ORIGINAL RESEARCH PAPER

Volume-8 | Issue-7 | July - 2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MORPHOMETRIC & MORPHOLOGICAL ANALYSIS OF CAROTID CANAL EXTERNAL APERTURE IN HUMAN ADULT NEUROCRANIUM

Anatomy

Kanna Naga Vidya Lakshmi PhD Scholar, Department of Anatomy, RKDF Medical College, Hospital & Research centre, Bhopal.

Dr. Vivekanand Murlidhar Gajbhiye* Professor and Head, Department of Anatomy, RKDF Medical College, Hospital & Research centre, Bhopal. *Corresponding Author

ABSTRACT

AIM: To explicate bilateral morphological inequality & morphometric measurements of the Carotid canal (Ext. Aperture) in human adult skulls

MATERIAL AND METHODS: Study was carried out in 200 cranium (unknown sex) of Indian population. Disparities in Shapes of Carotid canal (Ext. Aperture) were noted & Digital vernier callipers is used to appreciate Anteroposterior&mediolateral diameters of both sides from which Areas were procured& evaluated statistically.

OBSERVATION & RESULTS:.Round shape of Carotid canal (Ext.Aperture) was observed in 54% , oval shape in 28% & almond in 18% of the crania. Dimensions for the right side (APD, TD& Mean) were 6.8+ 1.27mm,5.94+ 0.91mm ,31.89+ 8.37mm and the left side were 6.77+ 1.39mm,6+ 0.91mm ,32.16+ 8.33mm respectively.

CONCLUSION: Awareness of carotid canalmeasurements could assist neurosurgeons in surgical operations, the clinicians in radiographic scrutiny, & also for the clinical anatomists and the forensic experts in their routine practice.

KEYWORDS

Cranium, Carotid canal External Aperture, Morphology & Morphometry

INTRODUCTION:

Carotid canal is the passage way in the temporal bone and transmits the Internal carotid artery along with the carotid plexus of nerves into the cranium.

The carotid canal is considered as an important landmark by the neurosurgeons as the canal is most vital and easily visualized structure on magnetic resonance imaging angiography and digital subtraction angiography [1].

Basilar cranial fractures have been associated with injury to the carotid artery and vascular complications are more frequently observed when there is involvement of the carotid canal.

Fracture through the petrous segment of the carotid canal is related with quite a high occurence of carotid injury. Fracture through the carotid canal may serve as an indicator for injury severity,as patients with such fractures suffered more severe head injuries[2].

MATERIAL AND METHODS:

The present study is carried on 200 crania (non pathological) of unknown sex that has been obtained from various Anatomy & forensic departments of India. Morphology of the carotid canal ext. aperture has been noted. Bilateral morphometric analysis of Anterioposterior, mediolateral diameter was done by utilizing Digital vernier calliperswith a precision value of 0.1mm(Fig: 1& 2).Area is calculated by using the formula A= pi×APD×TD/4.Thorough check of data is done before analysis. Statistical significance in evaluated by utilising SPSS software version11.5. Comparisonof right and left sides is done by computing the means of dimensionsusing Student's t-test and p value with <0.05 are accounted as significant.

OBSERVATION AND RESULTS:

As depicted in Table-1& Chart-1 it was observed that Round shape (FIG-3) of Carotid canal (Ext.Aperture) was seen in 54% , oval shape(FIG-4) in 28% & almond shape(FIG-5) in 18% of the crania.

Mean Dimensions for the right side (APD, TD) were 6.8+ 1.27mm,5.94+ 0.91mm and the left side were 6.77+ 1.39mm,6+ 0.91mm respectively and the Mean areas of right and left sides include 31.89+ 8.37mm and 32.16+ 8.33mm.

T values were attained utilising students T-testfrom which right and left differences are compared. From the obtained values p values were analysed. Statistical data is shown in Table-2 and Table-3.Comparison of the Dimensions and the Areas of right and left sides were not significant as p values calculated was >0.05.

DISCUSSION:

Asymmetry in relation to the skull base or the respective foramina's and canals is considered as variant normal[3] which further represents congenital, hereditary or acquired diseases [4]. To identify the petrous course of internal carotid artery during skull base surgery it is essential to know the shape,position and dimensions of Carotid canal[5].

Hence the parameters acquired in present study are compared with the previous data. It was noticed in the present study that shape of the carotid canal external aperture is rounded in 54%,oval in 28%, almond in 18% of the crania that can be compared with the observations made by Aoun et al[3]and Somesh et al[6].

The mean antero posterior diameter in the current study noticed on the right side was6.8+1.27 and on left side was6.78+1.39 , which was smaller than the values recorded by somesh et al[6], shaikh et al[7], Abo et al[8], and tewari eta al[9] and larger than those reported by Ahmed et al[10]

Similary the mean transerverse diameter reported in the present study on the right and left side was 5.9+0.91and 6+0.91 respectively which were larger than the values noted by shaikh et al[7], Abo et al[8] ,tewari eta al[9], Ahmed et al[10], Berlis et al [11], Aarta et al[12],yamamoto et al[13],but shorter than the value noticed by somesh et al[6]. The comparison between the parameters of present study and other authors were shown in Table 4 &5.

The measurements of external aperture of carotid canal was carried out in the current study where as in previous studies conducted by Lang et al[14] who has reported that the mean anteroposterior diameter of the CC was 5.08+0.20mm and 5.20+0.34mm on the right and left sides of cranium, respectively, has taken the measurements of the anteroposterior diameter and of the transverse diameter of the internal opening of the CC.

Similarly Calguner et al[15] in another study have also noticed measurements of CCs(internal opening) from 307 dry skulls, which included 177 adult male and 130 adult female skulls, and the values of the mean anteroposteriorrespectively.The mean transverse diameter on the right and left side of male skulls were reported as 4.86+2.34 and 4.60+1.05, respectively and in the female skulls, these values were 4.59+0.87 and 4.33+0.91 on the right and left side, respectively.

CONCLUSION:

Knowledge in the Anatomy of Carotid canal External aperture could provide guidance for clinicians in radiographic analysis, confidence to surgeons & neurosurgeons in their surgical approaches, also aids in the routine practice of clinical anatomists and forensic personnel.

FIG:1CAROTIDCANAL EXT.APERTUREAPD(mm)

FIG:2 CAROTIDCANAL EXT.APERTURE TD(mm)

Table- 1 Shapes of CC Ext.Aperture

Shape	Right (n=200)	Left (n=200)	Total Percentage %
Round	110	106	54
Oval	50	62	28
Almond	40	32	18

Chart-1Shapes of CC Ext.Aperture

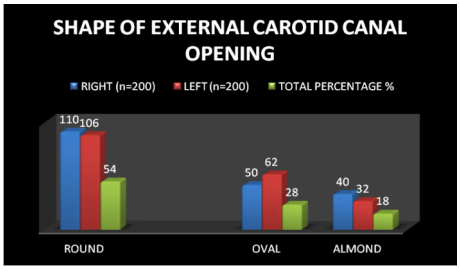

Fig:3 Round Shape Fig:4 Oval Shape Fig:5 Almond Shape

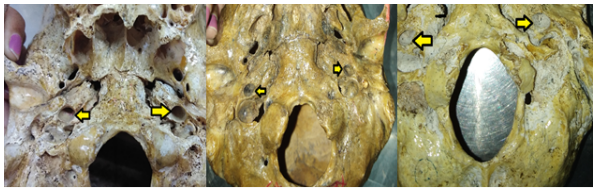

Table -2 Statistical Analysis Of Apd & Td Of Carotid Canal External Aperture

	APD RT	APD LT	TD RT	TD LT
MINIMUM	4.6	4.4	4.2	4.2
MAXIMUM	10	10.5	8.5	8.2
MEAN	6.80825	6.779293	5.9445	6.0045
STD	1.2712493	1.397779	0.913038	0.910314844
STD ERR MEAN	0.0898909	0.098838	0.064562	0.06436898
T VALUE	0.817441473		0.510836637	
P VALUE	0.414		0.6	

Table:3statistical Analysis Of Areas Cc Ext. Aperture

	RT AREA	LT AREA
MINIMUM	17.07	17.8
MAXIMUM	57.39	51
MEAN	31.8957	32.16
STD DEVIATION	8.3793	8.3365
STD ERR MEAN	0.5925	0.5894
T VALUE	0.7511	
P VALUE	0.45	

TABLE:4 Comparision of mean APDof CC Ext.Aperture

Study		Right side	Left side
Somesh et al5		8.128 +0.990	8.158 + 1.002
Ahmed et al15		6.795	6.285
Shaikh et al16	Male	7.62 + 1.05	7.51 + 0.88
	(> 25 years old)		
	Female	7.0 + 0.65	7.26 +1.03
	(< 25 years old)		
Abo et al17	Male	7.96 +0.89	6.77 + 0.8
	Female	7.0 + 0.65	6.77 + 0.6
Tewari et al		7.76 + 0.88	7.89 +0.88
Present study		6.8+1.27	6.78+1.39

TABLE: 5 Comparision of mean TD of CC Ext.Aperture

Study		Right side	Left side
Somesh et al5		6.310 + 0.641	6.195 + 0.804
Ahmed et al15		5.54	5.27
Shaikh et al16	Male	5.33 + 0.8	5.46 + 0.8
	(> 25 years old)		
	Female	5.3 + 1.23	5.25 + 0.81
	(< 25 years old)		
Abo et al17	Male	5.7 + 0.69	5.58 + 0.67
	Female	5.0 + 0.5	4.86 + 0.44
Tewari et al		5.81 + 0.71	6.32 + 0.80
Present study		5.94+0.91	6 +0.91

REFERENCES:

1. Mohamed Abo Aoun; Ashraf Y. Nasr and Adel M. Abdel Aziz Morphometric Study of the Carotid Canal Life Science Journal 2013;10(2)
2. Resnick DK, Subach BR, and Marion DW: The significance of carotid canal involvement in basilar cranial fracture. Neurosurgery 1997; 40: 1177–1181
3. Aoun MA, Nasr AY, Aziz AMA. Morphometric study of the carotid canal. Life Science J. 2013.; 10(3): 2559–2562
4. Russo P, Smith R. Asymmetry of human skull base during growth. Int J Morphol. 2011; 29(3): 1028–1032, doi: 10.4067/s0717-95022011000300062.
5. Leonitti, J.P.; mith, P. G. and Linthicu, F. H. (1990): The petrous carotid artery: An anatomic relationship in skull base surgery. Otolaryngol Head Neck Surg., Jan; 102 (1): 3-12.
6. Somesh MS, Sridevi HB, Murlimanju BV, et al. Morphological and morphometric study of carotid canal in Indian population. Int J Biomechanical Res. 2014; 5(7): 455–460
7. Shaikh VG, Kulkarni PR. A study of morphology, morphometry, symmetry and development of external opening of carotid canal withcomparisoninmale, femaleand foetus. IntJAnatRes.2014;2 (04):797–805 17
8. Abo AM, Ashraf Y, Adel N, Abdel M. Morphometric Study of the Carotid Canal. Life Sci J 2013;10(10):2559–2562
9. Tewari et al Morphometric Study on Carotid CanalJournal of Morphological Sciences Vol. 35 No. 4/2018;261–265
10. AhmedMM,JeelaniM,TarnumA.Anthropometry:AComparativeStudyofRightand LeftSidedForamenOvale,JugularForamenand Carotid Canal. Int J Sci Stud 2015;3(05):88–94
11. Berlis A, Putz R, Schumacher M. Direct and CT measurements of canals and foramina of the skull base. Br J Radiol. 1992; 65(776): 653–661, doi: 10.1259/0007-1285-65-776653, indexed in Pubmed: 1393389.
12. Arata W, Tomohiro O, Hidehito K, et al. Bony carotid canal hypoplasia in patients with moyamoya disease. J NeurosurgPediatr. 2010; 5(6): 591–594, doi: 10.3171/2010.3.PEDS09417, indexed in Pubmed: 20515332
13. Yamamoto M, Jimbo M, Ide M. X-ray CT study of the carotid canal. International Atomic Energy Agency. 1987; 9(6): 659–664
14. Lang J, Schreiber T. Uber Form und Lage des Foramen jugulare (Fossa jugularis), des Canaliscaroticus und des Foramen stylomastoideumsowiederen postna tale Lagever änd erungen. HNO 1983;31(03):80–87
15. Calgüner E, Turgut HB, Gözil R, Tunç E, Sevim A, Keskil S. Measurements of the carotid canal in skulls from Anatolia. ActaAnat (Basel) 1997;158(02):130–132