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Research Article

Study of Dominance in the Foramen of Human Crania in Maharashtra Region

M. M. Peerzade[1*], S. P. Fulari[2], G. S. Chakre[3], N.B. Masaram[4], W. F. Hiroli[5]
[1*,2,3,4,5]Associate Professor, Department of Anatomy, Dr. V. M. GMC. Solapur, India.
Email: msharebkausar94@gmail.com
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ABSTRACT
Background: 104 non - pathological dried adult cranial bases studied for dominance of various foramina by using hand lens. Jugular foramina (70.19%), Superior Orbital Fissure (30.2%), Foramina ovale (32.3%), Carotid Canal (21.5%), optic canal (4%) were dominant on right side, statistically highly significant (P<0.01) with Chi. Square (x2) goodness of fit test. While Inferior orbital fissure (19.38%), foramen Rotundum (25%), foramina spinosum (24.7%), stylomastoid foramina (14.4%), internal acoustic meatus (20.3%) were dominant on left side & statistically highly significant (P<0.01) with Chi. Square (x2) goodness of fit test. This study will certainly help the radiologists because CT scan, MRI does not show exact footage of the foramina, moreover the dominance of these foramina will also help the Neurosurgeons during the surgery of basal crania. Moreover Medico- legal expert, Anthropologist, Anatomist to specify the Maharashtra state crania from other state crania.

Keyword: Hand Lens, Dominance, Foramina, Maharashtra.

INTRODUCTION

Basal view of the crania is not clearly defined as another aspect because the base of surface being looking towards the neck.(1)

As it is cartilaginous surrounding the neurovascular bundles at different intervals of ossification depending on functional and Morphological factors. Hence the foramina of the norma basalis resume different shape and size unilaterally or bilaterally. Moreover there is no anthropological instrument or parameter to measure these foramina. Hence attempt is made to study the dominance of foramina of the basal crania. An experienced radiologist may find these dominance of foramina as small tumour around foramina through which blood vessels and nerves are passing. Hence it appears to be quite new study.

MATERIAL AND METHOD

104 crania are studied form Anatomy Department of Dr. V.M. Gmc. Solapur, Gmc Miraj, Gmc Dharashiv & Gmc Latur. Since the number of female crania was very small. The observation for the both sexes were pooled together. The occupation of the person from whom the skull came was not known. A hand lens is used for judging the foramen, wherever necessary. Photos are taken by digital camera to show left sided dominance statistically Chi Square (x^2) goodness of fit test.

OBSERVATIONS AND RESULTS

Table 1: Analysis of Right Dominant Foramina in 104 Human Skull (N=104)

Sr. no.	Name of foramen	Total no. of foramina in pair	Right dominant	Left dominant	Equal in size
1.	Jugular Foramen (%)	104	73(70.19%)	18(17.30%)	13 (12.5 %)
2.	Superior orbital fissure (%)	96	29(30.20%)	11(11.45%)	56 (58.33 %)
3.	Foramen ovale	103	33 (32.03%)	24(23.30%)	46 (44.66 %)
4.	Carotid canal	102	22(21.56%)	17(16.66%)	63 (61.76 %)
5.	Optic canal	100	04 (4 %)	00 (0 %)	96 (96 %)

Table 2: Chi.Square (X^2) Goodness of Fit Test in Right Dominant Foramina of Human Skull (N=104)

Sr.no	Name of Foramina	(x2)Goodness of fit test	df	P value
1	Jugular foramina	x^2= 63.94	df =2	P<0.01 (significant)
2	Superior orbital fissure	x^2=32.06	df =2	P<0.01 (significant)
3	Foramen ovale	x^2=7.13	df =2	P<0.01 (significant)
4	Lower opening of orbital canal	x^2=37.47	df =2	P<0.01 (significant)
5	Optic canal	x^2=176.46	df =2	P<0.01 (significant)

Table 3: Analysis of Left Dominant Foramina in 104 Human Skull (N=104)

Sr. no	Name of Foramina	Total no. of foramen in pairs	Right dominant	Left dominant	Equal size
1	Inferior orbital fissure Percentage (%)	98	06 (6.12%)	19 (19.38%)	73 (74.48%)
2	Foramen rotundum Percentage (%)	104	08 (7.69%)	26 (25%)	70 (67.30%)
3	Foramen spinosum Percentage (%)	101	17(16.83%)	25 (24.75%)	59 (58.45%)
4	Stylomastoid foramen Percentage (%)	104	03 (2.88%)	15 (14.42%)	86 (82.69%)
5	Internal acoustic foramen Percentage	103	18(17.47%)	21 (20.38%)	64 (62.13%)

Table 4: Chi Square (X2) Goodness of Fit Test in Left Dominant Foramina of Human Skull (N=104)

Sr. no	Name of Foramina	(x2) Goodness of fit test	df	P value
1	Inferior orbital fissure	x^2=77.29	df =2	P<0.01 (significant)
2	Foramen rotundum	x^2=58.69	df =2	P<0.01 (significant)
3	Foramen spinosum	x^2=29.54	df =2	P<0.01 (significant)
4	Stylomastoid foramen	x^2=116.1	df =2	P<0.01 (significant)
5	Internal acoustic Meatus	x^2=38.58	df =2	P<0.01 (significant)

Chi square x^2 goodness of fit test significant when $x^2 > 3.5$, $p<0.01$

Table 5: Comparison of the Finding of Jugular Foramina.

Sr. no	Studies	Presence of dominant jugular foramen			
		Rt.side	Lt.side	Bila side	Absent
1	Patel M.M (2007)	35 (38.57%)	13(14.3%)	19 (21%)	23

					(25.3%)
2	Sturrock R.R (1988)	47 (30.1%)	10 (6.4%)	84 (53.9%)	15 (9.6%)
3	Hussani	00	00	55(100%)	00
4	Vijisha. et all (Tamil Nadu Region)	76.6%	10%	-	-
5	Rhoton et all	6.8%	1%	12%	
6	Saurashtra region	60.4%	15.4%	24.2%	

Table 1: Percentage (%) of Analysis of Right Dominant Foramina

1	**Jugular foramina**	**70.19%**
2	Superior orbital fissure	30.20%
3	Foramina ovale	32.03%
4	Carotid canal	21.56%
5	Optic canal	4%

Table No- 2

The chi- square (x^2) goodness of fit test for right dominant show highly significant ($P<0.01$) with df =2 in following foramina

1) Jugular foramina
2) Superior orbital fissure
3) Foramina ovale
4) Carotid canal
5) Optic canal

Table No- 3

Percentage (%) of Analysis of left dominant foramina

1) Inferior orbital fissure = 19.3%
2) Foramina Rotundum = 25%
3) Foramina spinosum = 24.7%
4) Stylomastoid foramina = 14.42%
5) Internal acoustic foramina= 20.3%

Table No- 4

The chi- square (x^2) goodness of fit test shows statistically high significance ($P<0.01$) with df=2 in study of following foramina

1) Superior orbital fissure
2) Foramina rotundum
3) Foramina spinosum
4) Stylomastoid foramina
5) Internal acoustic foramina

DISCUSSION

In the present study, study of dominance in the foramina of human crania to the right side following foramina are found statistically highly significant ($P<0.001$)

(Table 1& 2)

1) Jugular foramina = 70.19%
2) Superior orbital fissure = 30.20%
3) Foramina ovale =32%
4) Carotid canal= 21.5%
5) Optic canal= 4%

To the left side following foramina are found statistically highly significant are ($p<0.01$) table 283

1) Inferior orbital fissure = 19.3%
2) Foramina Rotundum = 25%
3) Foramina spinosum = 24.7%
4) Stylomastoid foramina = 14.2%
5) Internal acoustic meatus = 20.3%

The exact cause of these dominance of foramina is not mentioned in the English literature. The following hypothesis can play vital role in the dominance of foramina

a) Variations are might be due to the geographical variation of the skeletons (2) Or it could be inherited (3). Right sided dominance of foramina could be heavier upper and lower extremities on right side (4).
b) Right side dominance in foramina could be due to ethnic and racial factors (5) and variations in the venous blood in the venous sinuses as there is asymmetry among the venous emissary foramina in the skull(6)
c) Left side dominance is due to compression of aortic arch by sternum perhaps it is disadvantageous for hemodynamic of blood flow. To overcome this compressed blood flow leads to dominance in the foramina of left side (7)
d) Rate of bone growth and maturation is influenced not only by age and sex but by economic status individuals total body weight and possibly by function Racial difference also require to be taken in to account (8)
e) Deficiency of vit A in the diet leads to abnormalities of skeletal growth so that bones become thickened and coarse in appearance. New subperiosteal bone is also deposited at the margins of the foramina for the passage of some of the cranial nerves (9).
f) The bilateral dominance of foramina in the

basal crania could be due to evolution and changes in modern manThe orbits have rotated Indicating stereoscopic vision

a. Shortening of neck of mandible & forward displacement of foramina magnum
b. Increased brain size.

Hence to maintain the equilibrium the foramina have adapted to facilitate normal blood flow to over came hemodynamic pressure, rotation of neck against gravitation pull by co-ordination with vertebral column.

b) In modern man dominance of unilateral or bilateral foramina are due to width of bizygomatic arch and distance between the extremities of tympanic plate equally far apart. Hence width of foramen magnum is rotated to bitympanic line
c) Ossification centre may express their morphological individuality with astonishing persistence even though the bones which they represent have long ago ceased to be any real functional importance. Many of the bones in the human skull by multiplicity of their center of ossification, reveal their phylogenetic derivation from the fusion of bony elements which are separate in the lowered vertebrates[10]
d) The skull includes flexure of basicranial axis. It is less acute in modern man. The acuteness of the angles is must to maintain head balance and locomotor posture[11]. On the other hand this acuteness of angle often compress the neurovascular bundles passing through the foramina of the crania. To get relief from this compression the foramina have adapted wider or dominance on either side preferably right side because which is more in action than left side to maintain the hemodynamic pressure

SUMMARY AND CONCLUSION

This comparative study of dominance of foramina on either side of basal crania in Maharashtra is physiological phenomenon because evolution is so far affects the various parts of the body has been asymmetrical. The skull in its various parts exhibits evidences of asymmetric evolution which resulted in dominance of foramina this study will also help the neurosurgeon and radiologist. This will help the medico legal expert, anthropologist, anatomist to specify the Maharashtra crania from other parts of (country) India.

This study demands further genetic, embryological, anthropological study, because exact period and mechanism of ossification of bones is still obscure.

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