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A Study on the Interparietal Bone in Man

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Abstract: In the present study a total of 44 dry skulls and 500 skull films from the Sivas region of Turkey were examined to determine whether or not the interparietal bone was present. The incidence of

interparietal bones was found to be 2.8 percent (15/544).

Key Words: Interparietal bone, human skull.

Introduction

The squamous portion of the occipital bone consists of two different parts: the upper, interparietal part, which is a membrane bone, and the lower, supraoccipital part, which is a cartilage bone. According to some researchers, the boundary between these parts is the highest nuchal line (1-5). Others, however, have identified the boundary to be the superior nuchal line (6, 7). In a recent experimental study on human fetuses, Srivastava (8) concluded that the boundary is the highest nuchal line, but in contrast to previous studies, states that the supraoccipital part, which lies below this line, is partly membrane bone and partly cartilage bone. The area between the highest and superior nuchal lines, called the intermediate segment, is composed of membrane bone.

The membranous part of occipital bone develops above the superior nuchal lines by three pairs of centres (8). The first pair, in which each centre consists of one nucleus, lies between the superior and highest nuchal lines and is known as the torus occipitalis transversus or lamella triangularis. These two ossification centres form the intermediate segment. Above the intermediate segment, there is a second pair of centres, one on each side of the midline, each of which has two nuclei, lateral and medial. These four nuclei form the lateral plate of the interparietal. The lateral portion of the lateral plate is separated from the intermediate segment by the lateral fissure. The third pair of centres consists of two nuclei on each side, upper and lower, forming the medial plate of the interparietal. Between the two medial plates there is a deep median fissure (Fig. 1).

Thus, formation of the interparietal bone depends on the separation of the intermediate segment and the lateral plate by the Sutura Mendosa (sutura occipitalis transversa). This means that the interparietal bone is formed by the lateral and medial plates together. Failure of fusion of these centres or their nuclei with each other

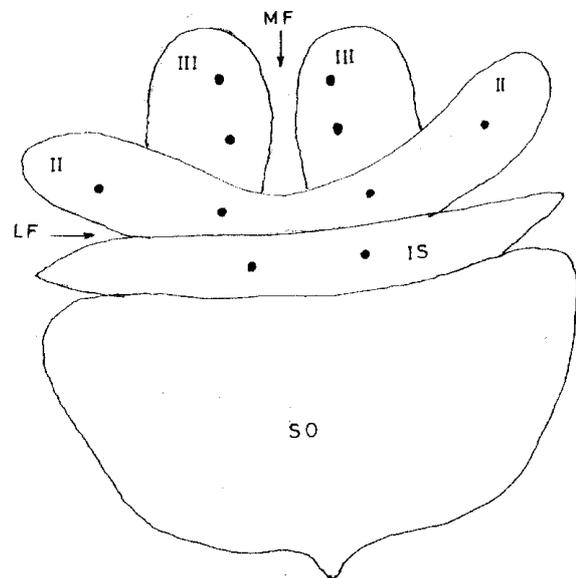


Figure 1. Diagram showing the ossification centres and their nuclei in the membranous part of the occipital bone above the supraoccipital bone (8). IS: Paired centres of the intermediate segment. II: 2nd pair of centres (lateral plate) with the medial and lateral nuclei. III: 3rd pair of centres (medial plate) with upper and lower nuclei. SO: Supraoccipital bone. LF: Lateral fissura. MF: Median

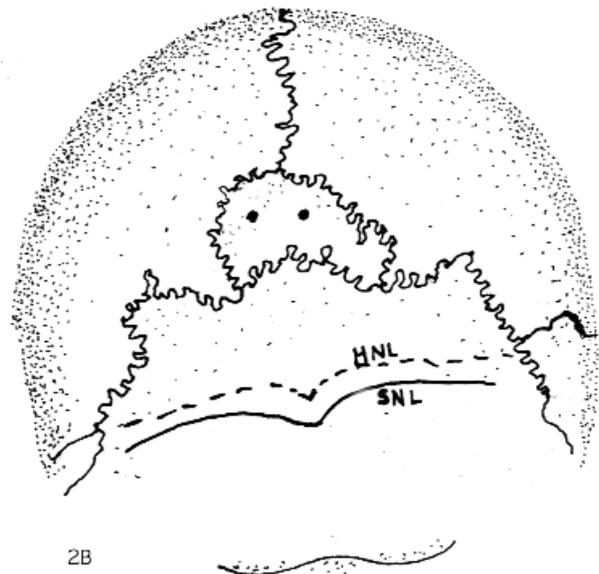


Figure. 2. 2A, 2B: An interparietal bone with its suture which is formed by the upper nuclei of the third pair. HNL: Highest nuchal line. SNL: Superior nuchal line.

or the intermediate segment gives rise to various anomalies of the interparietal bone (8).

In some previous studies, the pre-interparietal bone has been described as being located beside the interparietal bone. It is accepted that a true pre-interparietal bone can be seen when additional centres occurring anterior to the interparietal bone fail to fuse (1, 3, 9, 10). However, Srivastava (10), in his recent study, considers the pre-interparietal bone to be part of the interparietal bone, stating that the term "pre-interparietal" is a misnomer and should be avoided.

The purpose of this study was to check the appropriateness of our cases to the ossification centres

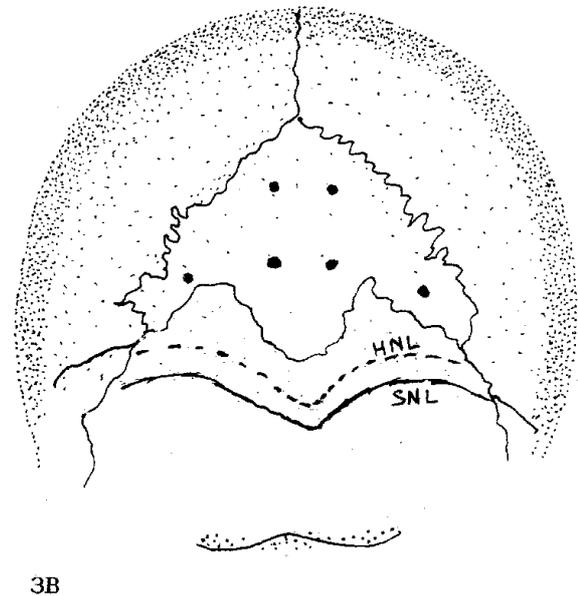
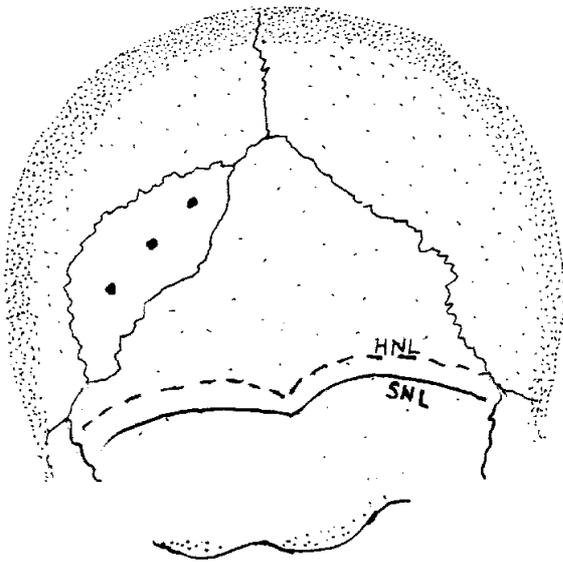
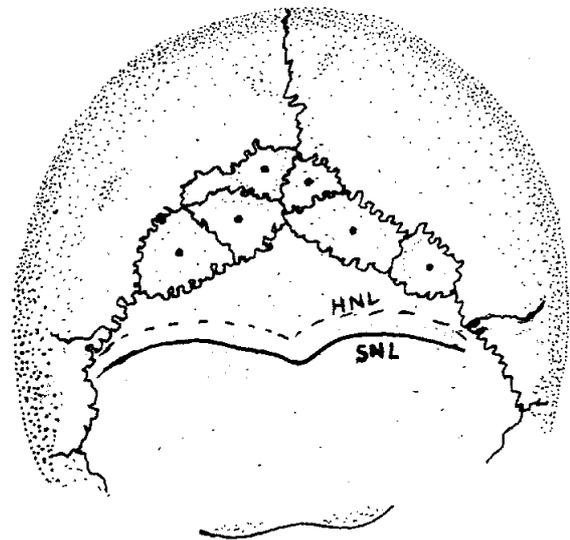


Figure. 3. 3A, 3B: An interparietal bone with its suture which is formed by the upper and lower nuclei of the third pair, and the lateral nuclei of the second pair on each side. HNL: Highest nuchal line. SNL: Superior nuchal line.



4B
 Figure 4. 4A, 4B: An interparietal bone with its suture which is formed by the upper and lower nuclei of the third pair, the lateral nucleus of the second pair on the left side. HNL: Highest nuchal line. SNL: Superior nuchal line.

suggested by Srivastava (8) and observe the incidence of interparietal bones, which varies among different groups of humans, in adult skulls from the Sivas region of Turkey.



5B
 Figure 5. 5A, 5B: Six independent bones with their sutures which are formed by all nuclei of the third pair, and the lateral nuclei of the second pair on each side. Each nucleus was separated from the neighbouring nuclei by a suture. HNL: Highest nuchal line. SNL: Superior nuchal line.

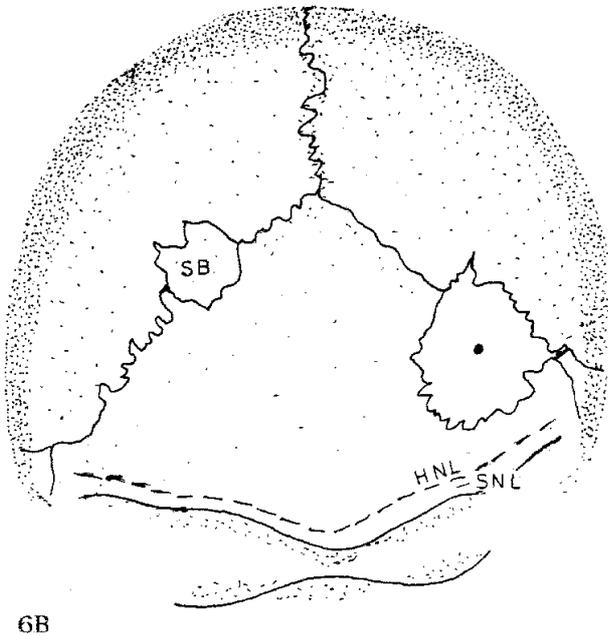


Figure 6. 6A, 6B: An interparietal bone with its suture which is formed by the lateral nucleus of the second pair on the right side. NHL: Highest nuchal line. SNL: Superior nuchal line. SB: Sutural bone (long arrow).

Material and Method

The material used in this study consisted of 44 adult skulls in the Department of Anatomy and 500 skull films taken in anteroposterior, lateral and Town position (an x-ray beam passing through the midpoint of the upper part of forehead of the supine patient, making an angle of 30° with the cranio-caudal plane). These materials were examined for the presence of the interparietal bone and the incidence was recorded.

Results

A total of 15 cases of interparietal bones were determined out of 544 skulls examined. The incidence of interparietal bones was 2.8 percent.

The complete separate interparietal bone (with fusion of all nuclei of the second and third pairs of centres) was not seen in any of the cases.

In seven cases, the interparietal bones were formed by the fusion of the upper two nuclei of the medial plate (Fig. 2A, 2B).

In five cases, a separate bone in the interparietal region was formed by the medial plate with all nuclei and lateral nuclei of the lateral plate. The medial nuclei of the lateral plate were fused to each other and to the supraoccipital part below (Fig. 3A, 3B).

In one case, a separate bone was formed by both the lower and upper nuclei of the medial plate and the lateral nucleus of the lateral plate on the left half of the occipital bone (Fig. 4A, 4B).

In one case, six independent bones were formed both by all nuclei of the medial plate, and the lateral nuclei of the lateral plates on both sides of the midline. All bones were separated from the others by sutures. The medial nuclei of the lateral plates were not fused to the separate bones (Fig. 5A, 5B).

In one case, a separate bone was formed by the lateral nucleus of the lateral plate of the right side (Fig. 6A, 6B).

Discussion

All anomalies of the interparietal bone in our series of skulls could be interpreted easily in the light of the ossification centres observed by Srivastava (8).

Previous studies describe pairs of centres in the interparietal part of the squamous portion of the occipital bone. The first pair is above the supraoccipital cartilage and is formed of two lateral plates of bone. A second pair of centres lies between these two lateral plates on either side of the midline. According to Pal (1), the lower boundary of these centres is very close to the external occipital protuberance. He mentions a third pair of centres seen occasionally near the upper angle of the bone. When this third pair remains unfused with the rest of the second pair of centres it is called the pre-interparietal bone. When we compare these centres with Srivastava's ossification centers, the lateral centers in Pal's study (1) lack the medial nuclei determined by Srivastava (8). This is possibly due to non-fusion of the medial nuclei of the lateral plates to the any separate bone

in this region other than the complete interparietal bone. Furthermore, in Pal's study (1) there is no mention of the intermediate segment. This segment is a piece of the supraoccipital part of the occipital bone which never separates from the lower piece of the supraoccipital part of the occipital bone, which is a cartilage bone.

As seen in figure 5, there are six independent bones in the interparietal region. In this sample, four nuclei of the medial plates and only the lateral nuclei of the lateral plate remain separate from each other, but the medial nuclei of the lateral plate are fused to each other and to the supraoccipital bone below.

According to Srivastava (8), all the bones seen in the region of the lambda and lambdoid suture outside the interparietal area are sutural or Wormian bones and are, in man, clearly the result of fragmentation of an originally single centre. Sometimes, sutural bones are confused with pre-interparietal bones. To prevent this confusion, the ossification centres and nuclei determined by Srivastava should be known. Furthermore, by knowing these ossification centres and their nuclei, we can differentiate the interparietal bone and its variations from fractures of the occipital bone. The radiographs taken in

Town position were excellent for the evaluation of the occipital bone.

The incidence of the interparietal bone varies among different groups of man. For example, it is 15% in Nigerians (both the interparietal and pre-interparietal bones), 1.2% in Europeans, 0.8% in Australians, 4.8% in Northern Americans, 2.4% in Indians (both the interparietal and pre-interparietal bones), (3, 4, 11). In Turkish skulls this incidence has been observed to be a 4% (6/150) by Cireli & Tetik (11); 3.8% (16/420) by Mağden & Müftüoğlu (12); and 6.59% (6/91) by Aycan (13). In the present study, it was found to be 2.8% (15/544). The incidence reported by Aycan is comparatively high. This incidence may have been affected by the number of samples used in his study.

In conclusion, the interparietal bone can be appear in various forms depending on the ossification centres and their nuclei in this region. Therefore, all bones that are not sutural or Wormian bones in the interparietal part of the occipital bone when it occurs in man are part of the interparietal bone. The term pre-interparietal is a misnomer and the incidence of the pre-interparietal bone should not be reported separately.

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