



## THE ANATOMICAL STUDY OF CRANIOMETRIC POINTS IN ADULT HUMAN SKULLS OF RAJASTHAN REGION

### Anatomy

|                                |                                                                                                                                       |
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| <b>Dr. Rekha Parashar*</b>     | Associate Professor, Department of Anatomy, National Institute of Medical Sciences& Research, Jaipur, Rajasthan *Corresponding Author |
| <b>Dr. Suresh Sharma</b>       | Assistant Professor, Department of Anatomy, National Institute of Medical Sciences& Research, Jaipur, Rajasthan                       |
| <b>Dr. Upendra Kumar Gupta</b> | Professor & Head, Department of Anatomy, National Institute of Medical Sciences& Research, Jaipur, Rajasthan                          |
| <b>Miss Pooja Kumari Verma</b> | Msc, Department of Anatomy, National Institute of Medical Sciences& Research, Jaipur, Rajasthan                                       |

### ABSTRACT

Pterion is formed by articulation of four bones like sphenoid, parietal, frontal, and temporal bone in norma lateralis 3.5 cm behind the zygomatico-frontal suture and 4 cm above the midpoint of the superior border of zygomatic arch, and marks the anterior branch of the middle meningeal artery and Sylvian point of the brain. Pterional approaches are used for the treatment of vascular neurosurgeries and surgeries of optic nerve. The present study has been carried out to find out the position, distance and thickness of pterion from various landmarks. The present study was carried out in Department of Anatomy, National Institute of Medical Sciences& Research, Jaipur, Rajasthan between the periods of January 2019 to December 2019. Measurements of pterion from external and internal aspects of skull were taken by digital vernier calliper and the various parameters like length of pterion and thickness of pterion at the center were analysed. Sphenoparietal was the only pterion occurring more bilaterally whereas frontotemporal was second- highest. The mean length of pterion were calculated as  $2.91 \pm 1.30$  cm (right) and  $2.97 \pm 1.44$  cm (left), thickness of the skull at the center of pterion as  $0.53 \pm 0.06$  cm (right) and  $0.59 \pm 0.06$  cm (left). The conclusion derived from this study is that position of pterion is important for burr hole surgeries, neurosurgeries, operations in Broca's motor speech area and the study will be helpful to anatomists, neurosurgeons and research

### KEYWORDS

Pterion, optic canal, frontozygomatic suture, sphenoidal ridge

### INTRODUCTION

Pterion is a small area present in norma lateralis of the skull and is formed by articulation of four bones like greater wing of sphenoid, parietal, frontal, and squamous part of the temporal bone.<sup>1</sup> Inside the cranial cavity pterion is related to several structures and this area is of great clinical and neurosurgical importance as this part of bone is very delicate and can be easily broken for doing craniotomy and Burr hole surgeries.<sup>2,3</sup>

Drainage of hematoma which is done after an accident is a life saving surgery, in this surgery the blood collected in subdural (space present between Dura mater and Arachnoids' mater) space is drained out. That is the reason why burr hole surgery is done at the site of pterion as it is the weakest site present on the Normalateralis of the skull. That is why knowledge of surface anatomy of the middle meningeal artery is important so that burr hole surgery can be done to evacuate extradural hematoma.<sup>4</sup>

Pterional approaches are used for the treatment of vascular neurosurgeries such as for arteriovenous malformation, cavernous angiomas and aneurysms in the internal carotid artery and middle cerebral arteries. Surgeries of optic nerve passing through the optic canal are only possible by pterion landmark.<sup>5</sup> Parkinsonian syndrome is also caused when meningiomas is present at the region of pterion.<sup>6</sup>

The present study has been carried out to find out the position and distance of pterion from various anatomical landmarks described by anatomists, anthropologists, forensic pathologists, and neurosurgeons.

### MATERIAL & METHODS

The study was conducted on 108 human dry skulls available in the Department of Anatomy, National Institute of Medical Sciences and Research and other Medical Colleges of Jaipur (SMS Medical College, JNU Medical College, and Mahatma Gandhi Medical College) between the periods of January 2019 to December 2019.

#### 1. Measurement Of Pterion From The External Aspect:-

a. Centre of pterion to the posterior lateral aspect of the frontozygomatic suture (PFZS).

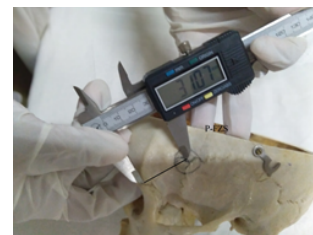


Fig 1:- P-FZS

b. Centre of pterion to the superior margin of Zygomatic arch (PZA).



Fig 2:- P-ZA

#### 2. Measurements Of Pterion From The Internal Aspect:-

- Internal aspect of centre of pterion to the lateral end of the ridge on the lesser wing of sphenoid bone (PSR).
- Internal aspect of centre of pterion to the lateral margin of the optic canal (POC).



Fig 3:- Showing PSR and POC

**RESULT****Table 1. Unilateral and bilateral incidence of types of Pterion**

| Type of pterion | Total         | Bilateral | Unilateral |
|-----------------|---------------|-----------|------------|
| Sphenoparietal  | 133 (61.57 %) | 120       | 13         |
| Frontotemporal  | 60 (27.77 %)  | 52        | 8          |
| Epipteric       | 23 (10.64 %)  | 12        | 11         |
| Stellate        | 0             | 0         | 0          |

Sphenoparietal was the only pterion occurring more bilaterally which was 120 in number, whereas frontotemporal was in 52 cases raking the second- highest and epipteric type of pterion occurred unilaterally the most which was found to be 11 out of 23 cases.

**Relative Position, Length Of Pterion From Various Bony Landmarks:-****Table 2: The mean, Standard deviation, 'f' and 'p' values for length and thickness of pterion.**

| Distance                           | The mean |      | Standard Deviation |       | 'f' and 'p' values |         |
|------------------------------------|----------|------|--------------------|-------|--------------------|---------|
|                                    | Right    | Left | Right              | Left  | f-value            | p-value |
| Length of pterion                  | 2.91     | 2.97 | ±1.30              | ±1.44 | 0.108              | 0.741   |
| Thickness of pterion at the center | 0.53     | 0.59 | ±0.06              | ±0.46 | 1.397              | 0.238   |

**Table 3: The mean, Standard deviation, 'f' and 'p' values for the location of pterion on the external aspect.**

| Distance                                  | The mean |      | Standard Deviation |       | 'f' and 'p' values |         |
|-------------------------------------------|----------|------|--------------------|-------|--------------------|---------|
|                                           | Right    | Left | Right              | Left  | f-value            | p-value |
| From FZM suture to the center of Pterion. | 3.54     | 3.49 | ±0.42              | ±0.44 | 0.686              | 0.3905  |
| From midpoint of Zygoma                   | 4.17     | 4.15 | ±0.18              | ±0.25 | 0.593              | 0.441   |

**Table 4: The mean, Standard deviation, 'f' and 'p' values for the location of pterion on the internal aspect.**

| Distance                                                                                               | The mean |      | Standard Deviation |       | 'f' and 'p' values |         |
|--------------------------------------------------------------------------------------------------------|----------|------|--------------------|-------|--------------------|---------|
|                                                                                                        | Right    | Left | Right              | Left  | f-value            | p-value |
| From center of pterion on internal aspect of skull to lateral margin of optic canal.                   | 4.57     | 4.51 | ±0.29              | ±0.36 | 1.594              | 0.214   |
| From center of pterion on internal aspect of skull to lateral end of sphenoidal ridge on sphenoid bone | 1.53     | 1.54 | ±0.36              | ±0.35 | 0.084              | 0.771   |

The mean position of pterion from various bony landmarks was measured and calculated.

- The mean length of pterion was calculated as 2.91±1.30 cm (right) and 2.97±1.44 cm (left).
- The mean thickness of the skull at the center of pterion was calculated as 0.53±0.06 cm (right) and 0.59±0.46 cm (left).
- The mean distance from the center of pterion to superior of the zygomatic arch was calculated as 4.17±0.18 cm (right) 4.15±0.25cm (left).
- The mean distance from the center of pterion to frontozygomatic suture was calculated as 3.54±0.42 cm (right) and 3.49±0.44 cm (left).
- The mean distance from the inner aspect of center of pterion to sphenoidal ridge was calculated as 1.53±0.36 cm (right) 1.54±0.35 cm (left).
- The mean distance from inner aspect of the center of pterion to the optic canal was calculated as 4.57±0.29 (right) and 4.51±0.36 cm (left).

No statically significant side differences were found in the length and thickness of the pterion location of the pterion, from midpoint of the pterion to ZA, FZS, SR, and OC.

**DISCUSSION****Table 5: PFZ- between pterion and frontozygomatic suture (cm)**

| Authors                      | Right     | Left      |
|------------------------------|-----------|-----------|
| Oguzet al, 2004 <sup>2</sup> | 3.30±0.40 | 3.44±0.39 |

|                                         |           |           |
|-----------------------------------------|-----------|-----------|
| Ankur Zalwadia et al, 2010 <sup>7</sup> | 3.73±0.51 | 3.55±0.42 |
| Anjana.S et al, 2015 <sup>9</sup>       | 3±0.4     | 2.9±0.2   |
| Present study                           | 3.54±0.42 | 3.49±0.44 |

The pterion is expected to lie 3.0 -3.5 cm behind the frontozygomatic suture. In the present study the pterion is 3.54±0.42 cm (right) and 3.49±0.44 cm (left) behind the frontozygomatic suture. In the study done by Ankur Zalwadia et al these measurements were 3.73±0.51 cm on (right) and 3.49±0.44 cm on (left) side which was slightly high as compared to the present study.

**Table 6: PZA-distance between pterion and middle of zygomatic arch (cm)**

| Authors                                 | Right     | Left      |
|-----------------------------------------|-----------|-----------|
| Oguzet al, 2004 <sup>2</sup>            | 4.05±0.39 | 3.85±0.25 |
| Ankur Zalwadia et al, 2010 <sup>7</sup> | 3.12±0.44 | 2.97±0.33 |
| Anjana.S et al 2015 <sup>9</sup>        | 4±0.5     | 4±0.2     |
| Present study                           | 4.17±0.18 | 4.15±0.25 |

The pterion is expected to lie 4.0 cm above the zygomatic arch and 4.17±0.18 cm (right) and 4.15±0.25 cm (left) above the zygomatic arch. In the study conducted on Turkish population the measurements observed were 3.98 cm. In the study conducted by Ankur Zalwadia on Western Indian population pterion lies about 3.12±0.44 cm (right) and 2.97±0.33 cm (left) which is low in comparison with the present study.

**Table 7: POC- distance of centre of internal aspect of pterion from optic canal (cm)**

| Authors                                   | Right     | Left      |
|-------------------------------------------|-----------|-----------|
| Zalwadia et al [2010] <sup>7</sup>        | 4.52±0.32 | 4.37±0.23 |
| Seema et al [2013] <sup>8</sup>           | 4.22±0.45 | 4.43±0.48 |
| Sneha Guruprasad et al 2017 <sup>10</sup> | 4.11±0.39 | 3.94±0.48 |
| Present study                             | 4.57±0.29 | 4.51±0.36 |

In the present study distance from inner aspect of centre of pterion to the optic canal is measured 4.57±0.29 cm (right) and 4.51±0.36 cm (left) respectively. In the study conducted by Ankur Zalwadia et al 2010 measurements observed were 4.52±0.32 cm (right) and 4.37±0.23 cm (left) which is similar to the present study

**Table 8: PSR- distance of centre of internal aspect of pterion from lateral end of lesser wing of sphenoid on sphenoidal ridge (cm)**

| Authors                                     | Right     | Left      |
|---------------------------------------------|-----------|-----------|
| Zalwadia et al [2010] <sup>7</sup>          | 1.36±0.35 | 1.33±0.22 |
| Seema et al [2013] <sup>8</sup>             | 1.71±0.45 | 1.84±0.59 |
| Sneha Guruprasad et al [2017] <sup>10</sup> | 1.04±0.47 | 0.90±0.39 |
| Present study                               | 1.53±0.36 | 1.54±0.35 |

In the present study this distance was found to be 1.53±0.36 cm (right) and 1.54±0.35 cm (left) respectively. In the study conducted by Ankur Zalwadia et al measurements observed were 1.36 ±0.35cm (right) and 1.33±0.22 cm (left) respectively which are low when compared to present study. It is low when compared to the study conducted by Seema et al which 1.71±0.45 cm (right) and 1.84±0.59 cm (lefts).

**CONCLUSION**

The present study concludes that the measurement of external aspect will be helpful to locate the position of pterion as it is important for burr hole surgeries and neurosurgeries of the lesions of anterior and middle cranial fossa. The measurement of internal aspect is useful in microsurgies of olfactory meningiomas present on the inferior aspect of the frontal lobe, tumor in retro orbital, orbital, sellar & chiasmatic areas and operations in Broca's motor speech area and the study will be helpful to anatomists, neurosurgeons, anthropologists and research

**REFERENCES**

- Standring, S.(2008) Gray's Anatomy. The anatomical basis of clinical practice. 40th Edition, chapter – head and neck, external features of skull. Churchill Livingstone Elsevier. London (UK); page: 403, 412, 418
- Oguz, O; Sanli, SG; Bozkir, MG; Soames, RW. (2004) Pterion in Turkish male skulls. Surg Radio Anat; 1: 32 – 33
- Snell, RS. (2012) Snell's Clinical Anatomy by Regions. 9th edition, chapter head and neck external features of the skull. Wolters Kluwer/ Lippincott Williams Wilkins. New Delhi, Philadelphia, Baltimore, New York, London, Buenos Aires, Hong Kong, Sydney, Tokyo; page: 532.
- Moore, KL; Dalley, AF; Agur, AMR.(2014) Moore Clinical Oriented Anatomy. 7th edition, chapter head. Wolters Kluwer/ Lippincott Williams and Wilkins. New Delhi, Philadelphia, Baltimore, New York, London, Buenos Aires, Hong Kong; page: 874 – 875.
- Mennan ec, Cem K, Mehmet TD, Ufuk C, Ahmet H, Localisation of pterion in neonatal cadavers: a morphological study 2010; Surg. Radiol Anat ; 32: 545-550
- Cheg WY, Lee HT, Sun MH, Shen CC. A Pterion keyhole approach for the treatment of

- anterior circulation aneurysms. 2006; Minim. invasive Neurosurg; 49(5): 257-262
7. Zalawadia, A; Vadgama, J; Ruparelia, S; Patel, S; Rathod, SP; Patel SV. (2010) Morphometric Study of Pterion in Dry Skull of Gujarat region. NJIRM; 1 (4): 25 – 29
  8. Seema, and Mahajan, A. (2014) Pterion formation in north Indian population: An Anatomico- Clinical study. Int. J. Morpholo; 32 (4): 1444 – 1448
  9. Anjana.S, Satheesha. K.S, Ravi Bhaskar. Morphometric study of pterion in adult dry skulls in dakshina kannada district, karnataka state, india; Int J Anat Res 2015, Vol 3(4):1603-06
  10. Sneha Guruprasad Kalthur, Shnmukha Varalakshmi Vangara. Metrical and non-metrical study of the pterion in South Indian adult dry skulls with notes on its clinical importance. Marmara Medical Journal 2017; 30: 30-39