OTOSCLEROSIS:
HEARING AID AND/OR SURGERY?

B. FRAYSSE
GOAL OF THE PRESENTATION

To discuss the various factors which may influence the decision in counselling patient between:

- Hearing aid
- Stapes surgery
- Auditory implant
CONDUCTIVE HEARING LOSS
DEGREE OF STAPES FIXATION
SENSORINEURAL HEARING LOSS

DEGREE OF HYALINIZATION

Amount of hyalinization by the degree of hearing loss
Pure cochlear otosclerosis

No stapes fixation, pure cochlear otosclerosis
DIAGNOSIS

- Progressive hearing loss
- Family history of otosclerosis
- Good understanding in noise
- Speaks softly
- Normal otoscopy

*Signe de Schwarts*
TUNING FORK TEST

- Weber: 256, 512, 1024, 2048 Hz
  compare the findings of the tuning fork with those found on pure tone

- Rinne Test negative indicates an air bone gap of at least 30 to 45 dB
The clinical application of bone conduction audiometry

Raymond CARHART, Ph. D.
SPEECH DISCRIMINATION

- Speech discrimination in quiet and in noise
- Normal tympanometry
- Stapedial reflex absent or ON/OFF
DO WE NEED A CT-SCAN IN THE DIAGNOSIS OF OTOSCLEROSIS?

The Role of Imaging in the Diagnosis and Management of Otosclerosis

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A Systematic Review of the Diagnostic Value of CT Imaging in Diagnosing Otosclerosis


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GUIDELINES OF THE FRENCH SOCIETIES

« Recommandations pour la pratique de l’imagerie de l’oreille et du rocher »

- These guidelines relate
  - The technique of acquisition
  - The normal anatomy
  - The morphological modification
  - The classification of lesions
TECHNIQUE OF ACQUISITION

- Slice thickness 0.3/0.6 mm
- Parallel to the lateral canal
- Axial and coronal reconstruction
- With magnification
INTEREST OF IMAGING IN THE EVALUATION OF OTOSCLEROSIS

1. To define a surgical strategy in case of
   - Anatomical difficulties
   - Negative CT-Scan
ANATOMICAL DIFFICULTIES

- Small fenestra
- Obliteration footplate
- Facial déhiscence
FACIAL NERVE / OVAL WINDOW

- Partial obliteration
- Total obliteration
ANATOMICAL DIFFICULTIES

- Malleus fixation
- Incus fixation
- Stapedial artery
COUNSELING PATIENTS IN CASE OF NEGATIVE CT-SCAN

- Middle ear exploration **BUT**

- **Risk of mobile footplate x 5**
  - Early form with an incomplete fixation of the stapes

- **Possible inner ear conductive hearing loss due to:**
  - An enlarged vestibular aqueduct
  - Minor inner ear malformation
  - Superior semicircular canal dehiscence
  - Modiolus anomalies
POSSIBLE INNER EAR CONDUCTIVE HEARING LOSS

▲ Superior semicircular canal dehiscence  ▲ Enlarged vestibular aqueduct  ▲ Abnormal modiolus
MODIOLUS MALFORMATION
INTEREST OF IMAGING IN THE EVALUATION OF OTOSCLEROSIS

To analyse the cause of failure
CAUSE OF FAILURE

- Persistence of conductive hearing loss
- Secondary conductive hearing loss
- Sensorineural complications
PERSISTENCE OF A CONDUCTIVE HEARING LOSS

- Prosthesis in place, no focus
- Dysjonction
- Malleus fixation
SECONDARY CONDUCTIVE HEARING LOSS

- Prosthesis displacement
- Lateralization syndrome
- Reossification
SENSORINEURAL COMPLICATIONS

- Intravestibular prosthesis
- Fistula with air
- Labyrinthitis
FLOATING STAPES
THERAPEUTIC OPTION

- Medical treatment
- Hearing aid
- Surgery
- Auditory implants
  - BAHA
  - Middle ear implant
  - DACS
  - Cochlear implant
MEDICAL TREATMENT

Third-Generation Bisphosphonates for Treatment of Sensorineural Hearing Loss in Otosclerosis
*†Alicia M. Quesnel, ‡Margaret Seton, *†Saumil N. Merchant,
†§Christopher Halpin, and *†Michael J. McKenna
The adaptation is easiest due to the good cochlear function.

The hearing aid amplification should:

- Compensate the sensorineural part of the loss
- Additional gain at each frequency to correct the conductive loss
- Due to the conductive component on low frequency an occluded ear mold may be used.
LASER

- KTP LASER (532 nm)

- Short or long angle

Vaporization of the stapedial crus: 1 W - 0.2 s
LENGTH OF THE PROSTHESIS AND COUPLING

- Incorrect prosthesis sizing and crimping are important causes of stapedotomy failure.
CT-SCAN EXAMINATION

- Obliteration footplate
- Facial déhiscence
- RW obliteration
CASE CLINIC 1

1 Hearing aid is the only option due to surgical contra indication

2 The two options are needed due to restaure binaural hearing

3 The two options are possible
SURGICAL CONTRAINDICATIONS

- **Absolute**
  - Severe tubal dysfunction
  - Pure sensorineural hearing loss
  - Patient refuse any risk
  - History of sudden hearing loss

- **Relative**
  - Only hearing ear *
ONLY HEARING EAR
IN THE ERA OF CI

Case 1
● M – 49 years old

Case 2
● W – 55 years old

Case 3
● W – 65 years old

Cochlear Neuroma
Progressive HL
Post stapedotomy
SURGICAL DECISION

First stage: CI

Second stage: Stapedotomy
SURGICAL RESULTS

Case 1

Cochlear Implant

Case 2

CI threshold

Case 3
SPEECH DISCRIMINATION RESULTS

Before surgery

Bimodal

HA + stapedotomy

CI
59 years old woman

- The optimal gain provide undesirable audiometric effects
- It is not possible to provide enough gain to compensate
SURGERY + HEARING AID

Gain par la prothèse
Gain par la chirurgie

HEAD SHADOW
S
N

SOMMATION
S
N

SQUELCH
N
S

DICHOTIC
Improve 8-10 dB

DIOTIC
Binaural redundancy - Improve 2-3 dB

INVERSE DICHOTIC
Binaural demasking - 2 dB
Improvement of binaural effect in all cases event without a complete symmetrical hearing

Strong correlation between gain and quality of live (SSQ)
CASE CLINIC 3

Far advance otosclerosis

Imaging criteria

- CT Scan evidence of otosclerosis focus
### POPULATION

- **Stapedotomy + CI**: 25 pts (38%)
- **Stapedotomy alone**: 32 pts (48%)
- **CI alone**: 9 pts (14%)

**Preop data**

<table>
<thead>
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<th></th>
<th>Air Conduction</th>
<th>Word Discrimination Score</th>
<th>Bone Conduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A</strong> : Stapedotomy</td>
<td>104.5 dB</td>
<td>12%</td>
<td>64 dB</td>
</tr>
<tr>
<td><strong>Group B + C</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI alone / CI + Stapedotomy</td>
<td>109 dB</td>
<td>12%</td>
<td>69.5 dB</td>
</tr>
</tbody>
</table>

NS

$p < 0.001$
## OVERALL RESULTS

N : 22

<table>
<thead>
<tr>
<th></th>
<th>Mean Word Discrimination Score</th>
<th>% Patients scoring ≥ 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group A : Stapedotomy</strong></td>
<td>50.6%</td>
<td>60%</td>
</tr>
<tr>
<td><strong>Group B + C CI alone / CI + S</strong></td>
<td>72.8%</td>
<td>89%</td>
</tr>
</tbody>
</table>

p = 0.002

p = 0.027
Previous stapedotomy has No impact on Cochlear implant outcome
Success of stapedotomy cannot be predicted pre-operatively.

Previous stapedotomy has no impact on cochlear implant results.

**ALGORITHM FOR MANAGEMENT**

- **Stapedotomy**
  - With Hearing aid
  - Simple, safe, low cost
  - Quality of sound

- **Cochlear implant**
  - Excellent predictable results
The two options are possible
BOTH OPTIONS ARE POSSIBLE

Risks due to surgery:
- Information content to the patient

No risk with hearing aid for a similar result?
- Do we have to propose hearing aid in first intention?

Economic data: Health cost support
DO THE AUDIOLOGICAL RESULTS ARE COMPARABLE?

**Inclusion criteria**
- Patient candidate for surgery with a conductive hearing loss > 30 dB and normal contralateral ear. First two months HA and then surgery.

**Study design**
- Prospective longitudinal study comparing audiological outcomes with hearing aid then stapedotomy at 2 months on 30 patients.

**Evaluation**

**Preliminary results**
- **Main criteria**: Improvement from 0 to 100 (GHSI) S
- **Secondary criteria**: Hearing threshold S
  - Sound localisation S
PRELIMINARY RESULTS

- PTA
- Discrimination
- GHSI

Significant improvement of quality of live after surgery

N = 22

** Significant improvement of quality of live after surgery
SOUND LOCALISATION

Localisation

Root main square

Total score

N = 22

Significant improvement of quality of sound localization

Initial App Surgery

Initial App Surgery

1 2 3

1 2 3
BINAURAL HEARING / MATRIX
CONCLUSION

- High resolution CT-Scan may be useful in the diagnosis of otosclerosis when the clinical symptoms are not indicative enough.

- Imaging CT may also help in counseling patients with anatomical difficulties and extensive otosclerosis.
Thank you for your attention