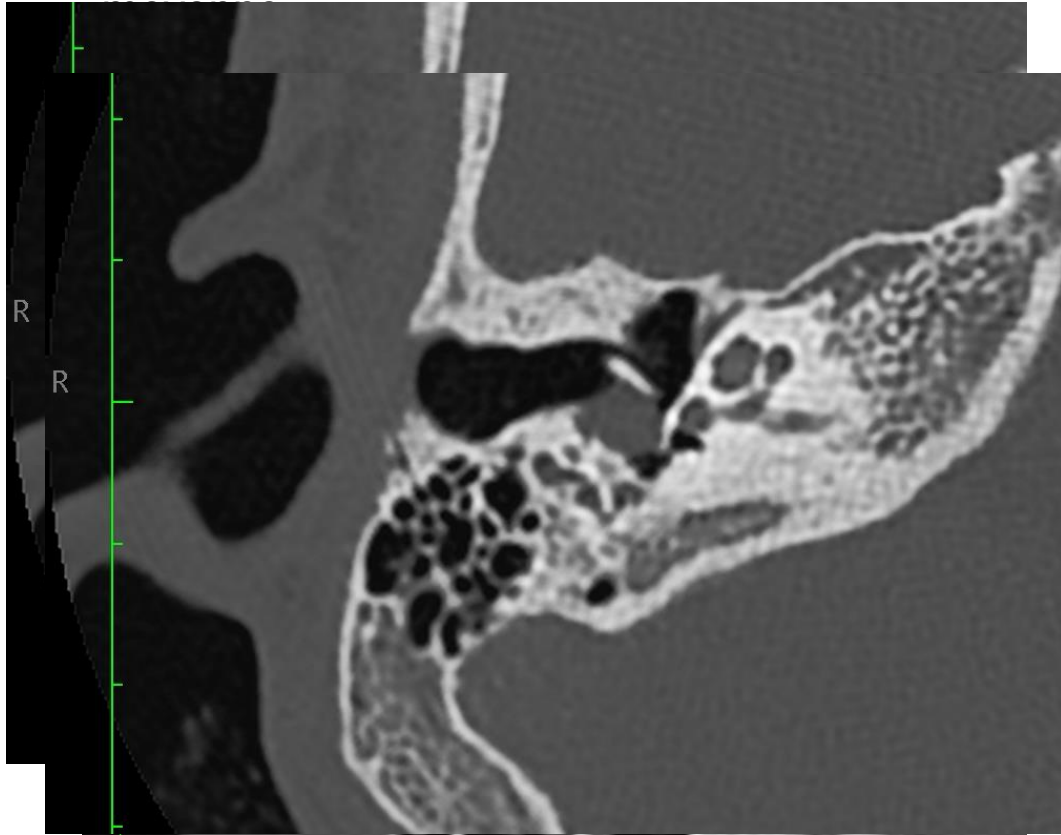
- Cause la plus fréquente
- Piston luxé
  - Rarement immédiat: défaut de serrage ?
  - Le plus souvent secondaire: spontané ou post-traumatique
- Piston trop court
  - Rare
  - Immédiat
- Lyse BDE
  - Secondaire

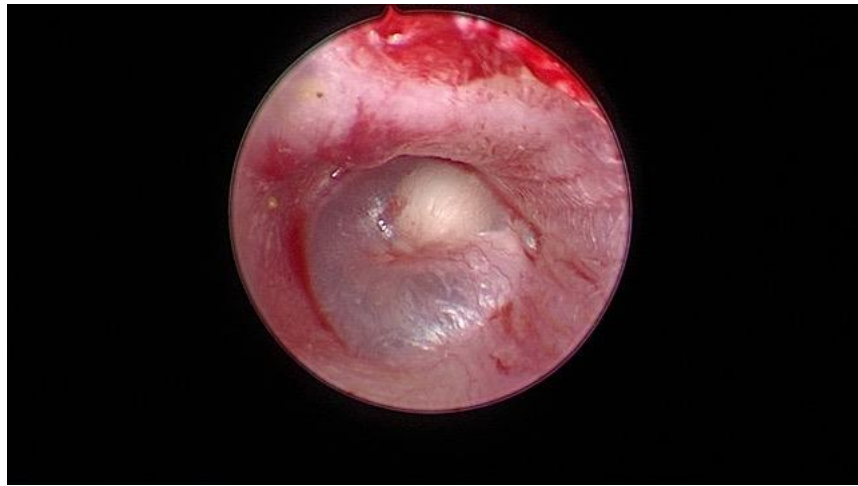


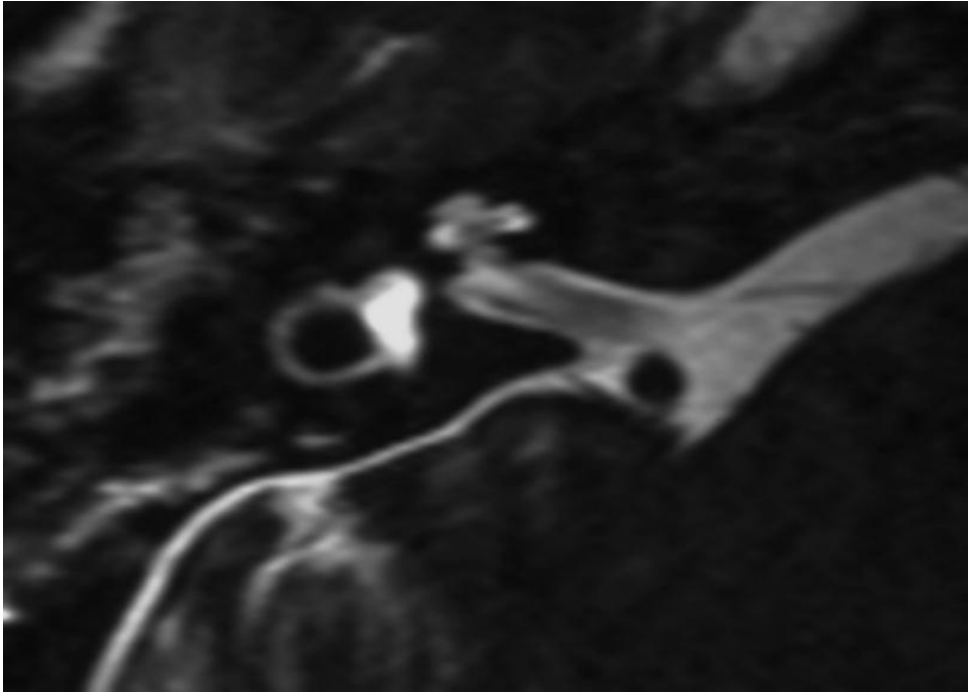
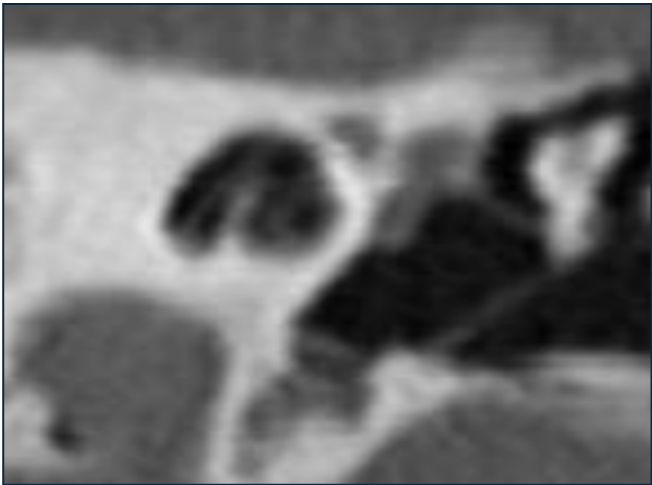
Patient 5: enfant âgé de 15 ans, suspicion de cholestéatome bilatéral

Rocher droit : opacité ronde bien limitée en rapport avec un cholestéatome lysant la pointe du mur de la logette

Rocher Gauche: opacité de l'oreille moyenne en rapport avec un canal carotidien ectopique au sein de l'oreille



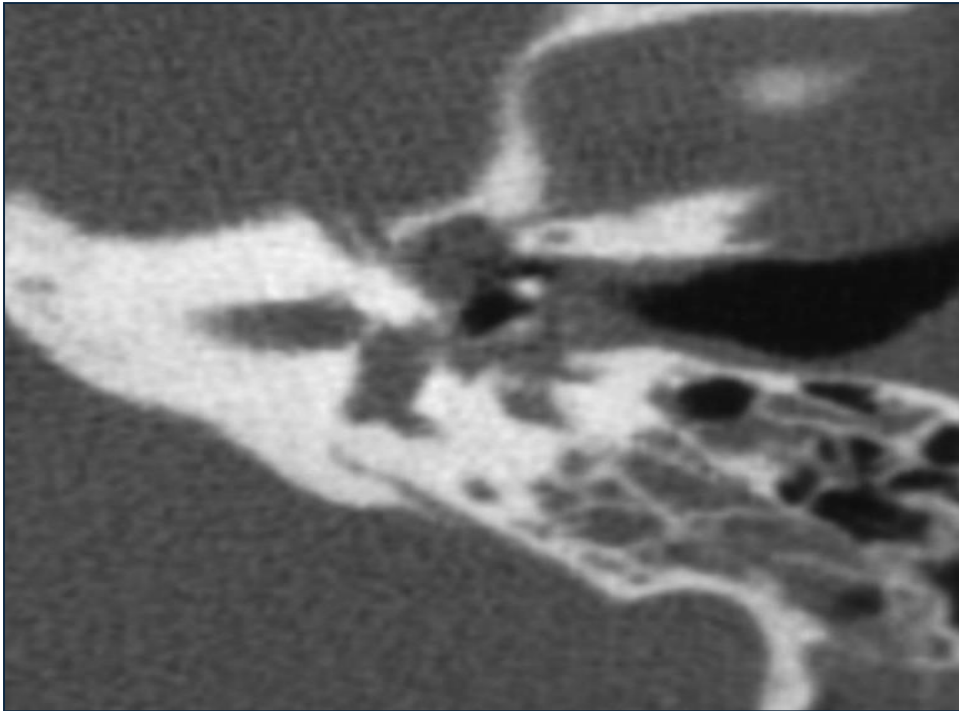




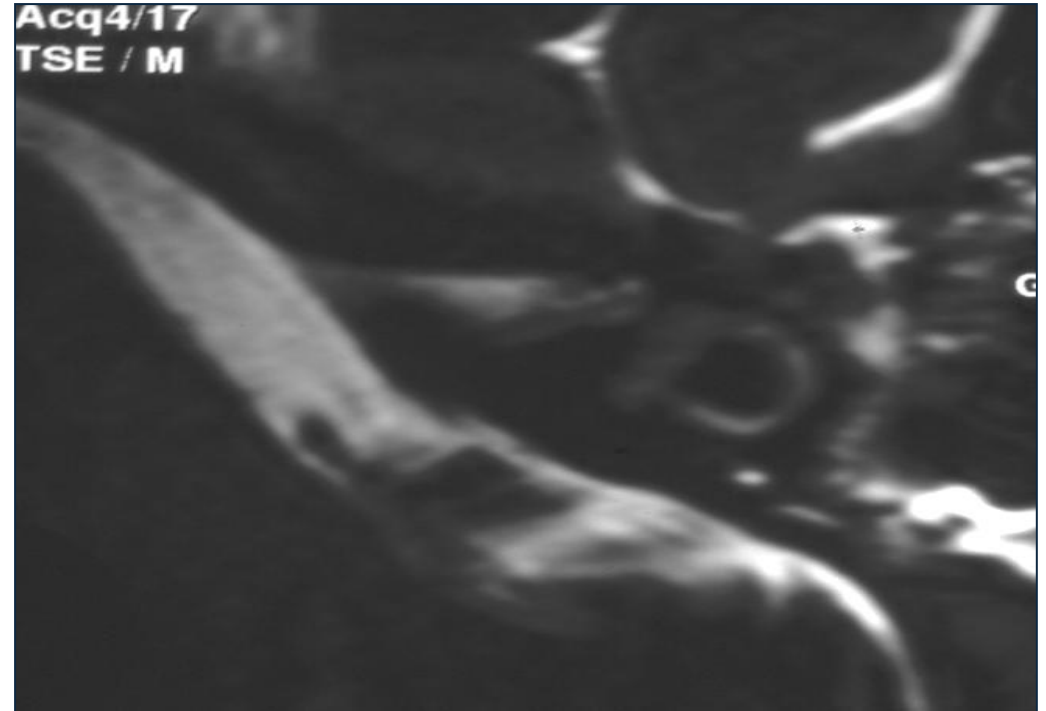
Hypersignal du vestibule. Rehaussement plus intense que l'hypersignal du LCR au niveau des espaces sous-arachnoïdiens de l'APC

# Failure or complications

2. Sensorineural hearing loss → CT scan + MRI



Labyrinthitis



Obliteration of the labyrinthine fluids



# Functional prognosis : vestibular extension

