INCIDENCE OF INTERPARIETAL (INCA) BONES IN THE POPULATION OF ASSAM
Rubi Saikia¹, Bijoy Kumar Borah², Jyotirmayee Lahon³, Natasha Gohain⁴

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ABSTRACT: The occipital bone forms the region of the back of the head. It consists of three parts- the squamous part, the basilar part and the two condylar parts on either side of the foramen magnum. The squamous part of the occipital bone consists of two parts – the upper interparietal and the lower supraoccipital part. Usually the interparietal part fuses with the supraoccipital part but sometimes it may remain separated by a suture. Then it is called interparietal bone or Inca bone. AIM & OBJECTIVES: The aim of the present study is to find out the incidence of interparietal or Inca bones in this part of north east India as data regarding its incidence rate and number of fragments of Inca bones from Assam is still underreported. MATERIALS & METHOD: In the present study, a total of 126 dry adult skulls were examined to know the incidence of Inca bones. All the specimens were procured from various departments in Assam Medical College, Dibrugarh, Assam. They were first examined for presence or absence of Inca bones and then for number of fragments. RESULTS & OBSERVATIONS: The incidence of Inca bone was found to be 1.58%. One skull presented with a single triangular Inca bone while another skull presented with two fragments of Inca bones. CONCLUSIONS: The knowledge regarding interparietal bones and that it may present with many fragments is certainly very useful for neurosurgeons, radiologists and anthropologists. KEYWORDS: Interparietal bones, Inca bones, Squamous, Suture, Occipital bone, Supraoccipital, cartilaginous.

INTRODUCTION: The squamous part of the occipital bone consists of two parts- the upper interparietal part & the lower supraoccipital part. Usually these two parts fuse but sometimes the interparietal part may remain separated from the supraoccipital part by a well-defined suture. It is then called the interparietal bone or Inca bone.(¹) The interparietal part develops in membrane whereas the supraoccipital part develops both in cartilage and membrane. The segment of supraoccipital bone between the highest and superior nuchal line forms the intermediate segment. It ossifies in membrane and probably never separates from the cartilaginous supraoccipital part.(²) The interparietal bones or Inca bones are bounded superolaterally on either side of the median plane by the lambdoid suture and inferiorly by sutura mendosa (transverse occipital suture).(³) Inca bones in humans were first found in the skulls of contemporary indigenous people of southern Andes as well as in those of mummies of the Inca civilization. Although Inca bone was originally encountered as a variation in South American and Latin American cranial remains, this variation does occur in people from all geographic regions of the world. Inca bones were previously known as os-Incae, os-interparietale, Gothe’s ossicle.(⁴) Inca bones resembles a triangular architectural monument design of the Inca tribe.(⁵) The members of
Royal family of Inca tribe had a crown like configuration on their head. Hence thereafter these ossicles have been known as Inca.\textsuperscript(6) The occurrence of Inca bone is rare as compared to sutural or wormian bones. Data on the incidence and number of fragments of Inca bones in Assamese population is under-recorded. Keeping this in mind, the present study was undertaken and the data collected was compared with other relevant literature.

**MATERIALS & METHODS:** The study was carried out in 126 dry human adult skulls of unknown sex, procured from the department of Anatomy, department of Forensic science & the Institute of Pharmacy at Assam Medical College, Dibrugarh, Assam. The selected skulls were without any antemortem or postmortem injuries. The skulls were examined macroscopically to determine the presence or absence of interparietal or Inca bones. Also the number of fragments of Inca bone was noted. Next, the length and width of the Inca bones were measured. The data collected was tabulated, analyzed and compared with others.

**Exclusion & Inclusion Criteria:** Adult skulls without any antemortem or postmortem injuries were only considered fit for the present study. Skulls with fractures were discarded.

**RESULTS AND DISCUSSION:** Among the 126 skulls, only 2 (1.58\%) skulls showed the presence of interparietal or Inca bones. Of these, one skull had a single large triangular interparietal bone (photograph A) while the other skull had two fragments, right & left, of interparietal bones (photograph B).

<table>
<thead>
<tr>
<th>No. of fragments found</th>
<th>No. of skulls</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Median</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Bipartite</td>
</tr>
</tbody>
</table>

Table 1: Showing the number of fragments of interparietal or Inca bones
Table 2: Showing the measurements of interparietal or Inca bones

<table>
<thead>
<tr>
<th>Type</th>
<th>Maximum length (cm)</th>
<th>Maximum width (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>6.4</td>
<td>12.3</td>
</tr>
<tr>
<td>Bipartite</td>
<td>4.1</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>3.3</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Available literature suggests that the occurrence of interparietal or Inca bones is rare.\(^{(3)}\) Studies also show that its incidence rate varies among different population around the world. It is found to be 1.2% in Europeans, 0.8% in Australians, 2.4% in Indians, 15% in Nigerians & 2.8% in Turkish population.\(^{(1,7)}\) The Inca bone may exist as a single bone, two symmetrical halves, in three pieces or even four in which case the upper two constitutes the preinterparietal bones.\(^{(8)}\) According to Srivastava HC,\(^{(2)}\) the membranous portion of squamous part of occipital bone develops from three pairs of Centre’s. The first pair of Centre forms the intermediate segment, which form the portion of the bone between the superior and highest nuchal lines and always fuses with the cartilaginous supraoccipital part. The second and third pairs of centers form the interparietal or Inca bone which lies above the highest nuchal line. The second pair consists of medial and lateral nuclei and it forms the lateral plate. The third pair consists of upper and lower nuclei which forms the medial plate. (Fig. 1)

Figure 1: Diagrammatic representation of ossification centres and their nuclei in the membranous part of the occipital bone above the supraoccipital bone (SO) - paired centres of the intermediate segment (IS), medial and lateral nuclei of second pair of centres (II) which will form the lateral plate and upper and lower nuclei of third pair of centres (III) which will form the medial plate.\(^{(2)}\)
Table 3: The incidence of interparietal or Inca bones as reported by various workers are as follows;

<table>
<thead>
<tr>
<th>Worker</th>
<th>Year</th>
<th>No. of skulls studied</th>
<th>Incidence of Inca bone found</th>
</tr>
</thead>
<tbody>
<tr>
<td>Srivastava HC(9)</td>
<td>1977</td>
<td>620</td>
<td>0.8%</td>
</tr>
<tr>
<td>Singh et al(7)</td>
<td>1979</td>
<td>500</td>
<td>1.6%</td>
</tr>
<tr>
<td>Pal et al(10)</td>
<td>1984</td>
<td>348</td>
<td>2.6%</td>
</tr>
<tr>
<td>Saxena et al(11)</td>
<td>1988</td>
<td>40</td>
<td>2.5%</td>
</tr>
<tr>
<td>Gopinathan(11)</td>
<td>1992</td>
<td>125</td>
<td>0.8%</td>
</tr>
<tr>
<td>Katkie et al(12)</td>
<td>1995</td>
<td>302</td>
<td>0.99%</td>
</tr>
<tr>
<td>Yucel et al(13)</td>
<td>1998</td>
<td>540</td>
<td>2.8%</td>
</tr>
<tr>
<td>Zambare BR(14)</td>
<td>2001</td>
<td>310</td>
<td>0.99%</td>
</tr>
<tr>
<td>Marathe et al(3)</td>
<td>2010</td>
<td>380</td>
<td>1.31%</td>
</tr>
<tr>
<td>Nirmale et al(15)</td>
<td>2012</td>
<td>148</td>
<td>4.054%</td>
</tr>
<tr>
<td>Walukar et al(16)</td>
<td>2013</td>
<td>175</td>
<td>2.86%</td>
</tr>
<tr>
<td>Present study</td>
<td>2015</td>
<td>126</td>
<td>1.58%</td>
</tr>
</tbody>
</table>

In the present study carried out on 126 skulls, interparietal or Inca bone was found in 2 (1.58%) skulls only. One of these skulls presented with a single, triangular interparietal bone and the other presented with two asymmetrical fragments of interparietal bones. Keith(17) stated that a separate single interparietal bone in man is an extremely rare anomaly. Our findings is similar to the findings of Singh et al and Marathe et al.(7,3)

CONCLUSION: It can be concluded that Inca bones may exist as one, two or more fragments and they may be of various sizes. It can also be concluded that the incidence of Inca bones is variable in different population. Inca bone may give rise to false appearance of skull fracture in x-rays. Its mere presence may lead to complications during burr-hole surgery. Meticulous knowledge about their incidence rate in different population and that they might exist in more than one fragment would be useful to the radiologists, clinicians and neurosurgeons. This information could also be useful in anthropological and anatomical studies.

REFERENCES:

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