

# Endoscopic evaluation of the patency of the aditus in tubotympanic type of chronic suppurative otitis media

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Received 08 October 2014

Accepted 17 November 2014

The Egyptian Journal of Otolaryngology  
2016, 32:45–48

## Objectives

Endoscopic evaluation of the aditus in tubo-tympanic chronic suppurative otitis media (CSOM).

## Study design

Prospective descriptive study.

## Methods

This study carried out on 50 patients presenting with inactive tubo-tympanic CSOM with only mild or moderate conductive hearing loss, attending the Alexandria university hospital (tertiary referral center). Tympanoplasty was done for all patients. The patency and dimensions of the aditus were assessed by performing antral window through which 30° endoscope was introduced. Biopsy was taken from unhealthy mucosa to detect the presence of hidden cholesteatoma or granulation tissue.

## Results

Ten out of 50 (20%) patients had blocked aditus. The dimensions of the aditus were measured. Biopsy taken from these cases revealed a granulation tissue in all cases. No hidden cholesteatoma was detected.

## Conclusion

In inactive tubo-tympanic CSOM with mild or moderate conductive hearing, the aditus was not always patent. It was obstructed in 20% of our study.

## Keywords:

aditus, dry tympanic perforation, otitis media

Egypt J Otolaryngol 32:45–48

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1012-5574

## Introduction

Tympanoplasty has been the mainstay of treatment in tubotympanic chronic suppurative otitis media (CSOM) [1]. However, the usefulness of cortical mastoidectomy together with tympanoplasty in the management of tubotympanic CSOM has been a very long debate [1]. Some argue that it would enhance the aeration of the mastoid cells and the middle ear and hence better results and less failure rates can be obtained following myringoplasty [2,3]. Others argue that it adds morbidity to the patients and increases the risk of better-avoided complications such as vertigo, sensorineural hearing loss, or facial nerve palsy [4]. However, no strict guidelines are available on whether or not to perform a cortical mastoidectomy in dry tympanic membrane perforation, especially if active infection is absent and in the presence of mild or moderate conductive hearing loss. Moreover, if cortical mastoidectomy adds more benefits, should it be performed on all patients or only on those fulfilling certain criteria.

It was pointed out that the middle ear should always be ventilated and its pressure regulated so that it can function as a sound conduction organ, and for this reason the middle ear has double ventilation and pressure regulation systems: the Eustachian tube and transmucosal gas exchange through the mucosa in the

middle ear, particularly mastoid. Therefore, these two ventilation and pressure regulation systems should be considered when analyzing middle ear pathophysiology or investigating for the appropriate management of middle ear diseases [5].

The normal mucosa in the middle ear, particularly in the mastoid, has morphological features, which are advantageous for gas exchange. Just underneath the single layer of simple squamous epithelium, there is a rich distribution of capillaries and there is little interstitial tissue between them. Furthermore, observations of the mastoid mucosa with electron microscope show that between the mucosal epithelial cells there is a wide space where capillaries are almost exposed to the mastoid air space. This structure is similar to that observed in the alveoli in the lungs, and appears as though it would facilitate efficient gas exchange between the middle ear cavity and the capillaries [6].

The aditus is an opening that connects the epitympanic recess with the mastoid antrum. Epitympanic

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compartments receive their aeration through the large tympanic isthmus between the medial part of the posterior incudal ligament and the tensor tendon. The aeration pathway from the Eustachian tube directly leads to the mesotympanic and hypotympanic spaces, whereas the epitympanum is away from the direct air stream and is only aerated through the tympanic isthmus [7–9].

Therefore, obstruction of the aditus contributes to the pathogenesis and accentuates pathologic conditions in otitis media. Moreover, it interferes with the aeration of the epitympanum and contributes to a great extent of the failure rates following tympanoplasty [2,3,9].

In this study we aimed to evaluate endoscopically the patency of the aditus in cases of tubotympanic CSOM and to measure dimensions of aditus. Furthermore, we examined histologically its mucosa if abnormal to detect the presence of hidden cholesteatoma or granulation tissue, so as to assess the usefulness of cortical mastoidectomy together with myringoplasty in cases of tubotympanic CSOM.

### Materials and methods

This study was carried out on 50 patients with inactive tubotympanic CSOM with no evidence of cholesteatoma between January 2013 and May 2014 in the Otolaryngology Unit, Head and Neck Surgery Department of Alexandria University.

All cases with only mild or moderate conductive hearing loss were included in the study. Patients with previous ear surgery or with severe conductive or mixed hearing loss were excluded. Before conduction of the study, detailed informed consent was taken from patients. This study was approved by the ethics committee in our institution.

All patients were assessed by means of thorough history, otologic examination, and full audiological evaluation.

All patients underwent tympanoplasty through postauricular approach and antral window was drilled. The 30° endoscope was inserted through this window to assess the patency and dimensions of aditus. Patent mastoid antrum was defined as those ears that showed free flow of irrigated saline between middle ear and mastoid antrum, without the surgeon being required to clear any disease to make it patent, what we have called the saline test. Moreover, biopsy was taken from unhealthy mucosa to detect the presence of hidden cholesteatoma or granulation tissue. The results were further analyzed in relation to many variables

such as patient age, duration of otorrhea, site of tympanic membrane perforation, and the presence of tympanosclerosis to find any clinical clue of obstructed aditus.

The data were analyzed using independent *t*-test and Fisher's exact test, and the statistical significance of *P* was set at 0.05.

### Results

Of the 50 patients in this study, 20 were male (40%) and 30 were female (60%). The mean age of the patients was 30.46 years with a range of 19–45 years.

Using otoscopy, the site of tympanic membrane perforation was assessed. In 48 cases, the perforation was central (96% of the studied group) and it was posterosuperior in two cases (4%). Of the 48 central perforations, 20 perforations were anterior, 23 were posterior, and five were subtotal perforations. There was tympanosclerosis in eight cases (16%) of the studied group.

Out of the 50 cases, 10 cases (20%) had blocked aditus with unhealthy, thickened, and edematous mucosa (Fig. 1). Biopsy was taken from these cases and it revealed a chronic inflammatory nature with granulation tissue in all cases (Fig. 2). No hidden cholesteatoma was detected. In contrast, the other 40 cases had patent aditus with a healthy mucous membrane lining (Fig. 3).

The dimensions of the aditus were measured, which ranged from 4.5 to 6.5 mm in medial to lateral distance. However, the up-down distance ranged from 6 to 8.5 mm.

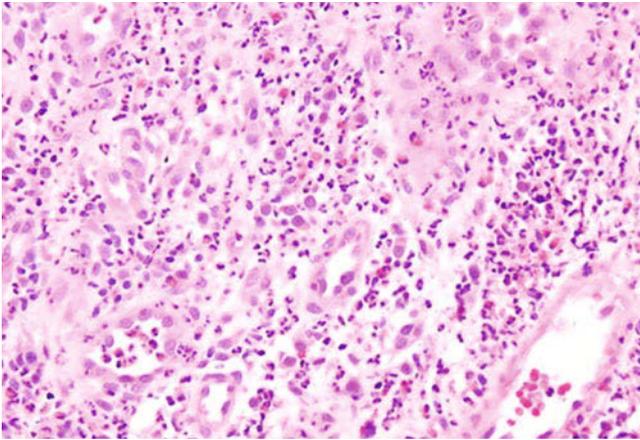
The results were further analyzed in relation to many variables to find any clinical clue of blocked aditus in the noncholesteatomatous CSOM. It was found

Figure 1



Obstructed aditus by edematous mucosa with granulation tissue.

Figure 2



Chronic inflammatory mucosa with granulation tissue.

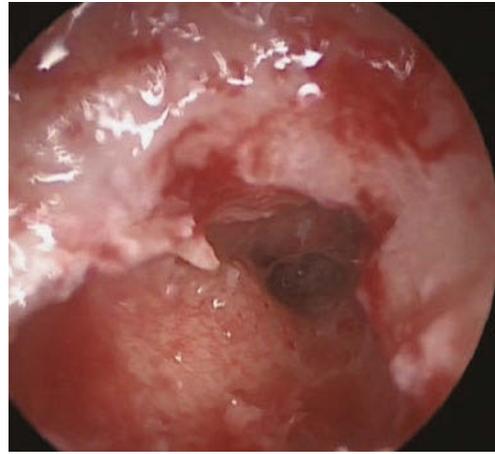
that the incidence of obstructed aditus increased significantly in the elderly patients. The age range of the blocked-aditus patients was 30–49 years with a mean of  $39.70 \pm 5.87$  years and a median of 39.50 years. In contrast, the patent aditus occurred in a younger age population. The mean age was  $28.15 \pm 7.62$  years and the median was 28 years. There was a significant relation between the age and the status of the aditus on statistical analysis (Table 1).

Moreover, the obstructed aditus increased in patients with long history (>2 years) of otorrhea. Eight out of 10 (80%) patients with blocked aditus had a long history of otorrhea. However, 36 of 40 (90%) patients with patent aditus had short onset ear discharge. Likewise, there was a significant relation between the history of ear discharge and the status of the aditus on statistical analysis (Table 1).

The site of perforation could give a clue as to whether or not the aditus is blocked. In the studied group, the two posterosuperior perforation patients (100%) were associated with blocked aditus. However, out of the 48 central perforation cases, eight cases were associated with obstructed aditus and 40 cases with patent aditus. Among the central perforation cases, the incidence of blocked aditus was higher in subtotal central perforation cases. Three out of five subtotal perforation cases were associated with blocked aditus.

Six out of eight (75%) patients with tympanosclerosis had a blocked aditus, which represented 60% of ears with blocked aditus. In contrast, 95% of the patients with a patent aditus and antrum did not have tympanosclerosis. There was a strong and significant relationship between tympanosclerosis and the status of the aditus on statistical analysis (Table 1).

Figure 3



Patent aditus.

Table 1 Factors affecting the patency of aditus

Factors	Patent (N = 40) [n/N (%)]	Obstructed (N = 10) [n/N (%)]	P
Age (mean $\pm$ SD)	28.15 $\pm$ 7.62	39.70 $\pm$ 5.87	<0.001 <sup>#</sup>
Otorrhea			
Short	36/40 (90)	2/10 (20)	<0.001*
Long	4/40 (10)	8/10 (80)	
Tympanosclerosis			
Absent	38/40 (95)	4/10 (40)	<0.0003*
Present	2/40 (5)	6/10 (60)	

<sup>#</sup>t-test; \*Fisher's exact test; Statistically significant at  $P \leq 0.05$ .

## Discussion

Tympanoplasty has been the mainstay of treatment in noncholesteatomatous CSOM [1]. Holmquist and Bergstrom [2] first suggested that mastoidectomy improves the chance of successful tympanoplasty for patients with noncholesteatomatous CSOM. They argued that creation of an aerated mastoid enhances success in patients with poor tubal function or a small mastoid air cell system. Several authors supported the theory proposed by Holmquist and Bergstrom [2], although none proved that the addition of mastoidectomy yields better surgical results compared with tympanoplasty alone. Furthermore, Sade [3] reported a correlation between mastoid pneumatization and middle ear aeration. Atelectatic tympanic membranes (poorly aerated middle ear systems) are associated with poorly pneumatized mastoids, and patients with deep retraction pockets are more likely to have a poorly pneumatized mastoid system [3].

In contrast, Balyan *et al.* [4] suggested that mastoidectomy is usually not necessary for treatment of patients with noncholesteatomatous CSOM. In fact, many otologists prefer to add cortical mastoidectomy only in cases with congested, polypoidal, moist, or

discharging ear [10,11]. Ruhl and Pensak [12] opined that mastoidectomy should only be considered in all failed cases of tympanoplasty reconstruction and also if the preoperative imaging showed poorly pneumatized mastoid, or in those with evidence of soft tissue in the mastoid, aditus, or epitympanum. However, to identify such cases with blocked aditus preoperatively is not easy. Presence of congested and polypoidal mucosa in the middle ear may not be associated with blocked aditus and antrum [10,11].

In our case series study, all of our cases had inactive tubotympanic CSOM with no evidence of cholesteatoma, with only mild or moderate conductive hearing loss. Surprisingly, 20% of the cases had blocked aditus. Theoretically, performing tympanoplasty alone without an aerating cortical mastoidectomy is associated with poorly ventilated epitympanum, which might be the cause of failure of myringoplasty and recurrence of otorrhea whatever the surgeon's skills or the technique used. However, this should be confirmed by postoperative long-term follow-up on a large scale population.

The dimensions of the aditus were measured as well, which ranged from 4.5 to 6.5 mm in medial to lateral distance, whereas the up-down distance ranged from 6 to 8.5 mm. The only literature evidence of the dimensions of the aditus was the study carried out by Long *et al.* [13], which measured the dimensions of the aditus in normal individuals using computed tomographic imaging. They reported that the average of left-right distance of aditus was  $5.19 \pm 1.39$  mm and that the average of up-down distance of aditus was  $5.74 \pm 1.16$  mm. In our study, we measured the dimensions of the aditus in cases with noncholesteatomatous CSOM intraoperatively. The aditus dimensions appeared to be within the same range in noncholesteatomatous CSOM as those in normal individuals.

The incidence of obstructed aditus in our patients increased in the older patients and in those with long history (>1 year) of ear discharge. Furthermore, the posterosuperior and subtotal central perforations and the presence of tympanosclerosis increased the probability of obstructed aditus and antrum dramatically.

The association between tympanosclerosis and the blocked aditus was discussed by Manjunath *et al.* [14], who published a paper confirming that myringosclerosis is an indication of blocked aditus. The same conclusion was suggested by Migirov and Volkov on the effect of myringosclerosis on the outcomes of the tympanoplasty. They stated that myringosclerosis is associated with higher recurrence rates [15].

## Conclusion

In the inactive tubotympanic CSOM with mild or moderate conductive hearing, the aditus was not always patent. It was obstructed in 20% of cases in our study group. The incidence of obstructed aditus increases in older patients and in those with long history of ear discharge (more than 2 years). Moreover, the presence of tympanosclerosis increases the probability of obstructed aditus dramatically. Performing an aerating cortical mastoidectomy in such cases would, theoretically, help in creating an aerated ear, thereby possibly reducing the recurrence rates.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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