

Original Research Article

Incidence of Facial Canal Dehiscent Noted Intraoperatively in Unsafe Chronic Suppurative Otitis Media: A Retrospective Study

Hardika B. Patel^{1*}, Neena H. Bhalodiya¹, Simple R. Bhadaia¹, Swati A. Mishra¹¹Department of Otorhinolaryngology; GMERS Medical College Sola Civil, Ahmedabad, Gujarat, India**Article History**

Received: 29.04.2022

Accepted: 03.06.2022

Published: 02.09.2022

Journal homepage:<https://www.easpublisher.com>**Quick Response Code**

Abstract: Background: Dehiscence of the facial canal is a matter of great concern for an otologist as one of the most dreaded complications of mastoid surgery is injury to the facial nerve study was carried to determine the intra operative presence of facial canal dehiscence in primary and revision cholesteatoma surgery in a tertiary care centre. And also, our second goal was to identify association between FCD and other intra-operative pathological findings such as labyrinthine fistula, Dural plate dehiscence, sinus plate dehiscence in a group of patients with cholesteatoma surgery. **Methods:** A retrospective study was carried out in the department of Otorhinolaryngology in a tertiary referral hospital, Gujarat among 302 patients. The study's inclusion criterion was primary and revision CWU and CWD tympano-mastoidectomy in patients who suffered from (CSOM) with cholesteatoma and exclusion criterion was charts with inadequate documentation. In addition, tympanoplasty cases were excluded as the study evaluated both tympanic and mastoid segments of facial nerve canal. Pre-operative clinical data and intra-operative findings were documented in a formatted questionnaire. **Results:** It was found that the incidence of FCD in our study of unsafe CSOM surgery was 21.22%. **Conclusions:** The surgeon should keep in mind during the procedures performed in the middle ear could potentially traumatize or damage the facial nerve at the site of dehiscence. A longer duration and more extensive cholesteatoma increase the chance of finding a dehiscent facial nerve. To this, we can prevent facial nerve paralysis and other complications in post-operative period and reduce the rate of morbidity.

Keywords: Dehiscence Facial canal, Cholesteatoma, Labyrinthine fistula, Dural plate dehiscence, Sinus plate dehiscence, Chronic suppurative otitis media.

Copyright © 2022 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Cholesteatoma is cyst or desquamated keratinized epithelium of pneumatized portion of temporal bone. It may expand in variable spaces of attic, mastoid, middle ear, with this there is expansion of cholesteatoma by destruction of bony structure. The major theories regarding the mechanism of bony destruction or absorption in chronic suppurative otitis media (CSOM) with cholesteatoma include the pressure theory and the inflammatory granulation tissue theory, which includes the enzyme destruction theory (Uno Y *et al.*, 1995).

Surgery for chronic suppurative otitis media (CSOM) with cholesteatoma is most prevalent operation in the field of otology, particularly in developing countries. The incidence of intra cranial and extra cranial complication of unsafe CSOM in developing countries is about 0.24-0.45%, respectively

(Kangsanarak J *et al.*, 1993). One of the common intra temporal complications is facial nerve paralysis (Lin YS *et al.*, 2009), it was observed in 0.43% of patients suffering from COM. Some researchers believe that from supportive COM is a predisposing factor for Facial nerve canal dehiscence (FCD) (Ozbek C *et al.*, 2009). Any injury of the facial nerve represents the ENT surgeon's greatest fear. Incidence of facial nerve injury reduced recently by using operating microscope and drills.

Anatomical variation of facial nerve is of significant concern to otologic surgeon. Facial nerve dehiscence most common variation usually present in tympanic part of facial nerve above the oval window may also present in geniculate ganglion and mastoid segment of retro facial cells (Quaranta *et al.*, 2007, Smith JA *et al.*, 2006, Chu *et al.*, 1988, Antoli-Candela F Jr *et al.*, 1974). Histological study of normal human bones ranges from 25% to 57% (Moreano EH *et al.*,

1994) that makes the risk of injury to facial nerve great when not covered by bony canal during surgery. On the other hand, the accuracy of the CT scan for detection of FCD was not constant and sometimes it may be impossible to find it in the thin bone of the facial canal precisely (Di Martino E *et al.*, 2005, Alzoubi FQ *et al.*, 2009, Rogha M *et al.*, 2014).

METHODS

This retrospective study was carried out in tertiary referral hospital in Department of otorhinolaryngology in GMERS medical college and hospital sola, in the Gujarat over two-year period from March 2019 to April 2021. This study included the patients undergoing primary and revision canal wall up (CWU) and canal wall down (CWD) tympano-mastoidectomy in patients who suffer from chronic suppurative otitis media (CSOM) with cholesteatoma, excluding all patient of tympanoplasty and patient with inadequate documentation. Included total 302 patients who underwent ear surgery for unsafe chronic otitis media by senior surgeon. Of these patients, 5 had revision ear surgery. Under the operative microscope with high magnification and also palpation with a blunt pick, facial nerve was assessed to find any possible dehiscence. The result of each surgery was used to define the presence of dehiscence of facial canal and its location and to identify the presence of labyrinthine fistula, Dural plate dehiscence, sinus plate dehiscence at same time (Moody MW *et al.*, 2007).

The location of facial canal dehiscence recorded on whether it was located in: 1)1st genu (geniculate ganglion), 2) tympanic portion, 3) 2nd genu, 4) vertical/mastoid segment. Pre-operative and intra operative finding documentation done and preoperative clinical data in form of sign and symptoms of presentation of patient before surgery, that are such as: otalgia, vertigo, hearing loss, otorrhea, facial paralysis, external canal polyp, post aural abscess/fistula.

RESULTS

In our study total 340 patient underwent tympano-mastoidectomy, out of them only 302 patients met inclusion criteria. Age of patients range from 2 year to 65 year, in which 108 (35.76%) total male patients underwent ear surgery ad 194 (64.23%) female patients

underwent ear surgery. Primary ear surgery was performed in 106 male patients and 191 female patients, where revision ear surgery performed in total 5 patient, 2 (40%) male patient and 3 (60%) female patients. In 22(20.75%) out of 106 male patient who undergoing primary ear surgery had facial canal dehiscence, in 40(20.94%) out of 191 female patient who undergoing primary ear surgery had facial canal dehiscence. In 1 male and 1 female patient have facial canal dehiscence in revision ear surgery (Table 1 Ear surgery performed in male and female patient).

All patient undergoing ear surgery, the most common complain they present were otorrhea (78.6%), hearing loss (88%), otalgia (7.1%), vertigo (4%), and facial nerve paralysis (2.1%). Preoperative present of external auditory canal polyp (8%), postauricular abscess (0.9%), and postauricular fistula was present (0.5%) (Table 2 site of facial canal dehiscence noted intraoperative).

Table 2 displays the distribution of facial canal dehiscence, the most common site for dehiscence was reported at tympanic segment 48.38% in primary ear surgery, second most common site for FCD was noted at vertical segment (mastoid part of facial nerve) 16.12%, third most common site for facial canal dehiscence at 2d genu and tympanic segment (9.68%), In revision ear surgery performed in 5 cases out of them 2 (100%) patient have facial canal dehiscence and common part involving was tympanic and vertical segment.

The study conducted in our tertiary institute and incidence of facial nerve dehiscence in otologic surgery in our study (21.22%). The most common location of facial nerve canal dehiscence by cholesteatoma in our study is tympanic portion is comparable with the most common areas of injury to the facial nerve, such as the tympanic portion. The surgeon should keep in mind during the procedures performed in the middle ear could potentially traumatize or damage the facial nerve at the site of dehiscence. A longer duration and more extensive cholesteatoma increase the chance of finding a dehiscent facial nerve. To this we can prevent facial nerve paralysis and other complication in post-operative period ad reduced morbidity.

Table 1: Ear surgery performed in male and female patient

PATIENT	MALE	FEMALE	TOTAL
Primary ear surgery without FCD	84	151	235
Revision ear surgery without FCD	1	2	3
Primary ear surgery with FCD	22	40	62
Revision ear surgery with FCD	1	1	2
Total	108	194	302

Table 2: Site of facial canal dehiscence noted intraoperative

Part of facial nerve dehiscence	Primary ear surgery	Revision ear surgery	Total
Tympanic segment	30(48.38%)		30
Vertical segment	10(16.12%)		10
1 st genu and tympanic segment	2(3.22%)		3
Tympanic and vertical segment	4(6.45%)	2(100%)	6
2 nd genu	4(6.45%)		4
1 st genu to vertical segment	2(3.22%)		2
2 nd genu and tympanic segment	6(9.68%)		6
1 st genu, tympanic segment, 2 nd genu	4(6.45%)		4
Total	62	2	64

DISCUSSION

This is particularly true for cholesteatomas, which by their biological nature can induce reabsorption of the bony covering of the facial canal. The environment created by the cholesteatoma triggers numerous mechanisms that favour bone destruction (e.g. mechanical compressive factors due to keratin debris accumulation, endotoxin and enzyme released by bacteria colonizing the cholesteatoma, and subepithelial mesenchymal cells and their bone resorptive enzymes). Facial nerve dehiscence independent of cholesteatoma or chronic otitis media is a well-described anatomic variation. In 1971, Baxter showed that the dehiscence rate of the fallopian canal in anatomic study of 535 normal temporal bones is 55% (Baxter A, 1971). Baxter also mentioned that the inferior wall of tympanic segment adjacent to the oval window was most frequently involved with an 85% incidence rate (Baxter A, 1971). Moreano *et al.*, reported that histopathologic study of 1000 temporal bones with no evidence of overt disease (Moreano EH *et al.*, 1994) or inflammation revealed that 56% of the temporal bones had at least one facial nerve dehiscence (Jaswal A *et al.*, 2008). A previous study identified the presence of neurotrophins in cholesteatoma (Kaneko *et al.*, 1980, Moriyama H *et al.*, 1987, Chole RA, 1993, Orisek BS *et al.*, 1987). Radiologic studies have attempted to predict before operation the site and degree of bone reabsorption of the fallopian canal due to cholesteatoma (Artico M *et al.*, 2008). In 1996, Fuse *et al.* confirmed that the facial nerve was involved in 75% of their cases during operation, with 66% sensitivity and 84% specificity (Fuse T *et al.*, 1996). These retrospective investigations provide valuable information on how, where, and in which patient's facial nerve dehiscence occurs most frequently.

Our research with a relatively high population under study, revealed that the incidence of FCD in COM surgery was 21.19%. Various investigations have explored the subject, in a study of 67 cholesteatoma cases, Selesnick and Lynn-Macrae showed the incidence of 30% in the primary and 35% in the revision surgery. In the research by Lin *et al.*, on 117 tympanoplasties (with or without mastoidectomy), they reported its incidence as 33% in the primary, and 37.5% in the revision procedures (Lin JC *et al.*, 2004). Also, in

a study by Ozbek *et al.*, on 265 cases of mastoid surgery, the incidence of FCD was 1.26 times higher in the revision surgeries, and the difference was not statistically significant (Ozbek C *et al.*, 2009). In this study, the dehiscence rate was a little higher in the revision procedures (21.2%) than the initial operations (17.3%). Recently in a retrospective study by Sun *et al.*, on 212 patients, who underwent tympano-mastoidectomy, they reported the prevalence of FCD in was 27.7% in patients without cholesteatoma and 64.0% in patients with cholesteatoma (Choi SA *et al.*, 2014). In other study by Genc *et al.*, it was found that the rate of FCD was about 32% in COM with Cholesteatoma; also, about 88% of the patients with FCD who had undergone tympano-mastoidectomy suffered from chronic otitis with cholesteatoma. In a study on 202 patients who had undergone mastoidectomy, Bayazit *et al.*, reported the incidence of 8.9 and 18.4% of FCD in patients without and with cholesteatoma, respectively (Bayazit YA *et al.*, 2002). In another retrospective study by Kim *et al.*, on 152 patients who underwent tympanoplasty with mastoidectomy for COM, they found that the rate of FCD was 8.6% (Kim CW *et al.*, 2008).

The location of facial nerve dehiscence in patients operated on for cholesteatoma in our study were mostly in the tympanic segment (92.3%). This corroborates the current understanding of the growth patterns of cholesteatoma, in which cholesteatoma closely approximates the tympanic segment of the facial nerve. In addition to close proximity of cholesteatoma to the tympanic segment, the bony covering of the fallopian canal is particularly thin in this region.

We found a significant association between FCD and some intra-operative findings such as labyrinthine fistula, external auditory canal polyp, Dural plate dehiscence and sigmoid sinus exposure. A possible interpretation of these findings is that it will presumably take some time for development of such destructive complications; therefore, time is essential.

In our study, 48.38% of the FCD cases were located at the tympanic segment; the next most frequent site was the mastoid (vertical) segment (16.12%).

In our study, overall incidence of labyrinthine fistula was about 6%. This incidence rate is just like Moody and Lambert's data in 416 ears with 6.5% fistula rate (Moody MW *et al.*, 2007). In the literature, the overall incidence of labyrinthine fistulas ranges from 3 to 13% (Ozbek C *et al.*, 2009, Gacek RR, 1974, Mustafa A *et al.*, 2008, Sheehy JL *et al.*, 1977, Orisek BS *et al.*, 1987, Palva *et al.*, 1971). On the whole, our results are within this range. Some researchers have found an increase in the incidence of COM complications in revision surgery (Gacek RR, 1974; Gormley PK, 1986, Ritter FN, 1970). Nevertheless, we did not find a significant difference in the frequency of labyrinthine fistula in primary and revision COM surgeries. In a review article by Copeland and Buchman, they found that in extensive COM with cholesteatoma, 29% of cases with labyrinthine fistula also had FCD or preoperative facial weakness (Copeland BJ *et al.*, 2003). In contrast, the presence of an SCC fistula increased the risk of facial nerve dehiscence by about 4.7 times. Preoperative identification of a fistula with imaging techniques should alert the surgeon to the possibility of a concomitant dehiscence. Similar to other studies, we found that the incidence of fistula was significantly higher in ears with FCD (Ozbek C *et al.*, 2009, Bayazit YA *et al.*, 2002, Moody MW *et al.*, 2007, Mustafa A *et al.*, 2008, Lee JH *et al.*, 2009). In the current study we found that all the cases of labyrinthine fistulas were limited to lateral semicircular canal (100%). Other Semicircular canals were never seen involved. These findings were similar to the studies of Faramarzi *et al.*, and Grewal *et al.*, who in their respective studies observed that lateral semicircular canal involvement was seen in 95.83% and 96% of cases compared to other sites (Faramarzi AH *et al.*, 2011, Grewal DS *et al.*, 2003).

We detected 11% cases with external auditory canal polyp. This study revealed a significant association between external auditory canal polyp and facial nerve canal dehiscence. Our result is in the same line with those of Jaswal *et al.*, study; they detected 12% polyp in 146 patients who underwent radical and modified radical mastoidectomy (Jaswal A *et al.*, 2008). In a study by Prasannaraj *et al.*, on 42 cases with aural polyp, they found that in 19% of them, there are facing other complications (Prasannaraj T *et al.*, 2003).

ACKNOWLEDGEMENTS

I would like to thank my whole department who help me in this project.

DECLARATIONS

Funding: None

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

- Alzoubi, F. Q., Odat, H. A., Al-Balas, H. A., & Saeed, S. R. (2009). The role of preoperative CT scan in patients with chronic otitis media. *European Archives of Oto-rhinolaryngology*, 266(6), 807-809.
- Antoli-Candela Jr, F., & Stewart, T. J. (1974). The pathophysiology of otologic facial paralysis. *Otolaryngologic Clinics of North America*, 7(2), 309-330.
- Artico, M., Bronzetti, E., Lo Vasco, V. R., Ionta, B., Alicino, V., D'Ambrosio, A., & Magliulo, G. (2008). Immunohistochemical profile of various neurotransmitters, neurotrophins and MIB-1 in cholesteatomas of the petrous bone. *Molecular Medicine Reports*, 1(3), 347-353.
- Baxter, A. (1971). Dehiscence of the fallopian canal an anatomical study. *The Journal of Laryngology & Otology*, 85(6), 587-594.
- Bayazit, Y. A., Ozer, E., & Kanlikama, M. (2002). Gross dehiscence of the bone covering the facial nerve in the light of otological surgery. *The Journal of Laryngology & Otology*, 116(10), 800-803.
- Choi, S. A., Kang, H. M., Byun, J. Y., Park, M. S., & Yeo, S. G. (2014). Analysis of differences in facial nerve dehiscence and ossicular injury in chronic otitis media and cholesteatoma. *Acta Oto-Laryngologica*, 134(5), 455-461.
- Chole, R. A. (1993). Differential osteoclast activation in endochondral and intramembranous bone. *Annals of Otology, Rhinology & Laryngology*, 102(8), 616-619.
- Chu, F. W., & Jackler, R. K. (1988). Anterior epitympanic cholesteatoma with facial paralysis: a characteristic growth pattern. *The Laryngoscope*, 98(3), 274-279.
- Copeland, B. J., & Buchman, C. A. (2003). Management of labyrinthine fistulae in chronic ear surgery. *American journal of otolaryngology*, 24(1), 51-60.
- Di Martino, E., Sellhaus, B., Haensel, J., Schlegel, J. G., Westhofen, M., & Prescher, A. (2005). Fallopian canal dehiscences: a survey of clinical and anatomical findings. *European Archives of Oto-Rhino-Laryngology and Head & Neck*, 262(2), 120-126.
- Faramarzi, A. H., Heydari, S. T., & Rusta, M. (2011). The prevalence of labyrinthine fistula in chronic otitis media surgery in shiraz, southern iran. *Iranian Red Crescent Medical Journal*, 13(8), 582.
- Fuse, T., Tada, Y., Aoyagi, M., & Sugai, Y. (1996). CT detection of facial canal dehiscence and semicircular canal fistula: comparison with surgical findings. *Journal of computer assisted tomography*, 20(2), 221-224.
- Gacek, R. R. (1974). The surgical management of labyrinthine fistulae in chronic otitis media with

- cholesteatoma. *Annals of Otolaryngology, Rhinology & Laryngology*, 83(1_suppl), 1-19.
- Gormley, P. K. (1986). Surgical management of labyrinthine fistula with cholesteatoma. *The Journal of Laryngology & Otolaryngology*, 100(10), 1115-1123.
 - Grewal, D.S., Hathiram, B.T., Dwivedi, A., Kumar, L., Sheth, K., Srivastava, S. (2003). Labyrinthine fistula: A complication of chronic suppurative otitis media. *JLaryngol Otol.*, 117(5):353-7.
 - Jaswal, A., Jana, A. K., Sikder, B., Sadhukhan, S. K., Jana, U., & Nandi, T. K. (2008). Fallopian canal dehiscence: can it be predicted. *Indian Journal of Otolaryngology and Head & Neck Surgery*, 60(1), 11-15.
 - Kaneko, Y., Yuasa, R., Ise, I., Iino, Y., Shinkawa, H., Rokugo, M., ... & Shibahara, Y. (1980). Bone destruction due to the rupture of a cholesteatoma sac: a pathogenesis of bone destruction in aural cholesteatoma. *The Laryngoscope*, 90(11), 1865-1871.
 - Kangsanarak, J., Fooanant, S., Ruckphaopunt, K., Navacharoen, N., & Teotrakul, S. (1993). Extracranial and intracranial complications of suppurative otitis media. Report of 102 cases. *The Journal of Laryngology & Otolaryngology*, 107(11), 999-1004.
 - Kim, C. W., Rho, Y. S., Ahn, H. Y., & Oh, S. J. (2008). Facial canal dehiscence in the initial operation for chronic otitis media without cholesteatoma. *Auris Nasus Larynx*, 35(3), 353-356.
 - Lee, J. H., Jung, S. H., Park, C. H., & Hong, S. M. (2009). Bilateral promontory fistula due to noncholesteatomatous chronic otitis media. *European archives of oto-rhino-laryngology*, 266(6), 933-936.
 - Lin, J. C., Ho, K. Y., Kuo, W. R., Wang, L. F., Chai, C. Y., & Tsai, S. M. (2004). Incidence of dehiscence of the facial nerve at surgery for middle ear cholesteatoma. *Otolaryngology—Head and Neck Surgery*, 131(4), 452-456.
 - Lin, Y. S., Lin, L. C., Lee, F. P., & Lee, K. J. (2009). The prevalence of chronic otitis media and its complication rates in teenagers and adult patients. *Otolaryngology—Head and Neck Surgery*, 140(2), 165-170.
 - Moody, M. W., & Lambert, P. R. (2007). Incidence of dehiscence of the facial nerve in 416 cases of cholesteatoma. *Otology & Neurotology*, 28(3), 400-404.
 - Moreano, E. H., Paparella, M. M., Zelterman, D., & Goycoolea, M. V. (1994). Prevalence of facial canal dehiscence and of persistent stapedial artery in the human middle ear: a report of 1000 temporal bones. *The Laryngoscope*, 104(3), 309-320.
 - Moriyama, H., Honda, Y., Huang, C. C., & Abramson, M. (1987). Bone resorption in cholesteatoma: Epithelial-mesenchymal cell interaction and collagenase production. *The Laryngoscope*, 97(7), 854-859.
 - Mustafa, A., Heta, A., Kastrati, B., & Dreshaj, S. H. (2008). Complications of chronic otitis media with cholesteatoma during a 10-year period in Kosovo. *European archives of oto-rhino-laryngology*, 265(12), 1477-1482.
 - Orisek, B. S., & Chole, R. A. (1987). Pressures exerted by experimental cholesteatomas. *Archives of Otolaryngology—Head & Neck Surgery*, 113(4), 386-391.
 - Ozbek, C., Tuna, E., Ciftci, O., Yazkan, O., & Ozdem, C. (2009). Incidence of fallopian canal dehiscence at surgery for chronic otitis media. *European archives of oto-rhino-laryngology*, 266(3), 357-362.
 - Palva, T., Kärjä, J., & Palva, A. (1971). Opening of the labyrinth during chronic ear surgery. *Archives of Otolaryngology*, 93(1), 75-78.
 - Prasannaraj, T., De, N. S., & Narasimhan, I. (2003). Aural polyps: safe or unsafe disease?. *American journal of otolaryngology*, 24(3), 155-158.
 - Quaranta, N., Cassano, M., & Quaranta, A. (2007). Facial paralysis associated with cholesteatoma: a review of 13 cases. *Otology & Neurotology*, 28(3), 405-407.
 - Ritter, F. N. (1970). Chronic suppurative otitis media and the pathologic labyrinthine fistula. *The Laryngoscope*, 80(7), 1025-1035.
 - Rogha, M., Hashemi, S. M., Mokhtarinejad, F., Eshaghian, A., & Dadgostar, A. (2014). Comparison of preoperative temporal bone CT with intraoperative findings in patients with cholesteatoma. *Iranian journal of otorhinolaryngology*, 26(74), 7.
 - Sheehy, J. L., Brackmann, D. E., & Graham, M. D. (1977). Cholesteatoma surgery: residual and recurrent disease: a review of 1,024 cases. *Annals of Otolaryngology, Rhinology & Laryngology*, 86(4), 451-462.
 - Smith, J. A., & Danner, C. J. (2006). Complications of chronic otitis media and cholesteatoma. *Otolaryngologic Clinics of North America*, 39(6), 1237-1255.
 - Uno, Y., & Satto, R. (1995). Bone resorption in human cholesteatoma: morphological study with scanning electron microscopy. *Annals of Otolaryngology, Rhinology & Laryngology*, 104(6), 463-468.

Cite This Article: Hardika B. Patel, Neena H. Bhalodiya, Simple R. Bhadaia, Swati A. Mishra (2022). Incidence of Facial Canal Dehiscent Noted Intraoperatively in Unsafe Chronic Suppurative Otitis Media: A Retrospective Study. *East African Scholars J Med Sci*, 5(9), 239-243.