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Original Article

Anatomy Section

Incidence of Foramen of Huschke in South Andhra Population of India

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ABSTRACT

Introduction: Foramen of Huschke (FH) is an opening present in anteroinferior wall of External Acoustic Meatus (EAM) on the tympanic plate of temporal bone. The developing tympanic ring normally gets closed by the age of 5 years, if not, leads to the persistence of FH, shows a communication between the EAM and mandibular fossa of temporal bone.

Aim: The aim of the present study was to report on the incidence of FH in adult skulls and individual temporal bones, belonging to South Coastal Andhra population.

Materials and Methods: Ninety three skulls and 34 temporal bones (18 right and 16 left) obtained from the Department of Anatomy and ENT respectively, irrespective of their sex were utilized. This Tympanic Plates (TP) was observed for the occurrence of FH.

Results: Incidence of FH was found in 18 (16.22%) on right and 24 (22.02%) on left side. Bilateral FH was seen in 13 (13.98%) and multiple FH was 13 (5.91%). Mostly it was situated on left than the right side.

Conclusion: This study revealed that about 38% of South Coastal Andhra crania have FH. The presence of FH may render external and middle ear structures vulnerable to injury during arthroscopy of the Temporomandibular Joint (TMJ). Since FH can result in TMJ herniation and salivary gland fistulisation through the anterior wall of the bony EAM, surgeons working in this area must be cautious during surgical procedures. Also, data obtained from different populations, as observed from our study can be useful in racial and anthropological studies.

Keywords: Temporal bone, Tympanic plate, External auditory meatus, Foramen tympanicum

INTRODUCTION

Foramen of Huschke (FH) or foramen tympanicum is an anatomic variation of Tympanic Plate (TP) of temporal bone due to a defect in normal ossification in the first 5 years of life [1] and may remain throughout life [2,3]. Persistent FH have been reported to be 5-46% in adult crania from ancient to modern population [4,5].

Tympanic Plate (TP) lies between the squamous and mastoid part of temporal bone. It forms the anterior wall, floor and lower part of the posterior wall of bony External Acoustic Meatus (EAM). FH is located on the antero-inferior wall of the EAM on the TP of the temporal bone, presenting a communication between the EAM and the mandibular fossa.

FH can either be asymptomatic or it may cause a persistent ear discharge after mastication in which case it might be connected to the Tempro-Mandibular Joint (TMJ) or to the parotid gland [6,7]. It may be attributed to conditions such as herniation of TMJ, as well as otological disturbances in the EAM. It may also lead to inadvertent passage of the endoscope into the TMJ leading to its damage [8-10].

AIM

The present study was undertaken to reveal the incidence of FH in the south coastal Andhra population of India hitherto unreported.

MATERIALS AND METHODS

Ninety three human skulls irrespective of sex and age were obtained from the anatomy department and 34 temporal bones (18 right and 16 left) from the ENT department, Narayana Medical College and General Hospital, Nellore. Total of 111 right (93+18) and 109 left side (93+16) Tympanic Plates (TP) were observed for the occurrence of FH. These bones were closely observed to rule out any fractures due to artificial means, especially in temporal region. The average maximum and minimum diameter of FH was noted with digital vernier caliper, wherever it is possible. Illuminated light was passed through the EAM to find out the weaker portion of TP.

RESULTS

Out of 93 skulls and 34 temporal bones which included 220 TP, unilateral FH were found in 18 right and 24 left sides [Table/Fig-1,2a]. Bilateral FH were seen in 13 TP [Table/Fig-2b]. In another 13 TPs, multiple FH were also noted which was seen mostly on the left side [Table/Fig-2c]. The range of maximum transverse diameter of the FH was 3-9.1mm along the transverse axis and 1-5.3mm along vertical axis in relation to mandibular fossa. In one skull, the complete erosion of upper part of TP was noted [Table/Fig-2d].

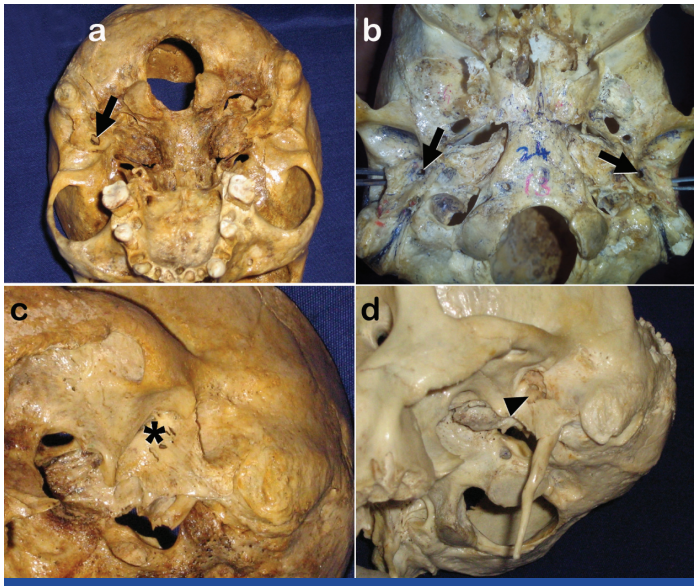
Variables	Right side TP N=111	Left side TP N=109
Unilateral	18 (16.22%)	24 (22.02%)
Bilateral*	4 (4.30%)	9 (9.68%)
Multiple	13 (5.91%)	

[Table/Fig-1]: Incidence of foramen of Huschke belonging to south coastal Andhra Pradesh skulls.
*-bilateral FH were confined only in 93 skulls.

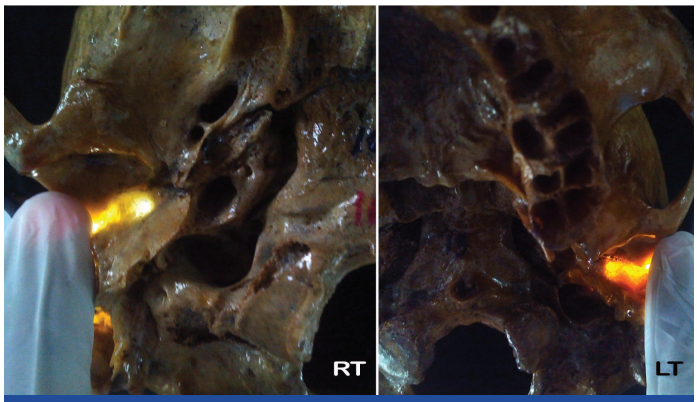
Light illumination through the normal skulls of EAM revealed the thinner and weaker part of the TP where the deficient, the FH may occur or present [Table/Fig-3]. In this study all the FH were found in the upper part of the TP.

DISCUSSION

Embryologically, the temporal bone develops intramembraneously and consists of five parts- periotic, squamosal, tympanic, stylohyal and tympanohyal. These parts give rise to squamous, petro-mastoid and tympanic portions in adult skulls. The first branchial pouch forms the eustachian tube and tympanic cavity while the groove forms EAM. The first branchial membrane, the tympanic membrane lies between this pouch and groove. At nine weeks of in-utero, four small ossification centres develop around the tympanic membrane to form the tympanic ring, an incomplete 'U' shaped bone, which fuses with the squamous temporal bone [2,4].



[Table/Fig-2a-d]: (a) Base of the skull showing the foramen of Huschke-FH (arrow) on left side; (b) Bilateral FH (arrows); (c) Multiple FH (asterisk) on left side; (d) Complete erosion of upper part of tympanic plate (arrow head).



[Table/Fig-3]: Basilar view of the normal skull without foramen of Huschke (FH) or fractures. A LED white light was illuminated through the external acoustic meatus of right (RT) and left (LT) side to find the weaker portion of tympanic plate (TP). Note the upper part of TP appears transparent (yellowish or reddish color), where FH occurs.

During 1st year of post-natal life, two nodular bony processes (an anterior and posterior) grow towards the 'U' shaped tympanic ring and fuses with each other. Later this ring expands to form the tympanic part, occurs in a cranio-caudal and from lateral to medial direction, thus forming the EAM [11]. If the point of fusion does not properly extend medially then the foramen persisting medial to the point of fusion is called FH.

In children, this foramen becomes smaller and gradually closes completely by 5 years of age but it may persist occasionally [10]. Hence, deficiency in the anteroinferior wall of EAM formed by tympanic part of the temporal bone should be considered as anatomic variant only after 5 years of age [6,12].

Several factors influence the closure of the tympanic ring, one of which the mandibular pressure against the tympanic bone by the actions of mastication, deglutition and respiration with the development of maxillofacial bones after birth [13]. However, the same mandibular pressure may increase the size of FH [14].

In the present study, out of 93 skulls and 34 temporal bones, unilateral FH were found in 18 right and 24 left sides and bilateral FH were seen in thirteen TP. In a total of 220 temporal bones the incidence of unilateral FH was 19% and multiple FH was 5.9%, while bilateral FH was found to be 13.97% out of 93 skulls.

In an osteologic study on 377 skulls conducted by Wang et al., found persistence of foramen of Huschke to be 7.2% [15]. It was different in diverse population [Table/Fig-4], in Chinese skulls, it was 6.7% and in skulls from Toronto was 9.1%. Toyama et al., noted unilateral FH in 6 and bilateral in 3 crania of patients [16]. Srimani et al., studied 53 crania of Indian Bengal population and observed FH in 7, all which belonged to left side of them [17]. Recently Yadav et al., Chauhan et al., and Zaidi et al., reported FH in North Indian populations as 30%, 23% and 10.7% respectively [18-20]. Rezaian et al., reported FH in Iron Age human skulls to be 4.4% [5]. However, its prevalence has been reported to range from 0.6% to 46% in different studies [11].

In the present study, the light illumination through the EAM showed the upper thin portion of the TP was found to have the FH [14].

Geographical region	Presence of FH in %
Chinese population [15]	6.7
Toronto-North American population [16]	9.1
Bengal population [17]	13.2
Uttar Pradesh North Indian population [18]	30
Delhi North Indian population [19]	23
Bareilly North Indian population [20]	10.7
Present study (South coastal Andhra Pradesh)	38.2

[Table/Fig-4]: Persistent of foramen of Huschke in different populations and the present study (South coastal Andhra Pradesh)

The maximum transverse diameter of FH in this study was found to be 9.1mm which may be due to the mandibular pressure in TM joint [18,21]. But, the maximum transverse diameter reported in literature ranged from 10mm to 20 mm [17].

CLINICAL SIGNIFICANCE

In most of the living subjects, persistence of FH is asymptomatic. Patent FH has been reported as being the cause of persistent ear discharge following mastication due to the connection with the TMJ [22,23]. The foramen is readily detected with high-resolution spiral CT or MRI can demonstrate the soft tissue herniation or parotid fistula into EAC. The FH is common in females and can cause transient Otorrhea from TMJ synovial fluid [24]. Rarely soft tissue lies posterior to TMJ can be herniated into the EAM during mouth closure and this can acts as a portal for the spread of infection or tumour between the EAM and TMJ [25,26]. This small bony gap is also prone to injury of the EAM during TMJ arthroscopy. Sometimes FH may misinterpret as bony fracture or destruction in the patients without history of trauma or no associated tumour [8].

LIMITATION

The present study has limitations as the sexes of the skulls were not determined. In-vivo study of the FH can be done by using spiral or cone beam CT and MRI scans because more data about FH was available using these procedures in live patients. To our knowledge only few studies on cadaveric bones were available in the literature and no studies were reported in south India especially in Andhra Pradesh. The present study may provide an important reference and may be used as a data for the description of anatomical deficient of FH with the radiological support.

CONCLUSION

Though it is a dry bone cadaveric study, anatomical knowledge of FH may of clinically and surgically important to ENT surgeons, dentists and radiologists. Specifications of this FH may be of immense help during endoscopic ear surgeries in which unintentional damage of TMJ can be prevented. Data obtained from the present study may also be added to the existing literature providing information of the south coastal population of Andhra Pradesh.

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