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MORPHOMETRIC STUDY OF JUGULAR FORAMEN IN 50 HUMAN ADULT SKULLS WITH ITS CLINICAL IMPLICATIONS.

Anatomy

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KEYWORDS

Introduction

The jugular is an elongated and irregularly shaped foramen lies between the occipital bone posteromedialy and the petrous part of the temporal bone anterolaterly. (Pereira GA, Lopes PT, Santos AM, 2010). It is the main route for the venous outflow from the skull. Bony septum called the intrajugular process divide it into anteromedial nervous and posterolateral vascular compartments. (Hatiboglu M.T and Anil A, 1992; Prades J.M et al., 1994; Williams P et al., 1995)

The glossopharyngeal, inferior petrosal sinus pass through nervous and vagus and cranial part of spinal accessory nerve and internal jugular vein pass through vascular compartments. Within jugular foramen glossopharyngeal nerve gives tympanic branch called nerve of Jacobsn. (Vijisha P et al., 2013)

Variations in shape and size of jugular foramen are common. Anomalies of the jugular bulb such as glomic tumors occurs in it. Metastatic lesions, infiltrating inflammatory processes from surrounding structures such as the middle ear and schwannomas, intracranial meningiomas, paragangliomas are also affecting the jugular foramen. (Pereira G.A et al., 2010)

The structures in jugular foramen also may get affected by intracranial and extra cranial lesions of posterior cranial fossa. Now a days microsurgical procedures, such as the lateral suboccipital access need detailed study and the knowledge about this foramen (Guido H and Zorzetto N, 1997; Idowu O.E, 2004)

As neurosurgeons become valiant in approaching this area, the need to become familiar with the detailed anatomy of this area becomes greater.

Hence, this study was carried out to analyze the shape, size, and presence of septa, spicules, presence of a domed bony roof of jugular fossa of the jugular foramen in dry adult skulls.

Material and Methods

The study was conducted on 100 jugular foramina from 50 dry human skulls. The skulls were obtained from department of anatomy, GMC Aurangabad, Maharashtra. All skulls were adult type and without any signs of erosion. Length, width of jugular foramen was measured using vernier calliper. Presence of some, complete and incomplete separation was also observed. Mean standard deviation and range of each dimension were computed. Differences in right and left side were analyzed.

DOME: The bony roof is related to the presence of superior jugular bulb.
LENGTH: Maximum latero-medial diameter of the foramen
WIDTH: The anteroposterior diameter of the foramen.
SPICULES: bony projections
SEPTATIONS: Bony bridges dividing the foramen into compartments.

Above parameters were measured using vernier caliper.

Result

The Morphometric analysis of the present study revealed the following observations:

SIZE:

The mean length of the foramen on the right and left were 32.48+3.16mm and 29.34+4.51 mm respectively; on right side maximum length was 33.26mm and minimum 30.24mm. On left side maximum and minimum length was 30.85mm and 26.54mm respectively.

The mean width measured 25.51+1.46 mm on the right (maximum =26.8mm, minimum=23.5mm) and 25.16+1.87mm on the left side (maximum =25.6mm, minimum=22.5mm).

The size of the jugular foramen is variable on both sides.
In the present study of 50 skulls right jugular foramen greater than left were in 43.8%, right jugular foramen lesser than left were in 16.2% and right jugular foramen equal to left were in 40%.

DOME:

The dome of jugular fossa was present in 20 % cases on the right side, 4 % cases on the left side, 40% cases bilaterally and absent bilaterally in 36% of cases.

COMPLETE SEPTATION OR INCOMPLETE SEPTATION

Present study observed that complete septation of jugular foramen was present on right side in 8% and left side in 2%. Partial or incomplete septation on right side in 10% and on left side in 4%.

BONY SPICULES

Small bony spurs projecting into the jugular foramen were seen in 20% on right side and 16% on the left side.

Discussion

According to the size of the internal jugular vein and the presence or absence of a prominent superior bulb, the size and shape of the jugular foramen varies.

The right foramen is usually larger than the left. Size and shape of jugular foramen is also related to the deviation in the anatomy of the intra cranial venous sinuses.

The difference in size of the two internal jugular veins is already visible in the human embryo at the 23 mm stage and probably results from differences in the pattern of development of the right and left brachiocephalic veins (Padget D.H, 1957).

SIZE

Khanday et al. (2013) found that the mean right and left A-P diameter, latero-medial diameter of jugular foramen as 10.06, 14.6, 118 mm and 8.9 mm. Pereira et al. (2010) mentioned the mean right and left A-P diameter, latero-medial diameter of jugular foramen as 9.21, 15.82 mm and 8.65, 15.86 mm.

When compared to previous studies we found larger A-P diameter, latero-medial diameter as well as the variable size of the jugular foramen on both sides in our study.

Sturrock R.R (1988) observed larger right foramen in the 68.6%, the left larger in 23.1% and equal on both side in 8.3% of 156 skulls.

Patel and Singel (2007) studied 91 Indian skulls (Saurashtra region) and noted larger right foramen in 60.4% cases, larger left foramen in 15.4 % and equal on both sides in 24.2%.

In Hatiboglu and Anil's (1992) investigation of 300 Anatolian skulls from the 17 th and 18 th centuries, in 61.6% the foramen was larger on

the right side and in 26% it was larger on the left side and in the remaining cases it is of equal size.

Present study shows greater right jugular foramen as compared to left which correlates with the studies of Sturrocks (1988), Patel and Singel (2007), Hatiboglu and Anil (1992), while in the present study frequency of occurrence of equal foramens on both side is more.

DOME

In Sturrock's (1988) study of 156 skulls the dome was present in 30.1% cases on the right side, 6.4% cases on the left side, 53.9% cases bilaterally and absent bilaterally in 9.6% of cases.

Hatiboglu and Anil (1992) observed dome bilaterally in 49%, on the right only in 36%, on the left only in 4.7% and ab-sent bilaterally in 10.3% of skulls.

In the study of 91 Indian skulls Patel and Singel (2007) mentioned dome in 38.5% cases on the right side, 14.3% cases on the left side, 21% cases bilaterally and absent in 25.3% of skulls.

Khanday et al. (2013) noted dome in 20% cases bilaterally, on the right only in 40% cases, on the left only in 29% cases and absent on both sides in 11%.

In present study dome on right side is more common than that on left side which is similar to the findings of Sturrock's (1988), Hatiboglu and Anil (1992), Patel and Singel (2007), Khanday et al. (2013).

Bilateral presence of dome in our study correlates with the study of Hatiboglu and Anil (1992).

In present study bilateral absence is more common than above previous studies.

SEPTATIONS OR COMPARTMENTS:

Sturrock RR's (1988) study observed that complete septation of jugular foramen was present on right side in 3.2% and left side in 3.2%. Partial or incomplete septation on right side in 1.3% and on left side in 10.9%.

Patel and Singhel's (2007) mentioned in the study of 91 indian skull that complete septation of jugular foramen was present on right side in 23% and left side in 17.6%. Partial or incomplete septation on right side in 49.5% and on left side in 59.3%.

Hatiboglu and Anil (1992) noted that complete septation of jugular foramen was present on right side in 5.6% and left side in 4.3%.Partial or incomplete septation on right side in 2.6% and on left side in 19.6%.
Hussain Saheb (2010) observed that complete septation of jugular foramen was present on right side in 20.3% and left side in 16.8%. Partial or incomplete septation on right side in 45.6% and on left side in 58.4%.

Present study observed that complete as well as partial or incomplete septation of jugular foramen was more on right side than that of left side. When compared with previous studies the present study showed variations in septation in jugular foramina.

SPICULES OR BONY BRIDGES:

Rhoton and Buza (2010) noted 26% bony bridges, bilateral presentation was in 8%.

Khanday et al. (2013) reported a small bony spurs projecting into the jugular foramen in 53% on right side and 22% on the left side.

Ekinci et al. (1997) observed bony bridges in 20%.
Bony spicules projecting into the jugular foramen were also more seen on right side than the left side and this finding is similar to that of Khandayet al. (2013).

Conclusion

Variation in size, shapes, compartments of jugular foramen were observed in present study. The structures in jugular foramen get affected due to most intracranial and extra cranial lesions of posterior cranial fossa and also due to intrinsic abnormalities. Jugular foramen is larger on right side than left side. Other variations like dome of jugular fossa, bony spicules, incomplete and complete separation of jugular foramen were also observed. Knowledge of this morphometric variation of jugular foramen helps clinician to understand progression of lesion, its clinical presentations and helps the neurosurgeons while doing surgery in this region.

FIGURE 1: Showing complete separation (C) of jugular foramen on left side and dome (D) of jugular fossa on right side.

FIGURE 2: Showing incomplete separation (IS) of jugular foramen on left side and dome (D) of jugular fossa on right side.

FIGURE 3: Showing dome (D) of jugular fossa on both the side.

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