

# Impact of mastoidectomy on tympanoplasty for recurrent suppurative otitis media

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## Background

There are still many questions about the pathogenesis of chronic suppurative otitis media (CSOM) and consequently about the optimal management medical or surgical interventions. Many otolaryngologists continue to routinely perform mastoidectomy with tympanoplasty, arguing that surgical aeration of the mastoid will improve outcomes by providing a reservoir of air that can buffer pressure changes in the middle ear according to Boyle's law.

## Patients and methods

During the period from December 2013 to October 2017, the mean age was ranging from 20 to 50 years; 25 (62.5%) patients were females, whereas 15 (37.5%) patients were male who were attending the Otorhinolaryngology Department, Al Zahraa University Hospital, with recurrent suppurative otitis media refractory to medical treatment. The 20 patients selected for this study were randomly assigned to undergo tympanoplasty with cortical mastoidectomy ( $n=20$ ) and tympanoplasty alone ( $n=20$ ).

## Results

The factors that may influence surgery success rates are age, perforation location and size, Eustachian tube conditions, status of the middle-ear mucosa, the type of graft used, and surgeon experience. The primary argument in favor of mastoidectomy has been an improvement in the middle ear and mastoid environment through clearance of the diseased mucosa and through the ventilatory mechanisms of an open mastoid system, as a buffer to the changes in pressure within the middle ear.

## Conclusion

There was no additional benefit to performing mastoidectomy with tympanoplasty for uncomplicated perforations. Mastoidectomies were generally performed with a worst disease, as suggested by the presence of extensive inflammation, or a sclerotic middle ear or mastoid.

## Keywords:

mastoidectomy, otitis media, tympanoplasty

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## Introduction

Chronic suppurative otitis media (CSOM) remains one of the most common chronic infectious diseases worldwide. Although microbial, immunological, and genetically determined factors, as well as eustachian tube (ET) dysfunction, are supposed to be involved in the pathogenesis of CSOM, many aspects of the pathogenesis still need to be clarified [1–3].

Tympanoplasty is a commonly performed surgical procedure to close perforations of the tympanic membrane; the results of tympanic membrane repair, although generally favorable, can vary significantly based on multiple factors, including infection (ET), dysfunction, and variations in the operative technique. The contribution of mastoid pneumatization remains controversial, and the role of mastoidectomy in treating tympanic membrane perforations continues to be

debated, particularly in the cases of chronic suppurative otitis media in the absence of cholesteatoma [2].

Mastoidectomies were generally performed with worst disease, as infection, extensive inflammation, or a sclerotic middle ear or mastoid [4].

The aim of this study is to assess the effect of mastoidectomy on treatment of chronic noncholesteatomatous otitis media; we performed a comparison of patients with recurrent tympanic membrane perforations treated with tympanoplasty

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or with tympanoplasty combined with the intact canal wall mastoidectomy.

### Patients and methods

A prospective study was performed on 40 patients ranging in age from 20 to 50 years, attending the Otorhinolaryngology Department, Al Zahraa University Hospital, who presented with recurrent suppurative otitis refractory to medical treatment, from December 2013 to October 2017. All of these patients had symptoms and signs of chronic suppurative otitis media that include audible whistling sounds during sneezing and nose blowing, decreased hearing, and a tendency to infection during colds and when water enters the ear canal. All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and or national research committee and with the 1964 Helsinki declaration and its later amendment or comparable ethical standards. Copious purulent drainage, which may be sanguineous in both acute and chronic perforation, did not respond well to medical treatment. Following routine physical ear–nose–throat examination, we focused on detailed ear examination.

Patients who presented with prior tympanoplasty and no active evidence of infection, were fit for surgery under general anesthesia, and tubotympanic disease was not associated with otitis externa. The noncholesteatomatous ear was selected. Patients were having active infection with ossicular abnormalities, cholesteatoma, prior mastoidectomy, and associated otitis externa.

Primary perforations were excluded from the study.

Informed consent was obtained from all patients. A total of 20 patients (12 females and eight males) were treated with cortical mastoidectomy with tympanoplasty (group A). A total of 20 patients (13 females and seven males) were treated with tympanoplasty alone (group B).

### Surgical procedures

Surgeries were performed under general hypotensive-controlled anesthesia with the patients in supine position with the head rotated  $\sim 30\text{--}45^\circ$  away from the surgeon positioned.

### Cortical mastoidectomy operation

Cortical mastoidectomy operation was performed under general anesthesia. The operative side is prepared by shaving the patient hair away from the field by a distance of approximately two-finger width

from the attachment of the auricle. Macewen's triangle is an area defined by three lines:

- (1) A tangent drawn vertically up from the posterior edge of the external auditory meatus (EAM).
- (2) A second tangent drawn horizontally back at a level between the superior edge of the EAM and the temporal line.
- (3) A third tangent drawn at the posterosuperior margin of the EAM. The area enclosed by these lines is the surface marking for the mastoid antrum, which lies 2–3-cm deep and slightly anterior to it. The aim is a round smooth cavity sharp edges that are drilled off. The epithelium is worked toward the antrum from the less-dangerous regions.

### Tympanoplasty operation

Incision: end aural incision.

Approaches: preauricular.

Technique: underlay technique.

The ear canal is opened by subperiosteal injection at the 3, 6, and 12 o'clock positions.

#### *Lempert 2 incision*

The intercartilaginous incision starts with a no. 10 scalpel with permanent contact to the bony external ear canal. The incision is extended parallel to the anterior portion of the helix upward in a smoothly curved line with reduced pressure.

#### *Lempert 1 incision*

The medial circumferential incision is placed 4–5 mm lateral to the tympanic annulus. The elevation of the tympanomeatal flap is created using the Plester's knife, until the portion of the annulus tympanicus can be posteriorly and circumferentially seen. The undersurface of the membrane is scarified to provoke a slight bleeding to improve the attachment to the graft. The middle ear is checked. The perforation is routinely closed by an underlay technique. A small piece of gauze was soaked with an antibiotic. It was removed after 10 days.

### Outcome parameters

The patients' satisfaction with the procedure was evaluated according to improvement of hearing and success of tympanic membrane healing; preoperatively and in 3 and 6 months after the procedure.

### Statistical analysis

Data were analyzed using statistical package for the social science (SPSS, version 20.0). Quantitative data

were expressed as mean±SD. Qualitative data were expressed as frequency and percentage.

The following tests were done.

The  $\chi^2$  test of significance was used in order to compare proportions between two qualitative parameters. A one-way analysis of variance was used when comparing between more than two means. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the *P* value was considered significant as the following:

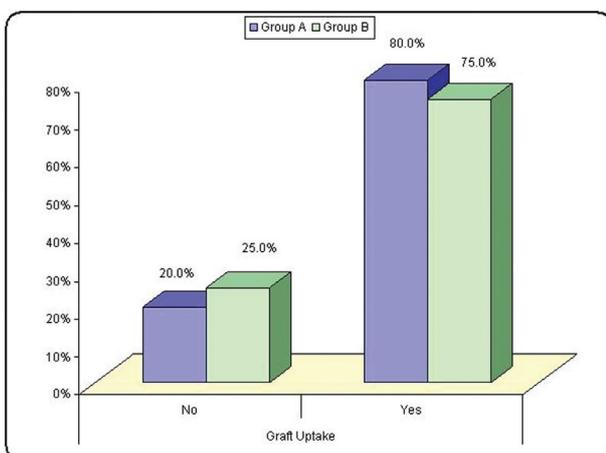
- (1) *P* value less than 0.05 was considered significant.
- (2) *P* value less than 0.001 was considered as highly significant.
- (3) *P* value more than 0.05 was considered insignificant.

Graft uptake between the two studied groups, improved significantly after the operation in both the groups. Intergroup comparisons did not reveal any significant differences between the two methods after 3 and 6 months postoperatively (*P*<0.05). The results are summarized in Fig. 1.

And after 6 months (mean±SD), the values were 24.95 ±11.30 in group A and 25.86±9.35 in group B. The results are summarized in Figs 2 and 3 and Table 1.

There were two studied groups according to the relation between graft uptake and graft type in both groups. There is a highly statistical significant difference as the graft uptake was 71.0% when we use cartilage graft, compared with 29.0% when we use facial graft (*P*=0.001) (Fig. 4).

Figure 1



Bar chart of the studied groups according to graft uptake.

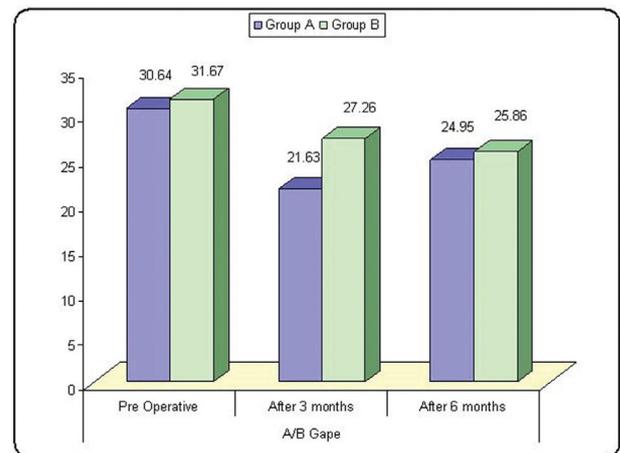
The graph shows a statistical significant difference as the graft uptake in group B with good ET compared to 13.0% of group B with fair ET (Figs 5 and 6).

**Discussion**

Mastoidectomy can allow surgical debridement of infected and devitalized tissues that can lead to persistent middle-ear disease. Others argue that performing mastoidectomy in these patients is unnecessary, does not improve the surgical outcome, and patients to increased surgical risks [5].

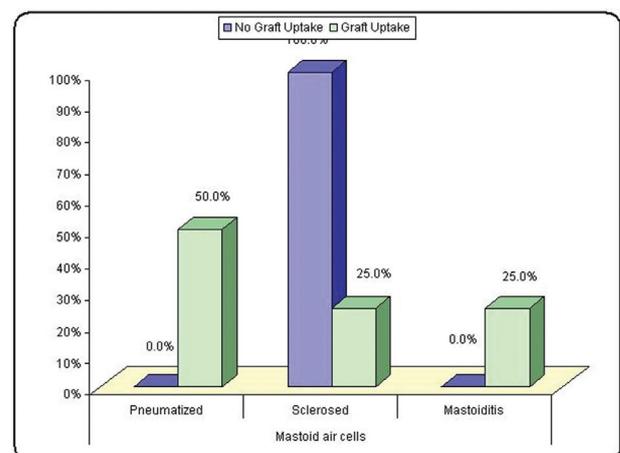
Eliades and Limb [6] showed a success rate for repair of tympanic membrane perforation. Success rates were generally good (>80%) for all studies, regardless of

Figure 2



Bar chart of the studied groups according to the postoperative ABG.

Figure 3

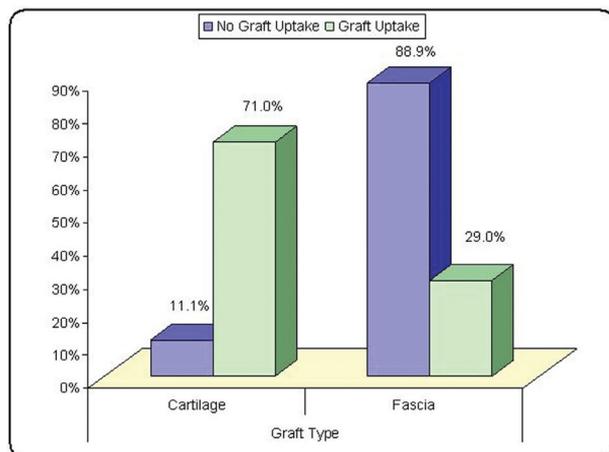


Bar chart of the studied group A according to the relation between graft uptake and aeration of mastoid air cells. The graph shows statistical significance as the graft uptake was 50.0% in pneumatized cells compared to 25.0% in both sclerosed and inflamed mastoid air cells.

**Table 1 Comparisons between the two studied groups according to postoperative airborne conduction gap (ABG) audiometric results**

AB gap	Group A (N=20)	Group B (N=20)	Test value	P value	Significance
Preoperative					
Mean±SD	30.64±6.98	31.67±11.70	-0.338●	0.737	NS
Range	23.3–40	16.6–60			
Negative [n (%)]	0	0	NA	NA	NA
Positive [n (%)]	20 (100.0)	20 (100.0)			
After 3 months					
Mean±SD	21.63±5.74	27.26±9.30	-2.025●	0.053	NS
Range	16.6–30	16.6–43.3			
Negative [n (%)]	4 (20.0)	6 (30.0)	0.533*	0.465	NS
Positive [n (%)]	16 (80.0)	14 (70.0)			
After 6 months					
Mean±SD	24.95±11.30	25.86±9.35	-0.237●	0.814	NS
Range	16.6–43.3	16.6–43.3			
Negative [n (%)]	4 (20.0)	6 (30.0)	0.533*	0.465	NS
Positive [n (%)]	16 (80.0)	14 (70.0)			

No statistically significant difference as the AB gap was Preoperative (mean±SD) 30.64±6.98 in group A and 31.67±11.70 in group B. After 3 months (mean±SD), 21.63±5.74 in group A and 27.26±9.30 in group B. NA, not applicable. \*Chi square test; ●Repeated measures ANOVA test.

**Figure 4**

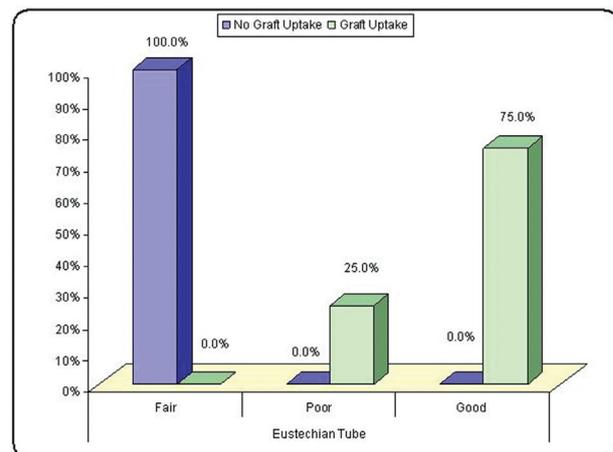
Bar chart of the studied groups according to graft uptake and graft type.

whether a mastoidectomy was performed or not. A total of 44% showed higher success rates with tympanoplasty plus mastoidectomy, and 66% showed the same.

Eliades and Limb [6] showed better success with tympanoplasty alone but none of the differences were statistically significant.

Mishiro *et al.* [4] compared tympanoplasty alone (104) with tympanoplasty and mastoidectomy (147). The authors found that graft success rates were 93.3 and 90.5%, respectively [4].

Boone *et al.* [7] assess the success of cartilage grafting for revision tympanoplasty without mastoidectomy; they reported that the use of cartilage in cases of retraction,

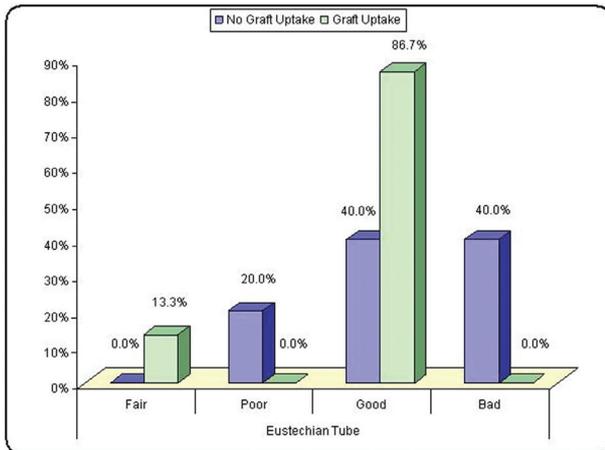
**Figure 5**

Bar chart of the studied group A according to the relation between graft uptake and ET function. The graph shows a highly statistical significant difference as the graft uptake occurs in 75.0% of group A with good ET compared to 25.0% of group A with poor ET.

recurrent perforation, bilateral perforations, and craniofacial abnormalities predisposing to (ET) dysfunction are common places. The intrinsic characteristics of cartilage provide a stiffer, hardier alternative to traditional graft materials. They use cartilage grafts in the tympanoplasty and rarely include mastoidectomy in the absence of cholesteatoma. Cartilage grafting provides enough structural stability during times of negative middle-ear pressure to allow the mucosa to revert to a more normal state naturally, and more readily resists continued (ET) dysfunction [7].

Mohamad *et al.* [8] found that temporal muscle fascia graft is of poor stability, because it contains connective

Figure 6



Bar chart of the studied group B according to the relation between graft uptake and ET function.

fibrous tissue with irregular elastic fibers [7]. Otherwise, cartilage or composite cartilage grafts are more resistant to infections, middle-ear pressure, and lack of capillary feed. Therefore, it can be preferred for revision tympanoplasty, in which the risk of perforation or retraction is higher [8].

Toros *et al.* [9] showed that the mean air bone gape (ABG) was generally good after tympanoplasty, ranging between 10 and 20 dB. The results for patients undergoing mastoidectomy were almost universally worse (ABG) than those who did not have a mastoidectomy. However, due to a more extensive disease requiring a mastoidectomy, the preoperative ABG was also often higher in mastoidectomy patients as well [9].

Mishiro *et al.* [4] compared tympanoplasty alone (104) with tympanoplasty and mastoidectomy (147). They

found that the postoperatively airborne gap within 20 dB was 90.4 and 81.6%, respectively. No statistically significant differences were noted for these variables or for discharging versus dry ears [4].

Ruhl and Pensak [2] found that hearing outcomes are dependent on more than just the elimination of middle-ear disease and restoration of an intact tympanic membrane. The status of the ossicles and the need for ossicular reconstruction also play an important role, regardless of the mastoid [2].

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#### Conflicts of interest

There are no conflicts of interest.

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