

## Research Article

# Foramen of Huschke in North Indians: an anatomical study

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### ABSTRACT

**Background:** The deficiency in the antero-inferior wall of the bony part of external auditory canal (EAC) closes by 5 years of age but if it persists beyond that age it is called foramen of Huschke. Depending on the population studied, persistence of this foramen has been seen in 0-67% of adult crania. Review of literature revealed that no data was available in North Indian population; therefore the present study is being undertaken.

**Methods:** Sixty North Indian adult human crania were examined and the presence of foramen of Huschke was noted. The side to which it belonged to, its shape and size were observed. Size of the foramen was measured using vernier caliper.

**Results:** Out of sixty North Indian adult human crania seen, foramen of Huschke was present in 14 crania. It was observed unilaterally in 10 crania and bilaterally in 4. Although different shapes of the foramen like pin point, pin head, circular, irregular and U shape were observed but in majority of cases it was U shaped. Its size varied from pin point- 10 mm transversely and pin point to 9 mm longitudinally.

**Conclusion:** This study revealed that about 23% of North Indian adult human crania have foramen of Huschke. Persistent foramen of Huschke in the adult life may be involved in different abnormalities of the EAC and may lead to otological complications. Therefore, ENT surgeons should be aware of persistent foramen of Huschke and keep it as one of the possible diagnoses while dealing with patients presenting with otological complications. Also the surgeons should be careful while performing endoscopy of Temporomandibular Joint (TMJ) so that accidental damage of TMJ can be prevented.

**Keywords:** Crania, Endoscopy, Foramen of Huschke, Otological complications, External auditory canal, Temporomandibular joint

### INTRODUCTION

If a deficiency in the anteroinferior wall of EAC, formed by tympanic part of the temporal bone, in human crania persists after 5 years of age then it is called Foramen of Huschke or foramen tympanicum. It was first described by a German anatomist and embryologist professor Emil Huschke (1797 - 1858).<sup>1,2</sup>

Foramen of Huschke can either be asymptomatic or it may cause a persistent ear discharge after mastication in

which case it might be connected to the TMJ or to the parotid gland.<sup>3-5</sup> It may also lead to inadvertent passage of the endoscope into the TMJ leading to its damage.<sup>6,7</sup>

Literature search did not reveal any data on the presence of this foramen in the adult North Indian population. Therefore, sixty North Indian adult human skulls were examined for the presence of foramen of Huschke. The shape, size and the side to which it belonged to were noted and analyzed.

**METHODS**

Dry adult human crania were collected from the Bone bank of Anatomy Department of UCMS and GTB Hospital. Only those crania were selected in which tympanic plates were intact. So a total of sixty dry adult North Indian human crania were finally available for the study. Any deficiency in the tympanic plate called foramen of Huschke was observed meticulously. The side, shape, size (longitudinal and transverse diameter) of foramen of Huschke was recorded and analyzed. Size was measured using vernier caliper, the least count of which was 0.02 mm.

**RESULTS**

Foramen of Huschke was observed in 14 dry human adult crania out of a total of sixty crania examined. It was present unilaterally in 10 crania (right=4, left=6) and was bilateral in four (Table 1) (Figure 1, 2, 3, 4, 5, 6 and 7).

**Table 1: Side determination of foramen of Huschke in the crania showing this foramen.**

Sr. No.	Right side	Left side
1	+	+
2	-	+
3	-	+
4	-	+
5	+	+
6	-	+
7	-	+
8	+	-
9	+	+
10	+	-
11	+	-
12	+	+
13	-	+
14	+	-



**Figure 2: Arrow pointing at pin head sized foramen on the medial part of anteroinferior wall of right EAC.**



**Figure 3: Arrows pointing at U shaped foramen bilaterally at the lateral margin of anteroinferior wall of EAC.**



**Figure 1: Arrow pointing at triangular foramen on the medial part of anteroinferior wall of right EAC.**



**Figure 4: Arrows pointing at irregularly shaped foramen bilaterally on the anteroinferior wall of EAC.**



**Figure 5: Arrow pointing at triangular shaped foramen on the anteroinferior wall of right EAC.**



**Figure 6: Arrows pointing at pin point foramen on the anteroinferior wall of EAC bilaterally.**



**Figure 7: Arrows pointing at circular foramen on the anteroinferior wall of EAC bilaterally.**

Pin point, pin head, circular, irregular, triangular and U shaped foramen of Huschke were observed (Figure. 1, 2, 3, 4, 5, 6, 7) but most commonly U shape foramina were seen (Table 2, Figure 3).

**Table 2: Different shapes of foramen of Huschke.**

Sr. No.	Right side	Left side
1	U	U
2	-	Δ
3	-	U
4	-	U
5	O	O
6	-	U
7	-	O
8	Pin head	-
9	Pin point	Pin point
10	Pin head	-
11	Pin head	-
12	Vertical, irregular	Transverse, irregular
13	-	Pin point
14	O	-

Maximum transverse diameter was 10 mm on the left and 8 mm on the right side. Whereas the maximum longitudinal diameter was 9 mm on the left and 8 mm on the right side (Table 3).

**Table 3: Size of foramen of Huschke in mm (L=left, R=Right).**

Sr. No.	Transverse diameter		Longitudinal diameter	
	L	R	L	R
1	8	8	5	6
2	2	-	2	-
3	6.4	-	7	-
4	10	-	7.2	-
5	6	3	6	3
6	7	-	9	-
7	2	-	2	-
8	5	6	7	8
9	-	3	3	-

**DISCUSSION**

The foramen of Huschke is a bony defect in the anteroinferior wall of external acoustic canal after 5 years of age. Anteroinferior wall of EAC is formed by tympanic bone, which develops from a membranous ossification process.<sup>8,9</sup> Therefore, foramen of Huschke is also known as foramen tympanicum. It connects the EAC to the temporomandibular joint

At birth, the tympanic bone is developed incompletely and forms a U shape. Two prominences, one anterior and one posterior to the U-shaped bone develop and grow

toward each other and fuse from lateral to medial side by 5 year of age. Therefore, if the point of fusion does not properly extend medially then the foramen persisting medial to the point of fusion is called foramen of Huschke. In most children, this foramen becomes smaller gradually and closes completely by 5 years of age. It may persist occasionally.<sup>8</sup> Hence, deficiency in the anteroinferior wall of EAC formed by tympanic part of the temporal bone should be considered as anatomic variant only after 5 years of age.<sup>10</sup> All the crania examined in our study were of the adult age group.

Wang et al. (1991), conducted an osteologic study on 377 skulls and found persistence of foramen of Huschke to be 7.2%. They found a difference in rate of persistence of this foramen in different population. In the skulls of Chinese origin it was 6.7%. Persistence of the foramen was seen in 9.1% of the skulls from Toronto.<sup>11</sup> Persistence of foramen of Huschke was found to be 23% in the present study (Table 1). Higher rate of persistence of foramen of Huschke in crania of Indian origin in comparison to the study of Wang et al could be an ethnic variation.

Toyama et al. (2009) noted unilateral presentation of foramen of Huschke in most of the patients as was observed in the current study in which this foramen was unilateral in 10 crania (right = 4, Left = 6) and bilateral in 4 crania only.<sup>12</sup> Srimani et al. (2013) studied 53 crania and observed foramen of Huschke in 7 of them. Foramen of Huschke was on the left side in all the seven crania though was unilateral in three only.<sup>13</sup> Our study was in contrast to Srimani et al. as this foramen was seen unilaterally in four crania on the right side also (Figure 1).

Tozoglu et al. (2012) looked for the presence of foramen of Huschke in 414 ears by conducting cone beam CT study and found that the mean axial diameter of the foramen if present was 5 mm and mean sagittal diameter was 2 mm.<sup>14</sup> Lacout et al. (2005) performed 102 consecutive HRCT studies of the temporal bone (204 ears) and found the mean axial diameter to be 4.2 mm, and mean sagittal diameter as 3.6 mm.<sup>15</sup> In a study on 53 crania of Bengal origin, Srimani et al. (2013) found that the transverse diameter ranged from pin head-20 mm and the longitudinal diameter ranged from pin head - 30 mm in the seven crania which showed the presence of foramen of Huschke.<sup>13</sup> In the present study, transverse diameter on the left side was from pin point - 10 mm and on the right side it ranged from pin point - 8 mm. The longitudinal diameter on the left side ranged from pin point - 9 mm and on right side it was from pin point to 8 mm in size (Table 3).

Kanodia G et al. (2012) conducted a prospective study on 100 consecutive normal CT scans of posterior fossa and 100 dry adult skulls with no bony abnormality. Apart from calculating posterior fossa volume they also studied various dimensions of posterior fossa and foramen

magnum. They found that the mean AP diameter of foramen magnum was slightly larger in dry skull as compared to CT Scans. They were of the opinion that higher range of AP diameter in dry skulls could be due to demineralization of dry skulls and concluded that dry skull dimensions could be different from CT scan measurement due to shrinkage or demineralization.<sup>16</sup>

Tozoglu et al. (2012)<sup>14</sup> and Lacout et al. (2005)<sup>15</sup> conducted a CT study of the dimensions of the foramen of Huschke. In CT scan the dimensions of the foramen get minified as compared to its gross measurements as suggested by Kanodia G et al. (2012),<sup>16</sup> therefore the size of the foramen of Huschke was about 3-4 mm less in their study as compared to the data obtained in the present study. Although Srimani (2013)<sup>13</sup> conducted an anatomical study on the crania but the dimensions of foramen of Huschke differed from the readings obtained in this study. Regional variation could be a possible explanation of this difference (Table 3).

The shapes of foramen of Huschke observed in this study were pin point, pin head, circular, triangular, irregular and U shaped (Figure 1, 2, 3, 4, 5, 6).

Srimani et al. (2013) noted only pin head, circular, oval and triangular foramen in their study.<sup>13</sup> Ethnic variation may be the reason because of which either pin point, irregular or U shaped foramen were not seen by them.

Knowledge of this anatomical defect may be useful in evaluating patients with short lived otorrhoea where no local cause is identified. Persistent ear discharge after mastication may be due to the connection of this foramen with the TMJ or with the parotid gland. Awareness of presence of foramen of Huschke may prevent inadvertent passage of the endoscope into the TMJ and ultimately resulting in its damage. If this foramen is present, infection may spread from EAC to infra-temporal fossa and vice versa. Data obtained from our study may not only benefit anatomists but also ENT surgeons, dentists and radiologists.

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