

A Study of the Interparietal Bones

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ABSTRACT

Background: The squamous part of the occipital bone has an upper membranous part which is called as the interparietal part and a lower cartilage part which is called as the suboccipital part. There is a controversy regarding the ossification of these two parts.

Aim: In this study, the incidence of the interparietal bone has been estimated and compared with the previous observations.

Materials: A total of 150 adult dried skulls were examined to determine the incidence of the interparietal bone.

Results: The skulls which were observed, displayed many variations in the occipital region. In 11 cases, single or multiple

separated bones were observed. In 6 (4%) cases, the lower edge of these additional bones was situated slightly above the external occipital protuberance and such bones could be classified as interparietal bones. In 5 (3.3%) cases, the lower edge of these additional bones was much higher (higher than the midline, between the lambda region and the highest nuchal line). These bones were much smaller in size. The latter can be classified as either pre-interparietal or sutural bones or as non-fused parts of the interparietal bone. Further studies are required to clarify the origin of these bones.

Key Words: Bone, Incidence, Ossification, Interparietal

INTRODUCTION

The squamous part of the occipital bone above the highest nuchal lines is developed in a fibrous membrane and it is ossified from two centres. This part of the bone may remain separate as the interparietal bone. Below the highest nuchal lines, the squamous part is pre-formed in the cartilage and it ossifies from two centres [1].

The upper membranous part is called as the interparietal part and the lower cartilage part is called as the sub-occipital part [2,3,4]. There is a controversy regarding the ossification of these two parts. Ranke [5] described the interparietal part as developing from three pairs of ossification centres and the occasional appearance of an additional fourth pair at the upper angle of the interparietal part. Others [6,7,8] stated that two pairs of ossification centres formed the interparietal part and they defined the additional pair as a primordium of the pre-interparietal bone.

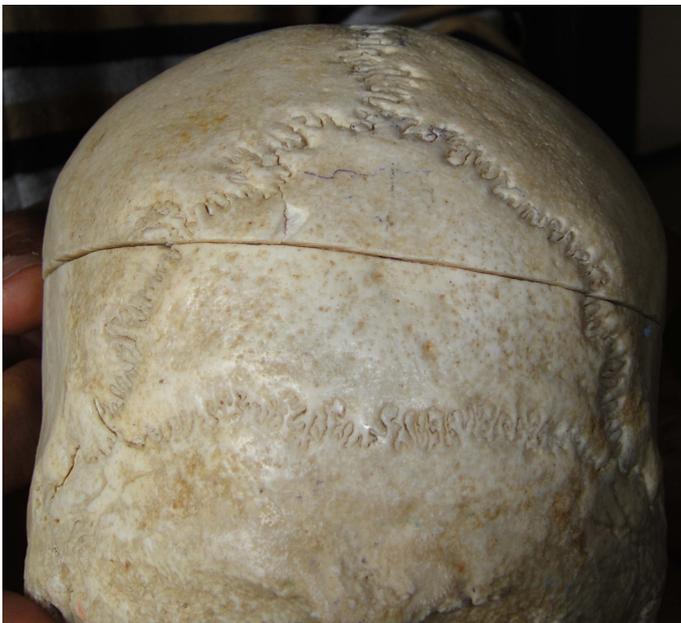
Terms like the 'inca bones' and the 'pre-interparietal bone' have been introduced, but Srivastva [9] stated that there was no pre-interparietal bone and that it should not be confused with the sutural bone which developed from its own ossification centre in the region of the lambda and the lambdoid suture, outside the limits of the interparietal bone and with the independent bone or bones developing in the interparietal region, which are actually parts of the interparietal bone. He further stated that the supra-occipital part develops both in the cartilage and the membrane. At the upper margin, the bone which lies between the superior and highest nuchal lines, which is known as the torus occipitalis transversus, is ossified in the membrane by a pair of centres. This segment of the bone is labeled as the intermediate segment, which probably never separates from the cartilaginous

supra-occipital part. The interparietal bone which lies above the highest nuchal lines, develops in the membrane from two pairs of centres, one pair for the lateral plate and the other pair for the medial plate. Each centre consists of two nuclei and the failure of the fusion between these centres or their nuclei with each other and with the supraoccipital part, may give rise to various anomalies in the interparietal region. This is the true interparietal bone which has migrated from the parietals of lower animals during evolution to become a part of the occipital bone in man. When it appears as an anomaly in the form of an independent separate bone, the suture between it and the supra-occipital bone lies at the level of the highest nuchal lines. Matsumra et al., [10] described the presence of the pre-interparietal bones and stated that these bones developed from additional ossification centres and that they could be clearly differentiated from other anomalies (sutural bones) in the lambda region by the shape of their territory and by their location.

In this study, the incidence of the interparietal bone has been estimated and compared with the previous observations.

MATERIALS AND METHODS

A total of 150 adult dried skulls were examined to determine the incidence of the interparietal bone. These skulls were taken from the archives of the Departments of Anatomy of Christian Medical College, Ludhiana, the Gian Sagar Medical and Dental College, Banur, Patiala and the Swami Devi Dayal Dental College, Barwala, India. The numbers of the additional bones- whether they divided the occipital bone into 2 (bipartite), 3 (tripartite) or more (multipartite occipitals) and the position of the additional bones- right (dextra) or left (levo) were noted.



[Table/Fig-1]: Skull showing triangular interparietal bone

RESULTS

The skulls which were observed, displayed many variations in the occipital region. In 11 out of 150 skulls (7.33%), single or multiple separated bones were observed.

In 6 (4%) cases, the lower edge of these additional bones was situated slightly above the external occipital protuberance. Out of these 6 skulls, two cases had a single, big, rhomboid shaped additional bone (symmetric bipartite occipital bone), one case had a single big triangular bone (symmetric bipartite occipital bone) [Table/Fig-1], two cases had a big additional bone only on the right side (dextra asymmetric bipartite occipital bone) [Table/Fig-2] and in one case, bones which were similar to [Table/Fig-2] were seen on both the sides (symmetric tripartite occipital bone).

In 5 (3.3%) cases, the lower edge of these additional bones was much higher (higher than the midline between the lambda region and the highest nuchal line). These bones were much smaller in size. In 3 cases, a single triangular bone (symmetric bipartite occipital bone) was observed, while in another skull, such a triangular bone was found to be divided into two halves by a midline suture (symmetric tripartite occipital bone) and in one case, three small ossicles (symmetric multipartite occipital bone) were observed in the region.

DISCUSSION

The inca bones have been named so, because of their abundance in mummies from the inca civilization which was found in Peru. The incidence of the interparietal bones varies among different populations. It is 15% in Nigerians, 1.2% in Europeans, 0.8% in Australians, 4.8% in north Americans and 2.8% in Turkish, but it has been reported to be as high as 27.71% in Peruvian skulls. Phylogenetically, while it ascended the hierarchy of evolution, the interparietal bone which was a part of the parietal bone in ruminants, ungulates and carnivores, shifted to the occipital bone in rodents onwards to the primates [11].

In the present study, various types of additional bones were observed in the occipital region. Matsumura et al., [10] classified these bones into three types: the interparietal, pre-interparietal and the sutural bones. The interparietal (inca) bones have their lower



[Table/Fig-2]: Skull showing interparietal bone only on right side

edge situated slightly above the external occipital protuberance, the pre-interparietal bones have their lower edge situated higher than the midline between the lambda region and the highest nuchal line, while the sutural bones have an irregular arrangement and they do not possess a triangular outline. But according to Srivastava [9], there is no preinterparietal bone and it should not be confused with the sutural bone or the non-fused parts of the interparietal bone.

So in the present study, the additional bones with their bases situated slightly above the external occipital protuberance, can definitely be classified as the interparietal or the inca bones, while the rest (having their lower edge situated higher than the midline between the lambda region and the highest nuchal line) fall under the category of the pre-interparietal bone according to Matsumura et al., [10] and also under the category of the sutural bones or the non-fused parts of the interparietal bone, according to Srivastava [9]. Further studies on the development of these bones are required to clarify the origin of these additional bones in the occipital region.

REFERENCES

- [1] Newell RLM. The back. In: *Gray's Anatomy*. 40th edition, Churchill Livingstone Elsevier; 2008; 711.
- [2] Hussain Saheb S, Mavishetter GF, Thomas ST, Prasanna LC, Muralidhar P. Incidence of the interparietal bones in the human skulls of south India. *J Biomed Sci Res* 2010; 2, 86-88.
- [3] Yucel F, Egilmez H, Akgun Z. A study on the interparietal bone in man. *Tr J Med Sci* 1998; 28, 505-09.
- [4] Zambare BR. Incidence of the interparietal bones in adult skulls. *J Anat Soc India* 2001; 50, 11-12.
- [5] Ranke J. Uber dasinterparietale und die Verknöcherung des Schädeldachs beim Affen. 1913 Cited in: *Quain's Elements of Anatomy*, vol IV, 11th edn, part 1, Longman Green: London, 1915; 53-55.
- [6] Brash JC. In *Cunningham's Text-book of Anatomy*. Romanes GJ editors. 9th edn, Oxford University Press: London, 1951; 220.
- [7] Breathnach AS. In *Frazer's Anatomy of the Human Skeleton*. 6th edn, J Anat. Churchill: London, 1965; 190.
- [8] Gopinathan K. A rare anomaly of 5 ossicles in the pre-interparietal part of the squamous occipital bone in north Indians. *J Anat* 1992; 180, 201-02.
- [9] Srivastava HC. Ossification of the membranous portion of the squamous part of the occipital bone in man. *J Anat* 1992; 180, 219-24.
- [10] Matsumura G, Uchiumi T, Kida K, Ichikawa R, Kodama G. Developmental studies on the interparietal part of the human occipital squama. *J Anat* 1993; 182, 197-204.
- [11] Dharwal K. Os incae- morphometric, clinical and medicolegal perspectives. *J Anat Soc India* 2011; 60, 218-23.

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