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MORPHOMETRIC ANALYSIS OF ANTERIOR CLINOID PROCESS AMONG SOUTH INDIAN SKULL

Running Title - Morphometric measurements of anterior clinoid process

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ABSTRACT :

INTRODUCTION :

In the cranial cavity, the anterior clinoid process (ACP) is a small a bony projection in the lesser wing of Sphenoid in its posterior border. Surgically removing this is an important procedure for the proper treatment of any aneurysms related to the internal carotid artery (ICA) and for tumours in that region. Very few studies have reported dimensions, various surgical approaches and anatomical variations of this.

AIM :

The aim of the study is to make morphometric measurements of ACP in the dry cranial cavity of South Indian adult skulls.

MATERIAL AND METHODS:

The study was conducted on 23 dry adult South Indian skulls of unknown age and sex. Basal width, length and thickness of ACP were measured using Vernier caliper. The data were tabulated and related samples Wilcoxon signed rank test was done using SPSS software.

RESULT :
The Anterior Clinoid Process exhibited different anatomical variations with respect to dimensions, in our study, The p values for length, breadth and thickness of ACP are more than 0.05. hence were not significant.
CONCLUSION :
The morphometrical measurements of ACP reported from this study can act as anatomical surgical landmarks for proper planning of clinoidectomy by the neurosurgeons thereby avoiding any serious surgical complications that may arise due to structures around ACP.

KEY WORDS : Anterior Clinoid Process; Anatomical variations; Sphenoid bone; Anterior clinoidectomy; Clinical importance.

INTRODUCTION:
In the cranial cavity, the anterior clinoid process (ACP) is a small a bony projection in the lesser wing of Sphenoid in its posterior border(1). Surgically removing this is an important procedure for the proper treatment of any aneurysms related to the internal carotid artery (ICA) and for tumours in that region(2). Anterior clinoidectomy provides a increased area of exposure of structures present near the optic canal(3) . Additionally, it also increases movement of the ICA and optic nerve, hence exact knowledge of dimensions ACP for neurosurgeons is critical to perform this procedure. Very few studies have reported dimensions, various surgical approaches and anatomical variations of this (4,5, 6) .

There are many reports regarding safe surgical approaches of Anterior clinoidectomy, the necessity of ACP removal has been emphasised previously in descriptions of surgery of the interior arteria carotis, the arteria ophthalmica (7). The complex anatomical structures surrounding the ACP may vary by bony bridges formed between the middle or posterior clinoid processes, its structural variations and relation to clivus causes microsurgical procedure more complicated and riskier (8,9,10).
Although there are many reports explaining the varied approaches for the safe removal of ACP, reports about their anatomical variation are only a few (11). The extensive knowledge and experience of our research team has been translated into high quality publications (12–19),(20),(21),(22),(23,24),(25),(26),(27–31). Therefore, this investigation was planned to review the anatomical variations and the various morphometric measurements of ACP in the dry cranial cavity of South Indian adult skulls.

MATERIAL AND METHODS:
Measurements was done on 23 South Indian adult cranial cavities of unknown sex and age, got from the Department of Anatomy, Saveetha Dental and Hospital, Chennai, Broken and damaged cranial cavities were not taken into consideration. The parameters that were measured on both ACP using digital vernier caliper A- length of ACP, B- base or breadth of ACP and thickness of ACP (Figure 1). The data were tabulated and related samples Wilcoxon signed rank test was done using SPSS software (version23).

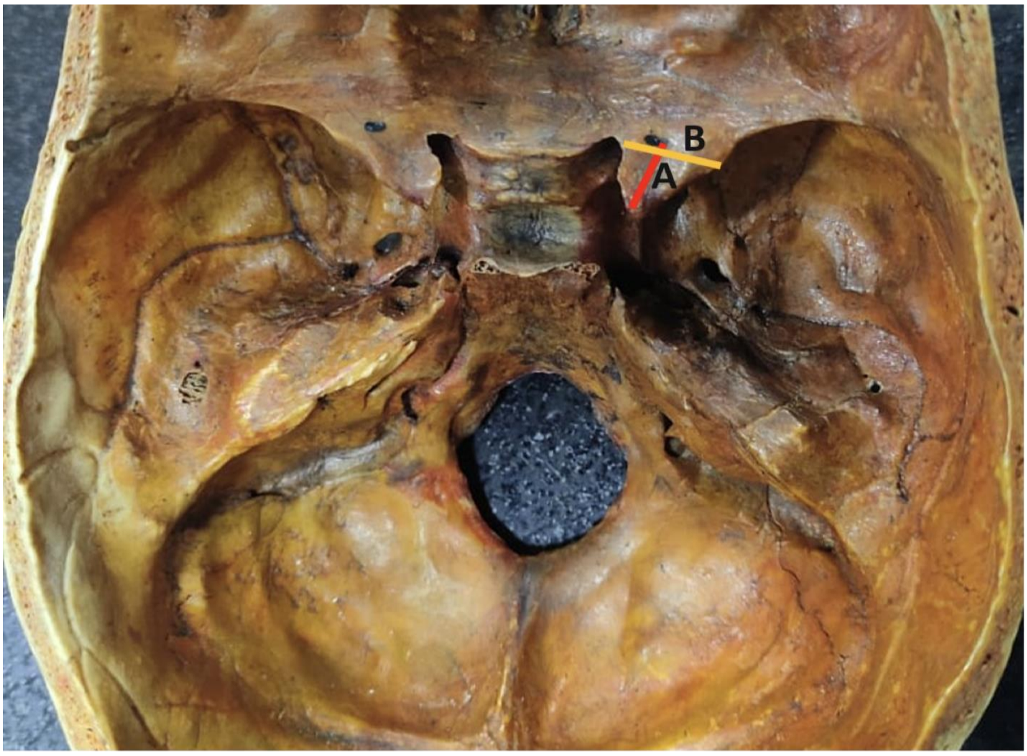

FIGURE 1: cranial cavity showing measurement of anterior clinoid process

The parameters measured:

A - Length - perpendicular distance measured between base line to apex of ACP.

B - Basal width - distance between both basal margins of ACP.

Thickness was measured near the base of ACP .

RESULT:

Table 1 - Mean and standard deviation of length, breadth and thickness of both sides of anterior clinoid process

All the values in mm	LEFT		RIGHT		P value*
	MEAN	STANDARD DEVIATION	MEAN	STANDARD DEVIATION	
LENGTH	11.21	2.39	11.64	2.11	0.37 (P>0.05)
BREADTH	11.56	2.52	10.75	2.43	0.11(P>0.05)
THICKNESS	6.21	1.58	5.54	1.48	0.055 (P>0.05)

*P value Related samples Wilcoxon signed rank test

The values were taken and tabulated Table 1. The sample related wilcoxon signed test was done for the mean of differences of length, breadth and thickness of both left and right. Related samples Wilcoxon signed rank test was done between the mean differences of length of left and right P value is 0.37 hence it was not significant. The Wilcoxon signed test was done for the mean of differences between breadth of left and right, P value is 0.11, hence was not significant. For the mean difference between thickness of left and right Wilcoxon signed test was done P value was 0.055. It was not significant. In our study, The p values for length, breadth and thickness of ACP are more than 0.05. hence are not significant.

DISCUSSION:

The region of pituitary fossa is a crucial area, due to its close relationship to the cavernous sinus along with anatomical structures present in it, sphenoid air sinus & pituitary gland (32) .Partial or complete clinoidectomy is an essential procedure during the superior approach to the sinus cavernosus , tumour removal or treatment of ICA aneurysms (33). The ACP represents the lateral bony limitation of the dural fold around ICA, its base on medial side forms the lateral margin of the optic canal (34). The ACP on its inferior surface is connected to the body of the sphenoid via the optic strut, that forms the boundary of the optic canal. The ICA, ophthalmic artery and cranial nerves II, III, IV, V1 and VI are related to the ACP (35).

In previous research, Anatomical dimension measured in Anterior Clinoid Process among North Indian Skulls. The mean of both right and left sides of basal width is 11.38 and 11.59. The Standard deviation of both left and right sides of basal width is 1.65 and 1.30. The mean of both right and left side of length is 12.99 and 12.61. The Standard deviation of both left and right side of length is 2.27 and 2.59. The mean of both right and left side of thickness is 6.05 and 6.50. The Standard deviation of both left and right side of thickness is 1.20 and 1.41. In my study, the mean length of left and right side is 11.21 and 11.64 which is similar to that of the previous study. The mean basal width of both right and left side is 10.75 and 11.56. The mean basal width of the left side is similar to that of previous studies, but the mean basal width of the right side shows some little variations. The mean thickness of the right and left side is 5.54 and 6.21. The mean thickness is similar to that of the previous study. The SD of length of left and right is 2.39 and 2.11 The SD of length of both left and right shows larger values than the previous study. The SD of breadth of both left and right is 2.52 and 2.43. The SD of breadth of left and right is similar to that of the previous study (6).

The SD of thickness of both left and right side is 1.58 and 1.48. The SD values of both the left and right side are similar to that of the previous study (7). The p value of previous is more than 0.05 which is insignificant. The same results were found in our study. In our study, the p value is greater than 0.05 which is statistically insignificant. The number of skulls used for the study was limited; in future it can be done in larger sample size and relative position of ACP to other anatomical landmarks can also be done.

CONCLUSION:
The morphometrical measurements of ACP reported from this study can act as anatomical surgical landmarks for proper planning of clinoidectomy by the neurosurgeons thereby avoiding any serious surgical complications that may arise due to structures around ACP.

AUTHOR CONTRIBUTIONS
M. SATHYA KUMAR : Study Design, Data collection, Data Analysis, manuscript writing
YUVARAI BABU .K : Study Concept, Data verification, Data Analysis, manuscript drafting and correction

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CONFLICT OF INTEREST
The authors reported the conflict of interest while performing this study to be nil.

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REFERENCES :

1. Cecen A, Celikoglu E, Is M, Kale AC, Eroglu BT. Pre-Operative Measurement of the Morphometry and Angles of the Anterior Clinoid Process (ACP) for Aneurysm Surgery [Internet]. Vol. 34, International

Journal of Morphology. 2016. p. 1333–8. Available from: http://dx.doi.org/10.4067/s0717-95022016000400026

2. Vajkoczy P. Intradural versus Extradural Removal of the Anterior Clinoid Process [Internet]. Vol. 77, World Neurosurgery. 2012. p. 615–6. Available from: http://dx.doi.org/10.1016/j.wneu.2011.10.026

3. Iyaji PI, Alashkham A, Alraddadi A, Soames R. ANATOMICAL STUDY OF THE MORPHOMETRY OF THE ANTERIOR CRUCIATE LIGAMENT ATTACHMENT SITES. Estudio anatómico de la morfometría de los sitios de fijación del ligamento cruzado anterior [Internet]. Vol. 8, Revista Argentina de Anatomía Clínica. 2016. p. 29–37. Available from: http://dx.doi.org/10.31051/1852.8023.v8.n1.14205

4. Avci E, Bademci G, Ozturk A. Microsurgical landmarks for safe removal of anterior clinoid process. Minim Invasive Neurosurg. 2005 Oct;48(5):268–72.

5. Nutik SL. Removal of the anterior clinoid process for exposure of the proximal intracranial carotid artery [Internet]. Vol. 69, Journal of Neurosurgery. 1988. p. 529–34. Available from: http://dx.doi.org/10.3171/jns.1988.69.4.0529

6. Priya A, Gupta N. Morphometric study of optic strut and it's relation with anterior clinoid process [Internet]. Vol. 67, Journal of the Anatomical Society of India. 2018. p. S7. Available from: http://dx.doi.org/10.1016/j.jasi.2018.06.175

7. Kalthur SG, Vangara SV, Kiruba L, Dsouza AS, Gupta C. Metrical and non-metrical study of the pterion in South Indian adult dry skulls with notes on its clinical importance [Internet]. Vol. 30, Marmara Medical Journal. 2017. p. 30–30. Available from: http://dx.doi.org/10.5472/marumj.299387

8. da Costa MDS, de Oliveira Santos BF, de Araujo Paz D, Rodrigues TP, Abdala N, Centeno RS, et al. Anatomical Variations of the Anterior Clinoid Process: A Study of 597 Skull Base Computerized Tomography Scans. Oper Neurosurg (Hagerstown). 2016 Sep 1;12(3):289–97.

9. Serindere G, Gunduz K, Avsever H. Morphological Measurement and Anatomical Variations of the Clivus Using Computed Tomography [Internet]. Journal of Neurological Surgery Part B: Skull Base. 2021. Available from: http://dx.doi.org/10.1055/s-0040-1722712

10. Kapur E, Mehić A. Anatomical variations and morphometric study of the optic strut and the anterior clinoid process [Internet]. Vol. 12, Bosnian Journal of Basic Medical Sciences. 2012. p. 88. Available from: http://dx.doi.org/10.17305/bjbms.2012.2502

11. Hunnargi S, Ray B, Pai SR, Siddaraju KS. Metrical and non-metrical study of anterior clinoid process in South Indian adult skulls [Internet]. Vol. 30, Surgical and Radiologic Anatomy. 2008. p. 423–8. Available from: http://dx.doi.org/10.1007/s00276-008-0346-1

12. Sekar D, Lakshmanan G, Mani P, Biruntha M. Methylation-dependent circulating microRNA 510 in preeclampsia patients. Hypertens Res. 2019 Oct;42(10):1647–8.

13. Princeton B, Santhakumar P, Prathap L. Awareness on Preventive Measures taken by Health Care Professionals Attending COVID-19 Patients among Dental Students. Eur J Dent. 2020 Dec;14(S 01):S105–9.

14. Logeshwari R, Rama Parvathy L. Generating logistic chaotic sequence using geometric pattern to decompose and recombine the pixel values. Multimed Tools Appl. 2020 Aug;79(31-32):22375–88.

15. Johnson J, Lakshmanan G, M B, R M V, Kalimuthu K, Sekar D. Computational identification of MiRNA-7110 from pulmonary arterial hypertension (PAH) ESTs: a new microRNA that links diabetes and PAH.

Hypertens Res. 2020 Apr;43(4):360–2.

16. Paramasivam A, Priyadharsini JV, Raghunandhakumar S, Elumalai P. A novel COVID-19 and its effects on cardiovascular disease. Hypertens Res. 2020 Jul;43(7):729–30.

17. Pujari GRS, Subramanian V, Rao SR. Effects of Celastrus paniculatus Willd. and Sida cordifolia Linn. in Kainic Acid Induced Hippocampus Damage in Rats. Ind J Pharm Educ. 2019 Jul 3;53(3):537–44.

18. Rajkumar KV, Lakshmanan G, Sekar D. Identification of miR-802-5p and its involvement in type 2 diabetes mellitus. World J Diabetes. 2020 Dec 15;11(12):567–71.

19. Ravisankar R, Jayaprakash P, Eswaran P, Mohanraj K, Vinitha G, Pichumani M. Synthesis, growth, optical and third-order nonlinear optical properties of glycine sodium nitrate single crystal for photonic device applications. J Mater Sci: Mater Electron. 2020 Oct;31(20):17320–31.

20. Wu S, Rajeshkumar S, Madasamy M, Mahendran V. Green synthesis of copper nanoparticles using Cissus vitiginea and its antioxidant and antibacterial activity against urinary tract infection pathogens. Artif Cells Nanomed Biotechnol. 2020 Dec;48(1):1153–8.

21. Vikneshan M, Saravanakumar R, Mangaiyarkarasi R, Rajeshkumar S, Samuel SR, Suganya M, et al. Algal biomass as a source for novel oral nano-antimicrobial agent. Saudi J Biol Sci. 2020 Dec;27(12):3753–8.

22. Alharbi KS, Fuloria NK, Fuloria S, Rahman SB, Al-Malki WH, Javed Shaikh MA, et al. Nuclear factor-kappa B and its role in inflammatory lung disease. Chem Biol Interact. 2021 Aug 25;345:109568.

23. Rao SK, Kalai Priya A, Manjunath Kamath S, Karthick P, Renganathan B, Anuraj S, et al. Unequivocal evidence of enhanced room temperature sensing properties of clad modified Nd doped mullite Bi2Fe4O9 in fiber optic gas sensor [Internet]. Vol. 838, Journal of Alloys and Compounds. 2020. p. 155603. Available from: http://dx.doi.org/10.1016/j.jallcom.2020.155603

24. Bhavikatti SK, Karobari MI, Zainuddin SLA, Marya A, Nadaf SJ, Sawant VJ, et al. Investigating the Antioxidant and Cytocompatibility of Mimusops elengi Linn Extract over Human Gingival Fibroblast Cells. Int J Environ Res Public Health [Internet]. 2021 Jul 4;18(13). Available from: http://dx.doi.org/10.3390/ijerph18137162

25. Marya A, Karobari MI, Selvaraj S, Adil AH, Assiry AA, Rabaan AA, et al. Risk Perception of SARS-CoV-2 Infection and Implementation of Various Protective Measures by Dentists Across Various Countries. Int J Environ Res Public Health [Internet]. 2021 May 29;18(11). Available from: http://dx.doi.org/10.3390/ijerph18115848

26. Barma MD, Muthupandiyan I, Samuel SR, Amaechi BT. Inhibition of Streptococcus mutans, antioxidant property and cytotoxicity of novel nano-zinc oxide varnish. Arch Oral Biol. 2021 Jun;126:105132.

27. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol. 2019 Dec;90(12):1441–8.

28. Priyadharsini JV, Vijayashree Priyadharsini J, Smiline Girija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species [Internet]. Vol. 94, Archives of Oral Biology. 2018. p. 93–8. Available from: http://dx.doi.org/10.1016/j.archoralbio.2018.07.001

29. Uma Maheswari TN, Nivedhitha MS, Ramani P. Expression profile of salivary micro RNA-21 and 31 in oral potentially malignant disorders. Braz Oral Res. 2020 Feb 10;34:e002.

30. Gudipaneni RK, Alam MK, Patil SR, Karobari MI. Measurement of the Maximum Occlusal Bite Force and its Relation to the Caries Spectrum of First Permanent Molars in Early Permanent Dentition. J Clin Pediatr Dent. 2020 Dec 1;44(6):423–8.

31. Chaturvedula BB, Muthukrishnan A, Bhuvaraghan A, Sandler J, Thiruvenkatachari B. Dens invaginatus: a review and orthodontic implications. Br Dent J. 2021 Mar;230(6):345–50.

32. Pritz MB. Closure of Dural Defects after Anterior Clinoid and Optic Canal Roof Removal: Technical Note [Internet]. Vol. 14, Skull Base. 2004. p. 217–20. Available from: http://dx.doi.org/10.1055/s-2004-860954

33. Sade B, Kweon CY, Evans JJ, Lee JH. Enhanced Exposure of Carotico-Oculomotor Triangle Following Extradural Anterior Clinoidectomy: A Comparative Anatomical Study [Internet]. Vol. 15, Skull Base. 2005. p. 157–61. Available from: http://dx.doi.org/10.1055/s-2005-871523

34. Zada G, Lopes MBS, Mukundan S Jr, Laws ER Jr. Atlas of Sellar and Parasellar Lesions: Clinical, Radiologic, and Pathologic Correlations. Springer; 2015. 546 p.

35. Elsawaf ME. Impact of Anterior Clinoid Process Pneumatization on Adjacent Anatomical Structures [Internet]. Vol. 4, Academia Anatomica International. 2018. Available from: http://dx.doi.org/10.21276/aanat.2018.4.1.3