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ORIGINAL ARTICLE

A RETROSPECTIVE STUDY OF FACIAL NERVE DEHISCENCE ENCOUNTERED DURING MIDDLE EAR SURGERY

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ABSTRACT: OBJECTIVE: The aim of this study to evaluate the incidence and localization of facial nerve dehiscence in patients undergoing middle ear surgery. **MATERIALS AND METHODS:** A retrospective study done at our ENT center consists of 103 patients undergoing various middle ear surgery. The patients who have been operated in our ENT center for middle ear problems in last 3 years were enrolled for the study. Among 103 patients, 35 were women, 68 were men with age ranging from 7 to 59. **STATISTICAL TOOL:** proportion and percentage, Chi square test. Statistical method analyzed by Graph Pad Instat software. **RESULTS:** Facial nerve dehiscence occurred in 15 (14.5%) of 103 patients. Involvement of tympanic segment more common than other segments. **CONCLUSION:** Conclusively, one out of every 10 surgical cases may have dehiscence of the facial canal which has to be always keeping in mind during surgical manipulation of the middle ear. Facial nerve is most vulnerable structure in middle ear and that should be dealt carefully to avoid complications.

KEYWORDS: facial nerve, middle ear surgery, dehiscent facial nerve, tympanic segment.

INTRODUCTION: Facial nerve is the most important structure in the middle ear which supplies facial muscle. Any injury to the facial nerve during middle ear surgery will result in facial paralysis. The facial deformity will produce considerable psychological impact, social isolation and diminished self-esteem for the affected patient. Historically, mastoid surgery performed without a microscope has been associated with rates of facial nerve injury was as high as 15%[1] but today, with the aid the modern technology has been dramatically reduced.

The risk is now between 0.6% and 3.6% for an initial procedure, although it rises to 4%-10% for surgical revisions.[2] Facial nerve dehiscence (FND) is a common anatomic variant that usually occurs in the tympanic segment above the oval window but is also encountered at the level of the geniculate ganglion and in the mastoid segment adjacent to the retro facial cells. Alternatively, FND may be attributable to longstanding middle ear inflammation with bony erosion of the facial canal such as cholesteatoma,[3] prior ear surgery or trauma, and the pressure effect of tumour. Baxter found that 57% of people have dehiscence of the facial canal in the oval niche.[4]

Di Martino et al. have compared the actual clinical findings in 357 operated cases with 300 temporal bones and have reported fallopian canal dehiscence in 6.4% of the operations and 29.3% of the autopsies.[5] The incidence of multiple dehiscences along the course of the fallopian canal in the same temporal bone is much higher in specimens of newborns and young children.[6] Good knowledge about facial nerve course is essential for middle ear surgery to be done safely. The ability to assess facial nerve dehiscence preoperatively can reduce risk the facial nerve injury and the morbidity.

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It has been noted that a gestational aberration during Weeks 21-26, generally involving failure of two ossification Centre's in the tympanic segments to fuse, is responsible for facial nerve dehiscence. One of these sites is anterior to the apical otic ossification Centre, while the other abuts the canalicular ossification center, near stapedius muscle.[7] The aim of this study is to evaluate the incidence and the location of the dehiscent facial canal in patients operated for facial paralysis, tympanoplasty with canal down or canal up mastoidectomy, stapedotomy, middle ear exploration for sudden hearing loss, and excluding middle ear tumour.

METHODS: Retrospective study conducted at our ENT Centre for the Patients who have been operated for middle ear problems for last 3 years were included in the study. Among 103 patients, 35 were women, 68 were men with ages ranging from 7 to 60. Patients' charts, clinical notes, and operation reports were reviewed. Otoscopic findings, type of surgery used, the presence and absence of cholesteatoma, and other intraoperative findings related to the facial nerve were systematically documented.

INCLUSION CRITERIA:

1. Patient willing for all the investigations to undergo the surgery with ages range from 7 to 60.
2. Only middle ear diseases.

EXCLUSION CRITERIA:

- Middle ear tumours, malignant otitis externa were the main items for exclusion criteria to rule out the possible erosive effect. Out of 103 patients, 55 were tympanoplasty with or without mastoidectomy, 16 were exploration of the middle ear for gradual or sudden hearing loss, 14 were ossiculoplasty for traumatic injury and 10 were facial nerve decompression due to paralysis not respond to medical therapy, 8 were stapes surgery for otosclerosis. Dehiscence of the facial canal was classified in 5 basic groups.
    1. If the dehiscence is before the cog, it is classified as geniculate ganglion dehiscence.
    2. If the dehiscence is between the second genu and the Cog, it is classified as tympanic or horizontal segment dehiscence.
    3. If the dehiscence is located in the second genu, very close to the lateral semicircular canal, it is classified as dehiscence at the second genu.
    4. If the dehiscence is protruding over the oval Window only, it is classified as dehiscence of oval window niche.
    5. If the dehiscence is after the lower level of the oval window at the mastoid or vertical segment, it is classified as vertical segment dehiscence.

RESULTS: STATISTICAL TOOL: proportion and percentage, Chi square test Statistical data analyzed by Graph Pad Instat software Intraoperative, we found 15 ears (14.5%) demonstrated an exposed facial nerve. Of those, 12 were at the horizontal segment, 1 was at the level of second genu, 1 was at the level of oval window niche and 1 was at vertical segment.

None of the patients in this series had a combined Horizontal or vertical segment dehiscence.

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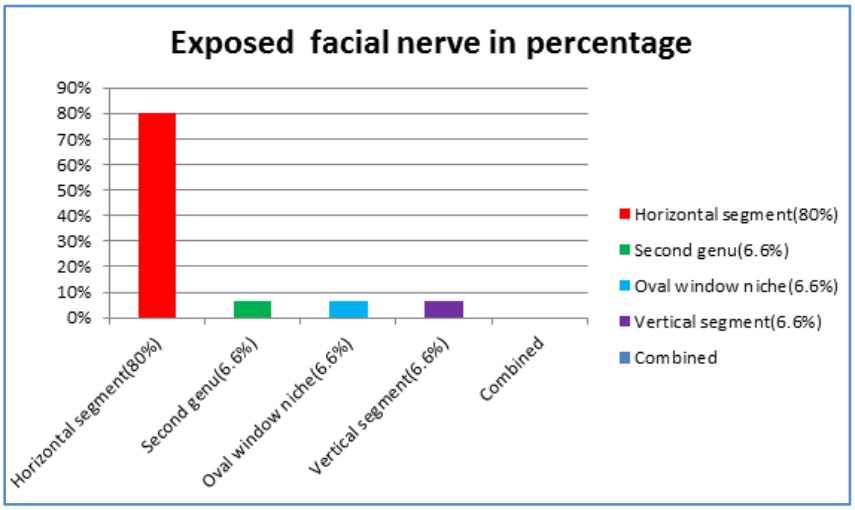
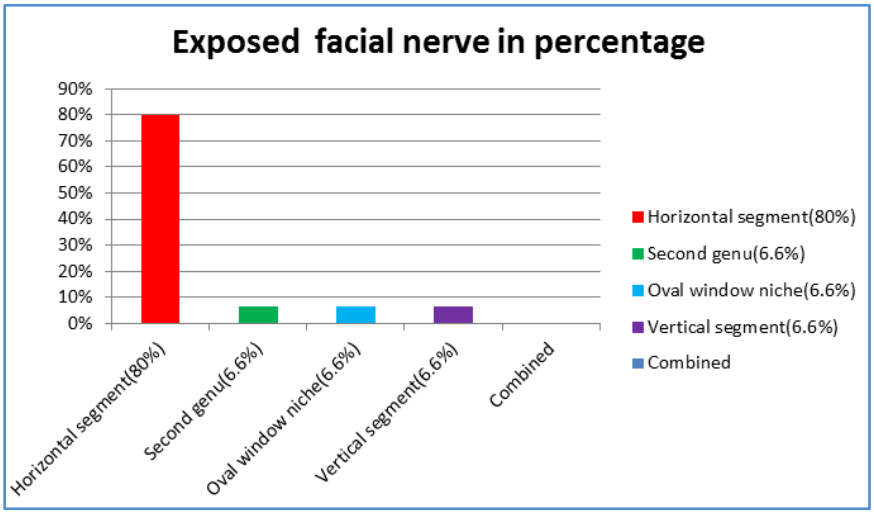
Site	Exposed facial nerve	%
Horizontal segment	12	80%
Second genu	1	6.6%
Oval window niche	1	6.6%
Vertical segment	1	6.6%
Combined	-	-

Mean: 3. Standard deviation ± 5.05. P-value: 0.001 which is considered highly significant.





Among 15 patients with facial canal dehiscent, 11 were from tympanoplasty surgery including canal wall up and down (20 %), 2 were from middle ear exploration (12.5 %). 1 was from ossiculoplasty (7.1%) and 1 was from stapes surgery (12.5%)

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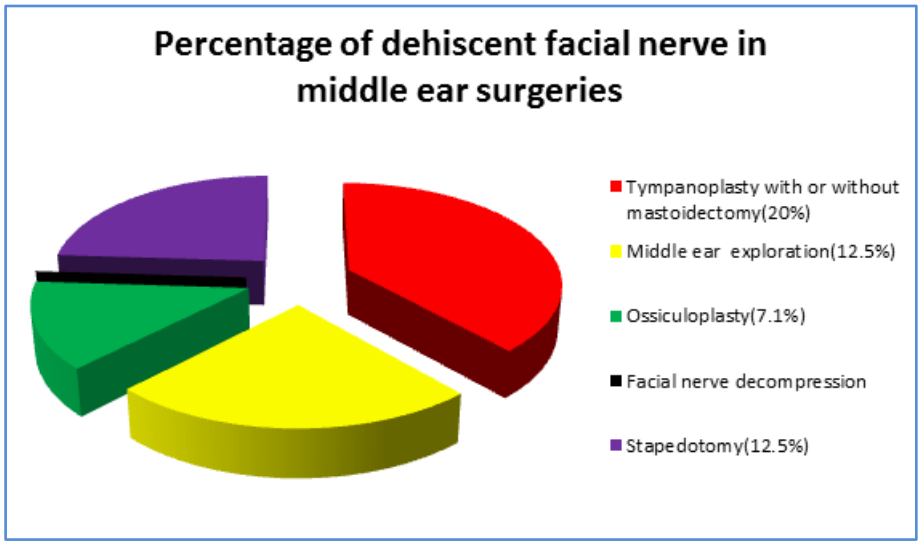
Ear surgery	No. of patients	No. of dehiscent facial nerve	%
Tympanoplasty with or without mastoidectomy	55	11	20%
Middle ear exploration	16	2	12.5%
Ossiculoplasty	14	1	7.1 %
Facial nerve decompression	10	_	_
Stapedotomy	8	1	12.5%
Total	**103**	**15**	**14.5%**

Mean-3. Standard deviation ± 4.5. Sample size-103. P-value found out to be 0.013 which is considered significant.



DISCUSSION: Iatrogenic facial paralysis, even now, remains a devastating complication of otologic surgery, although the incidence is low. Anatomic variants of the facial nerve, especially FND, may also increase intraoperative risks. It is important to know the nature of such defects to understand the possible underlying mechanism of facial paralysis due to chronic otitis media since a congenital dehiscence or bony defect exposes the nerve to the inflammatory effect of suppuration.

In our study, Incidence of FND in middle ear surgery was found to be 14.5% (15/103 patients), with tympanic segment alone (80%) [12/15 patients]) Most frequently involved and more commonly encountered during tympanoplasty with canal wall up and down mastoidectomy (20%). The highest incidence of exposed facial nerve has been reported to be 30–35% during surgery for middle ear cholesteatoma.[8] Published reports place the incidence of FND anywhere from 0.5% [9] to 74%,[10] based on histological studies of temporal bone and cumulative intraoperative findings.

Tympanic segment was the most common site of involvement (77.2%) which has been stated by the authors that the main reason for this occurrence is the dehiscent facial canal or very thin canal wall most frequently found at this part exposing the nerve to the inflammation.[11]

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Yetiser et al. have found 83.3% dehiscent facial canal in patients facial paralysis due to chronic otitis media with the most common sites being at second genu and horizontal portions [12]. It is likely true that the bony dehiscence over the nerve is responsible for the extent of the inflammation. In our study, regarding the site of the FND, tympanic segment found to be involved in 80% followed by second genu (6.6%) also oval window niche and vertical segment sharing 6.6%. Our rate of mastoid segment FND, 6.6% was comparable to prior reports in the 1.6% [13] to 9%[4] range.

The facial canal is shaped during enchondral ossification of the otic capsule in fetal life. However, it is not completely dependent to the ossification process.[14] Abnormal course of the facial canal is expected in malformed temporal bones and the nerve can be exposed.[15] Middle ear has several traps for new beginners to otologic surgery. It is sometimes difficult to identify the facial nerve covered by a thick mucosal layer only. The frequency of iatrogenic injury to the facial nerve has declined with the advent of microsurgical techniques.

CONCLUSION: The incidence of Facial nerve dehiscence in middle ear surgery was 14.5% with preferential involvement of tympanic segment and encountered more commonly during tympanoplasty. Therefore, otologic surgeons should be particularly cautious during mastoidectomy, given these conditions. Conclusively, one out of every 10 surgical cases may have dehiscence of the facial canal which has to be always keeping in mind during surgical manipulation of the middle ear.

REFERENCES:

1. Nilssen E, Wormald P. Facial nerve palsy in mastoid surgery. J Laryngol Otol 1997; 111: 113–116.
2. Wiet RJ. Iatrogenic facial paralysis. Otolaryngol Clin North Am 1982; 15: 773–780.
3. Bayazit YA, Ozer E, Kanlikama M. Gross dehiscence of the bone covering the facial nerve in the light of otological surgery. J Laryngol Otol 2002; 116: 800-803.
4. Baxter A. “Dehiscence of the fallopian canal,” Journal of Laryngology and Otology, vol. 85, no. 6, pp. 587–594, 1971.
5. E. Di Martino, B. Sellhaus, J. Haensel, J. G. Schlegel, M. Westhofen, and A. Prescher, “Fallopian canal dehiscences: a survey of clinical and anatomical findings,” European Archives of Otorhinolaryngology, vol. 262, no. 2, pp. 120–126, 2005.
6. Perez B, M. E. Campos, J. Rivero, D. L. Campos, and D. L´opez- Aguado, “Incidence of dehiscences in the fallopian canal,” International Journal of Pediatric Otorhinolaryngology, vol. 40, no. 1, pp. 51–60, 1997.
7. Spector JG, Ge X. Ossification patterns of the tympanic facial canal in the human fetus and neonate. Laryngoscope 1993; 103: 1052–1065.
8. Lin J. C, K. Y. Ho, W. R. Kuo, L. F. Wang, C. Y. Chai, and S. M. Tsai, “Incidence of dehiscence of the facial nerve at surgery for middle ear cholesteatoma,” Otolaryngology-Head and Neck Surgery, 131(4).p. 452–456, 2004 and Neurotology, vol. 22, no. 2, pp. 129–132, 2001.
9. Derlacki EL, Shambaugh GE, Harrison WH. The evolution of a stapes mobilization technique. Laryngoscope 1957; 67: 420–447.
10. Takahashi H, Sando I. Facial canal dehiscence: histologic study and computer reconstruction. Ann. Otol Rhinol Laryngol 1992; 101: 925–930.

DOI: 10.14260/jemds/2014/3531

11. D. L. Savic and D. R. Djeric, "Facial paralysis in chronic supportive otitis media," Clinical Otolaryngology and Allied Sciences, vol. 14, no. 6, pp. 515–517, 1989.
12. D. Li and Y. Cao, "Facial canal dehiscence: a report of 1465 stapes operations," Annals of Otology, Rhinology and Laryngology, vol. 105, no. 6, pp. 467–471, 1996.
13. Moreano EH, Paparella MM, Zelterman D, Goycoolea MV. Prevalence of facial canal dehiscence and of persistent stapedial artery in the human ears: a report of 1000 temporal bones. Laryngoscope 1994; 104: 309–320.
14. F. Declau, W. Jacob, S. Montoro, and J. Marquet, "Dehiscence of the facial canal: developmental aspects," International Journal of Pediatric Otorhinolaryngology, vol. 21, no. 1, pp. 21–32, 1991.
15. R. Saito, S. Watanabe, A. Fujita, A. Fujimoto, I. Inokuchi, and Y. Ogura, "Temporal bone pathology in congenital anomalies of the oval window and the facial nerve," Auris Nasus Larynx, vol. 12, no. 3, pp. 139-148, 1985.

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