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Main Article

Study of intratemporal course of facial nerve and its variations – 25 temporal bones dissection

Rashmi D. Kharat · Sanjiv V. Golhar · Chandrakant Y. Patil

Abstract

Introduction Facial nerve is the longest nerve in a bony canal. Three dimensional anatomical knowledge provides the foundation for safe and skillful dissection of the very complex temporal bone and tortuous facial nerve.

Objective A small surgical area and a fair incidence of anatomical variations makes the facial nerve prone to injury. Inspite of the problems presented, the nerve serves as an excellent landmark and guide to the competent otological surgeon who studies it deligently, the neophyte on the other hand lives in constant fear of finding the nerve inadvertently. The present study was undertaken to explore the micro-anatomy of tympano-mastoid segment of facial nerve.

Materials and methods The current study was conducted at Dept of E.N.T, temporal bone lab, J.N.M.C Sawangi, Wardha. 25 temporal bones were dissected to study the various parameters of the tympano-mastoid segments of the facial nerve, its relations with the important middle ear structures and their anomalies.

Results Mean length of tympanic segment was 9.28mm and that of the mastoid segment was 13.7mm. Mean depth of second genu from the cortex was 19.72mm. Amongst the variations noted commonest were the variations in the tympanic segment of about 12 %. An overhang in the region of oval window and a hump at the second genu was noted in one specimen each.

Conclusion The variations in the tympanomastoid segment occur with sufficient frequency showing not much racial and geographical variance.

R. D. Kharat · S. V. Golhar · C. Y. Patil
Deptartment of ENT,
JNMC,
Wardha, Sawangi - 442 001,
Maharashtra, India

R. D. Kharat (✉)
E-mail: dr_chandupatil@rediffmail.com

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Introduction

Many facial expressions like joy, sorrow and other human expressions is a result of 7000 motor fibers of facial nerve firing in unison and at a time [1]. Facial nerve dysfunction causes noticeable disfigurement, emotional distress leading to detriment in social interaction. Inability to smile due to a surgeon's faulty technique is an unforgivable crime. Only by cadaveric dissections can the aspiring ear surgeon learn to safely traverse the perilous anatomy of the temporal bone so as to avoid injury to the many vital structures concealed in an area no larger than an olive.

Throughout the era characterized by frequent operations for mastoiditis, one of the principle operative hazards was traumatic injury to the endotemporal segment of the facial nerve resulting in temporary or permanent facial paralysis. Most common site for the facial nerve injury during ear surgery is the tympanic segment. If the anatomical landmarks are followed and extra caution taken, iatrogenic injury to the facial nerve can be prevented [84].

Temporal bones were dissected in the present study and length of various segments of facial nerve, its relation with middle ear structures and variations were noted.

Materials and methods

Preserved 25 temporal bones were obtained for the study and dissection was carried out on wet temporal bones in temporal bone dissection laboratory, situated in Department of ENT, JNMC, Wardha.

A preliminary simple mastoidectomy was done. Lateral sinus plate, digastric ridge, bony horizontal semicircular canal exposed and identified. Digastric ridge was traced up to the rim of stylomastoid foramen.

The bone from posterolateral aspect of foramen and vertical segment gradually shaved off. Dissection continued upward to short process of incus care was taken to delineate the canal for chorda tympani so that exact origin could be readily seen. After facial bridge, ridge was removed.

By an oblique alignment dissection towards genu and further towards labyrinthine segment was done. Different branches and its relations was studied segment wise.

Measurements were done by means of malleable steel wire, straight and curved caliper, divider & protractor. Needle was used as pointer for photography.

Observations

Out of 25 bones dissected, 22 (88%) bones were well pneumatised and 3 (12%) bones were diploeic.

Length of the tympanic segment varied from 7–12 mm with a mean of 9.28 mm (±1.13mm). In 9 bones (36%) the length of the tympanic segment was 9 mm, in 7 bones (28%) it was 10 mm, while in 5 bones (20%) it was 8 mm. In 2 bones (8%) it was 11 mm, in 1 bone (4%) it was 7 mm, while in another 1 bone (4%) the length of the tympanic segment was 12 mm.

In all the 25 temporal bones tympanic segment of the facial nerve, turned posterior from the geniculate ganglion, the processus cochleariformis and tensor tympani were anterior to the nerve. The nerve passed above promontory and the oval window niche was inferior to the nerve. The nerve passed below the horizontal semicircular canal in all 25 temporal bones.

In all the 25 temporal bones, the degree of descent of tympanic segment in relation to horizontal was 30^0 Dehiscence in the tympanic segment was observed in three bones:

1. In the first case dehiscence was noted in the tympanic segment. It was 3 × 2 mm, oval in shape with smooth margin and the sheath of facial nerve was normal.
2. In the second case dehiscence was noted in the tympanic segment, which was oval in shape with smooth margin and the sheath of facial nerve was normal.
3. In the third case a dehiscence was noted in the region of oval window, 2 × 2 mm in size, round to oval in shape with smooth margin and intact nerve sheath without any prolapse of the nerve .

In one case, a bony overhang was noted in the facial nerve in the oval window region, which was 2 × 1.5 mm and without any dehiscence of the fallopian canal. This was partially obscuring the view of oval window.

In 7 bones (28%) length of the mastoid segment was 13.5 mm. in 6 bones (24%) the length was14 mm, while in 4 bones (16%) it was 14.5 mm . In 2 bones(8%) it was 12 mm and 10 mm in 2 other bones (8%). It was seen that the length of mastoid segment was 15 mm in 2 bones (8%) and 16 mm in yet another 2 bones (8%).

The length of mastoid segment varied from 10 to 16 mm, with a mean of 13.7 mm (±1.45mm). In all 25 temporal bones, the mastoid segment of facial nerve was anterior to the tip of mastoid and medial to tympanomastoid suture. The angle between tympanic and mastoid segment varied from 95^0 to 120^0 with a mean of 107.6^0 (±8.79mm). A lateral hump was found at the second genu. It was not dehiscent and the course of facial nerve was normal above and below to this hump.

The distance of second genu from outer cortex was 19 mm and 18mm in 6 bones (24%) each. In 7 bones (28 %) it was 20 mm, while in 3 bones (12%) the distance was 24 mm. In 2 bones (8 %) the distance was found to be 21 mm and in 1 bone (4%) it was 17 mm.

The distance of second genu from outer cortex varied from 17–24 mm with a mean of 19.72 mm (±1.90 mm). The distance between stylomastoid foramina and origin of chorda tympani nerve varied from 1–7 mm with a mean of 4.8 mm (±1.41 mm). The range of distance between origin of chorda tympani and geniculate ganglion was 13–22 mm, with a mean distance of 18.18 mm (±2.20 mm).

Discussion

In the present study the length of tympanic segment varied from 7–12 mm with a mean length of 9.28 mm (± 1.13 mm). The minimum length noted was 7 mm in 4 % of specimens. Minimum length of 7 mm has been noted by Agarwal (1993) [15] which was similar to the present study. The maximum length of the tympanic segment was 12 mm(seen in 4 % of specimens) in the present study which is similar to the maximum limit of length shown in the study of Wase(1979) [13] and Proctor B(1991) [8].

In all the 25 temporal bones dissected, the tympanic segment of facial nerve turned posterior from geniculate ganglion. Processes cochleariformis and tensor tympani tendon were anterior to the facial nerve. Tympanic segment of the nerve was found to lie above the oval window in all specimens, where as Nager GT and Procter B (1991) [8] reported that tympanic segment was coursing above oval window in 66% only.

The nerve passed above the promontory and below the horizontal semicircular canal in all 25 specimens. Similar findings have been reported by most of the other authors.

In the present study the degree of descent was noted as 30^0 in all specimens, which is same as that noted by all the other authors except Proctor B (1991) [8], who showed degree of descent as 37^0.

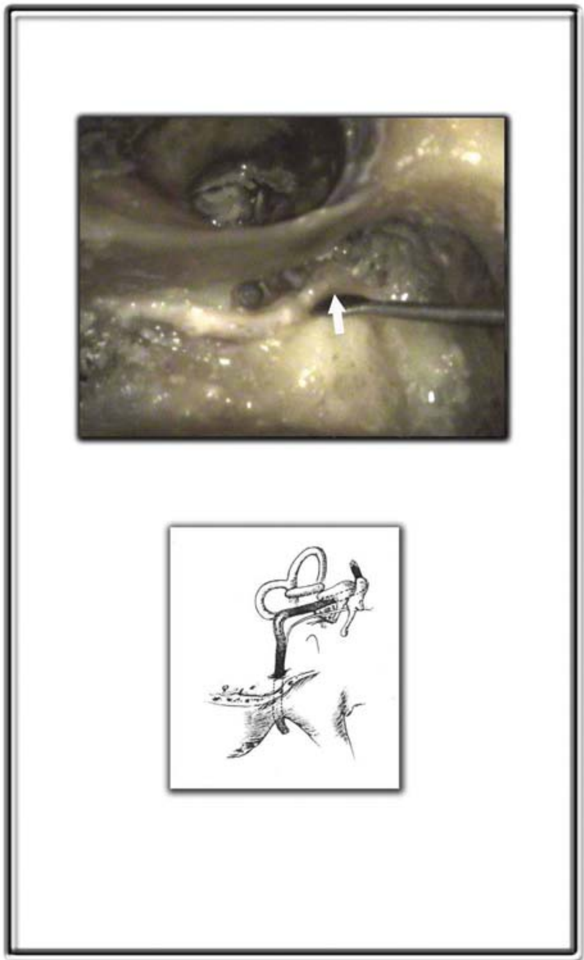

Fig. 1 **(a)** Temporal bone showing "Hump" at second genu **(b)** Facial Nerve showing Hump

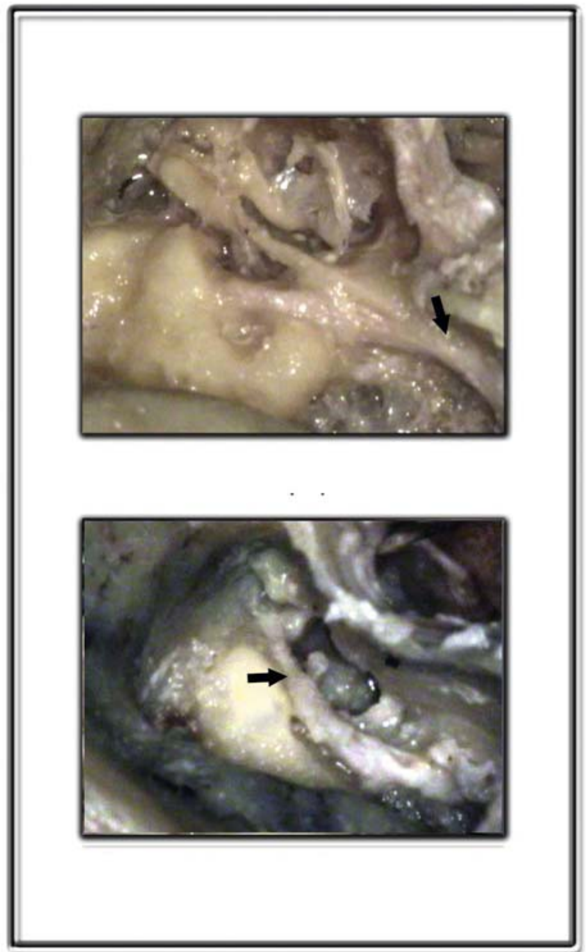

Fig. 2 **(a)** Temporal bone showing low origin of charda tympani **(b)** Temporal bone showing overhang in the region of oval window

In the present study, out of 25 temporal bone dissections, dehiscence in the tympanic segment, were found in 3 bones. In 2 bones dehiscence was noted at tympanic segment and in 1 bone it was seen in the region of the oval window. The incidence of dehiscence comes to 12 percent.

The incidence is low as compared to most authors, but it is similar with the study of Yadav S.P.S.et al. (2006) [25] and Agarwal (1993) [15] and in accordance to the study of other authors.

The incidence of dehiscence was much higher in the study of Beddard and Saunders (1962) [32] 25 %, Leonard (1968) [39] 31% and Baxter (1971)[42] 55%.

In the present study, overhang of the facial nerve in the region of oval window with intact facial canal was seen in one specimen (No. 3), which was 2 × 1.5 mm and without any dehiscence in fallopian canal. This was partially obscuring the view of oval window. The incidence is 4 % which is mimicking the incidence shown by the other authors.

The length of mastoid segment in the present study varied from 10 to 16 mm with a mean of 13.7 mm (±1.45 mm).

Though there is wide range of variation in length described by various authors, the mean length of vertical segment in present study (13.7 mm) is consistent with the mean length of vertical segment of various authors, except that given by Botman & Jonkees and Rulon & Hallberg whose mean length of tympanic segment was 10.5 mm.

Angle varied from 95 to 120 degree in the present study with a mean of 107.6 degree (± 8.79). The range of present study is in accordance with the range given by Proctor (1991) [8] and Yadav S.P.S. et al. (2006) [25].

In the present study, the distance of second genu from outer cortex varied from 17– 24 mm with a mean of 19.72 mm (±1.90 mm)

The range of distance of second genu from outer cortex in present study is concurrent with the study of Yadav S.P.S. et al. (2006) [25].

In the present study, in specimen No.14 a lateral hump was found at second genu. It was not dehiscent and course of facial nerve was normal above and below to this hump. The incidence is 4%.

The lateral hump or posterolateral bulge below the horizontal semicircular canal was seen in 20% of cases in the study of Yadav et al. (2006) [25] out of 25 bones dissected.

Fowler (1961) [55] had observed 7 patients, with the facial nerve was in a more lateral position than usual.

This indicates the rarity of this variation but one should keep the possibility in mind to avoid injury to the facial nerve

In the present study, the distance between origin of chorda tympani and stylomastoid foramen varied from 1 to 7 mm with a mean of 4.8 mm (± 1.41 mm).

This distance is similar with the mean distance shown in the study of all the other authors.

In the present study, the range of distance between origin of chorda tympani and geniculate ganglion varied from 13 –22 mm, with a mean distance of 18.18 mm (±2.20 mm), which is in accordance with the range of other studies.

Over the years, the variations in the course of the mastoid segment of the facial nerve have become apparent. It does not always follow the vertical course as described in textbooks, but shows variations of surgical significance between the second genu and the stylomastoid foramen.

In the present study of 25 temporal bones, 88% of bones were pneumatised and 12% were diploeic. This finding is concomitant with the literature.

Conclusion

In conclusion, the study has provided knowledge of anatomy of temporal bone and its pneumatization pattern, the anatomy of the facial nerve, its variations and their incidence, relation of various middle ear landmarks with the facial nerve and proficiency in dissection. The variations occur with sufficient frequency as described in available literature, showing not much racial and geographical variance and the otologic surgeon must be aware of them, to avoid the disasters and alleviate the fear regarding facial nerve.

"The surgeon learned in anatomy, with the knowledge and skill learned in the dead house may safely traverse the perilous narrow ocean of the operation in the fallopian aqueduct."

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