

The Relation Between Mastoid Condition and Clinical History, Middle Ear Examination and Preoperative CT Scan in Non-Cholesteatomatous Chronic Suppurative Otitis Media

Kolesteatomsuz Kronik Süpüratif Otitis Mediada Mastoidin Durumu, Klinik Geçmiş, Orta Kulak Muayenesi ve Preoperatif Temporal Kemik Bilgisayarlı Tomografi Arasındaki İlişki

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ABSTRACT

Objective: To compare intraoperative condition of the mastoid with preoperative otomicroscopic examination, CT findings and ear discharge history of the patient.

Material and Methods: Patients who had undergone tympanoplasty with mastoidectomy for non-cholesteatomatous chronic suppurative otitis media (NCSOM) and who had undergone temporal computed tomography (CT) before the operations were included in this study. Patients were evaluated retrospectively from their medical records. We were able to obtain detailed history, otoscopic findings and temporal CT findings in 51 patients. The history of ear discharge, middle ear mucosal condition in otoscopic examination and preoperative temporal bone CT scan findings were noted. Intraoperative view of mastoid condition is evaluated with mastoid ventilation and pathologic tissue in mastoid cellules. The relationship between intraoperative view of mastoid condition and history of ear discharge and otoscopic findings of middle ear and radiological findings were evaluated.

Results: Among a total of 51, 25 (49%) patients had granulation tissue, sclerotic tissue or hyperplastic epithelium in mastoid antrum or/and epitympanum. There was no statistically significant relationship between intraoperative view of mastoid condition and ear discharge and otoscopic findings of middle ear ($p>0.05$). In addition, mastoid aeration was not related with ear discharge and otoscopic findings of middle ear ($p>0.05$). There was statistically significant relationship between preoperative CT scan and intraoperative findings of mastoid cellules and mastoid aeration ($p<0.01$).

Conclusion: Assessment of mastoid condition is important before tympanoplasty in NCSOM. Our study demonstrated that NCSOM had higher rate of impaired mastoid condition; and history of ear discharge and otoscopic findings of middle ear did not give a reliable information about the mastoid condition. Preoperative CT scan should be routinely included for the patients with NCSOM in order to predict mastoid condition.

Keywords

Mastoidectomy; tympanoplasty; indication; computerized tomography

ÖZET

Amaç: Mastoidin durumu, temporal kemik bilgisayarlı tomografi (BT) taraması, hastalığın klinik geçmişi ve orta kulağın durumu arasındaki ilişkiyi değerlendirmek.

Gereç ve Yöntemler: Kolesteatomsuz kronik süpüratif otitis media (NCSOM) için timpanomastoidektomi yapılan ve operasyonlardan önce temporal BT ile değerlendirilen hastalar bu çalışmaya dahil edilmiştir. Hastalar, tıbbi kayıtlarından geriye dönük olarak değerlendirilmiştir. 51 hastanın detaylı geçmişine, otoskopik bulgularına ve temporal BT bulgularına ulaşılabilmektedir. Kulak akıntısı geçmişi, otoskopik muayenede orta kulağın mukozal durumu ve ameliyat öncesi yapılan temporal kemik BT bulguları kaydedilmiştir. Mastoidin durumunun intraoperatif görünümü, mastoid havalanmaya ve mastoid hücrelerdeki patolojik dokuya dayanmaktadır. Mastoidin durumunun intraoperatif görünümü, kulak akıntısı geçmişi, orta kulağın otoskopik bulguları ve radyolojik bulgular arasındaki ilişki çalışılmıştır.

Bulgular: Tüm hastaların 25'inde (%49) mastoid antrum ve/veya epitympanumda granülasyon dokusu, sklerotik doku veya hiperplastik epitel vardı. Mastoidin durumunun intraoperatif görünümü, kulak akıntısı ve orta kulağın otoskopik bulguları arasında istatistiksel olarak ilişki bulunmamıştır. ($p>0.05$). Ayrıca, mastoid havalanmasının, kulak akıntısı ve orta kulağın otoskopik bulguları ile anlamlı ilişkisi yoktu ($p>0.05$). Ameliyat öncesi BT bulgularının; mastoid hücrelerin durumu ve mastoid havalanmanın intraoperatif bulguları ile anlamlı ilişkisi vardı ($p<0.01$).

Sonuç: NCSOM'de timpanoplasti öncesi mastoidin durumunun değerlendirilmesi önemlidir. Çalışmamız, NCSOM'nın yüksek oranda kusurlu mastoid duruma sahip olduğunu ve kulak akıntısı geçmişi ile orta kulağın otoskopik bulgularının mastoidin durumu hakkında güvenilir bilgi vermediğini göstermektedir. Ameliyat gerektiren NCSOM'lı hastalara rutin olarak ameliyat öncesi BT taraması yapılmalıdır. Özellikle, kuru kulak zarı perforasyonunda, BT taraması, kusurlu mastoidin saptanmasını yardımcı bir metottür.

Anahtar Sözcükler

Mastoidektomi; timpanoplasti; gösterge; bilgisayarlı tomografi

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INTRODUCTION

Mastoidectomy is first described by Schwartze which is an effective drainage procedure for complicated otitis media.¹ Within several years, mastoidectomy was applied to treat chronic infectious drainage from the ear. In the antibiotic era, to perform mastoidectomy for non-cholesteatomatous chronic otitis media (NCSOM) has remained controversial, though, mastoidectomy is indicated to eliminate disease, to explore the mastoid to ensure that there is no disease, and to better aerate middle ear by buffering pressure changes according to Boyle's law. Therefore, predicting well-aerated and non-diseased mastoid cellules is crucial for successful tympanoplasty.² However, which of the preoperative findings such as clinical history, otoscopic findings or computed tomography (CT) scan, has value in predicting in mastoid condition has not been well studied.

In this study we aimed to determine predictive value of clinical findings including history of ear discharge, otomicroscopic findings, and temporal bone CT to detect mastoid condition preoperatively by comparing them to intraoperative findings.

MATERIAL AND METHODS

Our institution keeps a database for all patients with chronic otitis media who had undergone surgery. Subjects who had undergone primary tympanomastoidectomy for NCSOM were included in this study. Subjects with cholesteatomatous chronic otitis media, those who had canal wall-down tympanoplasty or tympanoplasty alone and revision surgery were excluded from the study. Fifty-one of 122 subjects underwent ear surgery due to chronic otitis media between January 2008 and December 2008 met the inclusion criteria. Mastoidectomy was indicated for NCSOM if there was at least one of the criteria of;

- i. History of intermittent or persistent ear discharge,
- ii. Presence of middle ear mucosal edema with or without ear drainage
- iii. Presence of soft tissue density in mastoid antrum or epitympanum in preoperative temporal bone CT scan.

Preoperative findings were classified into three groups; history of disease, otomicroscopic examination,

and 1.5-mm high-density temporal bone CT scan. History of disease was classified into three groups as; 1, no ear discharge; 2, intermittent ear discharge; 3, persistent discharge or refractory ear discharge to medical treatment. Otomicroscopic examination was also classified into three groups as; 1, dry ear; 2, serous drainage with or without minimal mucosal hyperemia or edema; 3, mucopurulent drainage with severe mucosal hypertrophy or edema. Preoperative CT scan noted the presence of soft tissue density in mastoid antrum or epitympanum and also noted aeration of mastoid.

Intraoperative findings were noted as presence of granulation tissue, infective mucosa, mucosal hypertrophy, sclerotic plaque in mastoid antrum and aditus. Mastoid ventilation was evaluated with patency of aditus ad antrum that was determined with flow of water from mastoid antrum to the tympanic cavity.

Preoperative CT scan findings, history of ear discharge and otomicroscopic findings were compared with intraoperative view of mastoid condition by chi-square analysis. SPSS 11.0 software was used for statistical analyses. Statistically significant difference was accepted as $p < 0.01$.

RESULTS

Fifty-one patients (32 males and 19 females) aged from 13 to 73 years, with a mean age of 44.42 ± 12 were included in this research. There is no statistically significant correlation between intraoperative findings and age and gender. Table 1 compares mastoid disease and aeration with history of disease and otomicroscopic findings. Nineteen (37%) subjects had no history of ear discharge, 22 (43%) subjects had intermittent discharge and 10 (20%) subjects had persistent discharge refractory to medical treatment. In otomicroscopic examination, 28 (58%) subjects had dry middle ear mucosa and normal epithelium, 15 (31%) subjects had serous drainage or/and minimal mucosal edema and hypertrophy and 5 (11%) subjects had purulent drainage/severe mucosal edema. In intraoperative assessment, 25 (49%) subjects had granulation tissue and/or sclerotic tissue, hyperplastic epithelium in mastoid antrum or epitympanum. There was no statistically significant relationship between presence of mastoid disease and history of ear discharge as well as otomicroscopic findings of middle ear ($p > 0.05$). However, there was a strong correlation between antral/epitympanic disease and both persistent ear discharge and severe middle ear mucosal disease.

Table 1. Comparison history of ear discharge and otoscopic findings of middle ear with presence of mastoid disease and mastoid ventilation.

		History of Ear Discharge			Middle Ear Findings			
		Dry	Intermittent	Persistent	No mucosal disease	Serous drainage min. edema	Purulent drainage/severe mucosal edema	
Mastoid Disease	Positive	9 (36%)	8 (32%)	8 (32%)	14 (63%)	5 (23%)	3 (14%)	p>0.05
	Negative	10 (38%)	14 (54%)	2 (8%)	14 (54%)	10 (38%)	2 (8%)	
Mastoid Aeration	Positive	10 (34%)	16 (55%)	3 (10%)	17 (61%)	10 (36%)	1 (4%)	p>0.05
	Negative	9 (41%)	6 (27%)	7 (32%)	11 (55%)	5 (25%)	4 (20%)	

Twenty-two (43%) subjects had impaired water flow from the mastoid antrum to the tympanic cavity. Mastoid aeration was not related with history of ear discharge or otomicroscopic findings of middle ear ($p>0.05$). Also, there was no influence of history of ear discharge and otomicroscopic findings of middle ear on predicting presence of mastoid disease ($p>0.05$).

On preoperative temporal bone CT scan findings, thirty-one (61%) subjects had opacification in mastoid antrum and/or aditus. Of those 31 subjects, intraoperative findings showed that twenty subjects (64%) had mastoid disease and nineteen subjects (61%) had impaired mastoid aeration. The relationship between preoperative CT findings and mastoid disease and mastoid aeration was shown on Table 2. Preoperative CT were findings were significantly related with mastoid condition according to intraoperative findings ($p<0.01$). Also, CT scan revealed the disease in mastoid cellules 5 fold more accurately than otoscopic findings and clinical history. Positive predictive value of CT findings in showing presence of mastoid disease was found 64.5% and negative predictive value of CT findings was 75%. Positive predictive value of CT finding in showing mastoid ventilation was found 65.5% and negative predictive value of CT findings was 85%.

DISCUSSION

Our study demonstrated, in contrary to common thought, history of ear discharge and otomicroscopic findings of middle ear really do not give us reliable information about mastoid condition. There was high percentage of mastoid disease and impaired ventilation even in dry tympanic membrane perforation with normal appearing middle ear mucosa. Additionally, mastoid condition was not significantly worse in discharging ears or ears with inflamed middle ear mucosa than the dry ears. These results suggested us that

Table 2. Comparison between preoperative temporal bone CT scan results and mastoid mastoid disease and mastoid aeration.

		Antral/epitympanic opacification on CT scan		
		Positive	Negative	
Mastoid Disease	Positive	20 (80%)	5 (20%)	p<0.01
	Negative	11 (42%)	15 (58%)	
Mastoid Aeration	Positive	12 (41%)	17 (59%)	p<0.01
	Negative	19 (86%)	3 (14%)	

the pathogenesis of ear drainage is independent from mastoid condition. We assume that the source of infection is the external meatus or Eustachian tube that makes a connection between middle ear and upper airway infection and allergic rhinitis, or the middle ear, itself, is the source rather than mastoid cellules. Therefore, it seems tympanic membrane repair could be enough to control an infection and mastoidectomy is not necessary in this regard.

The influence of mastoidectomy on success rate of tympanoplasty, closure of tympanic membrane and audiometric results, remains controversial.³⁻⁸ Several studies reported that mastoidectomy did not give better results in terms of graft take rate and audiologic results in patients undergone tympanoplasty.^{3,8} In the contrary, others reported that well aerated mastoid was related with higher graft success rate. According to literature, it might be useful to predict mastoid condition preoperatively in order to improve surgical results. Our results showed that ears with persistently discharging and severely inflamed middle ear mucosa were prone to have poor mastoid condition, but was not significantly different from others. In other words, it seems that clinical findings, presence of discharge and otomicroscopic view, did not give a reliable information in predicting mastoid condition.

It is generally thought that history of discharge could be related with disease in the mastoid cellules. However, positive cultures were not obtained irrespective of stage of disease activity.⁹ The infection could be originated from external meatus or Eustachian tube or ear discharge may be consequence of allergenic rhinitis or upper airway infection. These results suggest that mastoidectomy may not provide additional benefits in patients with active disease in order to eliminate infectious process. Balyan et al. treated patients who had discharging ears at the time of surgery, with tympanoplasty with and without mastoidectomy and patients with dry ears operated tympanoplasty without mastoidectomy.¹⁰ The success rates of groups were similar and there was no difference in graft success rate and final functional hearing results between discharging and dry ears. They concluded that mastoidectomy did not give better results in discharging ears. Our results are compatible with previous findings that history of discharge or middle ear findings may not relate with mastoid disease.

Our study also showed that CT is a valuable method to predict mastoid disease and ventilation preoperatively. In our study, CT scan showed disease free mastoid with 80% accuracy. There were only three cases, which had pathology at aditus ad antrum although they had normal CT findings. In those cases, there was a thin mucosal fold at the epitympanum obstructing the aditus ad antrum. CT scan is very useful to detect cases with disease free mastoid and patient for whom mastoidectomy is not necessary in dry tympanic membrane perforations and mild mucosal middle ear disease. CT scan specificity was not as high as its sensitivity. However, it is reasonable to perform mastoidectomy in patients with CT scan showing mastoid disease when we consider that the complication rate of simple mastoidectomy is very low. In our series there was no complication related to mastoidectomy. Consequently, we suggest all patients with dry tympanic membrane per-

foration or mild middle ear otoscopic findings should undergo CT scan investigation and mastoidectomy decision should be taken due to CT scan findings. Similar to our study, Walshe et al has found correlation between radiological findings and intraoperative appearances in twenty patients.¹¹

On the other hand, we agree with the studies that suggesting mastoidectomy should be performed in ears with constantly discharging and with severe middle mucosal pathology,⁴⁻⁶ even when preoperative CT scan is normal. Moreover CT scan did not have superiority for showing the disease in compare to the clinical findings in patients with severe mucosal changes and persistent ear discharge. However, there were not enough patients with constantly discharging ears and with severe middle mucosal pathology to make a statically analysis independently in our study. Thus presence of correlation between mastoid condition and clinical findings was not significant. However there could be an additional pathology such as osteitis, dehiscence of fallopian canal due to infection etc., which CT scan may reveal and allow us to decrease complication rate. As a result both radiological and clinical assessment should be considered in ears with constant discharge and severe middle mucosal pathology.

In conclusion, assessment of mastoid condition is important before tympanoplasty in NCSOM. History of ear discharge or/and preoperative middle ear mucosal examination did not give reliable information about mastoid condition. This study demonstrated that preoperative temporal CT scan is crucial to show mastoid condition. According to this study we suggest that;

- In contrary to general belief, dry tympanic membrane perforations have higher rate of impaired mastoid condition,

- Preoperative CT scanning is a useful method for predicting mastoid condition in patients with NCSOM.

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