

Main Article

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The effect of post-auricular canal wall down mastoidectomy on the position of the auricle

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Abstract

Objective. This study aimed to investigate the effect of surgical incision on the auricle position in patients undergoing canal wall down mastoidectomy to treat chronic otitis media.

Methods. Thirty-four patients who had undergone canal wall down mastoidectomy with a post-auricular incision approach were included in the study. Patients who had a previous auricle deformity, who underwent limited mastoidectomy surgery or mastoid obliteration, or who were younger than 18 years of age were excluded. The distances of the upper and middle parts of the auricle to the mastoid were measured.

Results. Measurements in the first post-operative year were found to be 13.15 ± 3.59 mm in the upper region and 16.29 ± 5.00 mm in the middle region. It was observed that the auricle was approaching the mastoid area in both regions.

Conclusion. In patients undergoing radical mastoidectomy, the distance between the auricle and the mastoid may decrease, leading to narrowing of the auriculo-cephalic angle.

Introduction

Canal wall down mastoidectomy is a successful and effective technique used to eliminate inflammatory lesions, especially in cases of chronic otitis media with cholesteatoma.¹

This technique has several advantages, such as providing the surgeon with a good visual field, reducing relapses and being easier to follow.² The disadvantages of this technique are that it requires a large cavity, is associated with prolonged epithelialisation, adversely affects hearing, and requires intensive ear cleaning for the rest of the patient's life because of accumulating secretions and the crust in the cavity.³

Although many complications of canal wall down mastoidectomy have been reported in the literature, reports on alterations in the auricle position are limited. Some patients have described their ears as looking asymmetrical or have complained they are not able to place their glasses in the same way.⁴

It is possible that canal wall down mastoidectomy may cause deformity in the long term, as this technique impairs the integrity of some structures that fix the auricle in position. It is also possible that the skin structures may collapse into the cavity formed behind the ear.

In this study, the distances of the upper and middle parts of the auricle to the mastoid region were measured pre- and post-operatively to determine whether canal wall down mastoidectomy caused a positional change of the ear over a long-term period.

Materials and methods

This study was carried out in the Department of Otorhinolaryngology, Samsun Health Practices and Research Center, Turkey, with the approval of the non-interventional clinical research ethics board (dated 30 October 2019, registered as 2019/1/4).

The study included 34 patients (14 males and 20 females) who had undergone canal wall down mastoidectomy via a post-auricular incision in our clinic. The average age of the patients was 34.15 years (range, 18–61 years). Twenty-one patients had the operation on the right ear, while 13 had the operation on the left ear. Patients aged over 18 years and who were being operated on for the first time to treat cholesteatoma were included in the study. Surgical interventions were performed by the same surgeon in one tertiary centre. This study did not include: patients undergoing limited mastoidectomy surgery or mastoid obliteration, those with previous auricular deformities, patients aged under 18 years, or those who developed post-operative complications.

In all the patients, an incision was made 3 mm behind the post-auricular sulcus. The mastoidectomy was then routed up to the tegmen in the superior direction, the sigmoid sinus in the posterior direction, and the digastric ridge in the inferior direction. The outer ear canal was lowered, and the middle ear and mastoid region were widened into a single cavity. None of the patients underwent mastoid cavity obliteration. The skin was closed with size 3-0 Prolene® sutures, and a pressure dressing was applied for 3 days post-operatively.

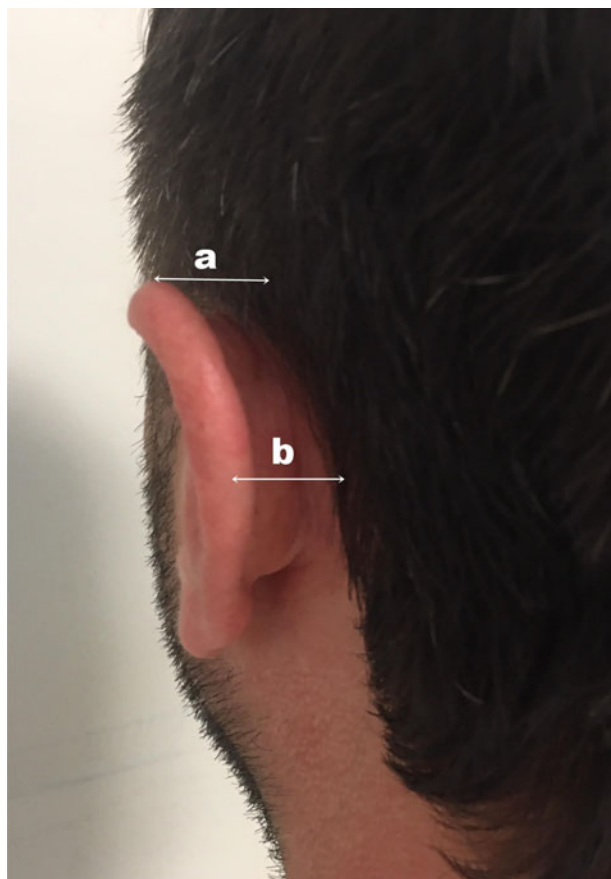


Fig. 1. Measurement sites: 'a' represents the distance between the superior-most aspect of the helix and the skull and the distance between the middle part of the auricle and the mastoid are determined for measurements.

The distances of the upper and middle regions of the auricle to the skull were measured pre-operatively and at one year post-operatively. The points of measurement are shown in Figure 1.

The data were analysed using SPSS statistical software for Windows, version 15.0 (SPSS, Chicago, Illinois, USA). Pre- and post-operative measurements were analysed using the paired samples *t*-test.

Results

The mean distance between the upper edge of the auricle and the skull was measured as 14.18 ± 3.77 mm (range, 7–20 mm) pre-operatively, while this distance was 13.15 ± 3.59 mm (range, 5–20 mm) at one-year post-operatively. The mean distance between the middle edge of the auricle and the mastoid bone was measured as 19.03 ± 4.62 mm (range, 10–26 mm) pre-operatively, while it was 16.29 ± 5.00 mm (range, 7–26 mm) at one year post-operatively. Accordingly, the distances in both of these regions were found to have significantly decreased post-operatively.

The measurements showing the position of the auricle relative to the mastoid region pre- and one-year post-operatively are summarised in Table 1. According to these data, in patients undergoing canal wall down mastoidectomy, the distance between the auricle and the mastoid region decreased, and the auricle retracted, during the post-operative period.

Discussion

Surgical treatment of chronic otitis media aims to provide the patient with a dry ear and to protect their hearing. Many

Table 1. Pre- and one-year post-operative measurements

Measurement	Pre-operation	1 year post-operation	<i>p</i> -value
Distance between upper part of helix & skull	14.18 ± 3.77 (7–20)	13.15 ± 3.59 (5–20)	0.017
Distance between middle part of auricle & mastoid	19.03 ± 4.62 (10–26)	16.29 ± 5.00 (7–26)	<0.001

Data represent mean \pm standard deviation (range) values, in millimetres, unless indicated otherwise.

surgical techniques have been described for the treatment of chronic otitis media. Canal wall down mastoidectomy is a surgical procedure that provides successful outcomes, especially in cases with extensive cholesteatoma. In this surgical approach, a large cavity is formed in the mastoid region.¹ Many cavity obliteration methods have been described, but these may result in complications in the mastoid cavity.^{5,6} Obliteration has some other negative consequences, including delays in the detection of relapse. One of the rare complications of canal wall down mastoidectomy is deformities in the auricle post-operatively.^{7,8}

Although the auricle cartilage touches the skull base, it is not physically connected to it.⁹ Stability of the auricle in the mastoid region is maintained by skin continuity, soft tissues, and the anterior, superior and posterior external auricular muscles.⁹ The posterior auricular muscle enables adduction of the auricle, preventing its outward protrusion. Dysfunction of this muscle can therefore cause protrusion.¹⁰ During the post-auricular incision, the skin, subcutaneous connective tissue and posterior auricular muscle are cut.⁸ In addition, the integrity of the mastoid bone, which is supported by a large portion of these structures, is broken, and a cavity is formed. In our study, disruption of the integrity of these structures was found to cause deformity in the auricle and a narrowing of the auriculo-cephalic angle over the long term.

van Hövell Tot Westerflier *et al.*⁷ reported that soft tissues were displaced into the cavity formed after mastoidectomy; they named this deformity 'sunken ear'. In their study, nine adult patients with sunken ear deformities were retrospectively analysed, and it was revealed that all the patients had previously undergone canal wall down mastoidectomy surgery more than one year previously. All nine patients subsequently underwent reconstruction with grafts taken from costal cartilage. Similarly, in our study, we detected an asymmetric auriculo-cephalic angle reduction at the middle part of the auricle.

Low-set ear deformity was defined in 10 patients who had undergone mastoid surgery for chronic suppurative otitis media.⁴ Seven of these patients had undergone canal wall down mastoidectomy, while three had undergone canal wall up mastoidectomy. Although seven patients were aware of this potential complication, two stated that they were dissatisfied with the outcome.⁴ Potential predisposing factors include dissection of the auricle and ear canal, and lowering of the posterior bony canal wall. In our study, we found that canal wall down mastoidectomies performed in 34 patients resulted in significant narrowing of the auriculo-cephalic angle and caused deformities.

Hong *et al.*⁸ reported that tympanoplasty performed via post-auricular incisions in 19 paediatric patients did not change the auriculo-cephalic angle. In another study, it was found that tympanoplasty performed with post-auricular

incision did not change the auriculo-cephalic angle in 35 adult patients.¹¹ Patients who underwent canal wall down mastoidectomies were not included in these studies.^{8,11} It was found that the auriculo-cephalic angles did not change after interventions where the mastoid bone was preserved. Soft tissue damage is not effective in changing the ear position, but, if mastoidectomy is performed, there is a possibility that the tissues will be buried in the cavity, in which case the ear position may change.

Kim¹² found that the position of the auricle returned to its initial position two months after tympanoplasty and canal wall up mastoidectomy, and four months after canal wall down mastoidectomy. However, the follow-up period was six months post-surgery in their study. In the current study, patients who underwent canal wall down mastoidectomy were evaluated one year after the initial surgery. The position of the auricle was found to be approaching the mastoid bone at this longer-term follow up.

- This study investigated the effect of surgical incision on the auricle position of patients undergoing canal wall down mastoidectomy to treat chronic otitis media
- Distances between the upper and middle parts of the auricle to the mastoid were measured
- Ear position was significantly altered after canal wall down mastoidectomy in the long term
- In radical mastoidectomy patients, the auricle–mastoid distance may decrease, narrowing the auriculo-cephalic angle
- Patients should be informed about potential asymmetry post-surgery, especially following unilateral operations

In a normal ear, the auriculo-cephalic angle is 25–30 degrees and the distance of the auricle to the mastoid is 15–20 mm. Okur *et al.* measured the auricle–mastoid mean distance as 16.9 mm.¹³ The helix upper-tip to scalp distance was measured as 10–12 mm.¹⁴ In our study, the distance between the middle part of the auricle and the mastoid was found to be 19.03 mm pre-operatively and 16.29 mm post-operatively, while the distance between the upper part of the helix and the skull was 14.18 mm pre-operatively and 13.15 mm post-operatively. Auricular deformity and the auriculo-cephalic angle reductions after canal wall down mastoidectomy cause dissatisfaction in some patients.^{4,7} Informing patients of this complication before surgery may help them to better accept the outcome.

Conclusion

In this study, it was found that the ear position was statistically altered after canal wall down mastoidectomy in the long term. We recommend informing the patients about potential post-operative asymmetry, especially following unilateral surgical procedures.

Competing interests. None declared

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