

Cadaver Temporal Bone Dissection - The JOS Experience

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Abstract

Background: The temporal bone is made up of nebulous complex neurovascular structure. A good grasp of this complex anatomy is necessary for the otologic surgeon in dissecting the temporal bone for various otologic surgeries and skills development.

Method: The land marks for the dissections were suprameatal crest, a perpendicular line through the spine of Henle and posterior wall of the external auditory meatus of the temporal bones connected by a tangent directly overlying the mastoid antrum. Cutting burr of 6mm was used to mark out the lines above. At the juncture; the bones were deepened to expose the dural plate, sinodural angle and the posterior wall of the external meatus. Moving from one land mark to another, otologic surgeries such as mastoidectomies, facial nerve exploration and cochlear implantation were performed.

Result: All the cadavers (100%) were adult males. The suprameatal crest, dural plate, aditus antrum, horizontal semi-circular canal, facial nerve canal, facial nerve, facial recess, Sigmoid plate, herald air cells, oval and round windows were present in the eighteen temporal bones. Eighteen canal wall ups and wall down mastoidectomies and cochlear implantation were performed.

Spine of Henle was present in 3(16.7) %, cribrifossae, highly, moderately and poorly pneumatized, herald air cells, wide mastoid cavity, narrow mastoid cavity, tympanic membranes remnants, incus and stapes were present in 16(88.9)%, 12(66.7)%, 2(11.1)% 4(22.4)%, 13(72.2)%, 16(88.9)%, 2(11.1)%, 11(61.1)%, 12(66.7)% and 6(33.3)% respectively.

Conclusion: Temporal bone dissection provides the learning curve in understanding anatomic features and the variations that pose challenge in otologic surgeries.

Introduction

The temporal bone is a complex of neurovascular structure. A good grasp of this complex anatomy is necessary for the Otologic surgeon. Navigation of this complex anatomy during operation by occasional and inexperienced surgeon might prove fatal. [1],[2],[3] Surgeries learnt by dissecting the temporal bones includes mastoidectomy, tympanoplasty, facial nerve exploration, stapedectomy, endolymphatic shunt, vestibular nerve sectioning and cochlear implantation.[4]

Otologic skills are therefore best developed by temporal bone dissection but the scarcity of temporal bones is a challenge. [5]

In order to acquire this necessary skill, we dissected eighteen temporal bones in nine cadavers of a period of three months preparatory for cochlear implant and other temporal bones surgeries in our centre.

Methodology

After obtaining the institutional permission from the Ethics Board of the Faculty of the Medical Sciences, University of Jos, Jos, Nigeria, eighteen consecutive temporal bones of nine cadavers were harvested for this prospective study. Each temporal bone was soaked for about thirty minutes prior to dissection.

The landmarks for the dissections were the “inferior temporal line” at the point of insertion of the temporalis muscles, the suprameatal crest and a perpendicular running through the spine of Henle and the posterior wall of the external auditory meatus of right and left temporal bones. A tangent was drawn connecting the two lines above (McEwen’s triangle) which lie directly over the mastoid antrum.

The largest cutting burr of 6mm was used to mark out the lines above. Starting at the junction where the two lines met; the bone was deepened so that the dural plate, sinodural angle and the posterior wall of the external meatus become thinned out while maintaining copious irrigation to keep the bone dust from obscuring our views. The dissection continues until the aditus antrum was met. At this point, the operating microscope was used to aid visualization to avoid damage to the incus at the fossa incudus. Using a 3mm cutting burr the rest of the marrow was drilled until the horizontal semicircular canal came into view. From this point a 2mm diamond burr was used to smoothen out the marrow and further drilling, using the needle the herald or retrofacial air cells were sorted, drilling through them the facial recess bound superiorly by incus, medially by the facial nerve and laterally by the chorda tympani was entered without damage to any of them nor the annulus of the tympanic membrane. This brings into view the incudostapedial joint, the promontory or medial wall of the middle ear and part of the round window membrane because the niche occludes the full view of the posterior part of the middle ear. This niche was drilled out until the full view of the round window membrane was seen.

With a clear focus using the operating microscope, an inferior cochleostomy was performed

by drilling the inferior part of the round window membrane into the scala tympani using 1mm diamond burr. There after facial nerve exploration, canal wall up and wall down, atticotomy, fenestration of lateral semicircular canal were practiced hands down on these specimens.

Anatomical features of importance: The landmarks which comprise the inferior temporal line or suprameatal crest, the spine of Henle, cribriform fossae, dural plate, degree of pneumatization, presence of aditus antrum, ossicles, horizontal semi circular canal, herald air cells, facial nerve, tympanic membranes and how narrow the mastoid cavity was. All these were identified and recorded.

Equipment: The equipment used includes temporal bone dissection microscope, House-Urban temporal bone holder, a high speed drill up to 40,000 rpm, cutting burrs of 6mm and 3mm, diamond burrs of 2mm and 1mm. slightly angulated needle, curette, micro scissors, drip stand, operating goggle and apron.

Discussion

All our cadaver specimens were adult males. These findings differ from that of Fernando et al where they had five females and a male cadaver. [6] This study did not provide us the opportunity to compare gender variations and paediatric temporal bones.

The suprameatal crest, dural plate, aditus antrum, lateral or horizontal semi- circular canal, facial nerve(Falopian) canal, facial nerve, facial recess, Sigmoid plate, herald air cells, oval and round windows were all present in the seventeen specimens (100) %; however; there were variations in the presence of spine of Henle 3(16.7) %, cribrifossae, ossicles, tympanic membranes and the degree of pneumatization. The spine of Henle may have been inadvertently removed during preparation by the anatomy technician. All eighteen temporal bones had intact Falopian canal. Falopian canal dehiscence was not found in this study and might be due to the relatively few number of temporal bones dissected; this is in contrast to the work of Moreano and co workers where they found a range of 25 to 57% particularly in his studies they found 56% of falopian dehiscence in 1000 temporal bones especially along the tympanic segment of the facial nerve, identifying the falopian canal dehiscence is very important in order to avoid iatrogenic injury to the facial nerve during operation along the course of the facial nerve especially facial recess creation..[7]

The high degree of pneumatization makes the dissection easier but may predisposed the individual to pneumatocele because the bones were very thin whereas the poorly pneumatized makes the dissection slower in order to avoid injury to underlying structure and also not to miss the land mark; however, most of the structures like the facial nerve and its canals maintain their anatomic position despite the few marrow spaces. [8], [9], [10] we did not however compare bilaterality or symmetry of pneumatization in this present study.

The narrow angle mastoid cavity made dissection slow especially in locating the mastoid antrum which was much obscured and the facial nerve canal was found to be closer to the posterior wall therefore making access to facial recess a good challenge. This is in agreement with the findings of Lee et al that positions of anatomic structures may alter slightly if the sigmoid sinus is anteriorly placed and closer to the posterior meatal wall. [11]

The tympanic membrane remnants were present in 11(61.1) % and absent in 7(38.9) %. This may have been due to previous cases of otitis media. [12], [13]

The ossicles especially incus were present in 12(66.7) %, stapes in 6(33.3)% and no malleus was present in all of our cases. This may have been absent congenitally or traumatically dislodged as noted by Soh, Lee D and co workers respectively. [14], [15]

Overall, eighteen canal wall up, canal wall down mastoidectomies and cochlear implantation surgeries were carried out providing good surgical experience in temporal bone surgeries, examples of the surgeries are shown in illustrations 1 and 2 respectively.

Limitations: All the temporal bones were male adults hence comparison between gender and paediatric temporal bones for now is difficult. The lack of proper functioning suction machine added to prolongation of dissection time.

Future: The use of fresh cadaver will provide the nearest ideal to human and more anatomic features will be visualize to enhance greater dexterity and navigation to better our surgical skills.

Conclusion: Temporal bone dissection provides the learning curve in understanding anatomic features and the variations that pose challenge in otologic surgeries.

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