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ASSESSMENT OF THE JUGULAR FORAMEN IN THE POSTERIOR CRANIAL FOSSA OF NIGERIAN ADULT SKULLS

***Bob-Manuel, Ibinabo Fubara, **Ogoun, Timipa Richard, *Martins, Blessing**

*Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt, P.M.B 5323, Port Harcourt, Rivers State

**Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, Bayelsa Medical University, Yenegoa, Bayelsa State.

Corresponding Author: Bob-Manuel, Ibinabo Fubara

Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt, P.M.B 5323, Port Harcourt, Rivers State

Email: ibinabo.bob-manuel@uniport.edu.ng

Phone number: +234 803 6724 965

ABSTRACT

Purpose: This study was undertaken to evaluate the length and width of the Jugular foramen using digital venier caliper of 0.01mm precision and to evaluate the occurrence and septation on the jugular foramen in the posterior cranial fossa.

Methodology: 95 Nigerian dry skulls were examined. Data was statistical analysed using student's t-test for paired parameters and the relationships between studied parameters were determined using Pearson's correlation coefficients.

Result: The minimum, maximum and mean values of the length of right jugular foramen are 9.11mm, 22.42mm and 16.20mm respectively while the minimum, maximum and mean values of the length of the left jugular foramen are 10.09mm, 19.36mm, and 14.88mm respectively. The minimum, maximum and mean values of the width of right jugular foramen are 5.27mm, 15.17mm, and 9.40mm while the corresponding values of the width of the left jugular foramen are 1.3mm, 12. 32mm, and 7.78mm respectively. On the right side, jugular septum was present in 34.73% of skulls (complete septum -13.68%, partial septum-21.05%) and absent in 65.62%; 42.11% (complete septum - 23.16%, partial septum - 18.95%) and absent in 57.89% on the left side. Similarly, on the right side of the skull, jugular dome was present in 52.89% and absent in 47.37%; on the left side, it was present in 38.95% and absent in 61.05%.

Unique contribution to theory, practice and policy: The knowledge of the morphometry of this foramen is important for forensic scientists, anthropologists and neurosurgeons. It could be concluded that the data provided in this study is important for advancement of Anatomical Science in Nigeria.

Key words: *jugular foramen, posterior cranial fossa, adult skulls*

INTRODUCTION

A foramen is an opening or hole, particularly in a bone. Foramina inside the body of humans typically allow muscles, nerves, arteries, veins or other structures to connect one part of the body with another. The skull has many foramina through which cranial nerves, arteries, veins and other structures pass through. Skull bones containing foramina include the frontal, splendid, ethnic, palatine, maxilla, temporal, and occipital bones. [1]

Cranial foramina are the portal to an otherwise closed cranium. Evaluation of these foramina is important in diagnostic medicine and will aid clinicians in surgical approaches to these region.[2] The cranial fossae presents a number of foramina, these foramina differ in their mophometric features and in terms of structures they transmit. The foramen studied here is the Jugular foramen.

The Jugular foramen lies between the occipital bone and the petrous part of the temporal bone, and it is elongated and irregularly shaped.[3] It is the chief route for the venous outflow from the skull. The glossopharyngeal, vagus, and cranial part of spinal accessory nerve pass through this and exit the cranial cavity. The neural and vascular compartments are generally separated by a bone projection called the intrajugular process.[4,5] The foramen can have many variations in its shape and size. [6] The so-called anomalies of the jugular bulb such as glomic tumors are related with the jugular foramen, as they come in direct contact with structures that cross it, like the internal jugular vein, the internal carotid artery, and the cranial nerves.[6] Moreover, schwannomas, metastatic lesions and infiltrating inflammatory processes can also occur in the jugular foramen[3].

Microsurgical procedures, such as the lateral suboccipital access, have allowed for the removal of these lesions, which were formerly thought to be very difficult to undergo an operation.[7,8] The aim of this present study is to conduct the assessment of the jugular foramen which is located in the posterior cranial fossa of Nigerian adult skulls.

MATERIALS AND METHODS

The quantitative biophysical research design was used in this study. 95 dry adult skulls of Nigerian population were used. 4 parameters of the jugular foramen were measured in each of the skull (Length and width of jugular foramen each from the right and left side of the foramen). The presence and absence of jugular bulb dome and septation on jugular foramen were examined. Data collected consists of metric and non metric data.

For the metric data, digital vernier caliper was used. The anteroposterior diameter of the jugular foramen called the sagittal diameter (length) was measured as the maximum transverse diameter in millimeters.

The mediolateral (width) diameter of the jugular foramen was measured from the medial border to the lateral border as the maximum transverse diameter in millimeters.

SPSS version 20.0 was used to analyse the data for this research.

Non-metric data was the septation of the jugular foramen which is a ridge that divides some jugular foramen completely or partially when present. Its presence or absence was observed. Septation was observed as complete or partially present.

The jugular bulb dome is associated with the jugular foramen was observed by physical examination as present or absent on both sides or on a single side of the skull.

RESULTS

The result of the study are shown in table 1 which contains the values of the maximum, the minimum, the mean, the standard deviation values of the length and width of the right and left sides of jugular foramen.

From table 1, the range of the length of Jugular foramen is 9.11mm - 22.42mm with a mean±SD of 16.20±2.28mm on the right side and 10.09mm - 19.36mm with a mean±SD of 14.88±2.01 on the left side while the minimum and maximum width of Jugular foramen is 5.27mm and 15.17mm with a mean±SD of 9.40±2.00mm on the right side and 1.3mm and 12.32mm with a mean±SD of 7.78±2.08mm on the left side.

The difference in length between the right and left side was statistically significant ($p=0<0.05$). Comparison between the right and left width of the foramen shows difference ($p<0.05$). There was statistical significant relationship between the right and left length of the foramen. However, there was significant relationship between the right and left width ($p>0.05$). The presence of jugular dome indicates the presence of jugular bulb. Jugular dome was present in 50 (52.63%) skull samples on the right side and in 37 (38.95%) samples on the left side. The dome was absent in 45 (47.37%) skull samples 58 (61.05%) skull samples on the right and left side respectively (Table 2). A complete septum was present in some of the skulls studied (right side – 13.68% and left side-23.16%).

The presence of partial septum was found in 20 (21.05%) skull samples on the right side and in 18(18.95%) skull samples on the left side. The result further showed 65.62% and 57.89% absence of bony ridge (that occasionally divide the jugular foramen) on the right and left sides respectively.

Table 1. Comparison of the minimum, maximum, and the mean +-SD of the measured dimensions of jugular foramen of right and left side of the posterior cranial fossa.

	Min	Max	Mean±SD	t- value p- value	r- value p- value
Right length	9.11	22.42	16.20±2.28	6.183 0	0.541 0
Left length	10.09	19.36	14.88±2.01		
Right width	5.27	15.17	9.40±2.00	5.537 0	0.026 0.8
Left width	1.3	12.32	7.78±2.08		

Table 2. Frequency distribution of jugular dome and septation in the jugular foramen.

JUGULAR FORAMEN		RIGHT		LEFT	
		Frequency	Percentage	Frequency	Percentage
Dome	Absent	45	47.37	58	61.05
	Present	50	52.63	37	38.95
	Total	95	100	95	100
	Absent	62	65.62	55	57.89
Septation	Partial	20	21.05	18	18.95
	Complete	13	13.68	22	23.16
	Total	95	100	95	100

DISCUSSION

The size of the right side of the jugular foramen is greater than the opposite side. Since the superior sagittal sinus drains into the right transverse sinus, the greater size of the right side of the jugular foramen over the left side is expected.

Previous works have noted that the right jugular foramen is larger than the left. In the present study, the mean mediolateral diameter(length) of jugular foramen on the right and left sides were 16.30+2.28mm and 14.89+2.02mm respectively. The minimum diameter (9.11mm) is approximately equal to 9.00mm which was the corresponding value reported by Namita and Rajendra [9] and 12.00mm reported by Avanish et al. [10] However, it was greater than 4.5mm reported by Rama and Mehta[11] and 7mm reported by Ekinci and Unur[12] on the right side.

The present study reported predominant distribution of computer septum on the left side. And this is the only study that reported equal distribution of septum on both right and left sides. It also observed that the jugular dome was prevalently present on the right and absent on the left side, this shows bilateral predominance.

CONCLUSION

People of different population or ethnicity can have similar anatomical features which could suggest an anthropologic linkage among them. The dimension of the jugular foramen is similar but not exactly the same with those of non Nigerians. According to the findings of this present study, complete and partial septation and jugular dome of jugular foramen occasionally exists and are widely distributed among Nigerian skulls.

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