INDEX COPERNICUS INTERNATIONAL

A rare case of aberrant facial nerve course in the mastoid segment

Rzadki przypadek nieprawidłowego przebiegu nerwu twarzowego w jego części sutkowej

Amit Kumar Rana[1], Mubarak Muhamed Khan[2], Sapna Ramakrishna Parab[2]

[1]Department of Otolaryngology and Head Neck Surgery, SRMS Institute of Medical Sciences, Bareilly (UP), India
[2]Sushrut ENT Hospital and Dr Khan Research Centre, Talegaon, Pune, India

Article history: Received: 26.12.2020 Accepted: 30.04.2021 Published: 07.05.2021

ABSTRACT: Facial nerve provides innervation to the majority of facial muscles responsible for facial expressions. The rates of iatrogenic facial nerve injuries in primary mastoid surgeries were 0.6% to 3.7% in different studies. Temporal bone is one of the most complex anatomical structures in the human body. Up to this date, a variety of facial nerve courses has been described in literature. Usually, the horizontal segment of the facial nerve traverses from the geniculate ganglion to the second genu, which is usually located medially and inferiorly to the lateral semicircular canal. It then travels posteriorly and laterally, passing along the medial wall of the middle ear. The mastoid or vertical segment extends from the second genu to the stylomastoid foramen and runs deep into the tympano-mastoid suture line, where the nerve exits the temporal bone. During our endoscopic dissection of one temporal bone, we encountered a grossly anomalous course of the facial nerve: after turning at second genu, the nerve curves posteriorly and lies in the mastoid process, traversing its whole length and instead of exiting the stylomastoid foramen, it travels towards the wall of the sigmoid sinus and then takes another (3rd) turn, running anteriorly towards the mastoid tip, where it finally exits.

KEYWORDS: anomalous facial nerve, cadaveric dissection, dissection, iatrogenic facial nerve palsy, temporal bone

STRESZCZENIE: Nerw twarzowy jest najważniejszym nerwem odpowiedzialnym za ruchowe zaopatrzenie mięśni mimicznych twarzy. Częstotliwość występowania jatrogennego uszkodzenia nerwu twarzowego podczas zabiegów chirurgicznych wyrostka sutkowatego wynosi od 0,6% do 3,7%. Kość skroniowa stanowi jedną z najbardziej złożonych anatomicznie części ludzkiego ciała. W literaturze opisywane są różne warianty przebiegu nerwu twarzowego. Z reguły poziomy odcinek nerwu twarzowego przebiega od zwoju kolankowego do drugiego kolanka nerwu, położonego najczęściej przyśrodkowo i ku dołowi od bocznego kanału półkolistego. Od tego miejsca nerw biegnie ku tyłowi i do boku wzdłuż przyśrodkowej ściany ucha środkowego. Część sutkowa lub pionowa nerwu twarzowego przebiega w głębi szczeliny bębenkowo-sutkowej od drugiego kolanka nerwu do otworu rylcowo-sutkowego, przez który nerw opuszcza kość skroniową. Podczas endoskopowego preparowania kości skroniowej zaobserwowano bardzo nietypowy przebieg nerwu twarzowego, który w swoim odcinku za drugim kolankiem zakrzywia się ku tyłowi, przechodzi przez całą długość wyrostka sutkowatego i zamiast przejść przez otwór rylcowo-sutkowy biegnie w kierunku ściany zatoki esowatej, a następnie wykonuje kolejny zwrot (trzeci) do przodu w kierunku szczytu wyrostka sutkowatego, gdzie w końcu opuszcza czaszkę.

SŁOWA KLUCZOWE: badanie sekcyjne, jatrogenne porażenie nerwu twarzowego, kość skroniowa, nietypowy przebieg nerwu twarzowego, sekcja zwłok

INTRODUCTION

Facial nerve is the nerve of the second branchial arch and it comprises of about 10,000 motor, sensory and parasympathetic fibres. The nerve was first described by Galen in 130–200 BC [1]. Facial nerve provides innervation to the majority of facial muscles which are responsible for facial expressions. It was believed that the nerve was protected against injury in its bony canal. Therefore, whenever the facial nerve was injured along its course, it was always assumed that the damage occurred due to lack of surgical skill. In fact, facial nerve injuries may result from pathologies of the facial nerve itself, from trauma to the nerve in temporal bone fractures or from iatrogenic events during middle ear surgeries. The reported rates of iatrogenic injuries to the facial nerve in primary mastoid surgeries reached from 0.6% to 3.7% in different studies. The risk is twice as high in revision surgeries, reaching from 4% to 10% [2]. Iatrogenic injuries may be caused either by incorrect surgical technique of an overly enthusiastic or inexperienced otologist, or by aberrant course of the facial nerve. Damage to the facial nerve represents the greatest fear of an otologic surgeon. Surgeons are afraid not only of cosmetic and functional complications, but they also fear medicolegal ramifications associated with facial nerve injuries.

 DOI: 10.5604/01.3001.0014.8691

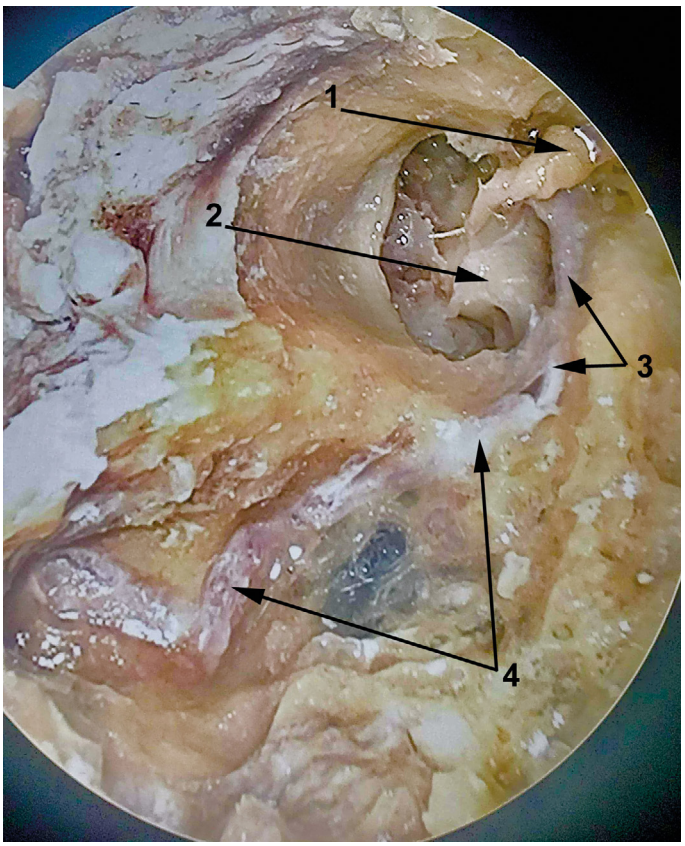

Fig. 1. Endoscopic view of the left human temporal bone. Aberrant facial nerve course in its mastoid segment. (1) Head of the malleus, (2) promontory of the tympanic cavity, (3) normal course of the facial nerve in its mastoid segment, (4) anomalous further course of the facial nerve in the mastoid process.

Nowadays we are well aware that the temporal bone is one of the most complex anatomical structures in the human body. Variations in relative positions of the facial nerve, sigmoid sinus and other middle ear structures can be observed in the temporal bone. Any disturbance in the nerve's structure or functioning may lead to dysfunctions such as deviation of the angle of mouth or inability to close eyes, as well as to functional disorders such as inability to clench teeth or express emotions, therefore affecting patients' psychological well-being and leading to difficulties in social interactions [3]. To give an example, a 1991 survey revealed that Americans' discomfort upon encountering people with facial paralysis was similar only to that associated with interacting with patients suffering from mental disorders [4]. Abnormal facial nerve course is not an uncommon finding in patients admitted for middle ear surgeries. A variety of facial nerve courses has been described in literature, the most common of which is its passage through the fallopian canal below the oval window instead of above the oval window [5]. This is usually due to dehiscence of the tympanic part of the fallopian canal [6]. Operating on a patient with the above-described facial nerve course anomaly can sometimes result in iatrogenic trauma, regardless of using a proper surgical technique [6].

Along with appropriate clinical judgment and technical skills, good understanding of anatomy is also a key factor in otology practice. This is especially important with relation to the course of the facial nerve in the middle ear. As a consequence, one of the most important aspects of resident training in otology is adequate exposure to cadaveric temporal bone dissection, in order to ensure good understanding of anatomical variations in the middle ear cleft. Facial nerve dissection is an integral part of temporal bone dissection practice. Temporal bone dissections allow aspiring otologists not only to understand the middle ear landmarks and the mastoid air cell system, but also to learn about the usual course and common variations and anomalies in the facial nerve course – from its entry in the middle ear at the first genu, to its exit from the stylomastoid foramen.

Otologists must be familiar with both common and uncommon variations of the facial nerve course and must proceed carefully whenever they suspect an abnormality in its course, in order to avoid injury to the facial nerve. We hereby report a case of abnormal facial nerve course encountered during a two-handed endoscopic human temporal bone dissection.

FACIAL NERVE COURSE REPORT

Normally, horizontal segment of the facial nerve traverses from the geniculate ganglion to the second genu which is usually situated medially and inferiorly to the lateral semicircular canal. It then passes posteriorly and laterally along the medial wall of the middle ear. Mastoid or vertical segment extends from the second genu to the stylomastoid foramen and runs deep into the tympano-mastoid suture line, where the nerve exits the temporal bone. The transition from tympanic into mastoid or vertical segment occurs at the junction of medial and posterior walls of the tympanic cavity.

During our endoscopic dissection, we encountered a grossly anomalous course of the facial nerve: after turning at second genu, the nerve curves posteriorly and lies on the floor of the mastoid cavity, traversing its whole length and, instead of exiting the foramen, it runs towards the sinus plate and then takes another (3rd) turn to travel anteriorly towards the mastoid tip, where it finally exits.

Not only is the mastoid segment of the facial nerve twice as long in this case, but it also runs on the floor of the mastoid cavity, where an unsuspecting otologist could damage it unknowingly. Mild deviations have already been reported in literature but such a displacement has not been reported in literature yet. Similarly, a third sharp turn has not been reported on in literature according to the best of our knowledge.

We also observed that the thickness of the nerve measured twice as much as its diameter normally seen on dissection.

DISCUSSION

Facial nerve has a lengthy and tortuous course in the temporal bone. Prolonged diseases of the middle ear may extend to the facial nerve and affect its function. Middle cleft bony structures and its close alignment with various neurovascular structures make this area a challenging surgical site, especially for inexperienced surgeons. In his textbook on otology, Bezold wrote that "an incompetent operator, who is not aware of many anatomical details crowded together

in the narrow space of the temporal bone and their extreme variability, poses a much greater danger to the patient than in any other regions of the body" [1]. The average length of the mastoid segment is reported to be 13.4 mm, as it was measured in fifteen fresh cadaveric temporal bones [2]. Anomalies of the facial nerve course have been observed since the times when magnifying sources were first introduced in otology practice and these anomalies are still a nightmare for inexperienced hands. Overconfidence of experienced medical practitioners and under-preparedness of the novice who do not expect to see any unusual findings in the course of the facial nerve still remain the leading causes of iatrogenic injuries to this structure [3]. Hohman et al. observed that 17% of all post-operative facial nerve palsies were caused by ear surgeries, 82% of which occurred during mastoid surgeries [7]. Correct identification of the facial nerve remains an important step and all surgeons should be well aware of anatomical bony landmarks of the facial nerve course.

Facial nerve course variations often coexist with congenital anomalies like microtia or meatal atresia. Frequently encountered anomalies of the facial nerve include abnormal relation to the oval and round windows, abnormal branching of the nerve, anomalous course involving the external auditory canal [3]. The most challenging condition for surgeon is when the facial nerve course is anomalous or dehiscent in its vertical part, since dehiscence of the facial canal often coexists with its displacement as it descends towards the stylomastoid foramen [3]. In order to avoid damage to the facial nerve, every surgeon should be familiar with both the normal course of the facial nerve and its anatomical variations which he or she may encounter when operating on patients with congenital anomalies; surgeons should be particularly prepared for unexpected anomalies which can sometimes remain undetected on imaging tests [8].

The middle ear and mastoid pneumatization varies from person to person , which is what makes mastoid surgery such a difficult task. We therefore conclude that knowledge of various anatomical landmarks of the temporal bone is still a key factor in successful surgery. Along with good understanding of normal anatomy, keeping in mind such anatomical variations while performing mastoidectomies may help avoid iatrogenic injuries to the facial nerve [4, 9].

CONCLUSION

Otological surgery is a challenging task and the rewards of a successfully performed procedure are indeed very gratifying to both the surgeon and the patient. In order to achieve success, surgeons should possess a thorough knowledge of temporal bone anatomy. Adequate surgical technique should include constant visualization of the course of the facial nerve, taking special care to identify any anomalies in its course.

References

1. Gupta S., Mends F., Hagiwara M., Fatterpekar G., Roehm P.C.: Imaging the facial nerve: A contemporary view. Radiol Res Pract., 2013; 2013: 248039.
2. Hohman M.H., Bhama P.K., Hadlock T.A.: Epidemiology of iatrogenic facial nerve injury: a decade of experience. Laryngoscope, 2014; 124(1): 260–265.
3. Thomas J., Ghate G., Kumar A., Kumar A.: Anomalies of the facial nerve: a surgeon's nightmare. Int J Otorhinolaryngology and Head Neck Surg, 2018; 4(5): 1202–1205.
4. Pensak M.L., Willging J.P., Keith R.W.: Intraoperative facial nerve monitoring in chronic ear surgery: a resident training experience. Am J Otol, 1994; 15(1): 108–110.
5. Gupta N., Gupta R., Singh I.P., Kotwal S., Suri A. et al.: To study the anatomy of tympanomastoid segment of facial nerve and its variations in human cadaveric temporal bone. Indian J Otol, 2017; 23: 108–112.
6. Kalairasi R., Satya K.A., Vijaykumar C., Venkataramanan R., Manusrut M. et al.: Anatomical features of Intratemporal course of facial nerve and its variations. Cureus, 2018; 10(8): e3085.
7. Jatale S.P., Chintale S.G., Kirdok V.R., Shaikh K.A.: Our experience of anatomical variations of facial nerve in cadaveric temporal bone dissection. Indian J Otolaryngol Head Neck Surg, 2020, https://doi.org/10.1007/s12070.020.01969/9.
8. Wackym P.A., Rhee J.S. Facial paralysis. W: Ballenger's Otorhinolaryngology Head and Neck Surgery, 16th ed, red. J.B. Snow, J.J. Ballenger, B.C. Decker. Inc. Hamilton, Ontario 2003, 489–520.
9. Hashemi S.B., Jahangiri R., Hosseinialhashemi M., Nighmachi M.: Aberrant course of facial nerve in the middle ear cavity. Indian J Otol, 2020; 26(3): 197–198.

Word count: 1672 Tables: – Figures: 1 References: 9

Access the article online: DOI: 10.5604/01.3001.0014.8691

Table of content: https://otorhinolaryngologypl.com/issue/13832

Competing interests: The authors declare that they have no competing interests.

Corresponding author: Dr Amit Kumar Rana; Department of Otolaryngology and Head Neck Surgery, SRMS Institute of Medical Sciences, Bareilly (UP), India; Phone.: +91 9412008100; E-mail: dr.akrana@gmail.com

Cite this article as: Kumar Rana A., Khan M.M., Parab S.R.: A rare case of aberrant facial nerve course in the mastoid segment; Pol Otorhino Rev 2021; 10 (2): 30-33