

Oto endoscopy Versus High Resolution Computed Tomography in Evaluation of the Patency of Aditus Ad Antrum

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Abstract

Objectives: To detect the value of otoendoscopy in assessment of patency of aditus ad antrum and to correlate the endoscopic findings with the pre-operative high resolution CT imaging.

Methods This study was conducted on 30 patients suffering from inactive tubo-tympanic chronic suppurative otitis media (CSOM). High resolution computed topography (HRCT) scanning was done preoperatively for all patients for assessment of the tympanomastoid pneumatization and condition of aditus. The patients were divided into 2 groups according to conditions of aditus ad antrum in HRCT scan: Group A includes 15 Patients with patent aditus ad antrum; Group B includes 15 patients with closed aditus ad antrum. All patients underwent cortical mastoidectomy operation with or without myringoplasty and Video Recording by a 30-degree rigid telescope for assessment of the patency of aditus ad antrum.

Results: The study included 30 patients, 14 males and 16 females with mean age of 27.5 years. According to preoperative HRCT, aditus ad antrum is blocked in 15 cases (50%) and opened in 15 cases (50%). These results confirmed intraoperative by Otoendoscope with accuracy 100%.

Conclusion: otoendoscope can be used for evaluation of the extent of middle ear disease, integrity of ossicular chain and explore the hidden sites of the middle ear. This study showed that CT scan temporal bone is 100% accurate in evaluation of the patency of aditus ad antrum and this is assured by intra-operative rigid endoscopic examination.

Keywords: CT – Aditus ad antrum – Otoendoscope - Mastoidectomy.

Introduction

The mainstay of treatment for inactive chronic suppurative otitis media (tubo- tympanic type) is reconstruction of Tympanic membrane ⁽¹⁾. Several studies discuss the factors that could influence the anatomical success. The classical House study concluded that active infection and hyperplasia of middle ear mucosa are factors which diminish the surgical success ⁽²⁾. Also, other studies consider graft material, revision surgery, technique of the graft position and size of tympanic perforate are predictive factors ⁽³⁾.

In addition, mastoidectomy is an effective method for treatment of chronic ear infection. Mastoidectomy with tympanoplasty is an appropriate option for treatment of simple perforations in patients with no evidence of active infection and reduces the need for revision ⁽⁴⁾. Many otologists suggested that absence of aerated mastoid share significantly to tympanoplasty failure ⁽⁵⁾.

Evaluation of mastoid aeration system can be done preoperatively by high resolution computed tomography (HRCT), which may show soft tissue density at the attic, aditus, and the antrum. Temporal bone anatomy is complex and it consists of numerous small, important and anatomically close structures. High resolution computed tomography (HRCT) temporal bone provides an important diagnostic tool in assessment of the bony temporal bone pathologies. Good CT acquisition and reformatting techniques can describe normal and abnormal anatomy for diagnosis and treatment planning ⁽⁶⁾. The use of operating microscope enhances the myringoplasty results significantly by improvement of technical quality. But it gives

magnification in a straight line, so the deep recesses of the middle ear cannot be visualized in a single operating field ⁽⁷⁾. The introduction of the otoendoscopes was first described by Mer by using fibreoptic system introduced through the existing tympanic membrane perforation ⁽⁸⁾.

Otoendoscopy has been previously used as an adjunct to microscopic examination in the office ⁽⁹⁾. The surgeon can visualize different middle ear structures in one frame by using endoscope. It enable the surgeon to move up, down, front and back more easily to visualize different points and regions inside the middle ear cavity. Endoscope gives another advantage by working through looking to the monitor, where it gives more magnification and precision of the work. Also, it gives a very important advantage of following the steps of surgery by young surgeons and students increasing the teaching and learning ⁽¹⁰⁾.

The aim of this study is to detect the value of otoendoscopy in assessment of patency of aditus ad antrum and to correlate the endoscopic findings with the pre-operative high resolution CT imaging.

Patients and Methods

This is a prospective study which was carried out at Otorhinolaryngology Department, Benha university hospital, from March 2017 to July 2018. This study was included 30 patients who presented to outpatient clinic by the symptoms of tubotympanic CSOM after control of infection (inactive cases only) with mild to moderate hearing loss and without any previous ear surgery. Their age ranged from 15 to 40 year. An informed written consent was obtained from all patients who were participating in this study. The patients were

enrolled into 2 groups according to the preoperative radiological conditions of aditus ad antrum:

Group A includes 15 Patients with patent aditus ad antrum. **Group B** includes 15 patients with closed aditus ad antrum.

All of the procedures followed were in accordance with the institutional ethics committee approval.

All patients were subjected to the following:

A- Pre-operative assessment: full history taking, complete otorhinolaryngological examination, including microscopic and otoscopic examination of the ear with audiological evaluation by tympanometry and pure tone audiometry (PTA). Routine chest X-ray and preoperative laboratory investigations were done.

High resolution CT image (axial and coronal) without contrast in 1mm slice thickness and 1mm intervals was taken preoperatively for evaluation of the tympanomastoid pneumatization and aditus condition (**figure 1a and 2a**).

B-Operative technique:

Cortical mastoidectomy (canal wall up technique) with or without myringoplasty was performed for all patient in both groups. All surgeries were conducted under general anesthesia with oral cuffed endotracheal tube through post auricular approach. Trimming of the edge of the perforation and dissection with elevation of the posterior meatal wall and burr the bone above and behind the external auditory meatus was gradually excavated to open the antrum, then Saline was evacuated in the antrum and its passage through

the aditus to middle ear was noticed and the result was recorded. Video Recording by a 30-degree rigid telescope was used for evaluation of the patency of aditus ad antrum (**figure 1b and 2b**). If aditus was blocked, the bony posterior metal wall was thinned until short process of the incus was identified, then by curved needle; the soft tissue aditus was removed and dissected until saline pass to the middle ear. Jel foam was applied to middle ear followed by insertion of the temporalis fascia graft underlay technique then Jel foam was applied on tympanomeatal flap and external canal. Post auricular incision was closed in layers with interrupted sutures. Finally packing of the external auditory canal.

C-Follow-up:

All patients were hospitalized for one day, received systemic antibiotics, analgesics, nasal drops and antihistaminics. Sutures and aural pack were removed after one week.

Statistical analysis: Descriptive data for continuous variables were analyzed using Independent sample (*t*) tests. Probability (P-value): P-value <0.05 was considered significant, P-value <0.001 was considered as highly significant, P-value >0.05 was considered insignificant.

Results:

In this study, the study cases were divided into two groups. Each group was 15 patients; Group A: includes 15 Patients with patent aditus ad antrum and Group B includes 15 patients with closed aditus ad antrum. The mean age in group A was 31.2 years, while in group (B) was 23.3 years. P value was (0.01) i.e. considered significant. According to the gender distribution, group A was

9 males and 6 females, group B was 5 males and 10 females. P value was 0.1 i.e considered insignificant. Regarding to the demographic data, including age, gender, side of surgery and the size of perforation, there were no statistically significant difference between the two groups. Regarding to the hearing loss in group (A) there was 3 patients (20%) with mild hearing loss and 12 patients (80%) with moderate hearing loss. In group (B) there were 13 patients (86.7%) with mild hearing loss and 2 patients (13.3%) with moderate hearing loss. P value was < 0.001 i.e. highly

significant (**Table 1**). Regarding to the aditus closure (granulation tissue, edematous mucosa or patent) in studied cases. In group A the granulation tissue was in 10 patients ((66.7%) and edematous mucosa was in 5 patients (33.3%). In group B the aditus was opened in 15 patients 15 (100%) p-value was < 0.001 i.e highly significant (**Table 2**). As regarding to the aditus status (closed vs opened) between otoendoscope and CT, the p value was 1.0 i.e. no statistical significant (**figure 1 and 2**).

Table 1: Comparison of CT aditus state (closed vs opened) in studied cases as regard hearing loss.

Groups		CT aditus closed (N = 15)	CT aditus opened (N = 15)	p-value
Hearing loss	Mild	3 (20%)	13 (86.7%)	$< 0.001^*$
	Moderate	12 (80%)	2(13.3%)	

Table 2: Comparison of CT aditus closure (granulation tissue, edematous mucosa or patent) in studied cases.

Groups		CT aditus closed (N = 15)	CT aditus opened (N = 15)	p- value
Aditus closure	Granulation	10 (66.7%)	0 (0%)	$< 0.001^*$
	Edematous mucosa	5 (33.3%)	0 (0%)	
	Patent	0 (0%)	15 (100%)	



Figure (1a): Pre-operative Ct petrous bone axial cut shows opened aditus ad antrum of the left ear (yellow arrow)

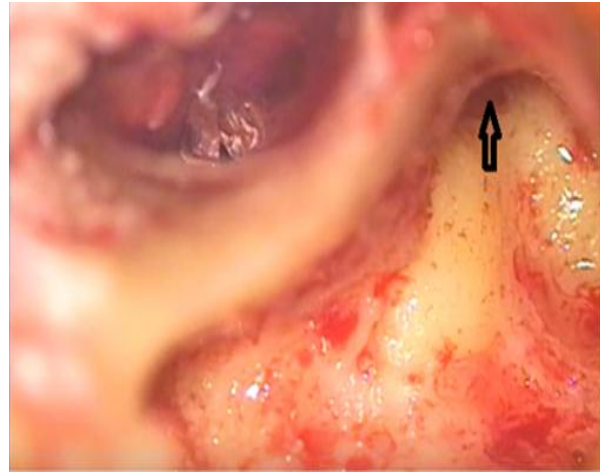


Figure (1b): intraoperative; left cortical mastoidectomy shows opened aditus ad antrum (black arrow)

Figure 1: opened aditus ad antrum

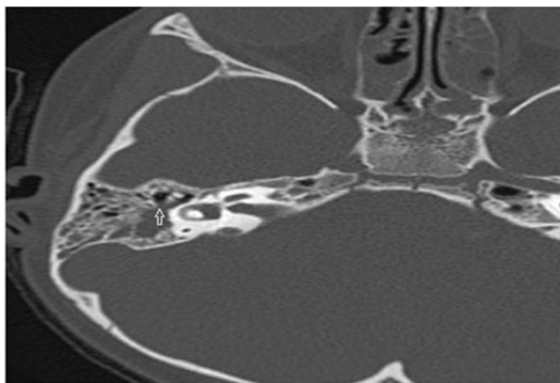


Figure (2a): Pre-operative Ct petrous bone axial cut shows closed aditus ad antrum of the right ear by soft tissue opacity (white arrow)



Figure (2b): intraoperative; Right cortical mastoidectomy shows closed aditus ad antrum by granulation tissue (black arrow).

Figure 2: closed aditus ad antrum.

Discussion

Although middle ear aeration occurred through two main pathways; the Eustachian tube anteriorly and the tympanic isthmus. The aditus ad antrum has an important role in ventilation of the mastoid air cell system. So, Aeration of mastoid is an important factor which enhances the outcome of tympanoplasty. Defect in mastoid aeration at the

time of tympanoplasty is a major cause for failure in patient with inactive mucosal chronic otitis media (COM). Although antrotomy is not necessary for successful repair of central perforation but adding an antrotomy to tympanoplasty improves clinical results. This may explained by increased middle ear cleft volume and pressure buffer created by open mastoid cavity. Improving the success rate of

tympanoplasty by cortical mastoidectomy for tubotympanic CSOM was first suggested by Holmquist and Bergstrom⁽¹¹⁾.

However, Balyan suggested that mastoidectomy is usually not necessary for management of tubotympanic CSOM. In fact, tympanoplasty with cortical mastoidectomy is preferred only in cases with congested, polypoidal, moist or discharging ear⁽¹²⁾. Ruhl and Pensak⁽⁵⁾ concluded that mastoidectomy is indicated in failed tympanoplasty and if pre-operative CT showed poorly pneumatized mastoid or soft tissue opacity in the mastoid, aditus or epitympanum. Temporal bone imaging using high resolution computed tomography (HRCT) has recently advanced significantly and considered the imaging modality that plays a major role in diagnosis, treatment planning, differential diagnosis and monitoring of temporal bone anatomy and pathology⁽¹³⁾. CT can show a detailed assessment of erosion or obliteration of important elements of the middle ear and the mastoid cavity, such as the ossicular chain, attic area, walls of the tympanic cavity, and the mastoid air-cell complex. So, it can influence the clinical management and affect the surgical technique in each particular case⁽¹⁴⁾.

In our study, we aimed to evaluate the patency of the aditus ad antrum in patients with inactive tubotympanic CSOM whether it is obstructed or not and detect the value of high resolution CT imaging in this evaluation and its accuracy regarding to endoscopic findings in the operation.

Thirty patients of tubotympanic CSOM were included in this work. In all patients antral window was done to evaluate the patency of the aditus ad antrum using the 30° endoscope. Then the results were analyzed according to many variables; age,

the duration of otorrhea, the site of tympanic membrane perforation and the degree of hearing loss to find any clinical clues regarding the blocked aditus.

Out of the thirty patients 15 patients (50% of the studied group) had obstructed aditus by unhealthy edematous mucosa or granulation tissue and the other 15 patients (50%) had patent aditus with normal mucosal lining.

The fifteen patients with closed aditus were further analyzed thoroughly to find any clinical clues regarding the obstructed aditus by looking at different variables. There was a statistically significant relationship between the age and the status of the aditus. The obstructed aditus increased in the elderly patients with age range 18-42 years (a mean of 31.2 years) compared to a mean of 23.3 years in the patent-aditus patients.

As, the closed aditus ad antrum could be suspected from the history of persistent ear discharge. There was a statistically significant relationship between the duration of otorrhea and the status of the aditus. The incidence of closed aditus increased in patients with a long history of otorrhea and 80% of the patients with closed aditus had a long history of otorrhea. While 73.3% of patients with patent aditus ad antrum had short history of ear discharge (less than one year).

These results coincide with Bahgat⁽¹⁵⁾ who concluded that incidence of blocked aditus was increased significantly in patients with prolonged ear discharge.

Moreover, the obstructed aditus increased in patients with higher degree of hearing loss. 80% of the patients with obstructed aditus had moderate conductive hearing loss. While 86.7% of the

patients with patent aditus ad antrum presented with mild conductive hearing loss.

The fifteen patients of obstructed aditus were further analyzed thoroughly to find the nature of the obstruction. We found that the obstruction by granulation tissue was in ten patients (66.7%), 5 patients (33.3 %) were obstructed by Edematous mucosa.

Comparing the intraoperative otoendoscopic findings with the preoperative HRCT findings the result shows that 15(100%) patients with closed aditus in CT was closed also in endoscopic view intraoperative and the 15 (100%) patients with patent aditus in CT was also patent in endoscopic view intra operative.

Our study shows that HRCT temporal bone is a reliable predictor of preoperative aditus patency. This finding is similar to study conducted by Arvind Varma, for Predictability of Aditus Patency in Mucosal COM with Sclerosed Mastoid⁽¹⁶⁾.

Conclusion and Recommendations

A rigid endoscope can be employed to visualize and evaluate the extent of middle ear disease, assess ossicular integrity and explore the hidden niches of the middle ear .

This study concluded that HRCT scan of the temporal bone is 100% accurate in evaluation of the patency of aditus ad antrum and this is assured by intra-operative rigid endoscopic examination.

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