Facial Canal Dehiscence in Patients with Chronic Otitis Surgery

Kronik Otiti Cerrahisi olan Hastalarda Fasiyal Kanal Dehissansı

Fasiyal Kanal Dehissansı / Facial Canal Dehiscence

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Özet

Amaç: Kronik otitis media (KOM) cerrahisi geçiren hastalardaki fasiyal kanal durumunu incelemek ve orta kulak patolojisiyle ilişkisini saptamaktır. Gereç ve Yöntem: Ocak 2006 ile Aralık 2012 arasında KOM nedeniyle mastoidektomili veya mastoidektomisiz timpanoplasti ve radikal mastoidektomi yapılan hastaların cerrahi bilgileri retrospektif olarak analiz edildi. Hastaların demostratif verilerinin yanı sıra fasiyal kanalın durumu ile hastaların preoperatif tanıları, yapılan ameliyatın tipi, orta kulağın durumu, cerrahinin sayısı, kolesteatom varlığı, kemikçik defektin varlığı, lateral kanal defektinin varlığı ve dura defektinin varlığı değerlendirilerek fasiyal kanal dehissansı (FKD) ile aralarındaki ilişki istatistiksel olarak araştırıldı. Bulgular: Yediyüzdoksanaltı hasta çalışmaya dahil edildi. Hastaların %10.05'inde FKD saptandı. FKD en sık timpanik segmentte görüldü. Orta kulağın patolojisi, kolesteatom, revizyon cerrahi, lateral semisirküler kanal defekti ve kemikçik defekti ile FKD arasında istatistiksel olarak anlamlı ilişki görüldü($p<0.05$). Tartışma: KOM cerrahisi uygulanacak hastaların preoperatif tanılarına, orta kulak patolojilerine, ameliyat sayısına ve kemikçik zincir defektlerine göre fasiyal kanalda defekt olabileceği öngörülmeli ve gerekli önlemler alınarak fasiyal sinir yaralanma riski en aza indirilmelidir.

Anahtar Kelimeler

Fasiyal Kanal Dehissansı; Kronik Otitis Media; Otolojik Cerrahi Prosedürler

Abstract

Aim: To examine facial canal status in patients with chronic otitis media (COM) surgery and to detect the relation between facial canals dehiscence (FCD) with middle ear pathology in these patients. Material and Method: The surgery data of patients who were subjected to tympanoplasty with or without mastoidectomy and radical mastoidectomy due to COM were analyzed retrospectively from January 2006 to December 2012. In addition to demonstrative data of the patients, status of facial canal and preoperative diagnoses of patients, type of the operation performed, status of middle ear, number of surgeries, existence of cholesteatoma, existence of ossicular chain defect, lateral canal defect and dura defect were assessed and the relation thereof with facial canal dehiscence (FCD) was analyzed statistically. Results: Seven hundred ninety six patients were included in the study. FCD was detected in 10.05% of the patients. FCD was most frequently observed in the tympanic segment. It was found out that there was a statistically significant relationship of middle ear pathology, cholesteatoma, revision surgery, lateral semicircular canal and ossicular chain defect with FCD. Discussion: COM diagnosed patients may have defect in facial canal according to their preoperative diagnoses, middle ear pathologies, number of operations and ossicular chain defects. These patients should be applied a more careful surgery and closely followed up in postoperative periods.

Keywords

Facial Canal Dehiscence; Chronic Otitis Media; Otological Surgery Procedures

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Introduction

Facial canal is a significant structure that should be known and protected in otological surgeries. Existence of a defect on the bone that surrounds the canal in the temporal bone in which the facial nerve is located is called facial canal dehiscence (FCD). In such a case facial nerve is only covered with a weak fibrosis membrane and it may be herniated to the tympanum [1, 2]. And sometimes it may imitate tympanum tumors as well [3, 4]. The most frequent reason for acquired FCDs is cholesteatomas. Apart from such life-threatening complications including central nerve system injuries or meningitis, facial nerve injury is the most frightening sequel in otological and neuro-otological surgeries. Although sensorineural hearing loss and/or vestibular injuries are serious, the ability of the normal contralateral internal ear to compensate these complications decreases the effects of these injuries. However facial nerve dysfunction is a permanent and troublesome event for both the patient and the surgeon [5, 6]. For this reason to be aware of anatomical and morphological variations of facial nerve is crucial for this sort of operations [6].

Recognition of how and where the Fallopian Canal is weak during ear surgery is of critical in order to be able to preserve integrity thereof. FCD may happen as a consequence of chronic inflammatory processes or secondary to the surgery and facial canal which is injured as a consequence of the disease may cause the nerves to be injured more easily [5]. Furthermore, congenital anomalies of facial nerve compose a predisposition for those two injury mechanisms. Preoperative facial nerve injury is rare in cholesteatoma but one may not claim that cholesteatoma located close to any dehiscence in tympanic segment is rare. It may be secondary to either congenital or chronic infections. In such ears tympanic segment may be vulnerable to injury during cleaning cholesteaotoma of tympanum and epitympanum. Nevertheless the case for intraoperative injury of mastoid segment is different. FCD in most mastoid segments is created depending on circulation during FCD mastoidectomy [6]. It is known that dehiscence facilitates development of neuritis and facial palsy in acute and chronic suppurative otitis media. Failure of closing of facial nerve sulcus with ossification during embryologic development and Reichert cartilage malformation's facilitating this closing defect was accused to be the reason for congenital FCD. Additionally, FCD may develop as secondary to middle ear located tumors as well [5].

The purpose o this study is to examine facial canal status in patients who had chronic otitis media (COM) surgery and to detect the relation thereof with middle ear pathologies.

Material and Method

Data of the patients who had surgical operation for COM in the Ministry of Health, Ankara Dışkapı Yıldırım Beyazıt Education Hospital, Ear Nose and Throat and Head Neck Surgery Clinics from January 2006 to December 2012 were examined retrospectively. Different surgeons in the surgery team performed operations. The findings about the status of the facial canal during surgery were classified according to intactness of the canal and whether there was any defect in mastoid, tympanic and geniculate segment. The findings in all surgeries performed were obtained using intraoperative microscope and autoendoscope.

Preoperative diagnoses of all ears subjected to surgery were classified as benign ear, granular COM, adhesive otitis and COM with cholesteatoma. Tympanum status was classified as normal, granular, tympanosclerosis and cholesteatoma. The surgeries performed were classified as tympanoplasty without mastoidectomy, tympanomastoidectomy where the canal is not reduced (CWU), tympanomastoidectomy where the canal is reduced (CWD) and radical mastoidectomy. Furthermore patients were grouped as primary and revision according to the number of surgeries. The relation between those groups and frequency of occurrence of FCD was researched.

The data of the patients were analyzed using SPSS version 18 program (SPSS Inc., Chicago, Illinois) for Windows. The data were assessed using Person Chi-Square test.

Results

Seven hundred and ninety six patients with an average age of 32,09 ±14,69 were included in this study. Data on demonstrative characteristics of the patients, preoperative diagnosis, type of surgery, status of the facial canal and other preoperative findings are summarized in Table-1 and Table-2.

FCD was detected in 80(10,05 %) of the 796 patients. In assessment of the segments of the defect in those 80 patients with FCD, defect was present at tympanic segment in 70 patients (87,5%); at mastoid segment in 8 patients and at genicu-

Table 1. Demonstrative parameters of patients and FCD rates observed

Characteristics		n	%	n (FCD)	% (FCD)	p
Sex	Male	428	53,8	52	14,1	p<0,05
	Female	368	46,2	28	6,5	
Side	Left	392	49,2	41	10,4	p>0,05
	Right	404	50,8	39	9,7	
Preoperative Diagnosis	Benign	381	47,9	1	0,3	p<0,05
	Granular COM	137	17,2	6	4,3	
	Adhesive Otit	62	7,8	5	8,1	
	Tymphanosclerosis	31	3,9	3	9,7	
	Cholestheatoma	185	23,2	65	35,2	
Type of Surgery	Tymphanoplasty	247	31	0	0	p<0,05
	CWU	383	48,1	18	4,7	
	CWD	112	14,1	40	35,8	
	Radical	54	6,8	22	40,8	
Middle Ear Pathology	Normal	340	42,7	5	1,5	p<0,05
	Granular	198	24,9	8	4	
	Tymphanosclerosis	94	11,8	3	3,2	
	Cholestheatoma	164	20,6	64	39	
Number of Surgery	Primary	656	82,4	48	7,3	p<0,05
	Revision	140	17,6	32	22,9	
Cholestheatoma	No	592	74,4	10	1,7	p<0,05
	Yes	204	25,6	70	34,3	
Ossicular Chain Defect	No	442	55,5	4	0,9	p<0,05
	Yes	354	44,5	76	21,4	
LSC Defect	No	772	97	66	8,5	p<0,05
	Yes	24	3	14	58,3	
Dura Defect	No	790	99,2	78	9,9	p<0,05
	Yes	6	0,8	2	33,3	

Table 2. FCD rates according to segment.

Facial Canal Status	n	%
İntact	716	89,95
FCD	80	10,05
Thymphanic	70	87,5
Mastoid	8	10
Geniculate	2	2,5

FCD: Facial canal dehiscence.

late segment in 2 patients.

Mean FCD length was detected as 2,9±2,2 mm. FCD was observed at higher rates in men (14,1%) compared to women (6,5%) and the difference was found to be statistically significant (p<0,05). FCD was statistically significantly more commonly observed in revision surgeries compared to those performed as primary (p<0.05).

It was found out that FCD had a correlation with cholesteatoma status and the probability of the patients with cholesteatoma to have FCD was found to be higher at a statistically significant degree (p<0,05). Furthermore FCD was found to be in correlation with ossicular chain defect and LSC defect and the probability of the patients with these defects to have FCD was found to be higher at a statistically significant degree (p<0,05). Existence of FCD was found to be statistically significantly related to preoperative diagnosis (p<0,05).

Tympanoplasty was applied to 247 of 796 patients and while FCD was not observed in any of those patients. However FCD was observed in 18 (4,7%) of 383 patients who were applied CWU, in 40 (35.7%) of 112 patients who were applied CWD and in 22(42.3%) of 52 patients who were applied Radical mastoidectomy. The rate of occurrence of FCD in radical mastoidectomy and CWD surgeries were observed to be higher compared to tympanoplasty and CWU. A statistically significant relation was detected between middle ear pathologies and existence of FCD (p<0,05).

Looking through FCD rates according to middle ear pathologies; while FCD was observed in 5 of 340 patients with normal mucosa in middle ear, FCD was detected in 3 of 94 patients with sclerosis, in 8 of 198 patients with granular mucosa and 64 of 164 patients with cholesteatoma. The rate of occurrence of FCD in patients with cholesteatoma and granular middle ear mucosa was detected to be higher compared to the patients with normal and sclerotic middle ear mucosa.

Discussion

Facial nerve is one of the anatomical structures located in the temporal bone, which differ most frequently. For this reason patients with FCD are under higher risk during ear surgeries compared to normal patients [6]. There is no consensus in the relevant literature about acquired FCD development mechanism. Although the initial theories focus on the idea that primary mechanism is pressure necrosis, today it is considered that bone resorption is primarily due to the excessively activated osteoclasts. Disintegration of organic and inorganic components of the bone occurs by secreted acid phosphatase collagenase and acid protease enzymes in the inflammatory process. Cytokines and growth factors including interleukin-1, interleukin-6, colony stimulating factor-1, tumor necrosis factor-alpha, and epidermal growth factor transforming growth factor-beta play a role in this situation as well [7]. Those mechanisms are also responsible from the complications secondary to ossicular chain and bone erosions as well.

Intraoperative FCD is observed between the rates of 0,5% and 33% in the studies performed. Stapes surgery and tympanoplasty without mastoidectomy are also included in these ratios and in those operations all segments of facial canal cannot be visualized. By this reason, in FCD studies on cholesteatoma, dehiscence ratio is determined to be higher [8,9]. Moreover, different surgeons perform surgeries. It is a truth that the dehiscence ratios may also change depending on the surgeons' experience and the technical devices. In this study, the FCD incidence was determined as 10.05% in all cases and 87.5% of those were in tympanic segment. Although FCD was not observed in cases with tympanoplasty, it was reported in mastoidectomy cases.

It is considered that real FCD prevalence is higher than FCD rates detected intraoperative period. The temporal bone dominance in this study was also supported with anatomic and histopathological studies as well. Moreano et.al [10] encountered minimum one FCD at a proportion of 56% in the histopathological study they conducted on 1000 temporal bones without any explicit disease or inflammation evidence in order to attract the attention to anatomic variations. They detected that it was located most frequently in tympanic segment and particularly around oval window (74%), and in the second elbow (12%). Baxter [1] reported facial canal dehiscence in 55% of 535 temporal bones in a similar anatomic study he conducted [11].

Wang et.al. [7] found FCD at a rate of 29,7% in the study they performed on 155 patients with cholesteatoma. Kim et.al. [8] specified this rate as 8,6% in the study they performed on 152 patients who were diagnosed with COM without cholesteatoma. Sheehy et.al. [12] detected 15% congenital FCD, 17% disease caused FCD, and determined that 44% FCD depending on surgery was created without explaining how discrimination was made on 1024 mastoid surgery cases they performed in 10 years. Beyazıt et.al. [11] detected an 8,9% FCD rate in the study they performed on 219 patients.

Facial nerve injury may either be a direct complication of cholesteatoma or be a complication of ear surgery made because of cholesteatoma [13]. In the analysis performed by Green et.al. [14] on 22 patients with iatrogenic facial nerve injury developed as secondary to non-neurootological procedures, it was detected that it occurred during mastoidectomy in 57% of the patients, and during exocytosis excision in 14% of the patients and additionally existence of cholesteatoma caused iatrogenic injury at a proportion of 36% as a predisposing factor. They suggested that the most frequently injured segment was the tympanic segment. In our study 35.2% FCD was determined in patients with cholesteatoma and 1,7% in patients without cholesteatoma. We suppose the existing pathology particularly cholesteatoma is related to FCD and that cholesteatoma is a risk factor for FCD development and consequently for preoperative facial nerve injury.

In the study performed by Selesnick et.al. [9] 30% FCD was observed in primary cases and 35% in revision cases. Revision surgeries were defied as risk factors for FCD in the study performed by Di Martino et.al [5]. Iatrogenic facial nerve injury

incidence was reported between 0,6-3,6% in primary cases and between 4-10% in revision surgeries in the literature [8]. Nevertheless Wiet [15] defended that iatrogenic facial nerve injury incidence depends on the form of the surgery performed and detected in the study he performed that facial nerve injury rate was between 0,6 and 3,6% in all otological surgeries and this rate increased up to 4-10% in revision cases. In our study 22,9% FCD was found during revision surgeries and the difference was found to be statistically significant. We are convinced that revision surgeries are risk factors for facial nerve injury due to high FCD incidence.

Wang et.al. [16] detected positive correlation between lateral semicircular canal (LSC) defect and FCD in their study and it was expressed that most of the patients with LSC defect had FCD particularly in tympanic segment. Fourteen (17,5%) of 24 (3) patients with LSC defect had FCD in our study and the section with dehiscence was in the tympanic segment in all of them. It was supposed that this was related to close neighborhood of LSC and facial nerve in tympanic segment [11, 17].

In the study performed by Wang et.al. [7] dural defect in mastoid tegmen was detected in 26 of 155 patients having ear surgery and it was expressed that most of these were related to cholesteatoma. Although the relation between dural defect and FCD was not found to be statistically meaningful in the same study, it was defended that this risk was related to the localization of cholesteatoma. Dural defect in mastoid tegmen was detected in 6 of 796 patients having surgery in our study.

FCD was detected in surgeries made for non-cholesteatoma reasons as well. Among these, FCD was detected in 5 (1,5%) of 340 (42,7%) patients whose middle ear mucosa was normal, in 8 (4%) of 198 (24,9%) patients in whom granular mucosa was observed, in 3 (3,1%) of 94 (11,8%) cases with sclerotic mucosa. FCD was observed in mucosal diseases where no cholesteatoma was observed and it is considered that it may be a risk factor in this case in terms of facial nerve injury. Additionally, it has been reported that facial nerve monitoring and computerized tomography do not have any contribution to the detection of FCD, particularly those in the tympanic segment [5].

According to the literature and the statistical analysis of the study a significant relation was detected between FCD with cholesteatoma, revision surgery, LSC defect, ossicular defect. We consider that the existence of those parameters is significant risk factors in the development of preoperative facial nerve injury. For this reason we recommend that those pathologies should be examined carefully in preoperative assessment and measures including selection of high definition video systems and microscopes, otoendoscope, proper surgery tools and intraoperative facial nerve monitoring should be taken in order to detect dehiscence more clearly in the patients within the risk group and avoid complications.

As a consequence; it should be anticipated that COM diagnosed patients may have a defect in facial canal according to their preoperative diagnoses, middle ear pathologies, number of operations and ossicular chain defects. Taking the necessary measures should minimize facial nerve injury risk. Furthermore, patients who are considered likely to have FCD should be applied a more careful surgery and close follow-up in postoperative periods should be done.

Competing interests

The authors declare that they have no competing interests.

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