

A study on variation of zygomatic bone in relation to bipartitism in Gujarat State

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Abstract

Background: It is usual to come across deviations from normal in human cranial bones. Incidence is little higher in bones of the vault and face which are formed by membranous ossification. Presence of bipartite zygomatic bone has been described since long. The division of zygomatic bone has been described to occur commonly in Mongolian race and hence such extra portion is known as os japonicum.

Objective: To study the incidence of bipartite zygomatic bones in Gujarat state.

Materials and Methods: This study was carried out on 486 zygomatic bones of 243 dry normal, adult, human skulls obtained from collection of bones in anatomy departments of various medical colleges of Gujarat. The bones studied were free of any pathological condition. The skulls were cleaned, dried, and observed in good day light and with the help of magnifying lens.

Result: The observations for presence of suture/sutures, their extent, directions, and variations in 486 zygomatic bones revealed that 21 zygomatic bones had bipartitism. This study showed 4.32% incidence of os japonicum among observed zygomatic bones in Gujarat state.

Conclusion: Zygomatic bone gets fractured commonly in facial injuries. Bipartite zygomatic bone is not uncommon and can be confused with the fracture of the bone.

KEY WORDS: Zygomatic, bipartitism, os japonicum, fracture

Introduction

Zygomatic bone is one of the facial bone, which forms the prominence of cheek. It helps in formation of walls of bony orbit, temporal, and infratemporal fossa.^[1] Apart from frontal process of maxilla and pterygoid process of sphenoid bone, zygomatic bone acts as a third important buttress to transmit the pressure exerted by lower jaw during the process of mastication.^[1]

Among the cranial bones, incidence of variation is higher in bones of the vault and face which are formed by membranous ossification. Presence of bipartite zygomatic bone has been described since long. In this condition, the zygomatic bone is sometimes divided into larger upper division and smaller lower division.^[2]

The zygomatic bone, being the most prominent part of the facial skeleton, is more likely to get injured during any accident or blow, and even a normal variation may simulate a fracture of the bone during examination. Apart from common variations in number of zygomatic foramina, presence of marginal tubercle and formation of inferior orbital fissure, it is sometimes divided into two parts by the presence of extra suture and is then called as bipartite zygomatic bone. Incidence of this condition is more in Japanese skulls belonging to Mongolian race and is traditionally described as os japonicum.^[3] Though the incidence of os japonicum is fairly common among Japanese population, it is not unusual to find this variation in Indian population too.

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Materials and Methods

This study was carried out on 243 dry, normal, adult human skulls, obtained from the collection of bones in the anatomy departments of various medical colleges of Gujarat. The bones studied were free of any pathological condition. The skulls were cleaned, dried, and observed in good day light and with the help of magnifying lens. Sexual dimorphism could not be established in this study. A thorough visual inspection was done from inner and outer aspects of the bone, keeping into consideration different variations of sutures, and their respective articulations. Focus of the study was to observe the following variations related to zygomatic bone resulting in division of bone either partially or completely by means of sutures.

- (1) Presence of intrazygomatic suture or sutures.
- (2) Variation in extent of zygomaticomaxillary suture.
- (3) Variation in extent of zygomaticotemporal suture.
- (4) Presence of an extended process from maxilla, resulting in complete division of zygomatic bone.
- (5) Any other variation resulting in division of zygomatic bone.

Result

This study was conducted on 486 zygomatic bones of 243 dry human skulls for incidences and variations of os japonicum. The study was performed for presence and variations of different sutures, resulting in division of zygomatic bone, partially or completely.

The observations for presence of suture/sutures, their extent, direction, and variations in 486 zygomatic bones, revealed that 21 bones had bipartitism. This study showed 4.32% incidence of os japonicum among observed zygomatic bones in Gujarat state [Figures 1 and 2, Table 1].

Table 2 shows that of 13 skulls with os japonicum, 8 bones showed the condition bilaterally (i.e. 3.29%) and 5 bones showed unilaterally (i.e. 1.02%) thus making the total percentage of incidence as 4.32% of the zygomatic bones.

Table 3 shows that there is greater incidence of bipartitism on the inner aspect than on the outer aspect of the zygomatic bones. There are only five zygomatic bones which show bipartitism on outer aspect only and 12 bones show bipartitism on inner aspect only, whereas four bones show the condition on both inner as well as outer aspects.

Discussion

The zygomatic bone is a bone of facial skeleton, which develops from intramembranous ossification. Apart from the variations in respect to number of zygomatic foramina, presence of marginal tubercle and tubercle of whitnall, it is not unusual to find that the bone is divided into two parts, the condition being referred to as the bipartitism.^[3] The incidence was commonly observed later in Japanese and the condition was aptly described as "os japonicum" and find a place in almost all text books.^[2,3]

Terry and Trotter^[4] reported 7% incidence of Japanese skulls. Studies in Indian population were conducted by a few authors in the states of Punjab, Madhya Pradesh, and Uttar Pradesh by Jit, Bhargava et al., and Jeya Singh et al., respectively.^[5-7]

Bhargava et al.^[5] studied 200 zygomatic bones of 100 adult skulls and found 13 zygomatic bones to be bipartite; in 5 skulls bilaterally and in 3 skulls unilaterally, which is 6.5% of the bones studied. Jit studied zygomatic bones in Punjab state. His study consisted of 100 adult skulls (200 zygomatic bones) and 75 disarticulated zygomatic bones. He recorded the incidence of bipartitism as 2.5%.^[6] Jeya Singh et al.^[7] have studied 500 skulls and recorded the incidence of bipartitism in 4% of zygomatic bones.

Table 1: Incidence of bipartitism in zygomatic bones of skulls

No of zygomatic bones observed	No of zygomatic bones showing bipartitism	Percentage of zygomatic bones showing bipartitism
486	21	4.32%

Table 2: No of skulls showing bipartite zygomatic bones

No of skulls observed	No of skulls showing bilateral bipartite zygomatic bone	No of skulls showing unilateral bipartite zygomatic bone	Total no of skulls showing bipartite zyoamtic bone
243	8	5	13

Table 3: Observation of bipartite zygomatic bone in relation with aspect

Total no. of bipartite zygomatic bones observed	No of zygomatic bones showing bipartitism on outer aspect only	No of zygomatic bones showing bipartitism on inner aspect only	No of zygomatic bones showing bipartitism on both aspects
21	5	12	4



Figure 1: Bipartite zygomatic bone as seen from outer aspect.



Figure 2: Bipartite zygomatic bone as seen from inner aspect.

The Compendium of Anatomic Variation^[8] has mentioned that the “os japonicum” present in 7% of Japanese population. In another ethnic group the incidence of bipartitism ranges from 2.5% to 6.5%, which is slightly lower than the Japanese population. This study is comparable to the incidence in other ethnic groups.

Inkster^[10] and Jeya Singh et al. have mentioned the division of zygomatic bone by an extended process of maxilla articulating directly with the zygomatic process of the temporal bone, separating the zygomatic bone in two parts. In this study four Zygomatic bones show division of bone in two parts by what can be called “temporal process of maxilla.”

In this study, one zygomatic bone was divided in two parts by a small vertical suture at anteroinferior angle of the bone. This possibly represents prezygomatic center which has failed to unite with rest of the bone. This condition gives support to the view of three centers for ossification of the zygomatic bone.

This study of 486 zygomatic bones of 243 skulls in the population of Gujarat state, has shown the incidence of the variation in zygomatic bones to be 4.32%, which is within the range of 2.5%–6.5% recorded for other ethnic groups than Japanese. The incidence in this study is lower than the

population of Madhya Pradesh and grossly higher than the population of Punjab.

The presence of higher incidence of so called temporal process of maxilla (4 in 486 bones) is an added observation not recorded earlier, though mentioned as isolated instances by other investigators. The variations observed are more or less within the range of incidences in other ethnic groups than Japanese. Occurrence of bipartitism in various studies including this study support the view of more than one center of ossification. This view was expressed in 1946 in *Buchanan's Manual of Anatomy* by FW Jones.

Conclusion

The zygomatic bone, being the most prominent part of the facial skeleton, is more likely to get injured during any accident or blow, and even a normal variation may simulate a fracture of the bone during examination. Therefore, incidence of os japonicum has to be kept in mind to differentiate it from an injury during a medicolegal examination. Hence this study is useful for medicolegal, anthropological, and academic interests.

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