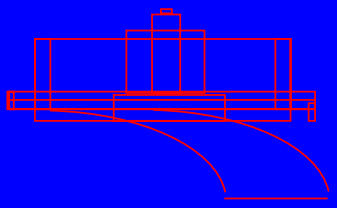


Choesteatoma of the middle ear:

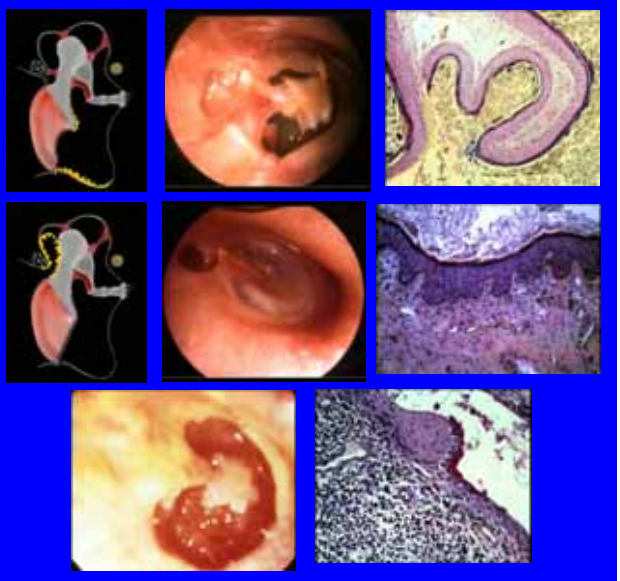
A modified canal-wall-up technique

Alexis Bozorg-Grayeli, Eric Rondini-Gilli,
& Olivier Sterkers
Otolaryngology Department, Beaujon Hospital,
and INSERM, Faculté Xavier Bichat, Université Paris 7, Clichy, France

Etiology

- Squamous epithelium inside middle ear cavities

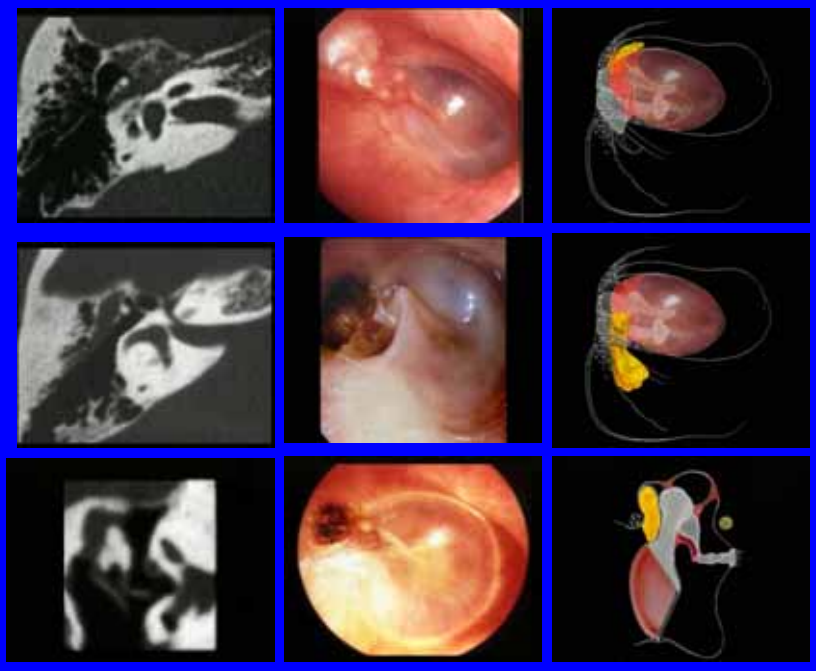
- Possible origins:
  - Cholesteatoma by migration after perforation or retraction
  - Papillary cholesteatoma in epitympanum
  - Metaplastic cholesteatoma



Courtesy of Pr. B. Fraysse

Locations (1)

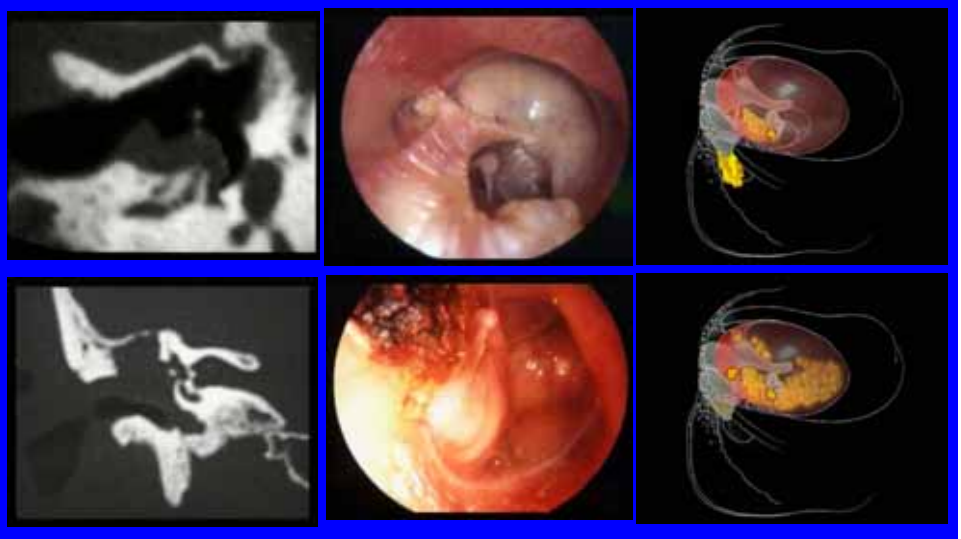
- Epitympanic:
  - Anterior
  - Posterior
  - Lateral



Courtesy of Pr. B. Fraysse

Locations (2)

- Mesotympanic
- Holotympanic

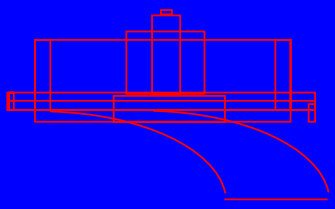


Courtesy of Pr. B. Fraysse

Stragtegy

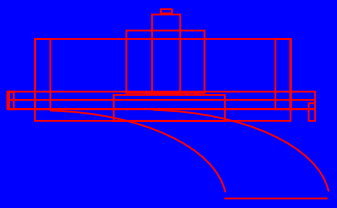
Approach adapted to:

- ✓ The location
- ✓ The degree of extension
- ✓ The size and pneumatisation of the mastoid



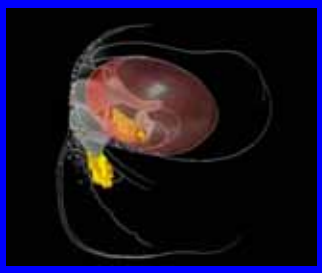
ONE STAGE SURGERY OF THE MIDDLE EAR CHOLESTEATOMA

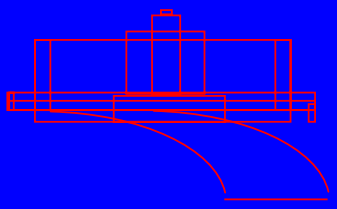
- Canal-wall-up (CWU) mastoidectomy:
  Limited cholesteatoma with developped mastoid
- Canal-wall-down (CWD) mastoidectomy:
  Extensive cholesteatoma in sclerotic mastoid



ONE STAGE SURGERY OF THE MIDDLE EAR CHOLESTEATOMA

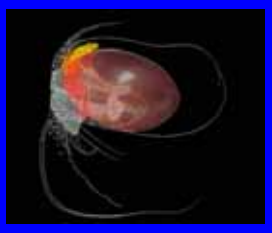
- Canal-wall-up (CWU) mastoidectomy with posterior tympanotomy: Meso- and holo- tympanic cholesteatoma with posterior extension to sinus tympani

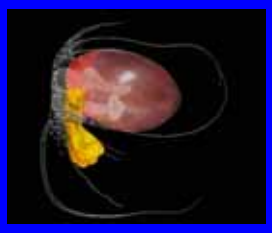


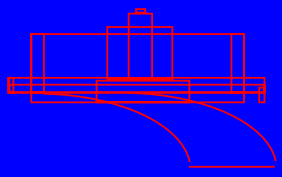


ONE STAGE SURGERY OF THE MIDDLE EAR CHOLESTEATOMA

- Canal wall up (CWU) mastoidectomy with transmeatal atticotomy: Epitympanic cholesteatoma

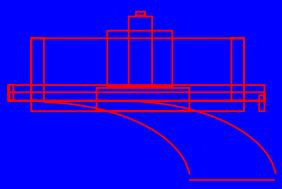






Material

- 1992-97 : 170 cholesteatomas in 150 adults (mean age: 54 years)
- 5 surgeons : Senior (80 % of procedures) and 4 fellows
- 150 first procedures (87 %)
- 20 revision procedures (13 %)
- 85 patients (57 %) previously operated on in other centers presenting with a cholesteatoma reccurence.



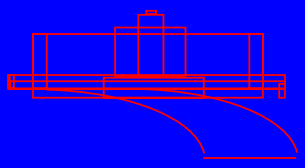
Methods

Clinical, and radiological data were analyzed at 24 months:

- Audiometric results *(mean thresholds at 0.5 - 1- 2 - 3 KHz)* :

- Air conduction (AC) hearing gain
- Air-bone gap (ABG)
- Bone conduction (BC) variation at 4 KHz

- Anatomical results

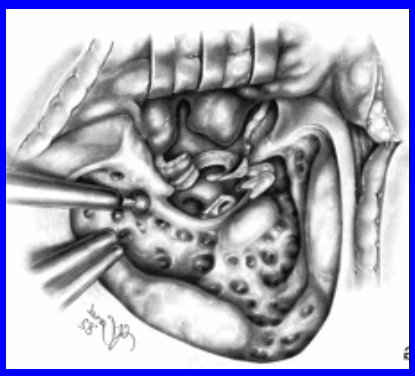


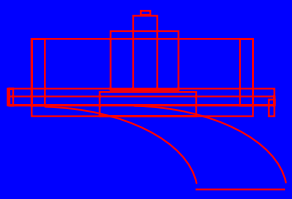
Surgical technique

- Retroauricular approach in 97 %
- 100 canal wall-up (CWU) mastoidectomy (59%) with posterior tympanotomy when necessary
- 70 canal wall-down (41 %)
- 91 ossicular reconstructions (61 %) in a one stage procedure
- Second look if abnormality on postop CT-scan and/or failure of ossiculoplasty

Surgical technique

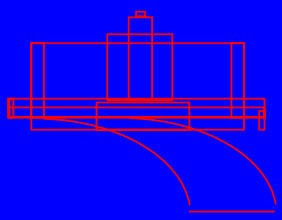
Revision of a canal wall down mastoidectomy cavity, and type 3 tympanoplasty





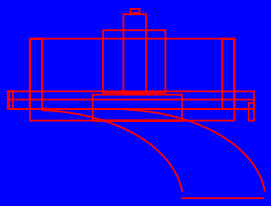
Cholesteatoma localization and complications

- Atrium 46 %
- Mastoid and attical 54 %
- Ossicular destruction 61 %
- Labyrinthine fistula 14 %
- Erosion facial nerve canal 27 %



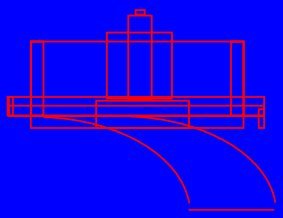
PORP (n=40)

- 15 Incus autografts (16 %)
- 14 Goldenberg® composite (15 %)
- 11 Xomed® hydroxylapatite covered with cartilage (12 %)

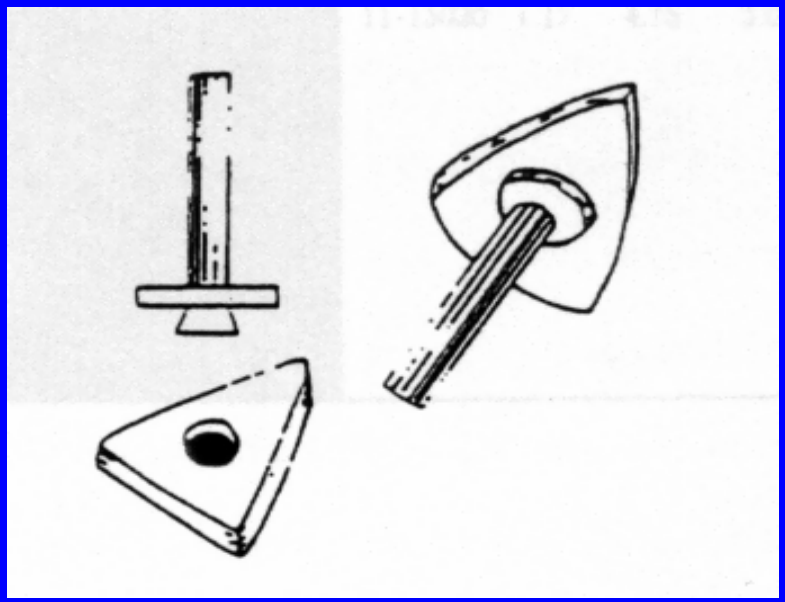


TORP (n=51)

- 21 Goldenberg® composite (23 %)
- 16 Xomed® hydroxylapatite covered with cartilage (18 %)
- 14 Teflon prostheses (15 %)



Klein® Teflon prostheses



Goldenberg® prostheses

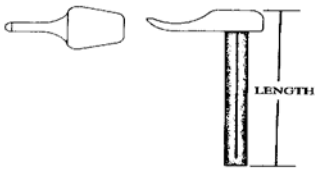
INCUS STAPES PROSTHESES

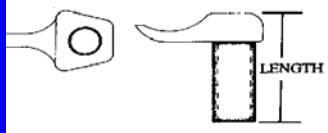
GOLDENBERG INCUS STAPES PROSTHESIS*
Hydroxylapatite/Plasti-Pore

Hydroxylapatite head designed with "hook" may be rotated inferiorly or superiorly along length of malleus handle. Wire reinforced Plasti-Pore shaft is easily trimmed to length, and provides stability and memory for bending to proper angulation.

Cat. No.	Description
14-0913	Hydroxylapatite Head, Plasti-Pore Shaft with Wire Reinforcement, 8.1mm Long, 0.8mm Diameter Shaft

*As developed in conjunction with Robert Goldenberg, M.D., Dayton, OH.

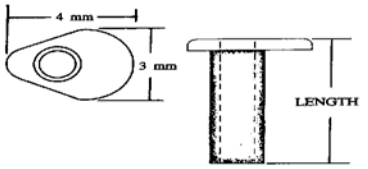




GOLDENBERG INCUS PROSTHESIS
Hydroxylapatite/Plasti-Pore

Hydroxylapatite head designed with a "hook" to be rotated inferiorly or superiorly along the length of the malleus handle, and includes a centering hole to view stapes capitulum. Plasti-Pore shaft may be trimmed to exact length, and notched for the stapedius tendon.

Cat. No.	Description
14-0912	Hydroxylapatite Head, Plasti-Pore Shaft, 4.2mm Long, Fully Cannulated

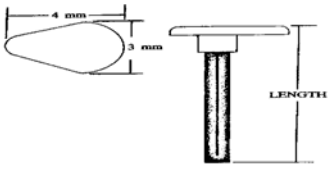


GOLDENBERG PORP PROSTHESIS*
Hydroxylapatite/Plasti-Pore

Wedge-shaped hydroxylapatite head conforms to tympanic membrane, and is cannulated to visualize stapes capitulum. Plasti-Pore shaft is trimmable and can be notched for stapedius tendon.

Cat. No.	Description
14-0916	Hydroxylapatite Head, Plasti-Pore Shaft, Fully Cannulated, 5.5mm Long

*As developed in conjunction with Robert Goldenberg, M.D., Dayton, OH.

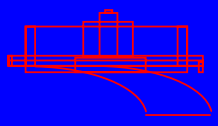


GOLDENBERG TORP® PROSTHESIS*
Hydroxylapatite/Plasti-Pore

Wedge-shaped head may be used when the malleus is not present, or is extremely anteriorly rotated. Plasti-Pore shaft is easily trimmed, and is wire reinforced for increased stability. A tissue graft over the oval window may be used when stapes footplate not present.

Cat. No.	Description
14-0917	Hydroxylapatite Head, Plasti-Pore Shaft with Wire Reinforcement, 8.0mm Long, 0.8mm Diameter Shaft

*As developed in conjunction with Robert Goldenberg, M.D., Dayton, OH.



Xomed® Hydroxylapatite Prostheses

IMPLANTS, DENSE H/A TOTALS (continued)

Total 90° Round

DESCRIPTION

- Round head provides stable platform for drum
- Solid dense H/A provides high level of bioactivity at interface sites
- May be shaped with diamond bur under irrigation
- 0.89mm shaft diameter, 4.0mm head diameter, 8.0mm length

ORDERING INFORMATION

	SD	HD	L	
11-12080	0.89	4.0	8.0	1 each

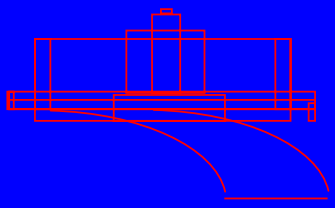
ORDERING INFORMATION

	SD	HD	L	
11-12090	1.1	4.0	5.0	1 each

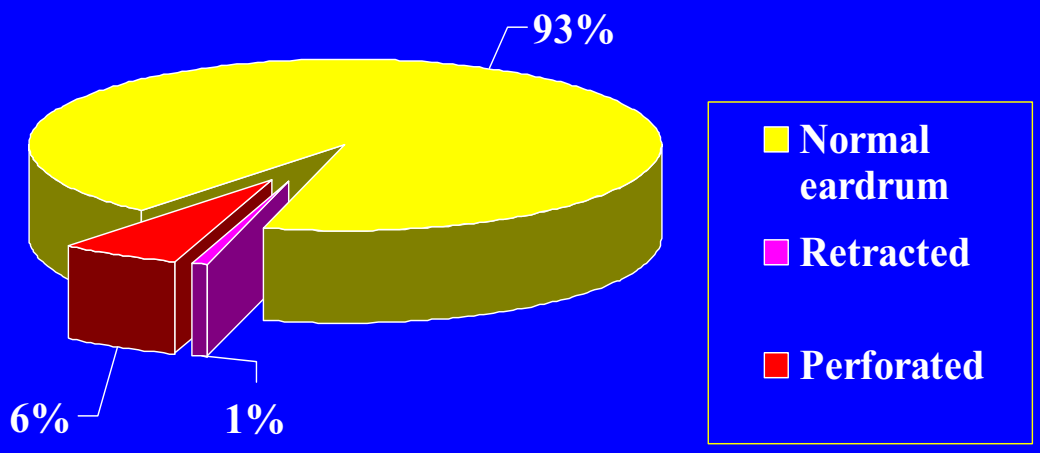
DESCRIPTION

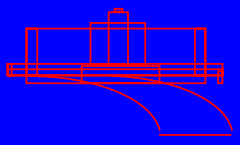
Partial 90° Round, H/A

- Solid dense H/A provides high level of bioactivity at interface sites
- Round head provides stable platform for drum
- Fully cannulated shaft fits on head of stapes
- May be shaped with diamond bur under irrigation
- 1.1mm shaft inner diameter, 4.0mm head diameter, 5.0mm length



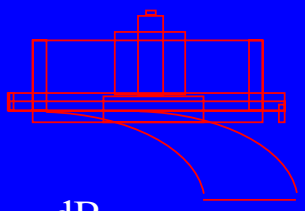
Anatomical results



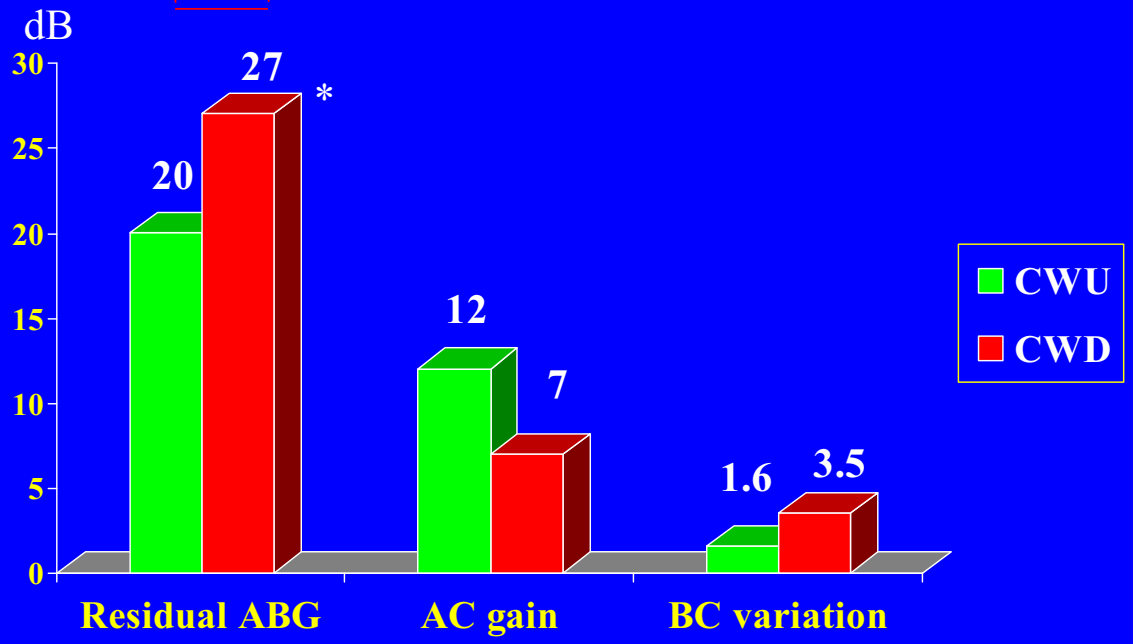


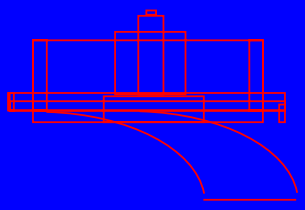
Anatomical results

Patients (n=150)	First procedure (n=150)	Residuals (n=14) Op via CWU	Recurrences (n=6) Op via CWD
85 (57%) Revision	25 CWU 60 CWD	10 residuals (11.7 %)	3 recurrences (3.5 %)
65 (43%) First surgery	65 CWU	4 residuals (6 %)	3 recurrences (4.6 %)

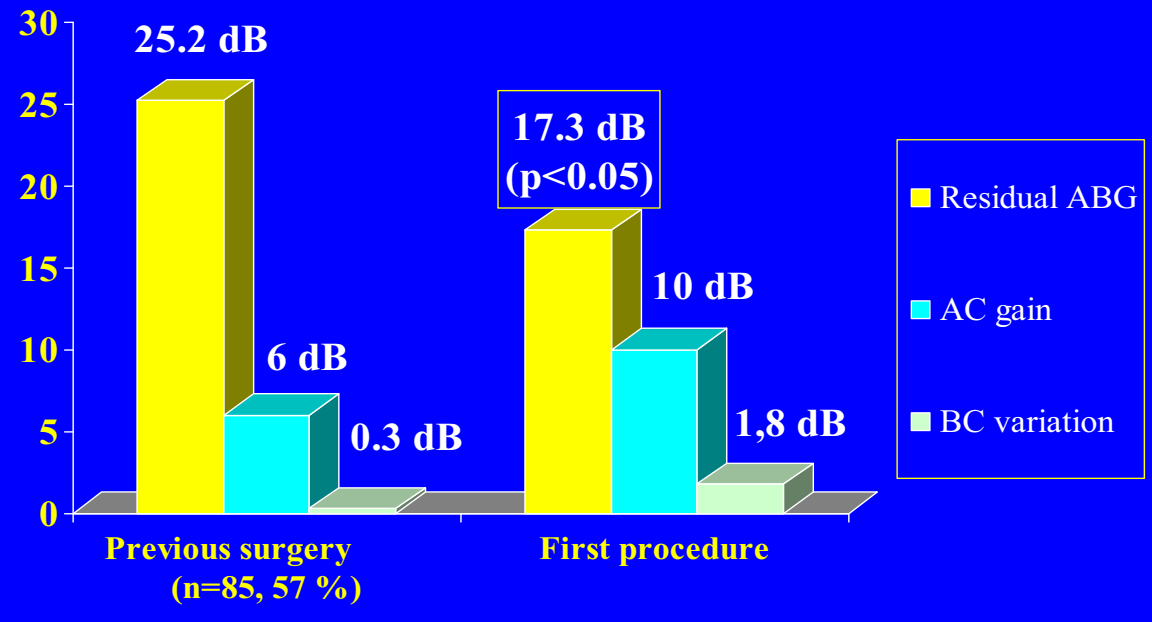


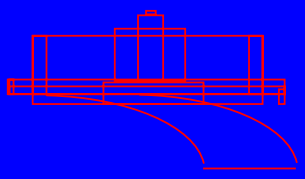
Mastoidectomy functional results





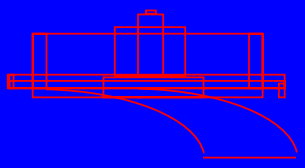
Functional results in first and revision procedures





Prosthesis anatomical results

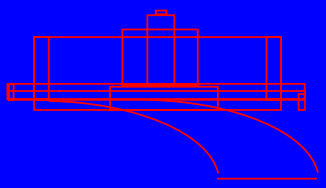
- 10 extrusions (6 %) after a 2 years delay :
  - 6 Goldenberg® (17 %)
  - 4 teflon prostheses (28 %)



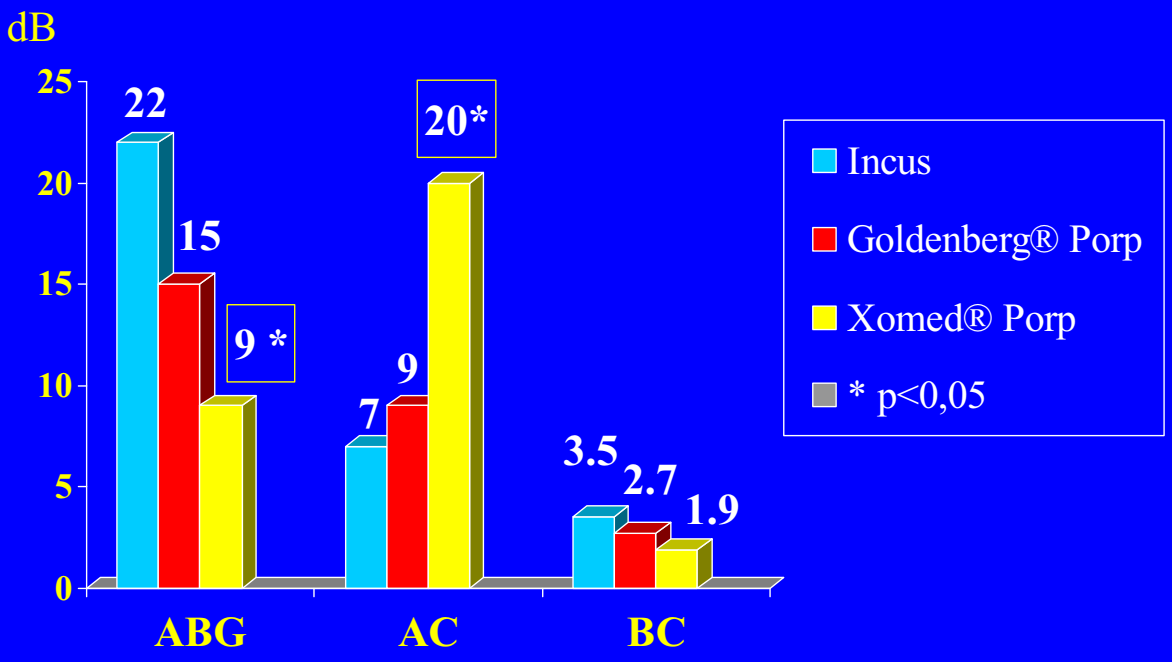
Functional results

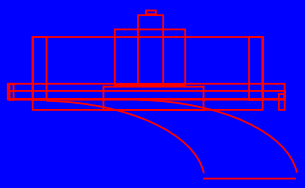
- ABG: 22 ± 16.5 dB, ABG < 20 dB: 60 %
- Air conduction gain : 14 ± 14,5 dB

24 months	ABG	% ABG < 20 dB	AC gain	BC variation 4 KHz
Type II tympanoplasty (n=40)	20 ± 9,2	65%	15,0 ± 14	2 ± 10
Type III tympanoplasty (n=51)	26 ± 12,9	48,00%	13,3 ± 13	3 ± 9,2
p (Anova test)	p = 0,0001	p = 0,0003	NS	NS

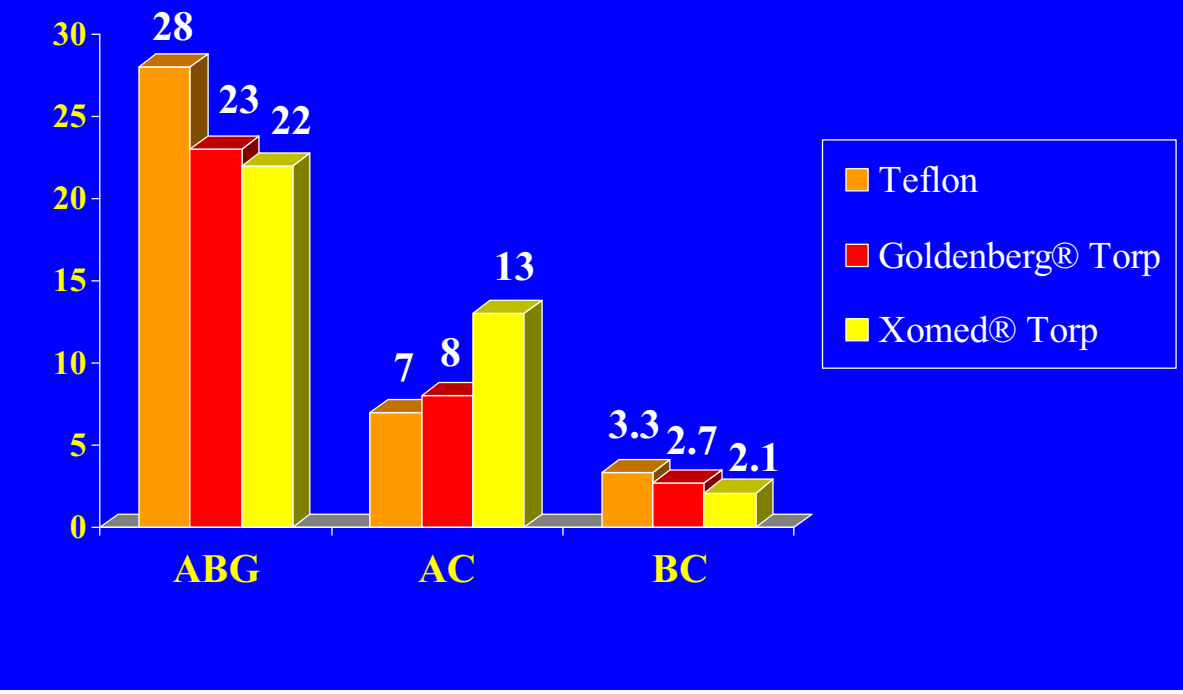


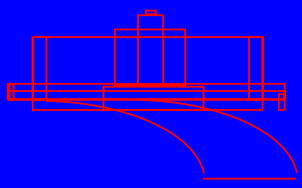
PORP functional results





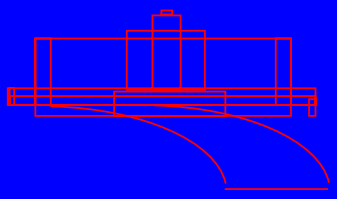
TORP functional results





Negative influencing factors on functional results (ABG)

- Canal wall down (n=70) mastoidectomy versus canal wall up (n=100): $p<0.05$
- Second surgical procedure versus first surgery (85 patients, 57 %): $p<0.001$
- Absent stapes arch (n=51): $p<0.001$
- Cholesteatoma (n=170) versus chronic otitis media (n=400): $p<0.02$



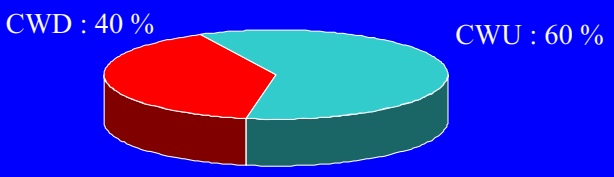
Conclusions

- Middle ear cholesteatoma in adult can be well cured by one stage procedure including ossicular chain reconstruction
- Regular clinical control, and systematic CT scan in case of closed technique are required
- Hydroxylapatite prostheses covered with cartilage achieved a valuable hearing restoration

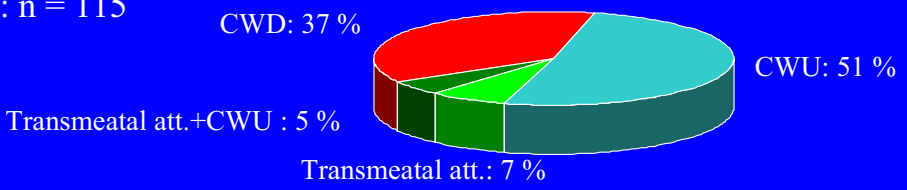
Technical progression : The transmeatal atticotomy

Progression of techniques

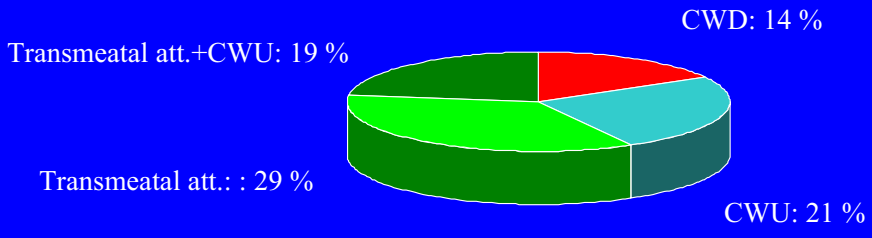
- 1985-1994 : n = 105



- 1994-1997 : n = 115



- 1998-2001 : n = 120



Transmeatal atticotomy

Indications

Cholesteatoma limited to the external attic
Attical retraction pockets
Ossicular fixation in the attic

Transmeatal atticotomy

- 1996-2001: 65 patients
- 38 males, and 27 females
- Mean age: 44 years (13-74)
- Mean follow-up period: 16 months (2-36)
- 39 first surgeries, and 26 revisions
- Indications :
  - Attical retraction pocket: 43 (66 %)
  - Attical cholesteatoma: 22 (34 %)

Preoperative audiometry

- Preoperative PTA: 45 ± 2.1 dB
- Mean preoperative ABG: 28 ± 1.3 dB
- Preoperative ABG < 20 dB in 18 patients (27 %)

Surgical technique

- Retroauricular approach
- Flap protection by a silastic sheet during drilling
- Thin cartilage slice for reconstruction (tragus or concha)

Technique

- Associated procedures in 28 cases (42 %):
  - CWU mastoidectomy: 24 (86 %)
  - CWU + posterior tympanotomy: 4 (14 %)
- Tympanic membrane graft in 53 cases (81 %) :
  - Under the malleus handle: 44 (83 %)
  - Over the malleus handle: 9 (17 %)
- Ossicular reconstruction in 50 cases (77 %):
  - Hydroxylapatite: 45 (90 %)
  - Autograft: 2 (4 %)
  - Other prostheses: 3 (6 %)

Anatomical results

- Normal tympanic membrane: 55 (85 %)
- Recurrence of retraction pocket: 8 (12 %)
- Perforation: 1 (1.5 %)
- Tympanosclerosis: 1 (1.5 %)

- One revision surgery for cholesteatoma recurrence: Canal wall down mastoidectomy

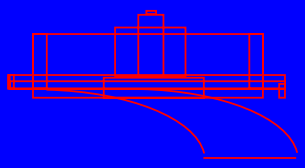
Postoperative functional results

- Mean ABG: 21 ± 1.4 *(versus 28 ± 1.3 dB preoperatively)*
- PTA: 36 ± 2,7 *(versus 45 ± 2.1 dB preoperatively)*
- Residual ABG < 20 dB: 32 patients (50%) *(versus 27% preoperatively)*
- secondary displacements of the prosthesis: 4 (8%)

Conclusions

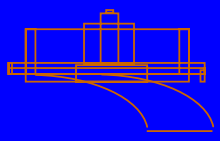
- Progression of the surgical strategy towards :
  - Transmeatal atticotomy + CWU mastoidectomy +/- posterior tympanotomy
  - Transmeatal atticotomy alone

  in selected cases
- This technique allows a direct, and easy access to the attic

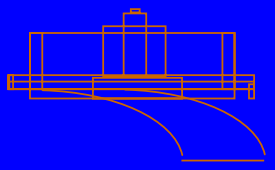


Summary

- Transmeatal atticotomy (TA) in:
  - Limited attical cholesteatoma
- TA+CWU mastoidectomy: Extended cholesteatoma with pneumatised mastoid, and posterior tympanotomy in selected cases)
- CWD mastoidectomy in:
  - Recurrence
  - Scleortic mastoid
- Temporal muscle flap except in case of ongoing infection

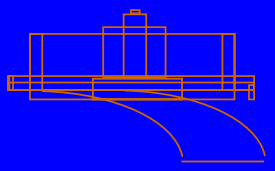


Complications :
Labyrinthine fistula



Population

- 1986-1996: Among 252 patients operated on for cholesteatoma, 33 (13%) presented with a labyrintine fistula



Population

- 29 files were studied (4 were not available).
- 19 males and 10 females with mean age of 47 year (24-87 y).
- 14 patients (48%) had been operated one to four times previously.

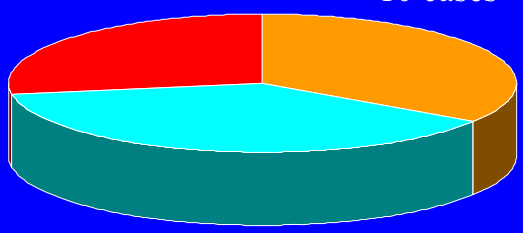
CLINICAL ASPECTS

- Otorrhea: 72%
- Vertigo: 45%
- Facial palsy: 13% (associated with total hearing loss in 3 cases out of 4)
- Positive fistula sign: 34%

Palva classification of fistulas

•Stage 3 - Labyrintine fistula > 2 mm *: 8 cases

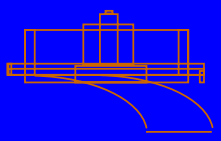
Stage 1 - Simple bone erosion: 10 cases



Stage 2 - Labyrintine fistula < 2 mm *: 11 cases

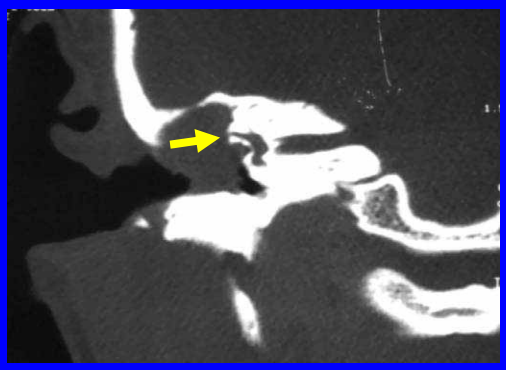
(* Contact between cholesteatoma and labyrinth)

- In 86% the fistula was located in LSSC
- MRI large fistula or tegmen defect



Labyrinthine fistula

- CT scan is performant for fistulas > 0.5 mm of diameter
- High resolution, thin overlapping sections in both axial and coronal planes
- Positive CT scan in this series: 76%



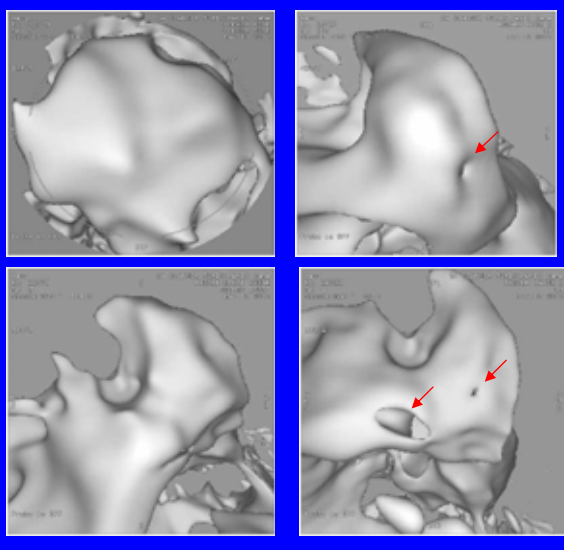
Virtual endoscopy with threshold variation: Experimental results

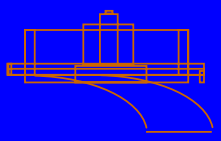
mastoidectomy:

before after

Posterior SCC (0.3 mm fistula) at 772 HU

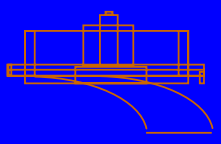
Lateral and superior SCC (0.5 mm fistulas) at 866 HU





Surgical technique

- Cholesteatoma matrix over fistula kept in place until the end of surgery and protected with a silastic sheet
- Open or closed technique was chosen with regard to the size of the mastoid and the extent of the lesion
- Antibiotic therapy was continued for 48h postoperatively



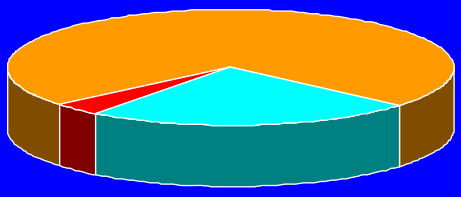
Surgical technique

- Cholesteatoma matrix removed at the end of the procedure except in case of an only hearing ear or large fistula in elderly
- Fistula covered with temporal fascia and bone or cartilage and fixed with fibrin glue

SURGERY

Technique

CWD: 72.5%

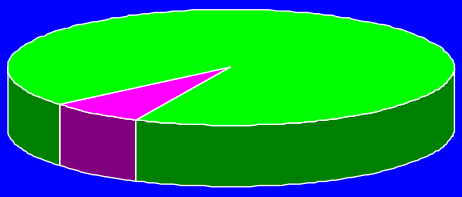


Middle Cranial Fossa: 3.5%

CWU: 24%

Cholesteatoma removal

Total: 93%



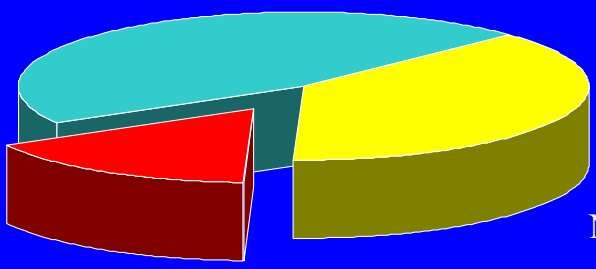
Partial: 7%

Follow-up

- Medium 18 months (1 month to 5 years)
- Up to 1 year in 21 patients (72%)

Hearing function

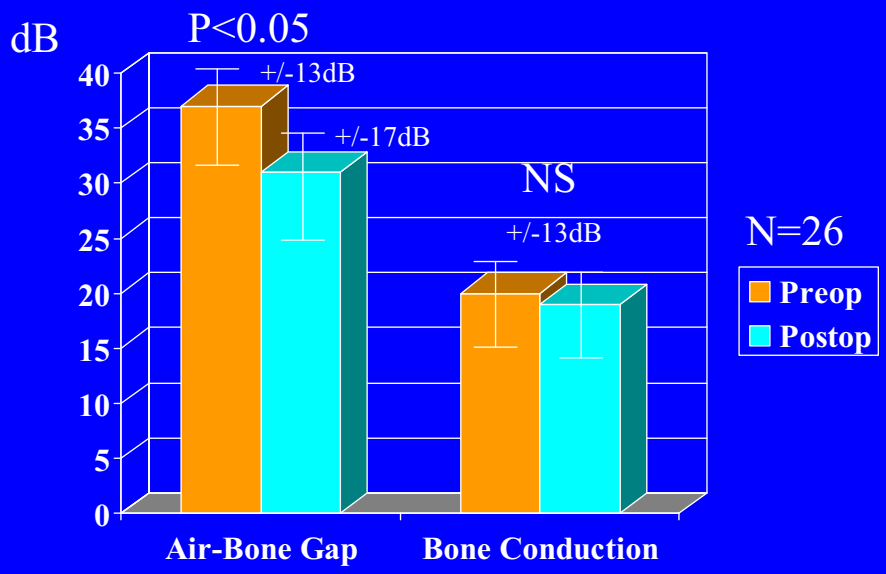
Better: 46%



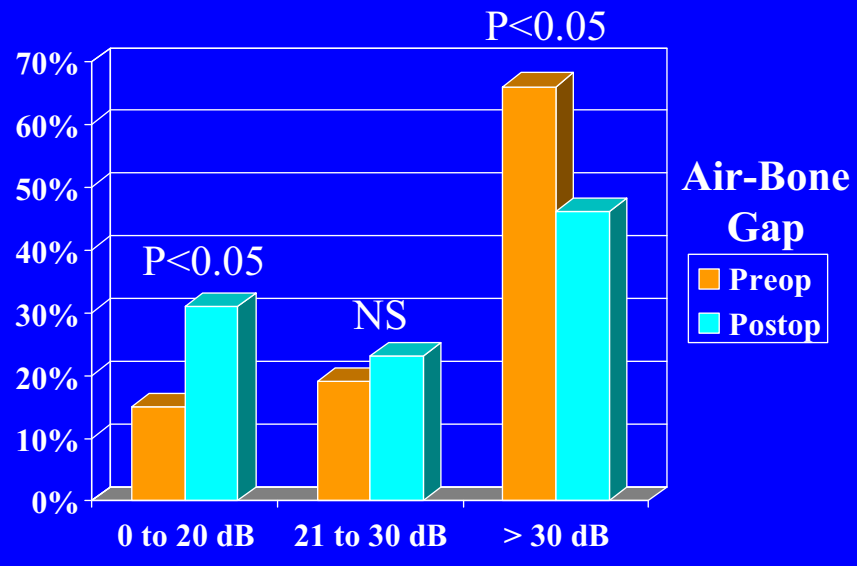
Not changed: 39%

Worse: 15%

Hearnig function



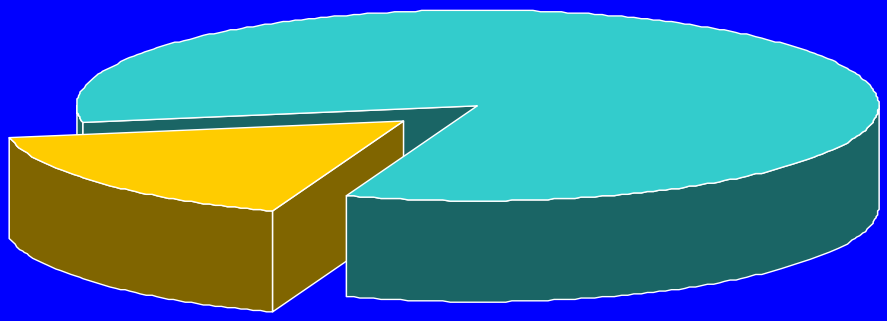
Hearing function



Postoperative dizziness

at 3 months postoperatively

No dizziness: 83%

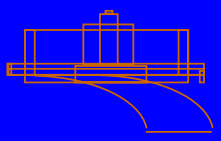


Dizziness: 17%

Revision surgery

N=10 (34%)

- Bone reconstruction: 6 cases
- Residual cholesteatoma: 3 cases
- Tegmen defect: one case



Conclusions

- The Labyrinthine fistula is still a frequent complication of middle ear cholesteatoma.
- CT-scan is performant in detecting fistulas > 0.5 mm of diameter.
- This complication should be detected preoperatively in order to avoid inner ear traumatism during cholesteatoma removal.
- Fistula should be protected during cholesteatoma removal with silastic sheet.