

ORIGINAL ARTICLE

Prevalence of Epipteric Bones in Central Indian Adult Dry Skulls

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Abstract:

Background: A sutural bone is present at the pterion then it is called "Epipteric" or "Flower's bone". They are frequently present in a variety of congenital disorders like hypothyroidism, cleidocranial dysostosis, progeria, rickets etc. Their presence is clinically important because it may lead to complication in making burr holes at pterion. **Aim and Objectives:** To find the incidence and number of Epipteric bones in Indian dry skulls of known sex. **Material and Methods:** In the present study, pterion region of 90 dried adult human skulls of known sex were examined for presence or absence of Epipteric bone. **Results:** Present study observed the incidence of Epipteric bones to be 13.33%. Incidence rate was higher in female skulls than male skulls (male: 10.83%; female: 18.33%). **Conclusion:** This data gives idea regarding overall incidence of Epipteric bones in human skulls of India. The knowledge of this variable is useful for neurosurgeons, anthropologists and radiologists.

Keywords: Epipteric Bone, Suture, Dry Skull, Pterion, Lambdoid Suture

Introduction:

A small, isolated irregular shaped bone, which are present in cranial sutures and fontanelles are known as Sutural or Wormian Bones (WB). Their number varies from person to person and can be present on either side of the skull. Usually, not more than two or three are found in a single individual, but more than one hundred have been found in the skull of a

hydrocephalic adult [1-2]. These bones are present more frequently in the course of the lambdoid suture but may be occasionally seen within the sagittal and coronal sutures [2]. In 1643, Olaus Wormius who was the Danish anatomist described these bones in a letter to Thomas Bartholin [3-4]. They are usually irregular in shape but they may be round, oval, triangular, polygonal. Also, they can vary in size from under 1 mm to 5 cm³. "Inca bone" or "Goethe's ossicle is a large sutural bone that is present at lambda [1]. When a sutural bone is present at the pterion then it is called "Epipteric" or "pterion" or "Flower's bone" or "oss Epipteric" [2,5]. They are variable in size, shape and can be present on either side of the skull. WBs are present in healthy individuals, but their high incidence of multiple WBs have been seen frequently in a variety of congenital disorders like hypothyroidism, cleidocranial dysostosis, progeria, hypophosphatasia, rickets etc. Also, these bones are very useful in primary diagnosis of brittle bone disease osteogenesis imperfect [6-8].

In 1884, numerous Epipteric bones were observed in skull of monkeys, dogs and other carnivores, and sheep by Sutton [9]. Incidence of these bones show the variation in various ethnic groups which may be due to genetic or environmental influences. The highest incidence is observed in Chinese

population [10]. Precise knowledge of Epipteric bones is essential to the human anatomy, physical anthropology and forensic medicine imaging and radiologist [11]. Their presence is clinically important because it may lead to complication in making burr holes at Pterion. Also, may be mistaken for fracture of skull in case of trauma of Pterion region. Due to clinical implication detail information of their presence, prevalence and number is essential to clinicians. Data on prevalence and number of epipteric bones from India are less reported. Hence, this study was undertaken.

Material and Methods:

The study was conducted on total of 90 (60 male; 30 female) dried adult human skulls of known sex.

The skulls that had the 3rd molar erupted were consider adult. Skulls with intact vault and articulated were included in this study and skull exhibiting advanced synostosis of the suture in the pterion were excluded. Both sides of the skulls were observed for the presence or absence of Epipteric bone and their numbers.

Results:

We observed a total of 180 pterion sites (i.e. right 90 and left 90). Overall prevalence of Epipteric bone was 13.33% (24 Epipteric bones in 90 skulls i.e. 180 pterions) (Figs.1, 2), (Table1). We observed higher prevalence in female skulls than male skulls (female: 18.33%; male: 10.83%) (Table 1). Out of the twenty four observed Epipteric bones, in one skull they were two in number (Fig.1).

Table 1: Incidence of Epipteric Bones

Epipteric Bone	Bilaterally	Unilaterally			Percentage
		Right	Left	Total	
Male (n=120)	4	5	4	9	10.83
Female (n=60)	2	2	7	9	18.33
Total (n=180)	6	7	11	18	13.33



Fig. 1: Shows Two Epipteric Bones (Black Arrows) on Left Side of Skull



Fig. 1: Shows Single Epipteric Bone (Black Arrow) (Ep) on Right Side of Skull

Discussion

WBs are supernumerary, accessory and small bones which are interposed between cranial bones and most commonly located in the lambdoid suture. They are present in both sexes and on both sides. Number and frequency of Epipteric bone is variable in different populations. The exact cause of these bone formation is not known but various hypothesis have been put forward but neither of these theories has been accepted universally. According to Ranke (1898) there was an additional portion of the greater wing of sphenoid bone near its postero-superior border having a separate center for ossification which fuses with the greater wing in 4th foetal month as a rule. When this center failed to unite that time an Epipteric bone formation takes place [12]. This is the most accepted hypothesis to explain the origin of these bones by many researchers.

According to Bergman *et al.* nearly 40% of skulls contain sutural bone in lambdoid suture [2] and the next most common sutural bone is the Epipteric bone which is present near the former anterolateral fontanelle. Presence of sutural bones is associated with other cranial and central

nervous system abnormalities [13].

Jeanty *et al.* (2000) [14] have reported the presence of WBs in four fetuses. But in these cases there were no associated anomalies. Erosy *et al.* (2003) [15] concluded in his paper that, in skulls with an Epipteric bone, the Pterion can mistakenly be assessed to be at the most anterior junction of bones and a burr hole placed over there may cause inadvertent penetration into the orbit. Nayak and Soumya reported 3 epipteric bones at the right side of skull which gave the fractured look to the pterion [5].

In the present study, the overall prevalence of epipteric bones was 13.33%. Ahuja *et al.* (1973) [12] reported the 18.5% prevalence of Epipteric bones in Indian (Punjabees) skulls of unknown sex. Manjunath *et al.* (1993) [16] observed 17.30% of Epipteric bones in South Indian skulls of unknown sex. We observed slightly lower values than Ahuja *et al.* [7], Manjunath *et al.* [11] and other workers (Table 2). This may be because of racial variation or different sample size. The incidence of Epipteric bones is variable in different populations within the same country as shown in Table 2.

Table 2: Comparison of Percentage Distribution of Epipteric Bones as Quoted in Different Studies in Indians

Author	Number of skulls	Percentage		
		M	F	Total
Ahuja <i>et al.</i> (1971) [7]	126			18.5
Manjunath <i>et al.</i> (1993) [11]	172			17.3
Murlimanju <i>et al.</i> (2011) [17]	78			11.5
Patil <i>et al.</i> (2012) [18]	180	7.60	17.04	12.22
Sucharitha <i>et al.</i> (2016) [19]	100			24
Gupta <i>et al.</i> (2018) [20]	55			2
Goyal <i>et al.</i> (2019) [21]	147			0.68
Present study	90	10.83	18.33	13.33

Table 3: Comparison of Epipteric Bones in Different Populations

Population and study	Number of skulls	Percentage of Epipteric bones
Nigerian (Saxena <i>et al.</i> , 1988) [23]	40	3.79
Indian (Saxena <i>et al.</i> , 1988) [23]	72	11.29
Japanese (Mastumara <i>et al.</i> , 1991) [24]	356	10
Indian (Ahuja <i>et al.</i> , 1971) [12]	126	18.5
Indian (Manjunath <i>et al.</i> , 1993) [16]	172	17.3
Brazilian (Braga <i>et al.</i> , 2000) [25]	205	15.1
Korean (Lee <i>et al.</i> , 2001) [26]	149	40.3
Turkish (Erosy <i>et al.</i> , 2003) [15]	300	9
Byzantine (Ilknur <i>et al.</i> , 2009) [27]	16	6.25
Contemporary (Ilknur <i>et al.</i> , 2009) [27]	28	3.6
Present study	90	13.33

We reported higher prevalence of Epipteric bones in female than the male skulls. Similar observation was noted by Mwachaka *et al.* (2009) [22] in Kenyans. Also, Patil and Sheelavant have reported same results (female: 17.04% and male: 7.60%) in Indians [18]. Epipteric bones were present more in numbers on left side in female skulls [12]. While searching the literature we noticed variation in prevalence of Epipteric bones and these variations in results presumably related to the racial characteristics of the different populations (Table 3) [18].

Epipteric bones are accessory bones present in human skulls in pterion region which may give a false appearance of fracture on X-ray and may confuse the radiologist or surgeon. Sometimes, fractures at these sites may be misdiagnosed as

normal and thus timely treatment for the fracture may not be given which results in health complications [11,23]. Such bones may produce complications during burr-hole surgeries and their extensions may lead to continuation of fracture lines [18,26]. The precise knowledge of presence of Epipteric bones, their prevalence and number is essential to neurosurgeons, radiologist due to clinical implication and they are of interest of anatomists, physical anthropologist, and forensic medicine experts.

Conclusion:

The overall prevalence of Epipteric bone in dried human skulls in central India was 13.33% and prevalence of Epipteric bone in females was more as compare to males.

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