

## Closed tympanoplasty in middle ear cholesteatoma surgery

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**Key words:** cholesteatoma, ear surgery, tympanoplasty, mastoidectomy.

**Summary.** *Objective.* To determine the effect of closed tympanoplasty surgery for middle ear cholesteatoma and to compare the postoperative results with the outcomes of canal-wall-down mastoidectomy.

*Methods.* Seventy patients with middle ear cholesteatoma were involved in the study. Pneumotoscopy, pure-tone audiometry, anamnestic and clinical data were evaluated before the surgery. Modified radical mastoidectomy was performed for 31 patients. Thirty-nine patients were treated with closed tympanoplasty surgery, including intact canal wall mastoidectomy, endaural atticotomy, lateral attic and aditus wall reconstruction and tympanoplasty. The follow-up examination was carried out 12 months after the surgery. The recurrence of cholesteatoma, otorrhea and hearing level were evaluated postoperatively.

*Results.* Otorrhea was estimated in 4 cases (10.3%) after closed tympanoplasty surgery and in 6 cases (19.4%) after modified radical mastoidectomy. Among the patients who were operated using closed tympanoplasty technique the middle ear cholesteatoma recurrence rate was 12.8% and among those, who underwent modified radical mastoidectomy recurrent disease occurred in 9.7% of the cases. The hearing improvement was found in 15 cases (38.46%) after closed tympanoplasty, while there was no hearing improvement after modified radical mastoidectomy.

*Conclusions.* We conclude that despite the fact, that cholesteatoma recurrence rate after closed tympanoplasty is relatively high, this surgical method permits to preserve adequate hearing level and releases from postoperative cavity care problems as compared with modified radical mastoidectomy.

### Introduction

The surgical treatment in the management of the middle ear cholesteatoma has been the matter under debate for years (1, 2). Various surgical techniques have been advocated to treat aural cholesteatoma, but the controversy over open or closed procedures for cholesteatoma surgery is still far from resolution (3, 4). The problem in middle ear cholesteatoma surgery is recurrence of cholesteatoma, which is reported to vary from 5% to 71% (5–10). Beside the eradication of disease and prevention of future cholesteatoma development, the surgical procedures for middle ear cholesteatoma are designed to attain some other general goals – to achieve a dry ear free from otorrhea and to stabilize or improve hearing (11, 12). Though the preference to gain these points is attributed to closed cavity techniques, the open cavity surgical procedures are not consummately rejected.

The present study was carried out to determine the effect of closed tympanoplasty surgery for middle ear cholesteatoma and to compare the postoperative results with canal-wall-down mastoidectomy outcomes,

considering the recurrence of cholesteatoma, otorrhea and hearing level.

### Material and methods

The study was carried out at the Department of Otorhinolaryngology of Vilnius University Hospital Santariškių klinikos in 1999–2002. A total of 70 patients (70 ears) with middle ear cholesteatoma were involved in the study. The patients ranged in age from 12 to 56 years, with the mean of  $37.1 \pm 12.4$  years. There were 29 male patients and 41 female patients, with male to female ratio 1:1.4. Pneumo-otoscopy, pure-tone audiometry, computer tomography were performed before the surgery. The anamnestic and clinical data were evaluated by the proposed questionnaire. According to the intra-operative findings, cholesteatoma was divided into 4 groups: cholesteatoma of sinus tympani, of attic, antrum and mastoid cells and extended cholesteatoma that pervaded more than two regions.

Closed tympanoplasty was performed to 39 patients (39 ears). All the ears were operated on through

the retroauricular incision. This surgical technique included intact canal wall mastoidectomy (canal-wall-up mastoidectomy), endaural atticotomy, lateral attic and aditus wall reconstruction and tympanoplasty. *M. temporalis* fascia, tragal or conchal perichondrium and cartilage were used as tympanic membrane grafting materials. The lateral attic and aditus wall reconstruction (scutumplasty) was accomplished with tragal or conchal cartilage. When ossicular reconstruction was indicated, one-stage surgery using modified autologous ossicular transplants was performed.

In the cases of technically limited possibility to perform closed tympanoplasty, the surgical method of modified radical mastoidectomy was chosen. Thirty-one patients (31 ears) were treated with that technique, which involved the removal of posterior canal wall (canal-wall-down mastoidectomy) and preservation of tympanic membrane.

The follow-up examination was carried out 12 months after the surgery. The status of tympanic membrane, otorrhea, recurrence of cholesteatoma and the air-bone gap on pure-tone audiometry were evaluated post-operatively. The depression of air-bone gap 25 or less dB on the pure-tone audiogram was estimated as hearing improvement.

The reliability of data difference was statistically analyzed with application of Student's t-test. The initial significance level of  $p \leq 0.05$  was chosen.

### Results

Closed tympanoplasty was performed to 55.71%, modified radical mastoidectomy – to 44.29% of the cases. The cholesteatoma predominantly pervaded more than two regions and was estimated as extended. In 20 cases cholesteatoma was identified in attic and the other localizations were less frequent.

Modified radical mastoidectomy was more often

performed in the case of sinus tympani and extended cholesteatoma, while closed tympanoplasty was more beneficial in the case of localization in attic (Fig. 1).

No intraoperative complications occurred neither during closed tympanoplasty nor during modified radical mastoidectomy surgery. The average duration of stay in the hospital after modified radical mastoidectomy was  $11.5 \pm 1.5$  days and  $7.2 \pm 0.2$  days after closed tympanoplasty surgery.

12 months postoperatively the intact tympanic membrane was estimated to 33 patients (84.6%) and the tympanic membrane perforation without any evidence of inflammation was diagnosed to 2 patients (5.1%), who underwent closed tympanoplasty surgery. The depression of air-bone gap 25 or less dB on the pure-tone audiogram was measured to 15 cases (38.46%) after closed tympanoplasty while there was no hearing improvement after modified radical mastoidectomy. The postoperative results of otorrhea rate, hearing level and cholesteatoma recurrence are shown in Fig. 2.

### Discussion

Surgical management of cholesteatoma remains controversial, with the main argument centering on the surgical handling of the posterior canal wall. Before the 1950s, the only surgery that was popularly recommended and used for middle ear cholesteatoma was radical or modified radical mastoidectomy, resulting in open cavities with their attendant problems – recurrent ear infections, necessity for periodic lifelong medical attention for cavity clearance, restrictions on social activity (13, 14). Canal-wall-up procedures preserve the normal anatomy of the ear canal, thus eliminating the cavity problems. The healing time is reduced and considering the reserved possibility of reconstructive hearing improvement during the second

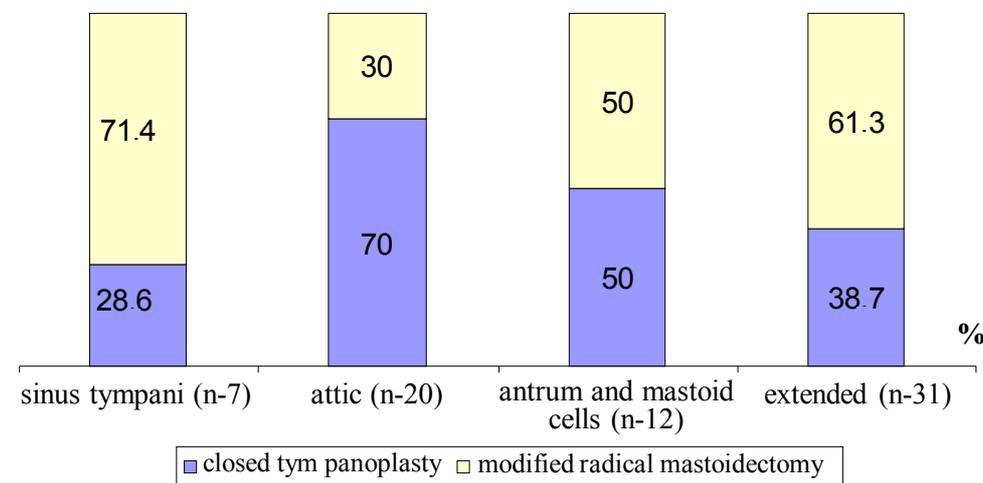
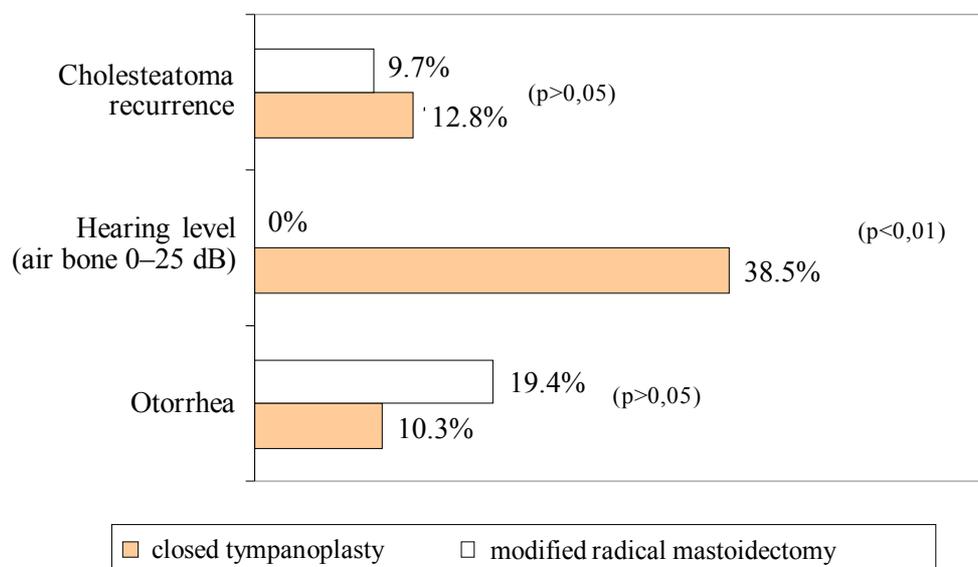


Fig. 1. Surgical technique reliant on the localization of cholesteatoma



**Fig. 2. The rate of cholesteatoma recurrence, hearing level and otorrhea 12 months post-operatively**

stage surgery, the hearing results are better (15).

The arguments used by supporters of the open-cavity procedure are based on the assurance that there is a higher incidence of recurrent cholesteatoma after closed procedures (16). Preserving the canal wall limits surgical exposure of the epitympanum and posterior mesotympanum, thus making interference to remove entire cholesteatoma, leading to high residual rates (17). The results, presented by different authors respecting the cholesteatoma recurrence rate, are diverse. The incidence of recurrent cholesteatoma is reported to range from 5% to as much as 71% (5–10, 17). This great disparity may be due to different methods of estimating recurrence rates, surgical technique, and length of the postoperative observation period (5). Our results reveal, that 12 months postoperatively the cholesteatoma recurrence rate was marginally higher after closed tympanoplasty (12.8%) than after modified radical mastoidectomy surgery (9.7%).

One of the merits of closed tympanoplasty surgery is a high dry ear rate. Our investigation revealed that the otorrhea rate after canal-wall-up procedures was lower than after canal-wall-down procedures and the dry ear rate was assessed to be 89.7% after closed tympanoplasty surgery. The supporters of canal-wall-down procedure predicate that the otorrhea rate can be reduced and suggest to avoid recurrent discharge from open cavities by surgically lowering the facial ridge and by creating a wide external ear canal and external meatus (2). Ch. Chang and al (2000) in their study present the dry ear rate after canal-wall-down procedure to be 90.4% (2).

The possibility to preserve or to improve hearing is referred to be the particular point of canal-wall-up

procedures (3, 12, 14). Our results show, that 12 months postoperatively the air–bone gap on pure tone audiogram was less than 25 dB in 38.46% cases after closed tympanoplasty, while there was no hearing improvement after modified radical mastoidectomy. The opponents of open techniques make the argument, that the non-physiological conditions that exist after the creation of an open mastoid cavity influence the worse hearing results. Others present, that the hearing results depend on the availability of the stapes superstructure for reconstruction of the sound transformer mechanism (2), but the expectancy of reconstructive hearing improvement is limited after canal-wall-down procedures. According to the works, presented by some authors, canal-wall-up technique is also effective in surgery for children cholesteatoma (3, 18, 19). V. Darrouzet et al (2000) reported that mean speech reception threshold among children who underwent closed technique was 26.7 dB. (18). E. E. Dodson et al (1998) revealed, that 75% of patients under 19 years, who underwent canal-wall-up procedure, presented a speech reception threshold of less than 30 dB (19).

### Conclusions

1. The utmost difficulties to perform closed tympanoplasty surgery occur in the case of extended or sinus tympani cholesteatoma.
2. Based on our findings we conclude, that closed tympanoplasty surgery is as much effective as modified radical mastoidectomy in consideration of postoperative otorrhea and cholesteatoma recurrence rate.
3. If technically acceptable, closed tympanoplasty surgery is preferred, as it permits to preserve adequate hearing level and releases from post-operative cavity problems.

## Antrotomija su timpanoplastika gydant vidurinės ausies cholesteatomą

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**Raktažodžiai:** cholesteatoma, ausies chirurgija, timpanoplastika, mastoidektomija.

**Santrauka.** Darbo tikslas. Įvertinti antrotomijos su timpanoplastika efektyvumą, operuojant vidurinės ausies cholesteatomą, ir palyginti šio chirurginio metodo pooperacinius rezultatus su tausojančios radikalios ausies operacijos.

**Metodai.** Ištirta 70 ligonių, operuotų dėl vidurinės ausies cholesteatomos. 31 ligoniui padaryta tausojanti radikali mastoidektomija, 39 ligoniams – antrotomija su timpanoplastika. Prieš operaciją išanalizuota anamnezė, ligonio skundai, pneumootoskopijos bei toninės ribinės audiometrijos duomenys. Pooperacinė būklė vertinta praėjus 12 mėnesių po operacijos.

**Rezultatai.** Po antrotomijos su timpanoplastika sekrecija iš ausies nustatyta keturiems ligoniams (10,3 proc.), klausa pagerėjo 15 ligonių (38,46 proc.), vidurinės ausies cholesteatomos atsinaujinimas konstatuotas 12,8 proc. Tiems ligoniams buvo padaryta tausojanti radikali ausies operacija, iš ausies pūliavo šešiams pacientams (19,4 proc.), cholesteatomos atsinaujinimas konstatuotas 9,7 proc., o klausos pagerėjimo nenustatyta nė vienam pacientui.

**Išvados.** Vidurinės ausies cholesteatomos atsinaujinimo dažnis po antrotomijos su timpanoplastika santykinai yra didelis, tačiau cholesteatomos chirurginio gydymo metodas leidžia išsaugoti arba net pagerinti klausą bei išvengti nepatogumų, susijusių su pooperacinio ruimo priežiūra, lyginant su tausojančios radikalios operacijos rezultatais.

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Received 10 June 2003, accepted 28 June 2004  
Straipsnis gautas 2003 06 10, priimtas 2004 06 28