Indian Journal of Basic and Applied Medical Research; June 2015: Vol.-4, Issue- 3, P. 488-491

Original article

Incidence of interparietal bone in population of Rajasthan

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Abstract:

Introduction: Human occipital bone consists of a interparietal part ossified in membrane and an supraoccipital part that develops in cartilage. Interparietal part of occipital bone above the highest nuchal line develops in membrane from two pair of centers and failure of fusion between these centers with each other or with supraoccipital part of occipital may give rise to interparietal bone or inca bone. Present study was undertaken to macroscopically evaluate the incidence of these variations and to investigate the development of the interparietal part of occipital squama of interparietal bone in the Northern Rajasthan region.

Materials & Methods: Eighty two skulls were examined for the presence of interparietal bones.

Results: Presence of interparietal bone was observed in only one skull, thus the percentage of interparietal bone was found to be 0.99.

Conclusion: incidence of interparietal bones are variable in different ethnic groups and hence it requires studies on different racial/ population basis. The presence of series of bony skull variations like interparietal bone may lead to problems in surgical approach to the cranial cavity.

Keywords: Interparietal bone, Squamous occipital bone, Anthropology.

Introduction

The skull is most complex and important component of vertebrate skeleton, as well as most studied and documented. This may be due to its association with neural system. In terms of homology and phylogeny, the bone and cartilaginous structures form the skull, with the same name in fishes are counterparts in mammals and maintain constant relationships with the nervous system. It is a well established fact that skull of beings like us as human beings are derived from our ancestors and have less bones than others. This happens in process of evolution and this might be due to fusion of bones of skull.[1] Supernumerary bones /wormian bones, other variants can be generated by differences in the skull ossification processes as discussed by Olaus Worm in the seventeenth century, they were also cited in the pharmacopoeias of Greeks physicians who employed these variations for the healing of neural diseases such as epilepsy.[1-3]

According to study done by Bergman et al. nearly 40% of skulls have sutural bones in the vicinity of the lambdoid suture. The next most common variation is the epipteric bone (pterion ossicle) found near the anterolateral fontanelle. The occurrence of one less studied variation preinterparietal bone or Inca bone at the lambda has been reported by few researchers. [5-7] Various studies have shown that the presence of these skull variations are associated with other cranial and central nervous system abnormalities.[6,8,9]

Human occipital bone consists of a interparietal part ossified in membrane and an supraoccipital part that develops in cartilage. Ranke described that interparietal part develops from 3 pairs of ossification centers and occasionally one additional 4th pair appears at the

upper angle.[10] While few other investigators reported that 2 pairs of centers form the interparietal part and additional pair as a primordium of the preinterparietal bone.[11-13] While Pal et al. stated that the additional pair the upper central part of the interparietal squama rather than forming true preinterparietal bone.[8] Shrivastava described that interparietal part of occipital bone above the highest nuchal line develops in membrane from two pair of centers and failure of fusion between these centers with each other or with supraoccipital part of occipital may give rise to interparietal bone or inca bone.

True Inca bones are bounded by sutura mendosa (transverse occipital suture) and lambdoid suture. These were previously known as os-incae, os-ipactal or Goethe's ossicles. Later on, Shapiro and Robinson (1976) reported Inca bones in Inca tribal's in south Andes-America.[15]

The presence of the interparietal bone in human populations were reported by several researchers as in native Americans, modern Japanese and Indian sub continental populations.[5,7,8,14,16]

The anatomical variations in skull are of great importance to Neurosurgeons, Radiologists, anthropologists and anatomists itself. The present study was undertaken to macroscopically evaluate the incidence of these variations and to investigate the development of the interparietal part of occipital squama of interparietal bone in the Northern Rajasthan region.

Material and methods

A total of eighty two skulls collected from different medical institutes of Rajasthan (INDIA) were studied. Skulls were examined for the presence of interparietal bones. The skulls were macroscopically observed with naked eye and with magnifying glass if required and photographed for further analysis. The statistical method used was the percentage relative frequency.

Observations

In present study, a total of eighty two skulls were examined. Presence of interparietal bone was observed in only one skull, thus the percentage of interparietal bone was found to be 0.99. (Fig-1)

Discussion

Neurocranium is derived from neural crest and paraxial mesoderm. The interparietal bone is a composite bone derived from both elements; that's why it is akin to a sutural bone. Development of the occipital bone shows phylogenetic differences. The interparietal bones fuses with parietal bones in marsupials and sirenia and with both parietal and occipital bones in rats, but they remain separate in most mammals.[14,17] The interparietal bone begins to fuse before birth and closure is completed between the second and fourth year of life.[18,19]

Table 1: Incidence of interparietal bone

Author.	Number of bones (n)	% of variation found
Shrivastava (1977)[14]	620	0.8
Singh et al (1979)[20]	500	1.6
Pal et al (1984)[8]	348	2.6
Cireli et al (1985)[21]	150	4
Saxena et al (1986)[7]	40	2.5
Gopinathan (1992)[13]	125	0.8
Aycan (1993)[22]	91	6.6
Present study (2015)	82	0.99

The development of occipital bone has been studied by various authors and it has been documented that failure of fusion of the ossification centers in the interparietal part remain as a separate interparietal or inca bone. In man these separated bones are named as os inca and may be single triangular piece or in multiples.

The incidence of a single separate interparietal bone is rare, ranging from 0.4% to 2.6%.[2,8,9,13,14,20] Even some higher figures were reported by Cireli et al.-4% and Aycan- 6.6%.[21,22] Saxena et al. reported a 10% incidence of a single interparietal bone in his study, but his sample size of 40 skulls was small compared to other studies.[7] In our study the incidence of 0.99% was found. (Table-1)

Geographic patterns of frequency distribution of the interparietal bone suggest its possible genetic basis as it is relatively low in Central and West Asia and in Europe and relatively high in New World populations with New World and the Subsaharan samples exhibiting the Inca bone in relatively high frequencies.[23] Higher incidence was found in Tibetan/Nepalese and Assam/Sikkim populations and in Eskimos. Ossenberg pointed out that among modern peoples, frequencies are highest in marginal isolates that believed to have retained traits of their early ancestors who migrated to the periphery due to population pressure in central areas.[16] Torgersen suggested that the interparietal bone is inherited as a dominant trait with about 50% penetrance.[24] Studies in mice subjects also suggest a genetic component in development of inca bone.[25]

Thus, we can be conclude that the incidence of interparietal bones are variable in different ethnic groups and hence it requires studies on different racial/ population basis. The presence of series of bony skull variations like interparietal bone may lead to problems in surgical approach to the cranial cavity. These bones may misguide and led to confusions in reading the radiographs in the cases of head injuries. The incidence of these skeletal variations is of extreme importance in fields like anthropology, anatomy, forensic science and is also useful on a day to day basis to neurosurgeons and orthopedic surgeons.

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