

The facial nerve at second genu

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Abstract

Background: The surgical relationship of the facial nerve is of great concern, because of the ease of which it may get injured or severed accidentally in various operations, if the operating surgeon is not cautious. Otologic surgery can be planned accurately and carried out safely and expeditiously through the comprehensive understanding and application of its variations and anomalies. **Objective:** To study the anatomy of the facial nerve at second genu. **Materials and Methods:** The present study was carried out in the dept. of ENT, GMC, Jammu, where in 30 wet human cadaveric temporal bones were dissected and the facial nerve at second genu was studied in terms of depth, relation and distance from important bony **Observations and results:** The depth of the facial nerve at second genu was $20.16 \text{ mm} \pm 1.391 \text{ mm}$ with no dehiscence recorded in any of the specimens.

Key Word: genu.

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INTRODUCTION

"Otology could be a dull way of life without seventh cranial nerve arrogantly swerving through the temporal bone to muscles of facial expression" said John Groves.¹ Facial nerve is composed of about 10,000 motor, sensory and parasympathetic fibres. The motor root supplies the striated musculature of the face & the neck and the stapedius muscle of the middle ear.² Therefore, the facial expression (nonverbal humanistic expression), an important means of social communication besides language and speech, depends upon about 7000 motor fibers of the facial nerve firing in unison to bring about the muscular contraction.³ Sensory and parasympathetic

fibres (about 3,000) are carried by nervus intermedius (nerve of Wrisberg) and consists of, general visceral efferent fibres to the submandibular, sublingual, minor salivary and lacrimal glands, special visceral afferent fibres, that provide taste to the anterior two-thirds of the tongue and somatic afferent fibres, that supply innervation to the skin of the external auditory meatus.⁴ Based on its course, the nerve is divided into three portions – intracranial portion, intratemporal portion and the extratemporal portion. The intra-temporal portion of the facial nerve runs from the entrance of the facial (fallopian) canal at the fundus of the internal auditory meatus and ends at the stylomastoid foramen. The second turn or the second genu of the facial canal is a curvature with a wide graceful radius that starts in the horizontal plane and then becomes almost vertical. The second genu hugs the inferior aspect of the lateral semi-circular canal and at the bottom of the bend, the nerve is lateral and posterior to the pyramidal eminence, which marks the beginning of the mastoid segment. Its orientation is noteworthy; it travels from the second genu posterior medially to the stylomastoid foramen anterior-laterally.⁵ The temporal bone without the facial nerve would reduce surgery to relative simplicity. The facial nerve serves as an excellent landmark and guide to the otologist during

the temporal bone surgery. Its surgical relationship is of great concern, because of the ease of which it may get injured or severed accidentally in various operations, if the operating surgeon is not cautious.⁶ Otologic surgery can be planned accurately and carried out safely and expeditiously through the comprehensive understanding and application of these variations and anomalies. Therefore, 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.⁷

RESULTS

MATERIALS AND METHOD

The present study was carried out in the Department of ENT and Head & Neck surgery, SMGS Hospital, Government Medical College, Jammu for a period of 1 year, during which a total number of 30 wet human cadaveric temporal bones were dissected in the temporal bone dissection laboratory under the operating microscope and the findings were recorded. After mounting the temporal bone properly on the temporal bone holder, the soft tissue covering the squamous and the mastoid part of the temporal bone was cleared and the bony landmarks were exposed and identified. The facial nerve was exposed in its entire intra-temporal segment using the transmastoid approach and after accomplishing the same, measurements were made and recorded according to the proforma attached.

Table 1: Showing the depth of the facial nerve at second genu.

Depth of facial nerve at second genu (mm)	Number of bones	Percentage (%)
18	3	10
19	7	23.33
20	10	33.33
21	4	13.33
22	4	13.33
23	2	6.67
Total	30	100
Mean depth	20.16 mm	
S.D	1.391 mm	

The mean depth of the facial nerve at second genu was 20.16 ± 1.391 mm with the depth varying from 18 – 23 mm. Maximum specimens i.e. 33.33% had a depth of 20 mm while just 6.67% had a depth of 23 mm.

Table 2: Showing the relation of the facial nerve at second genu with important bony landmarks.

Relation of the facial nerve at second genu	Relation	Number	Percentage (%)
With the lateral semi-circular canal	Below	30	100
With the pyramidal eminence	Posterior and lateral	30	100

In all the dissected specimens (100%), the facial nerve at second genu was found to lie below the arch of the lateral semi-circular canal and at the bottom of the bend, the nerve was posterior and lateral to the pyramidal eminence for the stapedius muscle. Any variation in the position of the second genu was not observed in any of the temporal bone specimens.

Table 3: Distance of second genu of facial nerve from important bony landmarks.

Table 3 (a): Showing the distance of the second genu from the ampullary end of the lateral semi-circular canal.

Distance of the second genu from the ampullary end of the lateral semi-circular canal (mm)	Number of Bones	Percentage (%)
1	24	80
2	6	20
Total	30	100
Mean distance	1.2 mm	
S.D	0.406 mm	

The mean distance between the second genu and ampullary end of the lateral semicircular canal was 1.2 ± 0.406 mm (1 – 2 mm). Maximum number of temporal bone specimens i.e. 24 (80%) had a distance of 1 mm while only 6 (20%) specimens had a distance of 2 mm.

Table 3 (b): Showing the distance of the second genu from the posterior commissure of the oval window

Distance of the second genu from the posterior commissure of the oval window (mm)	Number of bones	Percentage (%)
2	2	6.67
3	16	53.33
4	12	40
Total	30	100
Mean distance		3.33 mm
S.D		0.606 mm

The mean distance between the second genu and the posterior commissure of the oval window was 3.33 ± 0.606 mm, with the maximum distance being 4 mm in 40% specimens and the minimum distance being 2 mm in 6.67% specimens. Maximum number of specimens i.e. 53.33% had a distance of about 3 mm.

Table 4: Showing the dehiscence of the second genu of the facial nerve.

Dehiscence at second genu	Number	Percentage (%)
Present	0	0
Absent	30	100
Total	30	100

Dehiscence at the level of second genu of facial nerve was not observed in any of the dissected specimens.

Table 3: Showing the distance between the second genu and the posterior commissure of the oval window, as reported by different authors.

Studies	Year of Study	Distance between the second genu and the posterior commissure of the oval window		Mean (mm)
		Maximum (mm)	Minimum (mm)	
Present study	2014	4	2	3.33 ± 0.606
Măru N <i>et al.</i> ²	2010	4.5	2	3 ± 1.15
Ezzat WF <i>et al.</i> ¹¹	2009	4.1	2	3.314 ± 0.435
Yadav SPS <i>et al.</i> ⁶	2006	6	2	4 ± 1.29

DISCUSSION

It became apparent early, that in developmental anatomy, lay the means of understanding the previous baffling aspects of the adult structure of the human ear and temporal bone.⁸ A good grasp of this complex anatomy is therefore necessary for the otologic surgeon, as navigation during operation by occasional and inexperienced surgeon might prove fatal.⁹ A safe surgeon should use as many of the available anatomical landmarks as feasible to perform safe facial nerve surgery.¹⁰ A total of 30 wet human cadaveric temporal bones were dissected in the present study to study the anatomical details of the facial nerve at second genu. The depth of the second genu from outer cortex, in the present study was 20.16 ± 1.391 mm (range 18 – 23 mm). It was concurrent with the observations made by Yadav SPS *et al.*⁶ and Kharat RD *et al.*³, who in their respective studies reported the depth to be 21.6 ± 2.62 mm (18 – 26 mm) and 19.72 ± 1.90 mm (17 – 24 mm). The facial nerve at second genu was observed to lie below the arch of the lateral semi-circular canal in all the dissected specimens, in the present study. These finding were similar to those observed by Bibas T *et al.*⁴, Procter B⁵, Kharat RD *et al.*³ and Măru N *et al.*²

In the present study, the facial nerve at the

bottom of the bend was posterior and lateral to the pyramidal eminence in all the 30 dissected specimens. These findings were in agreement to those observed by Bibas T *et al.*⁴, Procter B⁵, Kharat RD *et al.*³, Măru N *et al.*² and Yadav SPS *et al.*⁶ Any variation in the position of second genu was not observed in any of the dissected specimens in the present study. These findings were consistent with those reported by Măru N *et al.*² but were contrary to those of Yadav SPS *et al.*⁶ who observed the second genu to have a normal course in only 68% of the specimens and found a lateral hump or postero-lateral bulge below the horizontal semicircular canal in 20% and a bulge lateral to the prominence of the horizontal semicircular canal in 12% specimens. Kharat RD *et al.*³ reported a lateral bulge at the level of second genu in 4% of specimens in their study on 25 temporal bones and Fowler had also observed 7 patients, in whom the facial nerve was in a more lateral position than usual. In the present study, the mean distance between the second genu and the ampullary end of the lateral semi-circular canal was measured and calculated to be 1.2 ± 0.406 mm (1 – 2 mm) which was less as compared to 2 ± 0.5 mm, as reported by Măru N *et al.*² The mean distance between the second genu and the posterior commissure of the oval

window was 3.33 ± 0.606 mm (2 – 4 mm), in the present study. These findings were similar to those observed by Procter B⁵, Ezzat WF *et al.*¹¹ and Măru N *et al.*² who found the distance to be 3 – 4 mm, 3.314 ± 0.435 mm (2 – 4.1 mm) and 3 ± 1.15 mm (2- 4.5 mm) in their respective studies. Yadav SPS *et al.*⁶ observed the distance to be 4 ± 1.29 mm (2 – 6 mm), more as compared to the present study.

CONCLUSION

The present study provided detailed anatomical knowledge of the facial nerve at second genu, in terms of its depth, relation and distance from important bony landmarks, any variations or dehiscence.

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