

## Main Articles

# Long-term observation after soft posterior meatal wall reconstruction in ears with cholesteatoma

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### Abstract

We performed tympanoplasty with reconstruction of the soft posterior meatal wall for the prevention of post-operative retraction pocket formation. Our method is characterized by the reconstruction of the soft posterior meatal wall, non-obliteration with permanent or temporary materials, including Gelfoam, no use of a Palva flap and the use of fibrin glue for attaching the fascia to the posterior meatal skin. None of the patients experienced post-operative narrow-neck retraction pocket formation, and whenever aeration of the middle ear was disturbed, a balloon-like retraction was observed. Not all the posterior meatal walls retracted. The final position of the posterior meatal wall varied among the subjects. No serious cavity or hearing problems have occurred since surgery. Due to the strong possibility of post-operative retraction pocket formation in cases with a large balloon-like retraction, we rejected adopting the canal wall up technique or hard posterior meatal wall reconstruction.

**Key words:** Cholesteatoma; Tympanoplasty

### Introduction

There is serious controversy pertaining to the choice between canal wall up and down tympanoplasty for ears with cholesteatoma (Jansen, 1985; Smyth, 1985; Sadé *et al.*, 1986; Sheehy, 1988). However, considering the risk of recurrence and procedural ease of the operative technique, the most advisable procedure for achieving complete removal of the cholesteatoma and control of inflammation is first to remove the posterior meatal wall and then to reconstruct the wall. This procedure helps to maintain a trouble-free cavity, and dry ears are attained within a short post-operative period. Techniques for posterior meatal wall reconstruction include the use of cartilage (McCleve, 1969; Smyth and Dome, 1971), the external auditory meatus bone (Smith, 1970), the mastoid bone (Marquet, 1976), and mastoid bone paté (Pulec, 1976; Palva and Ramsey, 1993). In the past, hard materials were mainly used for the fortification of the posterior meatal wall. However, a tendency for retraction to occur still exists.

There are a few reports of soft posterior wall reconstruction, but no report of tympanoplasty with soft wall reconstruction to prevent post-surgical retraction pocket formation before our short report (Hosoi and Murata, 1992). Tos (1977) reported

myringo- and meatoplasty using a large piece of fascia with obliteration by pedicled muscle flaps, which was considered to be a soft posterior meatal wall reconstruction. He did, however, use a Palva flap to fortify the auditory meatus. Although Smith *et al.* (1986) reported reconstruction using a Palva flap and a large piece of fascia, totally obliterating the middle ear and mastoid cavity with Gelfoam, their purpose was not to prevent post-operative retraction pocket formation, but to simplify reconstruction. Therefore, patients who manifested aggressive cholesteatoma were not considered for soft-wall reconstruction. We changed our way of thinking and tried to make a soft posterior meatal wall without the aim of fortification but with the aim of preventing post-operative retraction pocket formation, as this can be a cause of recurrence of cholesteatoma (Hosoi and Murata, 1992, 1994). With our technique, instead of retraction pocket formation, a balloon-like retraction may occur on the soft posterior meatal wall when there is aeration disturbance of the middle ear. The purpose of this study was to assess the effectiveness of our surgical method for the prevention of retraction pocket formation and to study long-term post-operative results pertaining to reconstructed soft posterior meatal wall.

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**Surgical procedures**

*Eradication of the lesion*

First, the skin and periosteum of the auditory meatus are elevated from the posterior bony wall. Then the posterior bony wall is removed. The lesion in the middle ear and mastoid antrum is then eradicated. A functional sound conduction mechanism is reconstructed according to conditions with each case.

*Reconstruction of the posterior meatal wall*

Instead of placing the incision on the posterior meatal skin and retracting the incised skin to cover the bony facial ridge, every effort is made to leave the posterior meatal skin as intact as possible in order to preserve the original cylindrical shape of the external auditory canal. Myringoplasty is performed using one end of the fascia sheet, and the posterior wall is reconstructed by gluing the other end of the fascia sheet to the reverse side of the peeled-off posterior meatal wall skin with fibrin adhesive (Figure 1) (Hosoi and Murata, 1992, 1994).

**Subjects and methods**

Fifty-seven patients with unilateral cholesteatoma were treated using this method of tympanoplasty between October 1989 and August 1995 at Kinki University Hospital. Of these, 45 could be observed post-operatively until August 1997 and are the subjects of this paper. In these patients, the post-operative follow-up ranged from two years to seven years and 10 months. Eight patients were observed from two to three years, six from three to four years, 12 from four to five years, and 19 for more than five

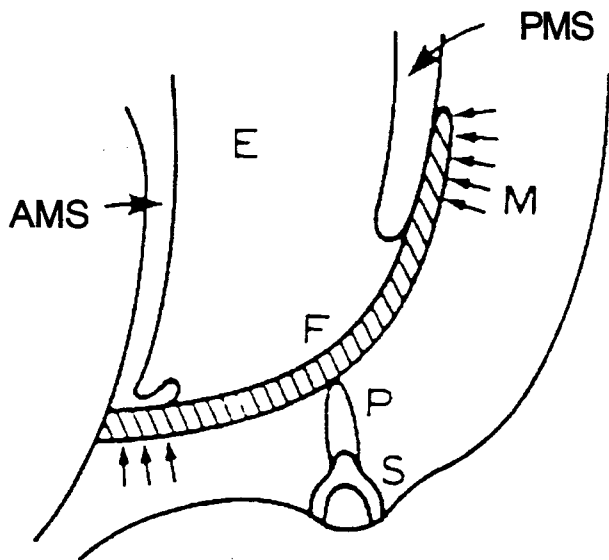
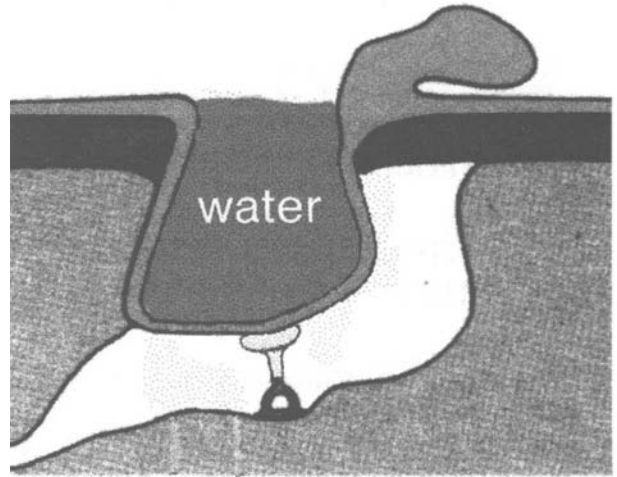


FIG. 1

Schematic representation of surgical procedure of reconstruction of functional conduction mechanism and posterior meatal wall with fascia. AMS: Anterior meatal skin, PMS: Posterior meatal skin, E: External acoustic meatus, M: Mastoidectomy cavity, P: Prosthesis, S: Stapes, F: Fascia, ← Fibrin glue.



Post-operative balloon-like retraction

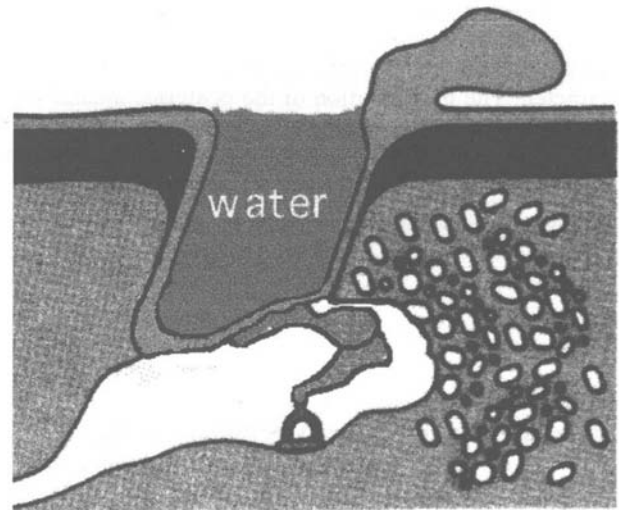


FIG. 2

Schema for explaining the method of calculating the ratio of the volume of the post-operative external auditory canal and canal of the normal side. Volume is measured by pouring water into the external auditory canal.

years. Observation was to determine whether or not the post-operative retractions in narrow-neck pockets occurred and what kind of changes occurred on the reconstructed soft posterior meatal wall.

Since we could anticipate that a balloon-like retraction would occur in some patients, the degree of retraction on the soft posterior meatal wall in each case was investigated by calculating the ratio of the volume of the post-operative external auditory canal and the canal on the normal side. The volume was measured by pouring water into the external auditory canal (Figure 2) serially (once a month in the first post-operative year, once every two months in the second year, once every three months in the third year, and so forth) to monitor the dynamics of retraction formation. Before adopting the method of using the canal on the normal side for comparison,

we measured the volumes of the external auditory canals on both sides in 10 subjects with normal ears as a preliminary investigation to study equality in volume for each subject.

**Results**

No patient had recurrent otorrhea, and only one patient had a residual perforation. This latter patient is not included in this report because follow-up did not extend until August 1997. None of the patients manifested retraction pocket formation, and whenever changes occurred on the soft posterior meatal wall, a balloon-like retraction was observed (Figure 3). Preliminary investigation of equality in volume of both external auditory canals showed that the ratio of the volume of the bigger ear to the other ear ranged from 1.0 to 1.07. Since differences in such

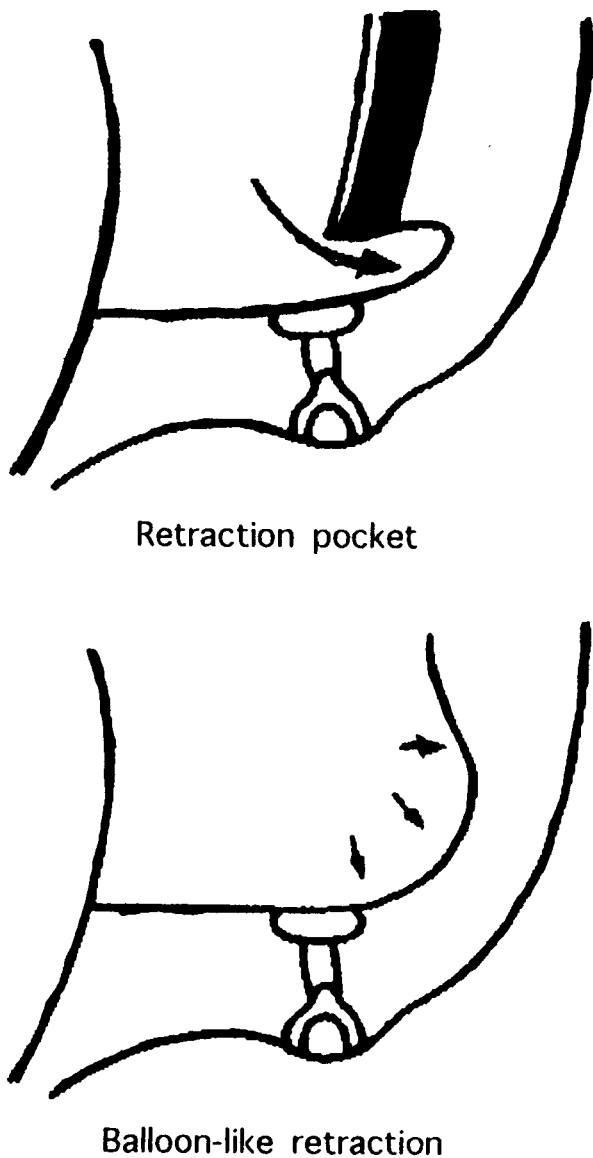


FIG. 3

Post-operative retraction due to disturbance of aeration. The upper figure shows the posterior meatal wall reconstructed with a hard plate, and the lower figure shows reconstruction with soft material.

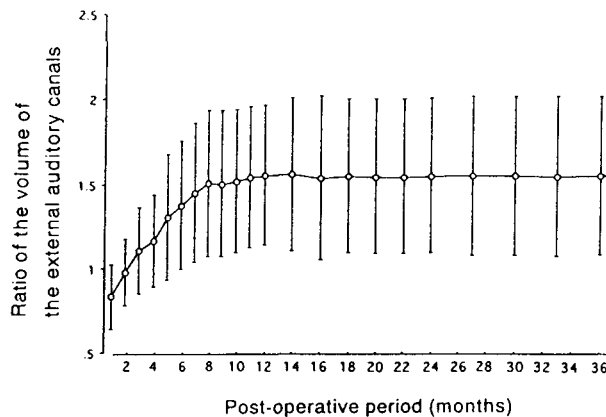


FIG. 4

The relationship between the post-operative period and the degree of retraction of the posterior meatal wall. Circles indicate the average ratio of the volume of the external auditory canals and bars indicate standard deviation for the respective post-operative period.

volumes between the ears of each subject were small and all changes on the soft wall were balloon-like retractions, we assumed that we could measure the degree of retraction using the above-mentioned method. Regardless of the degree of the balloon-like retraction, none of the patients experienced post-operative cavity problems.

Figure 4 shows the relationship between the post-operative period and the average ratio of the volume of the post-operative external auditory canal and the canal on the normal side. Judging from the change in the ratio of the volume over time, retraction of the posterior meatal wall appears to occur mainly within one year of surgery.

Figure 5 shows the relationship between the degree of retraction of the posterior meatal wall at the final observation of each patient and the number of ears affected. Regarding the X axis, the larger the ratio of volume, the larger the degree of retraction. No retraction of the posterior meatal wall means that the ratio of the volume is 1.0. The soft posterior meatal wall was maintained at a normal position in five ears in which the ratio of the volume was 1.0. The remaining ears had various degrees of balloon-like retraction. However, in the majority of these cases, the degree of retraction was within the ratio of 2.0.

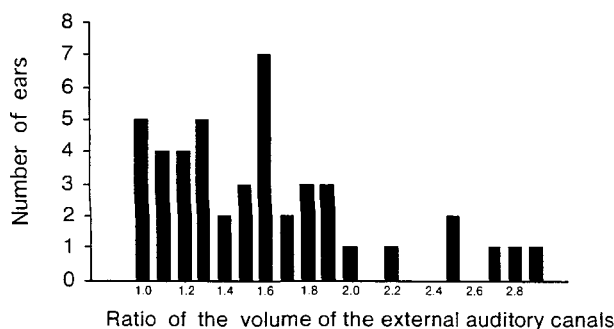


FIG. 5

Number of ears and degree of retraction of the posterior meatal wall at the final observation.

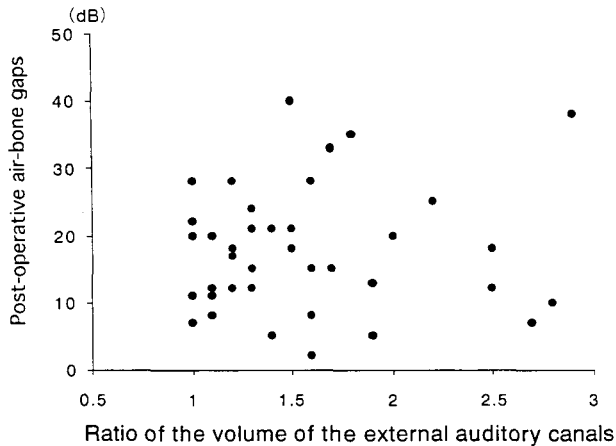


FIG. 6

The relationship between the degree of retraction and post-operative air-bone gaps.

In Figure 6, the relationship between the degree of retraction and post-operative air-bone gaps was studied to ascertain whether the retraction affected post-operative hearing. The sample correlation between the ratio of the volume of the external auditory canals and post-operative air-bone gaps was 0.004, which was not considered to be significant.

### Discussion

Our surgical techniques have some unique characteristics: non-oblation with permanent or temporary materials (including Gelfoam), the Palva flap is not used and fibrin glue is used to attach the fascia to the posterior meatal skin. In the past many otolaryngologists used obliteration techniques, a Palva flap or hard posterior meatal walls. Since our aim was not to resist the negative pressure in the middle ear, we avoided the use of these materials and methods. In comparison to the mastoid obliteration technique, this method also has advantages in other areas. Mastoid obliteration is difficult in patients with intracranial complications and metabolic disorders, such as diabetes mellitus. In addition to a wider range of applications, our method allows for easier exposure of residual cholesteatoma, and dry ears can be obtained in a shorter post-operative period (Hosoi and Murata, 1994).

Considering the dynamics of balloon-like retraction formation as shown in Figure 4, retraction of the soft posterior meatal wall appears to occur mainly within one year of surgery. Hence, we believe that the final position of the reconstructed soft posterior meatal wall is controlled mainly by the degree of post-operative negative pressure in the middle ear in each individual case within a year, although the volume change in the operated external auditory canal may be related to surgical scarring.

Considering that the posterior meatal wall reached the final position within one year after surgery, the results shown in Figure 5 can be regarded as the degree of retraction in the final stage in each subject because the result was obtained at least 24 months

after surgery. Because the degree of retraction ranged between 1.0 and 2.9 (Figure 5), we can conclude that not all the posterior meatal walls retracted and that the final position varied among the subjects, due to the degree of aeration disturbance. More importantly, there was a large retraction of the posterior meatal wall in some patients. It should be noted that such a large negative pressure would easily cause a retraction pocket with either canal wall up tympanoplasty or the hard posterior wall reconstruction method. Therefore, adopting either of these methods would not be advisable.

In considering this method, many otolaryngologists may worry about the effect on post-operative hearing, particularly in ears with large post-operative retraction of the posterior meatal wall. However, there was no significant correlation between the degree of the retraction and post-operative air-bone gaps. Hence, we concluded that the post-operative balloon-like retraction did not necessarily have a detrimental effect on post-operative hearing.

### Conclusions

When we constructed a soft posterior meatal wall, a balloon-like retraction occurred instead of retraction pocket formation. The balloon-like retraction is not a disadvantage, because the soft posterior meatal wall can automatically assume the best position, which will be determined by the degree of post-operative negative pressure in the middle ear in each patient. In addition, we found no hearing problem caused by balloon-like retraction on the soft posterior meatal wall.

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