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Anomalies of the facial nerve: a surgeon's nightmare

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ABSTRACT

Background: Most of the anomalies of the facial nerve have been encountered during otological surgery or dissection of the temporal bones. ENT surgeons are taught from a nascent stage to always be wary of an anomalous facial nerve during otological surgery. Today's surgeon is assisted with high definition imaging and nerve monitoring; yet iatrogenic facial palsy still is encountered even today.
Methods: This study was conducted in a select population of patients who reported with aural symptoms with an aim to see the number of facial nerve anomalies one encounters during aural surgery. The filter applied was no patient with congenital anomaly was considered and patients with squamous COM were also excluded.
Results: Almost 4.5% of the patients subjected to surgery had varying kinds of facial nerve anomaly, the most common being dehiscence of the fallopian canal.
Conclusions: Facial nerve anomalies are not so uncommon as one expects it to be. So it is mandatory that every ENT surgeon should be well versed with facial nerve anatomy and be wary of any structural anatomical abnormality, and irrespective of the experience it pays to be extra cautious when operating on the ear because in the event of damage to the facial nerve the patient has to carry the stigma of a facial deformity for his/her life.

Keywords: Facial nerve, Anomaly, Expertise, Precaution

INTRODUCTION

Anomalies of the facial nerve have been documented from the time otological surgeries were done using magnifying sources, but till date it remains a nightmare for ENT surgeons. For the experienced hands it is at times overconfidence and for the novice it is unpreparedness to expect something unusual and the worst scenario is the inexperienced surgeon with sheer lack of knowledge of the course of the facial nerve and it's surprises.

From a patient's perspective an unexpected facial nerve paralysis following surgery affects the facial appearance and also imposes a demoralising effect on the social, psychological, and economic aspects of their lives afterwards.[1] Despite the technological advances, such as the advent of the operating microscope and high end operating surgical drill systems the overall risk of postoperative facial nerve paralysis still remains a potent risk. Hohman et al reported that surgery to the ear resulted in 17% of all postoperative facial nerve palsy of which almost 82% of facial nerve injuries were caused by mastoid surgery.[2] Identifying the facial nerve is the mainstay in performing good mastoid surgery, and every surgeon should be aware of the landmarks for canal wall down procedures which are divided into major pointers and minor pointers; viz. the short process of the incus, the lateral semicircular canal, and the posterior bony external auditory canal being the major pointers. The minor pointers include the digastric ridge, the processus cochleariformis, and the oval window. In cases of

revision surgery of the mastoid surgeons are cautious due to the absence of some of the landmarks because of prior surgery, but when the course of the facial nerve is itself faulty the unwary surgeon in spite of professional expertise may unwittingly damage the facial nerve.

Thus there is a need to emphasize that in spite of the various aids available to the surgeon it is mandatory that during any surgery in the vicinity of the facial nerve extreme caution should be exercised especially to detect any anomalous course of the nerve. These basic precautions will help prevent any damage to the facial nerve and save the patient from being scarred for life.

METHODS

The study is a retrospective collation done from January 2015 to November 2017 in the ENT department of a tertiary care centre. The 11 patients from whom the data was drawn were part of 260 patients who came with varying complaints ranging from hearing loss to discharging ears with concomitant hearing loss. Patients who were diagnosed with active squamous chronic otitis media and those with external canal deformity and aural atresia were not included in the study. Two patients came with aural symptoms and facial paresis which recovered following surgery.

All the patients were subjected to standard protocol of conventional audiometry and HRCT of the temporal bone which was done to ascertain status of the middle and inner ear and adjoining structures including anatomical status of the facial canal. We did not use facial nerve monitoring during the surgeries. Most of the surgeries were performed under local anesthesia with sedation; few including the patients with facial paresis were operated under general anesthesia. In all the patients the primary aim was to treat the aural pathology which ranged from 27 cases of otosclerosis, 39 patients with unexplained acquired conductive hearing loss and the rest were cases of mucosal COM (Figure 1).

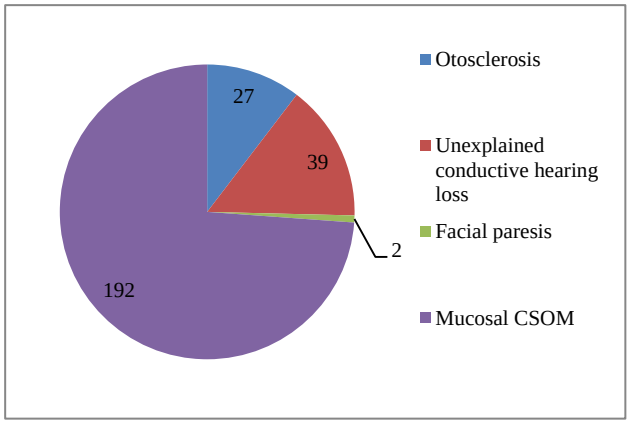

Figure 1: Clinical presentation of the patients selected for the study.

RESULTS

The facial nerve was found to have an anomalous course in 11 patients. Seven of the patients with facial nerve anomalies were male and four were females (Table 1). The most common abnormality of the facial nerve was dehiscence of the facial canal, of which in 4 cases the facial nerve was found lying over the oval window and the chorda arising from it. In 2 patients the tympanic segment of the fallopian canal was intact but distal to the second genu the canal was partially exposed and the nerve was embedded in the partially open canal. In 2 patients the tympanic segment of the facial canal was passing over the oval window with the crura of stapes partially deformed and not attached to the incus. In 2 patients one of whom was already detected preoperatively by imaging the facial nerve devoid of any bony covering, traversed across the floor of the external auditory canal. In 1 patient in the mastoid segment the canal wall was dehiscent and the nerve got partially evulsed while raising the tympanomeatal flap (Figure 2).

Table 1: Gender wise distribution of facial nerve anomalies.

Gender	Patients with facial nerve anomaly Nos. (%)	Patients without facial nerve anomaly Nos. (%)	Total number of patients Nos. (%)
Male patients	7 (3.7)	182 (96.3)	189 (72.7)
Female patients	4 (5.6)	67 (94.4)	71 (27.3)
Total	11 (4.2)	249 (95.8)	260 (100)

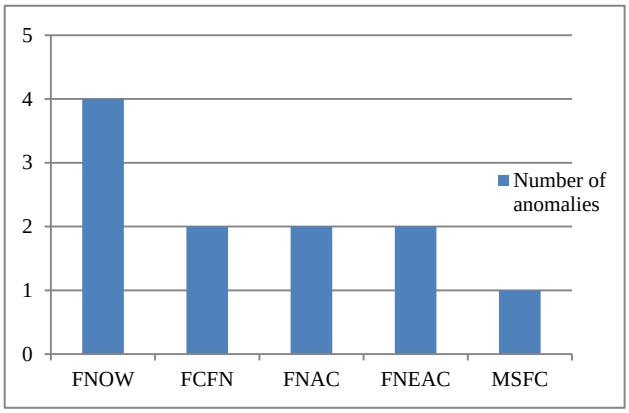

Figure 2: Types and number of the anomalies of the facial nerve encountered.

FNOW-Facial nerve passing over Oval window; FCFN-Facial nerve partially exposed in dehiscent facial canal; FNAC-Facial nerve passing over Oval window with abnormal crura of stapes; FNEAC-Facial nerve without facial canal lying over floor of EAC; MSFC-Mastoid segment of facial canal dehiscent.

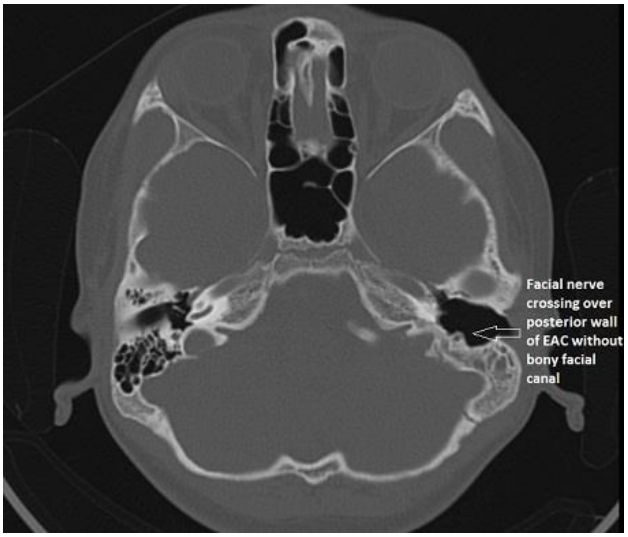

Figure 3: Facial nerve crossing over posterior wall of EAC without facial canal.

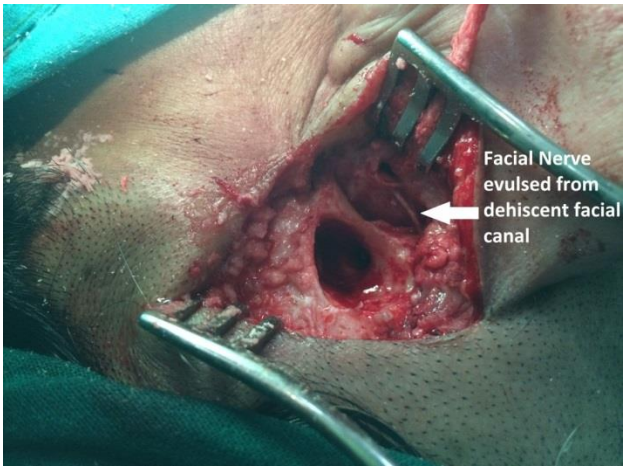

Figure 4: Facial nerve avulsed from dehiscent fallopian canal.

DISCUSSION

Medical literature documents that there are certain harbingers which herald caution when operating close to the facial nerve. Most often being some associated anomaly of the temporal bone ranging from total atresia of the external auditory canal to anomalies of the auricle and congenital conductive deafness with no external abnormality. Anomalies involving the facial nerve frequently are encountered in malformations of the temporal bone which include anomalous course of one or all of the segments of the canal; abnormal relation to the oval and round window; abnormal branching of the nerve; and associations with dysplasia of the stapes, oval window, external ear canal, and auricle. Jahrsdoerfer in his study said early recognition of the anomalous nerve is critical in safeguarding the nerve. He classified anomalies in the tympanic segment to be facial nerve encroaching on the stapes and oval window, facial nerve displaced with either present or absent oval window.[3] Baxter found that dehiscence of the Fallopian canal were found in 294 (55%) of 535 temporal bones. Of the 294, 83 per cent were dehiscent at the oval window region, 16 per cent at the processus cochleariformis, and 11 per cent in the vertical segment and 5 per cent lateral to the genu of the facial nerve. Takahashi and Sando reviewed 160 temporal bones and have reported the most frequent site of dehiscence was the oval window area. Dehiscence in the area of the processus cochleariformis was 16%. The second genu area and the mastoid portion were sites of dehiscence in 21% and 18%.[4] So surgeons are usually cautious when working in and around the oval window especially in surgeries involving the stapes and depending on their level of expertise either proceed with the surgery or in very rare circumstances abort it, to prevent damage to the facial nerve.

However the most testing conditions of facial nerve anomaly are when there is bony dehiscence of the facial canal in the vertical part of the mastoid segment, because at times besides the dehiscence of the facial canal there can be displacement of the facial nerve as it descends towards the stylomastoid foramen. In patients with aural atresia the second genu and mastoid segment may be displaced anteriorly and laterally making the facial nerve more susceptible to intraoperative injury. What makes the facial nerve vulnerable to injury in these situations is that if the nerve is encountered while raising the tympanomeatal flap during aural surgery, only an astute level of suspicion can prevent damage to the nerve, as it can get evulsed from the dehiscent facial canal, Figure 2. and get abnormally stretched or resected along with the tympanomeatal flap which is being raised, particularly when the surgery is being performed by a novice surgeon. But a bigger risk is when the nerve is devoid of bony cover, grossly displaced and traverses along the posterior wall of the external canal wall. In this situation the nerve can get transected during a classical endomeatal incision, even prior to raising the tympanomeatal flap.

Today with the availability of very high definition imaging techniques the role of the radiologist is paramount, especially one who is familiar with temporal bone anatomy and its variations. It is often debated whether every patient has to subjected to a high resolution computerized tomography of the temporal bone before every otological surgery. High resolution computed tomography (CT) of temporal bone especially with slices of 0.30 mm can be a valuable preoperative guide to show any dehiscence of the fallopian canal.[5]

Another valuable aid is intraoperative monitoring and stimulation of facial nerve function during otological surgery. The device has several advantages: it signals unintentional mechanical stimulation of the facial nerve during surgery; it allows mapping of the nerve and predicts dehiscence in the bony covering of the nerve; and it allows confirmation of the electrical integrity of the nerve before and after surgery.[6] The use of facial nerve monitoring is particularly useful especially when cases

with associated congenital anomalies are being operated and even when young surgeons are undergoing training for otological surgery. As a matter of fact facial nerve monitoring is now routinely recommended in most surgeries involving retrocochlear lesion, and chronic ear surgeries. Hu et al reported that facial nerve monitoring should be considered in chronic ear surgery, especially in younger surgeons.[7]

It is a well-known that the surgeon performing otological surgery can encounter many kinds of difficulties. It could be due to the distorted anatomy of the mastoid by varying pathologies including cholesteatoma, bony erosion, or revision of previous surgery. But the most uncertain pitfalls are due to anomalies of the facial nerve.[8] In order to avoid injury to the facial nerve, every surgeon should be familiar with the normal course of the facial nerve, and in particular be aware of the anatomical variations that may be encountered in congenital anomalies and particularly be prepared for the unexpected anomaly which has escaped detection even after imaging studies.[5] Another golden rule of caution is whether or not there is facial nerve dehiscence, the surgeon should never use diathermy to stop any bleeding in the middle ear.

CONCLUSION

Otological surgery is a challenging task and the rewards of a successful surgery are indeed very gratifying to the surgeon and the patient. Though today most centres where such surgery is performed is well equipped with high quality imaging facilities and intraoperative facial nerve monitoring to identify the facial nerve and provide an early warning signal of potential injury.[6] But in the ultimate analysis the surgeon has to have a thorough knowledge of the anatomy of the temporal bone.[2,6] The surgical technique should include constant visualization of the course of the facial nerve especially with extra vigilance to detect any anomalous course of the nerve. These basic precautions will help prevent any damage to the facial nerve and save the patient from being scarred for life.

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