Lateral semicircular labyrintine fistula

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Abstract

Labyrinthine fistula (LF) is a well-known complication of chronic otitis media with cholesteatoma. The most common location of the LF is in the area of the lateral semicircular canal, but it can also affects other semicircular canals and in rare cases the cochlea. The treatment of LF has been discussed in the literature by various authors and is still debatable [1,2,3]. Hearing preservation is an important goal of labyrinthine fistula treatment. The appropriate management of LF depends on factors like hearing condition of both ears, the extent of the disease and the intraoperative size of the fistula. Sometimes the disease induced changes can't be detected radiologically or diagnosed clinically preoperatively. Such cases surprise the surgeon during intraoperative period and can be very challenging.

Introduction

Chronic otitis media with cholesteatoma can lead to various complication due to its ability to erode bone structures. Cholesteatoma is defined as presence of an keratinizing squamous epithelium in the middle ear spaces that can aggressively expand and destroy the ossicular chain and other surrounding structures. Among the spectrum of extracranial complications, LF is one of the most common complications. It represents an erosive loss of the endochondral bone overlying the membranous labyrinth. This loss of bone allows movements caused by external pressure or mass induced motion to reach the underlying endosteum and perilymph and thus be transmitted to the endolymph-filled part of the inner ear causing vestibular and sometimes auditory symptoms.

The causes of cholesteatoma-related labyrinthine fistula are still poorly understood. Cholesteatoma growth pattern, age of the patient and time of the disease are possible factors that influence the site of bone erosion and aggressiveness of the disease, which may lead to development of LF.

The incidence of LF in middle ear cholesteatoma varies from 4 to 15%. About 50–80% of cases of LF occur with vertigo, along with the other symptoms of chronic otitis media like ear discharge and hearing loss. According to the literature, a positive fistula sign presents in around 9–55% of LF cases[4,5].

Clasiffications:

1) ***Modified intraoperative classification of Dornhoffer and Milewski*** – depending on the degree of destruction of the bony and membranous labyrinth, established intraoperatively (Fig. 1)[6].

- Type I Perilymphatic membrane covered with bone;
- Type II Perilymphatic membrane exposed.
- Type III Perilymphatic membrane eroded onto organs or cholesteatoma inside the labyrinth.

2) ***Sanna's classification – depends on the size of the fistula*** (Fig. 2)
   – small fistulas (0.5–1 mm)
   – medium (1–2 mm)
   – large fistulas (>2 mm).

Labyrinthine fistula, particularly in cases of lateral semicircular labyrinthine fistula, may not be associated with any specific symptoms before surgery. However, the surgeon must be prepared to deal with this type of complication in any case of chronic otitis media, so preoperative detection of LF is of great importance. The length of symptoms may heighten suspicion. The preoperative clinical signs and symptoms, examination of the auditory and vestibular system and imaging findings are crucial for the diagnosis. In most cases high- resolution computed tomography (HRCT) of the temporal bone can detect the presence of LF. Although CT is the most reliable preoperative method, the final diagnosis can only be made intraoperatively.

The primary goal in the surgical management of chronic otitis media with cholesteatoma is the complete removal of squamous epithelium from the middle ear spaces, closure of the fistula and the creation of a dry and safe ear.

Case Report

A. A 53 year old patient who came for the first time into the ENT department of UMHAT "St. George" Plovdiv on 16.02.2018 complaining of:

1. Frequent medial otitis in childhood.
2. Hearing loss of the right ear with unclear moment of emergency in the past / no previous hearing tests /, it was worsening during the last 2–3 weeks subjectively
3. Periods of purulent secretion flowing out of the right ear with a unpleasant odor, which during the last few days become bloody-purulent and more abundant.
4. Ringing in the right ear started 2 months ago or more.
5. Dizziness, nausea and loss of balance started 2–3 weeks before.

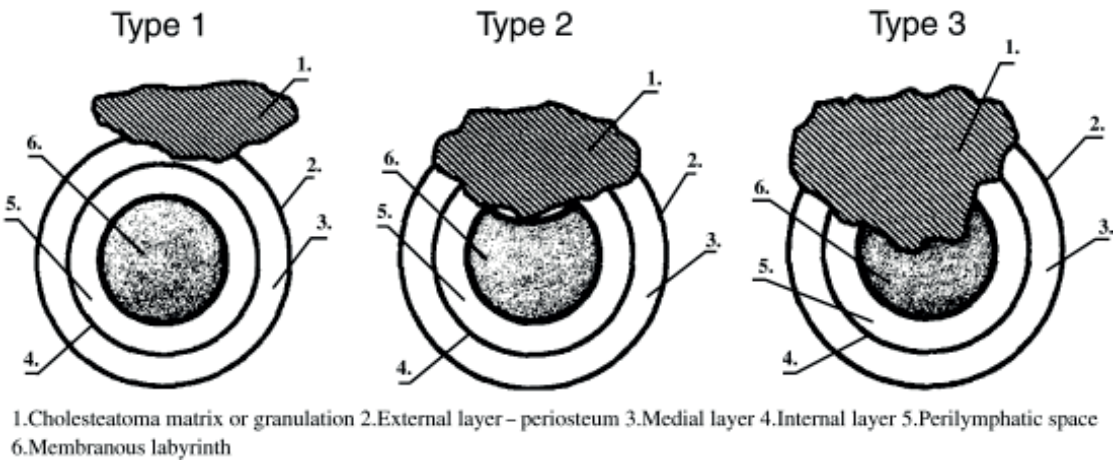


Fig. 1. Modified intraoperative classification of Dornhoffer and Milewski

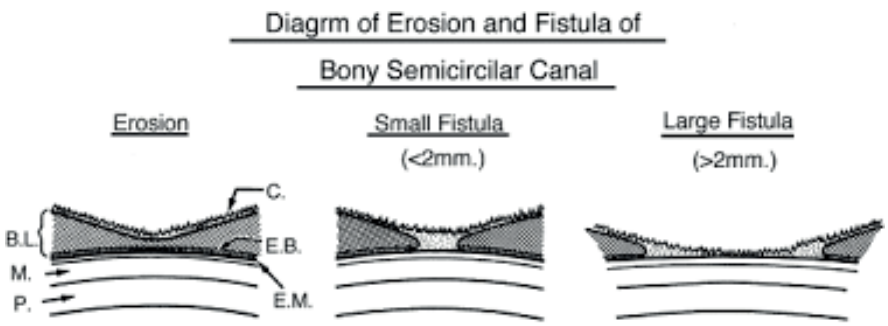


Fig. 2. Sanna's classification

No anamnesis for concomitant diseases.

Local staus – severely narrowed and hyperemic right external auditory canal, filled with abundant purulent secretions with an unpleasant odor; presence of exophytic soft tissue formation with macroscopic character of polyp emerging from the posterior-superior part of the external auditory canal; shaped old peripheral perforation in the upper-posterior quadrant of the right tympanic membrane, through which granulation tissue also prolapses.

Tests: Bloog tests – normal; Audiometric assessment of the hearing showed conductive hearing loss for the right ear and socially adequate hearing for the left ear (Fig. 3).

Imaging tests: CT without contrast– osteosclerotic altered cellular system of the right mastoid process; calcifications in the area of the right external auditory canal (Fig. 4).

Radical trepanation was performed Извършена е радикална трепанация, in which the antrum appears to be filled with an abundant amount of granulation tissue. The ossucular chain was found with impaired integrity, the hammer ant incus were involved in the inflammatory process and were removed. In the area of the second bend of the facial nerve we came across heavily bleeding granulation tissues, after their removal we found a segment where the bony wall of the facial nerve canal was missing. In the area of the upper tympanic cavity wall and the antrum dura mater were reached. There we came across an extradural abscess from which purulent secretions are drained. Canaloplasty of the external auditory canal was performed, tamponade was put into the canal and compression bandage was made. A transient facial nerve paresis on the right side was found during the postoperative period. The patient was discharged on the 14th day after surgery with home therapy, instructions for behavior and continuing neuroprotective treatment. The material sent for histological examination was interpreted as „Chronic productive inflammatory process and granulation tissue“

B. In 2020 after two years period without control examinations, the patient entered again the ENT clinic with complains similar to those from the first hospitalization:

1. Hearing loss of the right ear;
2. Dizziness which is getting worse wen moving the head;
3. Subjective high frequency noise.

Local status: Condition after radical trepanation; severely narrowed right external auditory canal, operative cavity filled with granulation tissue; remnant of the tympanic membrane retracted to the medial wall of the tympanic cavity; scarce amount of purulent secretion with a foul odor; fistula symptom presence – aggravation of vestibular symptoms with changes in pressure into the external auditory canal.

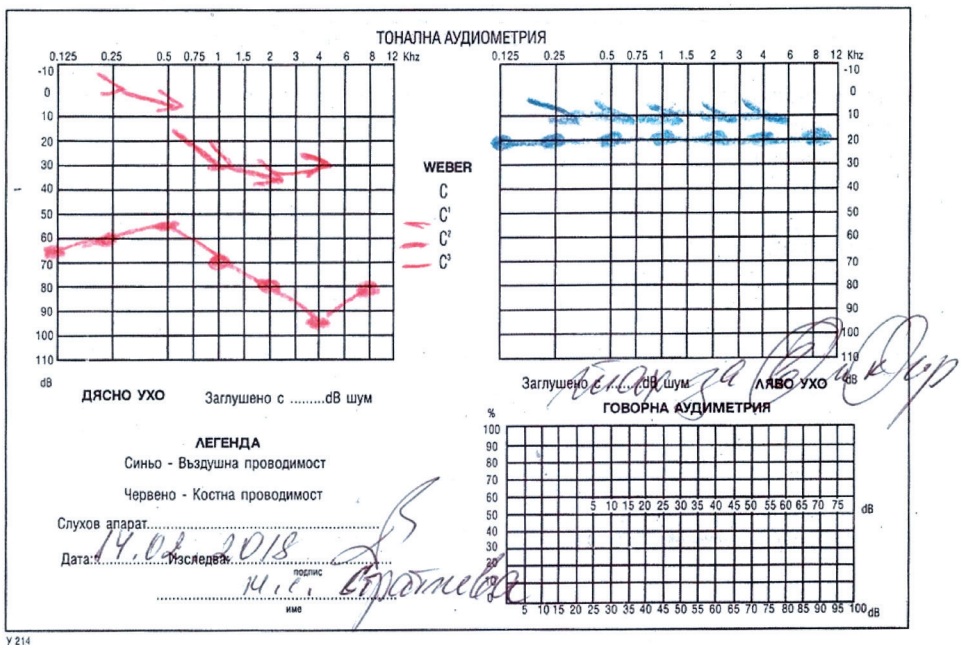


Fig. 3. Preoperative hearing test of the patient.

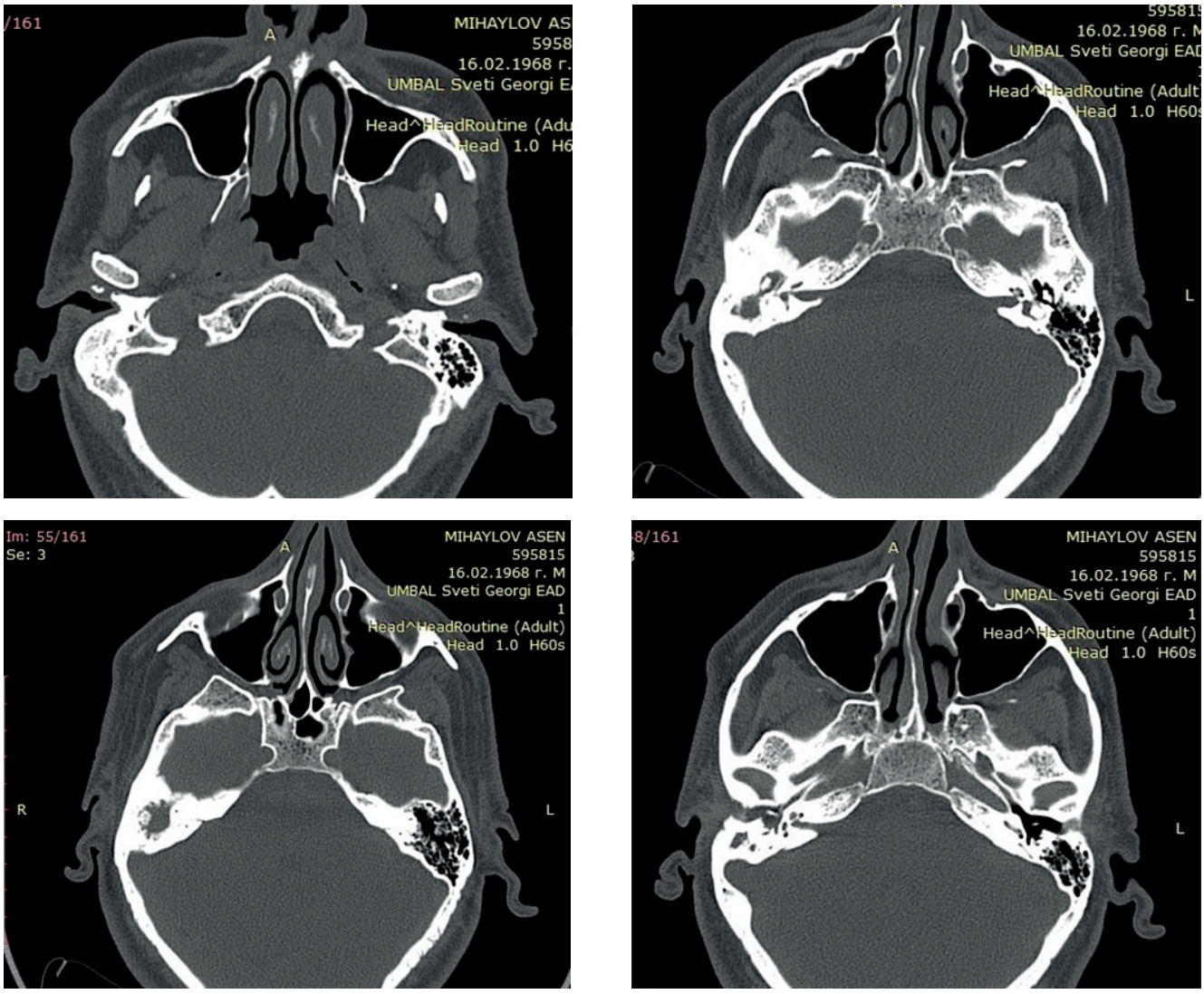


Fig. 4. Preoperative CT images of the patient.

Tests: Bloog tests – normal; Audiometric assessment of the hearing – conductive hearing loss for the right ear and socially adequate hearing for the left ear (Fig. 5).

A decision for surgery was made. Using retroauricular incision the operating cavity was reached, which presented as cariously altered and filled with granulation tissue; we came across a cholesteatoma mass located outside the cavity from the first surgical intervention, it was completely removed. The remnants of the retracted tympanic membrane were removed also. Suture and dressing of the operative wound.

Smooth postoperative period until tamponade removal. After its removal the patient developed a clinic of severe vestibular crisis:

1. Dizziness towards the operated ear;
2. Inability to stand up and walk;
3. No vegetative symptoms.

Bony defect was found by otoscopy in the area of the lateral semicircular canal, with spontaneous small perilymph leakage from it. When using a delicate aspiration in the area of the defect, there was an immediate violent vestibular response. The audiometry showed a combined hearing loss for the right ear and socially adequate hearing for the left (Fig. 6).

Imaging tests (Brain CT scan with reconstruction of the pyramids)**:** Condition after reoperation of the right temporal bone – radical trepanation; part of the lateral semicircular canal wall was missing; the canal was in a direct communication with the external auditory canal; aerial collection in the vestibule (Fig. 7 and 8).

Fourteen days after the cholesteatoma removal, due to persistence of the patient‘s complaints, third surgery was performed. The fistula opening was filled

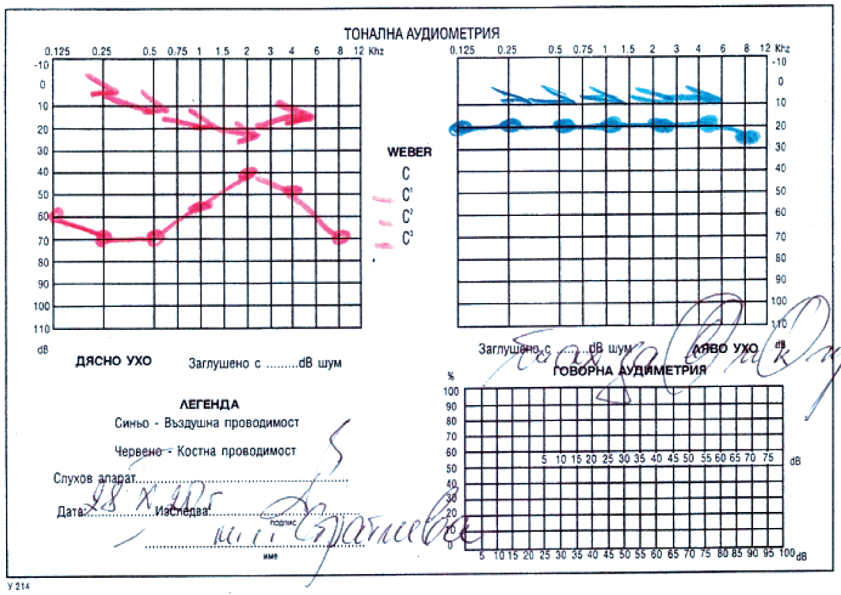


Fig. 5. Preoperative audiometry 2020 year.

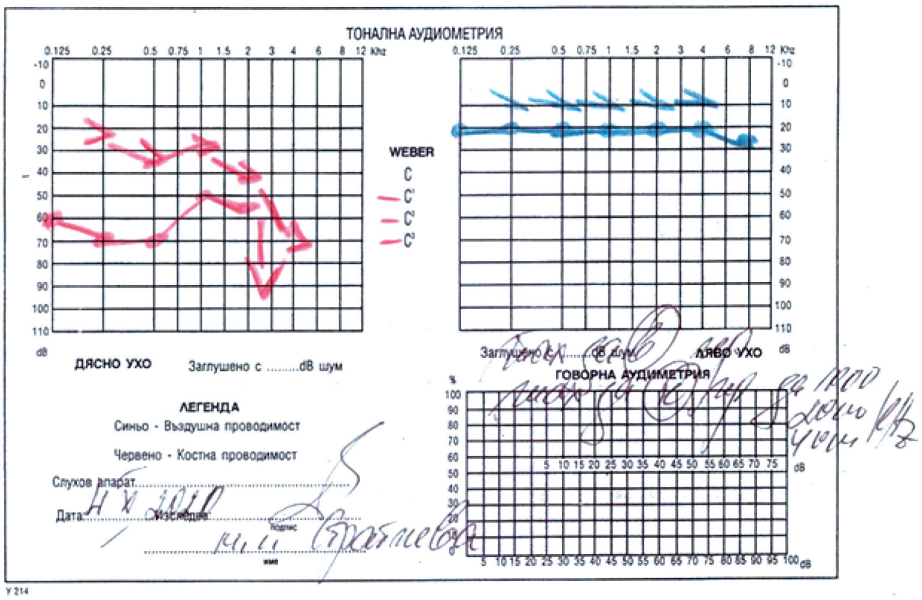
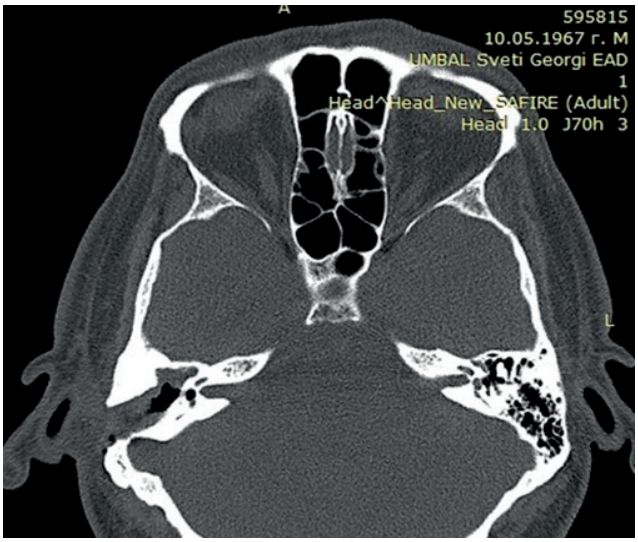


Fig. 6. Postoperative audiometry of the patient 2020 year.



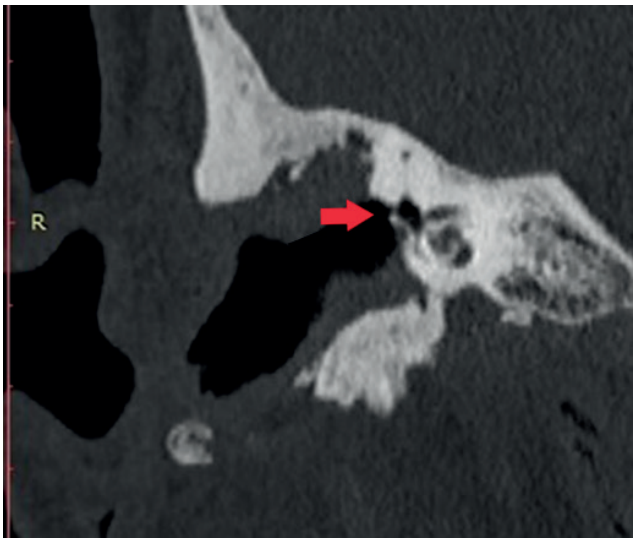


Fig. 7 and 8. CT image of the right lateral semicircular canal fistula.

with bone meal harvested from the external bony layer of the mastoid process and was covered with fascia from the temporal muscle. The defect was additionally sealed with fabric glue. In order to protect the tympanic cavity, tympanoplasty with cartilage was made. Tamponade, the operative wound was sutured in layers (Fig. 9, 10, 11, 12, 13 and 14).

Postoperative follow-up

Smooth postoperative period with gradual disappearance of the vestibular symptoms. The patient was discharged on the tenth postoperative day and returned to work on the 40th postoperative day. Follow-up of the patient's right ear condition showed full achievement of the goals of the surgical intervention– plastical closure of the fistula opening of the lateral semicircular canal and stopping the course of chronic inflammation of the middle ear. (Fig15 and 16).

The audiometry at the 40th postoperative day showed severe hearing loss for the surgically treated ear.

The audiometry at the 10th postoperative month was without any change from the previous one (Fig. 17).

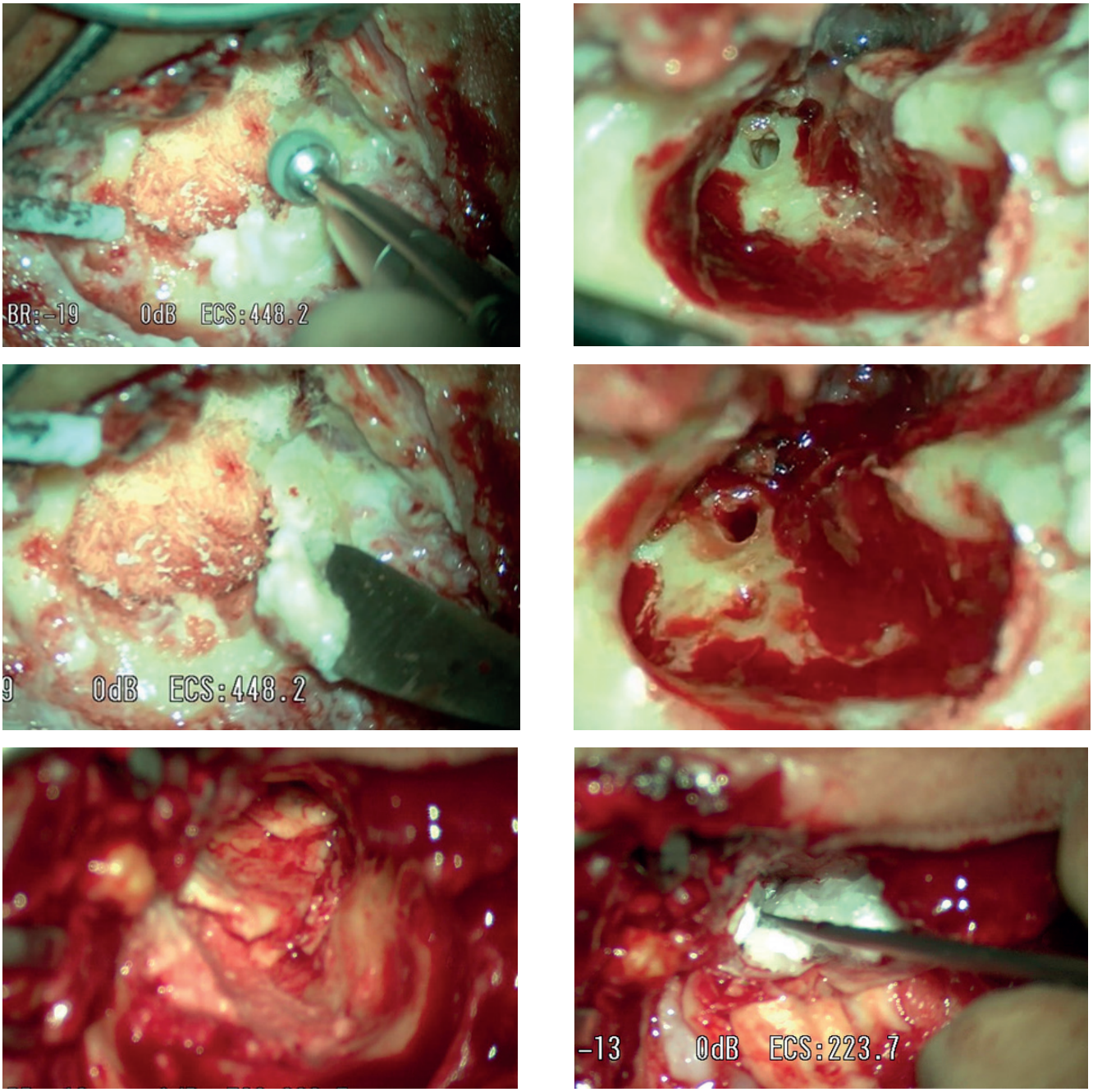


Fig. 9, 10, 11, 12, 13 and 14. Steps in the operative closure of the fistula of the lateral semicircular canal.

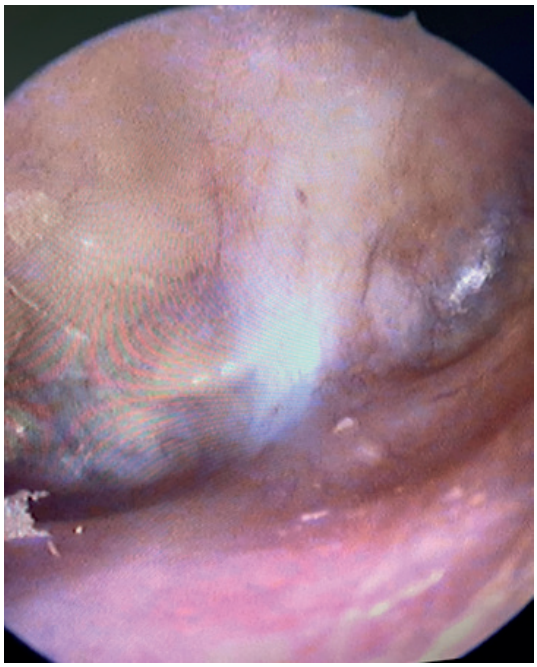


Fig. 15 and 16. Otoscopic findings 10 months the closure of the lateral semicircular canal fistula.

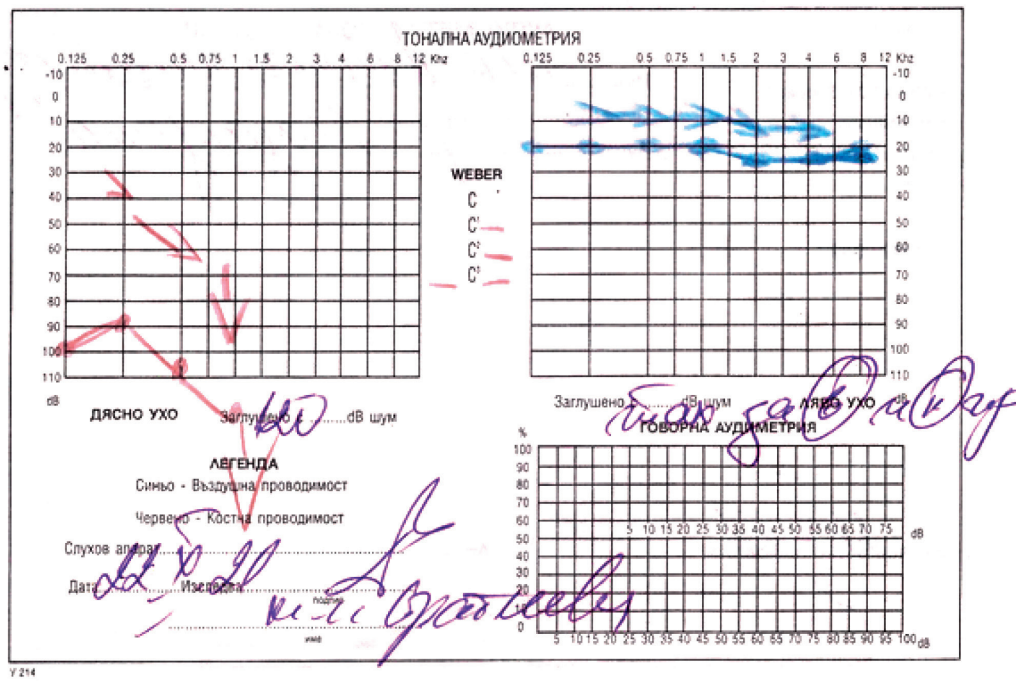


Fig. 17. Patient`s hearing test 10 months after the plastic restoration of the integrity of the lateral semicircular canal.

Conclusions

In patients with chronic otitis media with cholesteatoma, the labyrinth fistula is not often diagnosed preoperatively. On the other hand, in some of those cases it is very difficult the hearing to be preserved, especially when in its development the cholesteatoma has affected the endosteum of the labyrinth or has involved the membranous labyrinth, that is why the removal of the cholesteatoma matrix from the area of the labyrinth fistula must be left as late as possible in the course of the operative intervention and must be supported by intravenous application of glucocorticosteroids. The surgeon must be prepared to deal with that complication in order to preserve the function of the labyrinth and the cochlea!

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