Research Paper

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Retrospective Analysis of Mastoid Findings in Cholesteatoma Surgery

Medical Science

KEYWORDS : Cholesteatoma, Facial nerve dehiscence, mastoidectomy, chronic otitis media.

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ABSTRACT

Retrospective analysis of mastoid findings such as labyrinthine fistula and facial nerve dehiscence in cases of chronic otitis media with cholesteatomas; to review incidences and elucidate their association of occurrence, with its outcome.Case record basedanalysis of one hundred twenty eight patients (77 Males, 51 Females) enrolled in the study of tympanoplasty with or without mastoidectomy, complicated by labyrinthine fistulas between 2008 to 2013 was done retrospectively. Most of the patients underwent Preoperative scans. Sizeof the fistulas were assessed by CT scans and operative microscopic evaluation. The overall incidence of FND, and rates of lateral canal fistulas were 15.6% and 4.7% respectively. The relationship between them was positive in our study

Introduction

Cholesteatoma is a cystic lesion formed from keratinizing stratified squamous epithelium, the matrix of which is composed of keratin debris found within the middle ear cleft of the temporal bone. The resulting hyperkeratosis and shedding of keratin debris usually results in a cystic mass with a surrounding inflammatory reaction. It can present either extradural or intradural. Extradural cholesteatomas mainly involves the middle ear cleft of the petrous bone.

Cholesteatoma is a generally a benign disease, however, it may behave aggressively causing invasion locally which are associated with significant morbidity.[1]

Cholesteatoma may cause subsequent bone destruction with intra and extra cranial complications such as meningitis, brain abscess, and facial nerve paralysis.[2]

However, the mechanism of the bony destruction in cholesteatoma is controversial, theories of pressure necrosis, enzymatic destruction, inflammation have been speculative in cases of chronic otitis media leading to complications.[3,4]

The recurrence rates reported after surgery have been between 7.6% and 57.0% and are related to the length of follow-up[5]. The facial nerve is particularly vulnerable to infection during chronic otitis media, and facial palsy is a common complication of cholesteatoma, although it might also occur during tympanomastoid surgery[1,3].

Apart from the normal anatomical variations of the facial nerve, distortions of landmarks can been seen from previous operations, on going inflammation, granulations, and recurrence of cholesteatomas which are of concern at the time of surgery. The tympanic and mastoid segments are mostly vulnerable to injury during otologic surgery [6,7].

Although facial nerve injury is an iatrogenic complication, incidence has decreased significantly, from 15% to 1%, because of improvisation of microscopes and with the use of motorized drills[8]. Anatomical variations of the facial nerve from bony erosion caused by cholesteatoma may be the primary reason why current incidence remains unchanged.[3,6,9]

Numerous otologists have reported cases with facial nerve dehiscence (FND), which is common in the humans, The frequency of FND varies from 0.5% to 74%, and it typically occurs in the tympanic segment near the oval window according to the medical literature.[10]

Labyrinthine fistulae are abnormal communications between the inner ear and surrounding structures. Bone resorption of the otic capsule is generally a consequence of longstanding otitis media with cholesteatoma. The incidence of fistulas found during surgery for cases with cholesteatoma has been reported to be ranging between 2.9 % and 12.5 % 3. Management and evolution of surgical techniques have been courting controversy.[11]

The purposes of this study of FND were to review its incidence at cholesteatoma surgery, to analyse its association with semicircular canal fistula

Methods and material

One hundred twenty eight patients (77 Males, 51 Females) who underwent surgery to eradicate disease for cholesteatoma by a single operator performed at Department of ENT, KHUH and Dammam Medical Complex between the period 2008-2014, were enrolled for the study. All the patients underwent mastoidectomy for removal of cholesteatoma. Those who had limited surgery as atticotomy or atticoantrostomy formed one group, while those who underwent CNWD mastoidectomy formed the other group.

Age of the patients ranged from 11-61 years, with mean age 40.4 for Males and 39.6 for females. One male patient and 2 female patients had undergone bilateral middle ear surgery. Symptoms like aural discharge and hearing loss was present in all the patients. 6 patients reported symptoms of vertigo preoperative, intermittent in 4 and persistent in 2 of them. 3 patients underwent revision surgery, 2 had CNWD procedure and 1 had atticoantrostomy. Pre operative Audiometry was done in all the patients. Normal auditory (bone conduction) 0-20 Db HL was taken as normal. Conductive HL of 30 -55 dB was noted in all the patients except one who had a preoperative dead ear.

All the patients had a HRCT mastoids to know the extent of the disease. LSCC was identified in 4 cases. Based on patients history, physical findings and CT evaluation 6 patients were suspected to have a fistula. This included, a positive fistula test and associated preoperative vertigo.

Of the 128 operated ears, Atticoantrostomy was performed in 48 ears (28Males, 20 females) and 80 ears underwent CNWD (46 Male patients, 34 female patients). Initial or primary surgery was performed in 116 ears (70 males, 46 females) and revision surgery in 12 ears (7 males and 5 females).

Facial nerve was carefully evaluated intraoperatively for the involved segment. Facial Nerve dehiscence (FND) was noted in 14 ears with CNWD Mastoidectomy (n=80; 17.5 %) and 6 ears in atticoantrostomy group (n=48; 12.5%). Intraoperative results were assessed for presence of FND, for its location and identifying the LSCC fistula.

Results

The results between the two groups FND showed no significant difference using the $_x$2 test (Table1). Facial nerve dehiscence (FND) was identified in 17 ears (14.6%) of 116 patients , at initial surgery and 3 (25%) of 12 ears after revision surgery and statistically no difference was seen between them using the Fisher exact test (Table 2).

Data was analysed x2 and Fisher exact tests. Inferential statistics such as Chi square test and Fisher exact probability tests are used to analyse the data.

FND occurred in 12 Male patients (45 ears) in CNWD and 4 Male patients in ears in limited mastoidectomy group. The incidence of FND in Males with limited and complete mastoidectomy was 34.3 % and 20.1% respectively. Total FND in Male was 27.2 % and 31.4 % operated on had previous surgery with FND. In the primary middle ear surgery cases FND was identified in 16 of 56 in male patients.

FND was identified in 20 patients. In tympanic segment 17 ears (85%), vertical segment only (10%) in 2 patients and involving both segments in 1 patient (table3). Tympanic segment predominated (91%) with 16 ears (80%) at the primary/initial surgery, involving the segment. In the vertical segment, FND was noticed in 1 of 2 patients who underwent revision surgery. Though only tympanic location of FND was noted in Atticoantrostomy compared to complete mastoidectomy (with other locations also), there was no statistical difference in their location among the groups. None of the patients reported with facial paralysis and neither of the operate ears developed facial paralysis post operatively.

The concomitant occurrence of LSCC fistula was identified in 6 (4.7%) of 128 ears. Of these 6 patients, 2 Males and females also had FND, in the tympanic segment. A positive association (50%) was found between FND and presence of LSCC, which is higher than overall occurrence of FND 15.6% (table4).

Fistula test signify poor correlation with CT findings.

Table 1: FND Incidence in limited/ complete mastoidectomy in 128 ears

Operations	FND Present	FND Absent	Total
Atticoantrostomy	6 (12.5%)	42(87.5%)	48(100)
CNWD	14(17.5%)	66(82.5%)	80(100)
Total	20(15.6%)	108(84.3%)	128(100)

Chi square – 0.57, P – 0.450

Table 2: Incidence of FND at Primary/initial and revision surgery

Surgery	FND		
	Present	Absent	Total
Primary	17(14.6%)	99	116(100)
Revision	3(25%)	9(75%)	12(100)
	20 (15.6%)	108 (85.4%)	128 (100)

Fisher exact probability test – 0.88, P - 0.281

Table 3: Location of FND In 20 Pts

Segment	Mastoidectomy		
	Complete (CNWD)	Atticoantrostomy	Total
Tympanic	10(58.9%)	7 (41%)	17 (85%)
Vertical	2 (10%)	0	2(10%)
Both	1(5%)	0	1(5%)

Chi-square – 1.90, P – 0.386

Table 4: Association of FND with SCC fistula

LSCC fistula	FND		
	Present	Absent	Total
Present	3	3	6
absent	17	105	122
Total	20	108	128

Fisher exact probability test – 5.64, P - 0.048 (significant)

Discussion

Facial nerve dehiscence has been reported since long time, with studies relating to the clinical conditions and histopathological studies with the focus on improvising surgical techniques. We carried our study of detecting FND based on operative findings microscopically.

Dehiscence of the fallopian facial canal can occur congenitally, or due to persistence of inflammation, but can also be iatrogenic. The bony fallopian canal is that segment of the facial nerve which starts ossification in utero, and gets completed by the 1st year of life although some parts may remain unossified resulting in dehiscence. [6]

The compounding factors are associated inflammatory course with underlying cholesteatoma which further causes osteolysis resulting in dehiscence of the fallopian canal. Other factors increasing the risk to the facial nerve are previous surgery, granulations, residual or recurrence of cholesteatoma which distort the normal anatomy. Otological middle surgery makes the facial nerve the most vulnerable structure, and accidental trauma are seen frequently with dehiscence at the second genu and more likely with unskilled operator.

In congenitally malformed ears, facial nerve is expected to have an abnormal course with a risk of exposed segment [19]. Therefore, it becomes imperative to be aware of the incidence of facial nerve dehiscences in the routine development course. The incidence of exposed facial nerve have been reported as high as 30–35% during middle ear surgery which makes the importance of understanding the facial nerve anatomy and the underlying mechanism of chronic otitis media which risks the exposed or dehiscent facial nerve .[3]

In one series of 250 consecutive operated chronic otitis media cases, with cholesteatoma in 77%, facial nerve dehiscence was seen in 38% of them. [20] In other series of 64 cases with facial paralysis due to chronic otitis media bone destruction of the facial canal was found in 75% of cases and Tympanic segment was the most common site of involvement which reasons for the dehiscent facial canal or very thin canal wall most frequently found at this part exposing the nerve to the inflammation[21].Another series have reported 83.3% dehiscent facial canal, most commonly the second genu and horizontal segment in cases of facial nerve paralysis due to chronic otitis media cases [9]

The prevalence of dehiscence according to anatomical and histology studies have been reported to be from 25% to 57%. Baxtr in their study of temporal bones found dehiscent facial nerve in 55% of the 535 examined temporal bones, in the horizontal and vertical segments in 91% and 9% cases respectively [12]. It was found in 85% of cases dehiscence was present at the inferior surface the tympanic portion. Another study of 100 temporal bones histopathologically, FND was noted in 56% with 74% of them located at the tympanic segment close to the oval window.[11]

On the other hand the incidence of FND based on the operative findings, have been reported differently in several different studies. In one study an incidence of 11.4% have been reported in a retrospective study of 1465 number of stapedotomies which is

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quite low[10]. In another retrospective analysis of 1000 cases operated for cholesteatoma dehiscent facial nerve effected by the disease was found in 17%, but was noted operatively in 44% of them by [13].

In a small study conducted by Harvey and Fox Harvey, Facial nerve dehiscence was found to be significantly dehiscent in 3 out of 47 (6%) performed mastoid operations, the incidence is much lower than our study ,while Selesnick and Lynn-Macrae [1] reported an incidence as high as 33% which is the highest incidence reported according to any series.

The overall incidence of FND in our series was 15.6% (20 ears). Tympanic FND is strongly implicated in the middle ear infections and inflammation, and is found to be dehiscent in patients planned for middle ear surgery. It is predominantly affected, at the tympanic segment. In our study, tympanic segment was dehiscent was noted in 17(85%) of the ears with CNWD numbers more than the other group. It parallels the development of cholesteatoma with tympanic segment dehiscence and since the disease mainly invades this segment requiring surgery and this segment is more prone to trauma during drilling.

The occurrence of facial paralysis during primary surgery has been reported from 0.6% to 3.6% which increases up to 10% in revision cases. In a large series of 1024 mastoidectomies facial palsy was noted in 1.7% of cases Nilssen and Wormald, but we didn't have any postoperative facial paralysis, may be our study size was small.

It has been seen that male sex with cholesteatoma has a predisposition to facial nerve injury, but the incidence of FND was similar between sexes (34.8% and 38.1% for male and female patients respectively. In our study, male sex did not predispose to facial nerve paralysis. It has also been observed that there was no statistical difference in FND between initial and at revision surgery, hence previous surgery doesn't seem to be significant factor relating to facial dehiscence.

Conclusions

In this study the overall incidence of FND after exenterating the disease was found to be 15.6 % . The prevalence of FND in the horizontal segment was 85%, with tympanic segment predominantly the most common site for injury. The incidence rates of lateral canal fistulas were 4.7%. The relationship between them was positive in our study. It lead to conclusion the careful manipulation of the matrix is essential to preserve hearing postoperatively. Thus to decrease the facial nerve injuries, the importance of the understanding of the anatomical landmarks cannot be overemphasized.

Conflict of Interests

None

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