Original Article

Anatomical variations of the chorda tympani nerve observed during middle ear surgeries-an institutional study

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Abstract

Objectives: The aim of this study is to describe observed variations in the middle ear anatomy of the chorda tympani nerve during middle ear surgeries in our institution. **Study Design:** A prospective study of 2 years covering 100 middle ear surgeries analyzing the course of the chorda tympani nerve in the middle ear. The surgeries were subdivided into myringoplasty (78 cases) and mastoidectomy with tympanoplasty (22 cases). **Results:** Chorda tympani nerve anatomy was observed based on its entry into the middle ear from the junction of the posterior and lateral walls of middle ear at the level of the tympanic sulcus. The variations observed were based on its entry at either three levels 1) Iter chordae posterius (35 cases) 2) Inferior toiter chordae posterious (63 cases) 3) Lateral to the tympanic sulcus (2 cases). **Conclusion:** Variations in the middle ear course of chorda tympani nerve were commonly seen in our case series. The most common variation being its entry into the middle ear inferior to the iter chordae posterious at the level of tympanic sulcus and the least common being its entry lateral to the tympanic sulcus.Understanding the middle ear anatomical variations in the course of chorda tympani nerve is surgically significant in preventing post-operative taste and salivary morbidity following middle ear surgeries. The present study highlights the varied course of the chorda tympani nerve in the middle ear and minor anatomical variations are not very rare.

Keywords: Chorda tympani, facial nerve,middle ear, tympanomeatal flap.

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INTRODUCTION

The chorda tympani nerve arises from the vertical segment of the facial nerve in the mastoid bone. It can arise anywhere from the level of stylomastoid foramen to the pyramid. Commonly it takes off six millimetres above the stylomastoid foramen. After branching from the facial nerve, the chorda tympani nerve courses superiorly parallel to the facial nerve. It angles anteriorly forming the chordo facial angle before entering the middle ear cavity through iter chordae posterius. It then travels between the incus and malleus before exiting the middle ear via iter chorda anterius. It then enters the petro tympanic fissure or huguier canal accompanying the anterior tympanic artery. It joins the lingual nerve to carry the special sensory faculty of taste from the anterior two thirds of the tongue. It also carries visceral efferent/secretomotor preganglionic parasympathetic innervation to the submandibular, lingual and other minor salivary glands after synapsing in the submandibular ganglion. This study highlights the variations observed peroperatively in a series of 100 cases. Knowledge pertaining to these variations is essential in preventing postoperative taste and salivary complications following middle ear surgeries. There are not many studies available in the literature highlighting the prevalence of these variations.

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MATERIALS AND METHODS

A prospective peroperative study of one hundred cases who were diagnosed with mucosal type of chronic otitis media with central perforation and underwent myringoplasty or mastoidectomyin a period of two years between January 2014 and december 2015.Patients had pars tensa perforations with mild to moderate conductive hearing loss. Patients underwent my ringoplasty or cortical mastoidectomy with tympanoplasty under general anaesthesia. Peroperatively, under transcanal endoscopy local four quadrant infiltration with premixed two percent lignocaine and 1:100000 adrenaline was given. Tympanomeatal skin incisions were taken at six and twelve O'clock positions along with a connecting incision. Upon tympanomeatal flap elevation up to the tympanic sulcus the entry of the chorda tympani nerve into the middle ear cavity was carefully observed. The entry of chorda tympani nerve was found to vary between three locations at iter chordae posterius (Figure 1), inferior to iter chordae posterius (Figure 2) or few millimeters lateral to the tympanic sulcus (Figure 3). Upon further elevation, the chorda tympaninerve ran parallel to the chordal eminence, upward and anteriorly into the middle ear between the malleus and incus before entering the petro tympanic fissure. Fewpatients had post-operative taste loss on one half of the anterior two third tongue which recovered in 4-12weeks.

OBSERVATIONS AND RESULTS

One hundred middle ear surgeries were observed peroperatively in a prospective study of 2 years analyzing the course of the chorda tympani nerve in the middle ear. Of the 100 middle ear surgeries 78 cases were myringoplasty and 22 cases were mastoidectomy with tympanoplasty. Sixty three patients were female and 37 patients were males. All the patients observed were in the age group of 20 to 60 years. Chorda tympani nerve variations observed were based on its entry into the middle ear at either three levels (Table 1)

Table 1: Percentage distribution of chorda tympani nerve entry into middle ear

Level	Percentage (%)
At Iter chordae posterius	35
Inferior to iter chordae posterious	63
Lateral to the tympanic sulcus	2

Those patients with the chorda tympani nerve entry lateral to the tympanic sulcus had ipsilateral postoperative taste loss following myringoplasty which recovered in 4 to 12 weeks. The rest of the cases had no post-operative taste loss. All the patients had no other associated external or middle ear deformity.

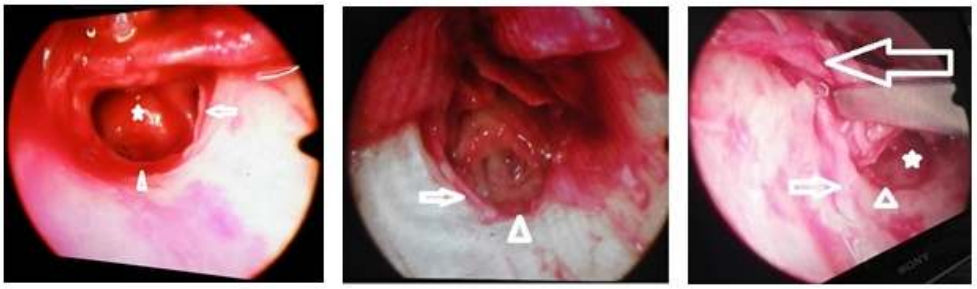

Figure 1: Chorda tympani entry at iter chordae posterius Arrow – Chorda tympani nerve Asterisk – Promontory Triangle – Tympanic sulcus

Figure 2: Chorda tympani entry inferior to iter chordae posterius Arrow – Chorda tympani nerve Triangle – Tympanic sulcus

Figure 3: Chorda tympani entry lateral to tympanic sulcus Small arrow – Chorda tympani nerve Large arrow – Tympanomeatal flap Asterisk – Promontory Triangle – Tympanic sulcus

DISCUSSION

The chorda tympani may arise from the facial nerve at three levels: most commonly from the mid third of its mastoid segment (70%), less commonly from the proximal third (20%), and very rarely from the distal third (10%) based on a study on human temporal bone specimens.[1] Chorda tympani nerve can have variations in its anatomy. Its origin may vary one millimetre to eleven millimetres from the stylomastoid foramen, and in some cases the origin is extra temporal.[2] The chorda tympani nerve may exit from the facial nerve at the level of the lateral canal.[3] The chorda tympani nerve may have variations in size, it may be bipartite like the facial nerve.[4,5] The entry point into the mesotympanum may vary between one to two millimetre lateral to the rim of the external auditory canal. Also, the chorda may pass lateral to the tympanic membrane and malleus, rather than medial.[6] In few subjects, the nerve may be exposed and dehiscent in the posterior bony ear canal just lateral to the bony annulus and is liable to trauma upon tympanomeatal flap elevation.[7] Nerve traction or transection may cause symptoms of partial or total taste loss along with dryness

of mouth.[8] Traction on the chorda tympani nerve is associated with more pronounced manifestations than transection. Complete recovery has been reported in 76% of cases.[9] Around 15 to 22% of patients experience post-operative taste disturbance and mouth dryness after middle ear surgery as a result of iatrogenic injury of the chorda tympani.[9] Variations of the chorda tympani nerve in the middle ear are very significant in terms of middle ear procedures. Nerve traction or transection may cause symptoms of partial or total taste loss along with dryness of mouth.[8] Traction on the chorda tympani nerve is associated with more pronounced manifestations than transection. Complete recovery has been reported in 76% of cases.[9] Around 15 to 22% of patients experience post-operative taste disturbance and mouth dryness after middle ear surgery as a result of iatrogenic injury of the chorda tympani.[9] Michael P. *et al*., in their study of 140 subjects observed that postoperative loss of taste was found in 15% patients and taste disturbance was more common with nerve traction rather than nerve transection. There was no recovery in 24% symptomatic cases and those who recovered, needed a year for complete recovery.[9] During middle ear procedures the chorda tympani is vulnerable to injury.[10] Numerous anatomical variations of chorda tympani nerve have been documented in literature by Nager and Proctor, their observations included the variation of origin of the chorda tympani from one millimetre distal to eleven millimetre proximal to the stylomastoid foramen and an extra temporal origin of the chorda in two percent cases of their study where the nerve travelled in its own separate canaliculus parallel to the facial canal.[11] It is not common to find major anatomical variations of chorda tympani nerve as these can be found only in the presence of congenital deformities.[12] There was a report on bifurcation of the chorda tympani nerve in three of their cases by Durcan *et al*.,[12] There are very rare observations like the ones made by Kalcioglu *et al*.,[13] and Sudhir V Bhise *et al*.,[14] wherein a case each was reported with chorda tympani nerve presenting between bony external auditory canal and mucoperiosteum.

CONCLUSION

Awareness about variations in the middle ear course of chorda tympani nerve is paramount in performing middle earsurgeries as it can greatly reduce the postoperative morbidities. As observed in our case series, variations appear to be common than a rare occurrence. Meticulousness is needed in elevating the tympanomeatal flap to recognise any variations in the course of the chorda tympani nerve. There is a dearth of clinical studies pertaining to the middle ear variations in the course of the chorda tympani nerve. More clinical case studies like our study are required to ascertain the importance of these variations in middle ear surgeries.

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