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The abnormal opening of the bony labyrinth in the middle ear runs the risk of recurrent labyrinthitis with dizziness, sensorineural hearing loss, purulent labyrinthitis and meningitis. Its treatment is surgical, however, an alteration of cochleovestibular function during surgery may occur.

We propose in this development to review signs that suggest this complication and to establish a practical management of labyrinthine fistula in chronic otitis media with cholesteatoma.

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Management of the Labyrinthine Fistula in Chronic Otitis Media with Cholesteatoma

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I. INTRODUCTION

The labyrinthine fistula, defined by a destruction of the bony labyrinth, is a common condition in the evolution of chronic otitis cholesteatoma (4-12% of cases) [1]. In terms of nosology, we conventionally distinguish bony labyrinth lysis (LOL) from perilymphatic fistula (PF).

II. ANATOMICAL PRESENTATIONS OF LABYRINTHINE FISTULAS

a) Sites

Fistulas are located:

- Essentially on the lateral semi-circular canal (70-80% of cases), mostly in the middle of its loop or slightly behind,
- More rarely on the promontory, the superior or the posterior semi-circular canal, and the stapes footplate. The combination of several fistulas may occur. [2-3]

b) Lesions

Labyrinthine fistulas are classified by the size and depth of invasion [4]:

The size is defined by the diameter of bone erosion (<2mm and > 2 mm). Narrow fistula of less than 2 mm on the largest diameter, where the matrix of the

cholesteatoma is less likely to pass, present a low risk of invasion of the membranous labyrinth.

The prognosis of labyrinthine fistula is correlated with **depth**. Dornhoffer et al. classified labyrinthine fistulas according to depth in three types (5): Type I - erosion of the bony labyrinth with an intact endosteum; Types II - Exposure of membranous labyrinth and thus opening of the perilymphatic area; Type III: -Invasion of the membranous labyrinth

In large fistulas, palpation of the stapes footplate by a protected absorbable sponge fragment, using a blunt instrument, can sometimes bring interesting feedback:

- Perilymph leaking in case of a permeable canal.
- Bulge of the membranous canal in case of perilymph blocking.

III. WHEN TO SUSPECT A LABYRINTHINE FISTULA?

Some circumstances may evoke this complication, especially if a chronic otitis is evolving for many years. However, it can also be observed in children.

Recall in case of:

- History of dizziness, frequently found at the anamnesis and described as "Little dizziness" or brief episodes of imbalance,
- Sign of the fistula, by finger pressure on the tragus, systematic measure to seek in all chronic otitis examination,
- Facial paralysis,
- Facial canal Lysis, during surgery.

However, absence of dizziness and fistula sign does not totally eliminate labyrinthine fistula. [6-1]

That's why imaging is usually decisive in the preoperative. CT scan with millimeter cuts allows in general positive and topographic diagnosis of the fistula. However, it isn't sensitive enough to affirm or eliminate extension to endosteum, which will define surgical procedure and functional prognosis. In theory, MRI is the best way to diagnose a labyrinthine fistula by highlighting:

- ❖ A reduction of the space between cholesteatoma and the membranous labyrinth.
- ❖ A labyrinthine inflammation

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- ❖ or a partitioning of the perilymphatic fluid in CISS sequence. Only this sign has been studied in the literature and shows excellent sensitivity.[7]

Consequences: [8]

1st notion:

Labyrinthine fistula has to be feared in any chronic otitis media surgery. The operative strategy must take this into account and consider that there is a possible fistula until proven otherwise.

2nd notion:

When inflammatory tissue is discovered in a "risk area", such as in the lateral semi-circular canal, avoid any dissection that would expose the membranous labyrinth. First, search for a fistula by gentle pressure on the stapes.

3rd notion:

Once the fistula is found, or even merely suspected, the site must be protected by an absorbable sponge or paper piece, until its treatment.

4th notion:

To treat labyrinthine fistula in best conditions, bloodless surgical field is imperative for a lesser use of suction which is a very important bone conduction impairment factor.

5th notion:

Accordingly, labyrinthine fistula must be proceed at the end of surgery, when there is no milling and therefore no heavy suction. Also, cholesteatoma dissection should be conclude by areas likely to be the site of alabyrinthine fistula, mainly lateral semi-circular canal and promontory.

Management of Labyrinthine Fistula: [9-10]

Management of labyrinthine fistula still raises discussions because:

- Leaving the cholesteatoma matrix theoretically expose to a further erosion bone and recurrent cholesteatoma.
- Removing the matrix may cause bone conduction impairment or even deafness in cases of membranous labyrinth trauma.

Fistula of the lateral semi-circular canal:

Towards cholesteatoma, two perspectives are opposed.

The matrix dissection. It can be performed under reserve of:

- Using a very fine suction, through an absorbable sponge ball if necessary and non-traumatic instruments, like button-hook
- stopping at every grip.
- Lining the area with a large fascia fragment at the end of the matrix dissection, eventually with the use of a biological glue.

- *Leaving an epidermal layer* over all or part of the fistula, which is a wise solution :
- In case of One-off ear or better ear.
- If the cholesteatoma matrix adheres to the membranous labyrinth or Granulomatous area, or if the ear is infected.

Towards the bony fistula, one can:

- Simply cover the area with a temporal fascia fragment and possibly with the use of biological glue, if the lumen of the canal is not exposed.
- Closing with bone powder if the canal is open, before covering with the fascia.

In case of labyrinthine leaking, especially during palpation of the stapes, simply covering the site with a fragment of fascia may not be enough to stop the fluid flow, which is a bone conduction impairment factor. Filling the lumen of the canal with the bony powder (optionally with the biological glue) can effectively plug the fistula.

In case of labyrinthine fistula on a deaf ear the procedure must initially seal the canal lumen with bone powder before covering it with temporal fascia to avoid a possible spread of infection to the subarachnoid spaces.

Fistula of the promontory:

Cochlear function prognosis are worse in promontory fistulas than lateral semi-circular canal ones. Therefore, Caution is to leave a thin matrix layer and line it by temporal fascia fragment.

Canal Wall up or Canal Wall Down Tympanoplasty? :[9-10-11-12]

The presence of a labyrinthine fistula is not a deciding factor for the type of procedure.

Technique choice depend on some general factors but especially on characteristics of cholesteatoma. In addition, it appears that the choice of the technique does not influence bone curve quality in postoperative. Apart from some particular circumstances (multi-operated ear, multiple fistulas, one-off ear) or when letting up the matrix (large fistula of the posterior canal, promontory and cochlear fistula), It's suitable to recommend a canal wall up to facilitate à further monitoring.

Hearing Results of Labyrinthine Fistula Surgery: [11]

Average postoperative deafness risk is 10% and most of the time unpredictable. However, if the cochlear function is usually spared, the risk seems correlated for some authors to the size of the fistula and its site, which lead to a greater caution in case of a large fistula or a dicey site.

IV. CONCLUSION

Labyrinthine fistula is a common complication of chronic otitis media with cholesteatoma.

Diagnosis is based on clinical features and imaging (MRI, CT +/-). However, Surgery remains the only way to diagnose for sure a labyrinthine fistula.

Surgeon must remain cautious whenever operating a large cholesteatoma, because CT scan can be falsely reassuring.

The choice of surgical technique (canal wall up or canal wall down tympanoplasty) is more likely defined by the characteristics of cholesteatoma than by the presence or the nature of the fistula.

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