A MORPHOMETRIC STUDY OF PTERION IN ADULT HUMAN SKULLS IN NORTH INDIA POPULATION

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ABSTRACT

Introduction: Pterion is a point of irregular H-shaped sutural confluence seen in the Norma Lateralis of the skull, formed by the frontal, parietal, temporal and sphenoid bones. This is an important anthropometric landmark, as it overlies the anterior branch of the middle meningeal artery and the lateral fissure of the cerebral hemisphere. The pterion was first classified into three types (sphenoparietal, frontotemporal and stellate) by Broca. Subsequently, four types (sphenoparietal, frontotemporal, stellate and epipteric) were defined as by Murphy. The different types of pterion are of interest mainly to anthropologists and should be studied in other populations; such findings could also be useful for assessing the location of the pterion in incomplete archeological remains or forensic materials. Differences in the exact location of the pterion have been observed among different races, and this could be due to genetic or environmental influences affecting the craniometric indices of human skull.

Material and Methods: A cross sectional study was done on fifty dry skulls from the Department of Anatomy, Hind Medical College Lucknow. The skulls were of unknown sex and race. Abnormal and broken skulls were discarded. Both the sides of skulls were studied for the types and position of the pteria. The pterion was observed for its formation by different bones and distance of the centre of the horizontal limb of the pterion to the upper border of the middle of the zygomatic arch and to FZ suture was measured using sliding caliper. The types of the pteria were noted and recorded.

Results: In the present study, four types of pterion, i.e. sphenoparietal, frontoparietal, stellate and epipteric, were observed. The four shapes of pterion was classified and the most predominant was sphenopariteal, frontotemporal, stellate and less common is epipteric. The mean of sphenopariteal - 77.74, frontotemporal - 7.55, stellate - 5.55 and epipteric - 13.18. Sphenoparietal type is most common in the present study followed by EpiptericFrontotemporal and Stellate.

Conclusion: The knowledge regarding the various shapes and distances from different points to pterion is useful for treating number of pathologies in brain. So this is so useful for neurosurgeons, anatomists, anthropologist and forensic medicine. This study is aims and objective has done with the skulls of North Indian Moradabad region population, we suggest that the scope of the study can be further carried out in various populations to appreciate the variations better and it will further helps in other modern commonly used modalities such as radiological analysis to better predict the structure of pterion and allow better surgical safety and efficacy.

Keywords: Pterion, sutural confluence, craniometric, sphenoparietal, frontoparietal

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INTRODUCTION

Pterion is a point of irregular H-shaped sutural confluence seen in the Norma Lateralis of the skull, formed by the frontal, parietal, temporal and sphenoid bones. This is an important anthropometric landmark, as it overlies the anterior branch of the middle meningeal artery and the lateral fissure of the cerebral hemisphere. The pterion corresponds to the site of the antero-lateral fontanelle of the neonatal skull, which closes in the third month after birth. One or more sutural bones appear between the sphenoidal angle of the parietal and the greater wing of the sphenoid, known as pterion ossicles or epipetric bones. Pterional access has either alone or in combination with other approaches has paved the way for the management of wide variety of neurosurgical disorders in the anterior, middle & upper part of posterior cranial fossa with minimal tissue injury without compromising surgical results. Its location is approximately 4 cm above zygomatic arch and 3.5 cm behind the frontozygomatic suture. because here the bones are very thin and can easily be broken by the surgeons and neurosurgeons in their clinical work. Most
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Important surgery is done for the drainage of haematoma formed after the accident, where the collection of blood occurs in subdural space, to drain the collected fluid or blood, the burr hole is done at the pterion site. Sutural patterns or bony articulations within the region of the pterion have been generalized into different types by various anthropological and clinical studies. The pterion was first classified into three types (sphenoparietal, frontotemporal and stellate) by Broca. Subsequently, four types (sphenoparietal, frontotemporal, stellate and epipteric) were defined as by Murphy. Sphenoparietal (SP) type where greater wing of sphenoid articulates with parietal bone to form letter H; Frontotemporal (FT) type where the squamous part of temporal articulates with frontal bone; stellate type where all bones articulate in the form of letter K and epipteric type where a sutural bone is lodged between the four bones forming the pterion. Presence of epipteric bone or flower's bone in the pterion may be a surgical pitfall. In Neurosurgery, it is important to have the most suitable bony aperture in order to be minimally invasive. To achieve optimum craniotomy where neuronavigation devices are not available, the surgeon then relies on external landmarks such as the pterion. Locating the pterion is important in surgical interventions following extradural hemorrhage as well as tumors involving inferior aspects of the frontal lobe such as olfactory meningiomas. The different types of pterion are of interest mainly to anthropologists and should be studied in other populations, such findings could also be useful for assessing the location of the pterion in incomplete archeological remains or forensic materials. Differences in the exact location of the pterion have been observed among different races, and this could be due to genetic or environmental influences affecting the craniometric indices of human skull.

MATERIALS AND METHODS

A cross-sectional study was done on fifty dry skulls from the Department of Anatomy, Hind Medical College Lucknow. The skulls were of unknown sex and race. Abnormal and broken skulls were discarded. Both the sides of skulls were studied for the types and position of the pteria. The shapes of pteria were noted by looking the articulation of bones forming the sutures. The pterion was observed for its formation by different bones and distance of the centre of the horizontal limb of the pterion to the upper border of the middle of the zygomatic arch and to FZsuture was measured using sliding caliper. The types of the pteria were noted and recorded.

RESULTS

In the present study, four types of pterion, i.e. sphenoparietal, frontoparietal, stellate and epipteric, were observed. The four shapes of pterion were classified and the most predominant was sphenoparietal, frontotemporal, stellate and less common is epipteric. The mean of sphenoparietal - 77.74, frontotemporal - 7.55, stellate - 5.55 and epipteric - 13.18. Which is shown in Figure 1? The distance of pterion from various landmarks on both sides in four types of pterion is tabulated in Table 1. Sphenoparietal type is most common in the present study followed by Epipteric, Frontotemporal and Stellate. Table 2 showing comparison of various shapes of pterion in different population.

Figure 1: Mean of different type of Pterion
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Table 1: Showing the Distance of Pterion from Different Points Morphometry of Various Types of Pterion

<table>
<thead>
<tr>
<th>Landmark</th>
<th>Sphenoparietal type</th>
<th>Frontotemporal type</th>
<th>Stellate type</th>
<th>Epipteric type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right Mean (cm)</td>
<td>Left Mean (cm)</td>
<td>Right Mean (cm)</td>
<td>Left Mean (cm)</td>
</tr>
<tr>
<td>FZ-P</td>
<td>4.6</td>
<td>4.0</td>
<td>4.6</td>
<td>4.2</td>
</tr>
<tr>
<td>ZA-P</td>
<td>5.5</td>
<td>5.2</td>
<td>5.0</td>
<td>4.6</td>
</tr>
<tr>
<td>EMP</td>
<td>7.2</td>
<td>6.4</td>
<td>6.1</td>
<td>6.0</td>
</tr>
<tr>
<td>HF-P</td>
<td>4.8</td>
<td>4.6</td>
<td>5.6</td>
<td>5.0</td>
</tr>
<tr>
<td>OC-P</td>
<td>4.3</td>
<td>5.1</td>
<td>5.1</td>
<td>5.2</td>
</tr>
<tr>
<td>SR-P</td>
<td>3.2</td>
<td>2.9</td>
<td>3.4</td>
<td>3.1</td>
</tr>
</tbody>
</table>

FZ – P - FRONTOZYGOMATIC SUTURE TO PTERION
ZA – P - ZYGOMATIC SUTURE TO PTERION
EM – P - EXTERNAL ACQUOSTIC MEATUS TO PTERION
HF – P - HYOPHYPSEAL FOSSA TO PTERION
OC – P - OPTIC CANAL TO PTERION
SR – P - SPHENOIDAL RIDGE TO PTERION

Table 2 Showing Comparison of Various Shapes of Pterion in Different Population

<table>
<thead>
<tr>
<th>Populations</th>
<th>Sphenoparietal %</th>
<th>Frontotemporal %</th>
<th>Stellate %</th>
<th>Epipteric %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigerian</td>
<td>87.79</td>
<td>10.11</td>
<td>5.06</td>
<td>3.79</td>
</tr>
<tr>
<td>Indian</td>
<td>95.3</td>
<td>3.46</td>
<td>1.38</td>
<td>11.79</td>
</tr>
<tr>
<td>South Indian</td>
<td>93.55</td>
<td>3.52</td>
<td>2.93</td>
<td>17.3</td>
</tr>
<tr>
<td>Nigerian</td>
<td>82.1</td>
<td>23.6</td>
<td>-</td>
<td>5.7</td>
</tr>
<tr>
<td>Korean</td>
<td>76.5</td>
<td>-</td>
<td>-</td>
<td>40.3</td>
</tr>
<tr>
<td>North Indian</td>
<td>87.72</td>
<td>10.01</td>
<td>5.17</td>
<td>-</td>
</tr>
<tr>
<td>Turkish</td>
<td>88.01</td>
<td>10</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Kenyan</td>
<td>66</td>
<td>15</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>West Indian</td>
<td>91.07</td>
<td>2.4</td>
<td>1.2</td>
<td>4.8</td>
</tr>
<tr>
<td>R. Sudha et al.</td>
<td>80</td>
<td>3</td>
<td>5.3</td>
<td>11.3</td>
</tr>
<tr>
<td>MaryAntonyPrabaet al.</td>
<td>74</td>
<td>3</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Present study</td>
<td>77.74</td>
<td>7.55</td>
<td>4.55</td>
<td>13.18</td>
</tr>
</tbody>
</table>

DISCUSSION

Pterion is a bony landmark placed in the temporal fossa. It is usually H- shape; the main aim of the study was to analyze the types, the reason behind its occurrence and clinical implications of the pterion, location of different parameters from the pterion. A detailed understanding of the pterion is necessary to perform neurosurgery and diagnose and treat pathologies related to this region. The study on the types of pterion was primarily based on the works of Murphy who classifies it into 4 types namely sphenoparietal, frontotemporal, stellate and epipteric. The surface anatomy of the pterion has been widely studied by various authors in different populations. Wang et al.13 stated that population-based differences suggest that various genetic variations in humans underlie the different sutural patterns of the pterion. In the present study four types of pterion were observed. They were sphenoparietal in 77.74% of cases, frontotemporal in 7.55% of cases, stellate in 5.55% cases and epipteric in 13.18% cases. Sphenoparietal type is most common in the present study as in Asiatic Indians (95.1%), North Indians (87.72%), South Indians (93.55) and 93.48% in North Indians but is low in Koreans (76.5%) and Kenyans (66%).14,15,16,17,18,19 Present study showed 7.55% incidence of frontotemporal variety which is lower than Kenyans and Papuan (41.4%) but comparable to some study Turkish (10%) and Nigerian (10.11%). Epipteric bones were found in 13.18% of cases of skulls. The incidence was more in Korean (40%) and South Indians (17.3%) but comparable to Indian (11.79%), Kenyan (12 %) and R. Sudha et al.20 (11.3%). The present study shows that presences of sphenoparietal and epipteric bones are more common in Indian population. All these variations could be attributed to genetic and environmental factors. The incidence of sutural bone at pterion of pterion was common in primates and sphenoparietal typewas common in human beings. The anterosuperior segment of the temporal bone of the primate's mayfrontotemporal to sphenoparietal type of the pterion. If is highin Indians, and the presence of sutural bones may
or may not be associated with cranial & central nervous system anomalies.21 According to this theory, the fronto temporal type however the desquestrated portion remained permanently detached from both of the bones it becomes the epipertic type. In this study, the position of the pterion above the midpoint of the zygomatic arch is similar to other studies22,23 and the position of the pterion behind the frontozygomatic suture is only slightly different. The knowledge regarding this distance is very useful for neurosurgeons when they are treating any pathologies relating to pituitary gland. This distance also plays a very important neurosurgeon and ophthalmologist in treating the pathologies treating near the apex of orbit.

CONCLUSION

The knowledge regarding the various shapes and distances from different points to pterion is useful for treating number of pathologies in brain. So this is so useful for neurosurgeons, anatomists, anthropologist and forensic medicine. The information obtained from this study may be useful in planning prior to surgery and recognition of this anatomy may render pterional craniotomy safer. Knowledge of the location and relations of the pterion is important in relation to surgical intervention, particularly of the middle meningeal artery and Broca's motor speech area on the left side.24 We suggest that the scope of the study can be further carried out in various populations to appreciate the variations better and it will further helps in other modern commonly used modalities such as radiological analysis to better predict the structure of pterion and allow better surgical safety and efficacy.

REFERENCES


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