Case Report:

Absence of sagittal suture – an accidental finding

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Abstract:
The bones of the skull have two layers, the tabula interna and externa, which are separated by a vascular spongy bone space (diploe). These bones are separated by sutures which, in a series, are analogous to the epiphyseo-diaphyseal planes that in both are loci of growth, and that both have a sequence of timing and union.

In this case I have found absence of sagittal suture which was of normal shape with no saphocephaly. As India is a country with warm climate, there can be absence of any cranial suture as stated by Celsus in First century A.D.

From above it can be concluded that Absence of the sagittal suture does not result in scaphocephaly and due to hot climate in India there can be absence of any cranial suture.

Introduction:
The bones of the skull have two layers, the tabula interna and externa, which are separated by a vascular spongy bone space (diploe). These bones are separated by sutures which, in a series, are analogous to the epiphyseo-diaphyseal planes that in both are loci of growth, and that both have a sequence of timing and union. Just as the epiphyseo-diaphyseal union most frequently begins centrally and proceeds peripherally, so does suture closure begin endocranially and proceed ectocranially. Cranial sutures are classified as fibrous joints, meaning that they lack a synovial cavity and the bones are held together firmly by fibrous connective tissue. The functions of sutures are (1) to prevent separation of the bones when external forces are applied (e.g., muscle function or trauma), and (2) to allow some movement to occur between bones during rapid growth of the cephalic viscera. The role of cranial suture is primarily to allow growth of a developing brain during intrauterine and extra uterine life. It also facilitate passage of foetus during vaginal delivery by allowing non-traumatic compression of the skull bones. Since the bone resist putrefaction and destruction by animals, they can lead to the reliable determination of age, sex, race, stature in decomposed bodies.

Sometimes even when the age of person is known by the horoscope, hospital records and birth certificate, but still its scientific confirmation is required by court of law and certain administrative departments. In India and many other countries the task of scientific confirmation of disputed age issues of civil and criminal nature is the domain of forensic expert. The method of determining age by cranial suture closure has always been more generally used because the cranium is frequently the best preserved portion of the recovered skeleton.

In 1641, Thomas Bartholin (1616-1680) proposed the following uses for cranial sutures: 1) To permit the free transpiration of the vapours in the brain; 2) for the attachment and suspension of
the dura matter; 3) for the transmission of fibres of
the dura through to the pericranium; 4) for the
transmission, in both directions, of vessels carrying
nourishment and life to the parts; 5) to diminish the
likelihood of fracture of the bones of the skull
[Interestingly, Hershkovitz et. al. have once again
suggested that open sutures may increase skull
efficiency in absorbing related mechanical
stresses]; and 6) to permit the penetration of
applications from the exterior.5
Examination of cranial sutures can be a useful and
non-invasive technique in age estimation. In
addition, crania are durable in forensic and
archaeological contexts and are often the single
element recovered.6
Craniosynostosis is a condition in which one or
more of the fibrous sutures in an infant skull
prematurely fuses by turning into bone
(ossification), thereby changing the growth pattern
of the skull.7 Because the skull cannot expand
perpendicular to the fused suture, it compensates by
growing more in the direction parallel to the closed
sutures.7 It is estimated that craniosynostosis affects
1 in 2,000 to 2,500 live births worldwide.7 Sagittal
synostosis is the most common phenotype,
representing 40 to 55% of nonsyndromic cases.7
The second most common type is the coronal
synostosis representing 20 to 25%.7 The metopic
synostosis comes third with 5 to 15% and the
lambdoid synostosis is only seen in 0 to 5% of
nonsyndromic cases.7 Virchow’s law dictates that,
when premature suture closure occurs growth of
the skull is typically restricted perpendicular to the
fused suture and enhanced in a plane parallel to it,
thus trying to provide space for the fast growing
brain.8 Using this law, the pattern of skull deformity
in craniosynostosis can often be predicted.8
Scaphocephaly: A synonymous term is ‘dolichocephaly’ (the prefix dolicho- means
elongated).9 Premature sagittal suture closure
restricts growth in a perpendicular plane, thus the
head will not grow sideways and remain narrow.10
Compensatory growth occurs forwards at the
coronal suture and backwards at the lambdoid
suture giving respectively a prominent forehead,
called frontal bossing, and a prominent back
portion of the head, called coning.10 When viewed
from sideways the resulting shape of the head will
look a bit like a boat.
A premature closure of the metopic
suture is called as Trigonocephaly.11 Anterior
plagiocephaly means unilateral coronal synostosis,
while posterior plagiocephaly means Unilateral
lambdoid synostosis.11 Brachycephaly is the result
of a closure of both the coronal sutures &
Oxycephaly is the result of premature closure of the
coronial suture plus any other suture, like the
lambdoid.11 pansynostosis indicates closure of all
of the sutures.12 Historically alterations in skull morphology have
been noticed as early as 1300B.C. Hippocrates
(460-370 B.C.) illustrated variations in skull and
suture morphology in his treatise. In Greece
Herodutus (484-425 B.C.) described a skull without
sutures in his histories. Andreas Vesalius (1514-
1564 B.C.) further elucidated different forms of
craniosynostosis in his De humani corporis Fabrica.
Otto & Virchow ultimately pinpointed cranial
suture fusion as the primary cause of
 Craniosynostosis.
Method:
Post-mortem on a exhumed body referred to Sir jj
pm centre.
Results:
On post-mortem I have found absence of sagittal
suture with no evidence of scaphocephaly. Other
sutures like Coronal, Lambdoid & Parietotemporal
were present with no evidence of synostosis.
Metopic suture was found to be completely fused
i.e no evidence of Metopism. No lapsed union.
Discussion:

In 1869, Pommerol studied normal and pathological synostosis in different ancestral groups, but was limited to such a small sample that his work was not considered particularly useful. During the 19th century, Thomas Bartholin observed that cranial union first occurs in the sagittal suture, and that it occurred earlier within the cranium than upon the exterior.

The research by Todd and Lyon (1924, 1925a, 1925b, 1925c) was the first new attempt to estimate age using endo and ectocranial suture closure since Pommerol, Ribbe, Frederic, Parsons and Box, with the specific aim to create a precise numerical rating system for cranial closure. They observed that in certain instances, sutures seemed to fail to close completely. This condition was defined as ‘lapsed union’ of the suture. Todd and Lyon classified incidents of lapsed union as closed, since a suture in this condition would be unlikely to close to any great extent.

Premature fusion or craniosynostosis of suture(s) of the calvaria is known to result in skull deformation. However, absence of sutures may be interpreted as premature closure of a suture of the calvaria. In 2013 Author Dipti Padmalayam, carried out study on skull to see whether isolated absence of the sagittal suture produces a scaphocephalic skull or not. For this study, 400 adult and child skulls from all of the authors’ osteological collections were analyzed. In the study, the authors investigated skull configuration in skulls found to have isolated absence of the sagittal suture. Of these 400 skulls, three specimens were found to have isolated absence of the sagittal suture (one child and two adults). None of these three skulls were found to have scaphocephaly as a result of the suture absence. No other malformations were found on any specimen. The authors found that the isolated absence of the sagittal suture does not produce a scaphocephalic skull shape.

Celsus stated that it is rare for the skull to be solid without sutures; in hot countries, however, this is more easily found and that kind of head is the firmest and safest from headaches. Recently I did a post-mortem on decomposed body aged 25 yrs male, which was a case of Exhumation referred to sir JJ hospital postmortem centre, Mumbai? On external examination body was in decomposed state with features of mummification. Facial features were preserved. Face was dry, desiccated; shriveled. There was saponification of thoracic & abdominal walls. On internal examination all internal organs were converted into paste like material. Stomach with its content and part of intestine was recovered.

On opening the scalp to our surprise we found that sagittal suture was absent while rest of sutures like coronal and lambdoid were present, on opening the skull sagittal suture was absent internally also. The skull was of normal shape with no evidence of scaphocephaly.
Sagittal suture is the first to start to close at 25 yrs & completed by 35 to 40 yrs. Next to unite is coronal suture which starts at 25-30 yrs and completed by 40 to 45 yrs. Next to unite is lambdoid suture which starts at 30 yrs and completed at 45 to 50 yrs. In this case I found that sagittal suture was absent with skull having normal shape.

Dr R.K RAU found a case of absence of coronal suture accidentally with no evidence of abnormal skull shape, while rest of cranial sutures were intact and open. He also found metopism in same case. In our case coronal suture was present and there was no evidence of metopism.

Fig 3- Absence of sagittal suture. Discoloration over left part of skull is due to decomposition. As mentioned earlier author Dipti Padmalayam concluded that isolated absence of the sagittal suture does not produce a scaphocephalic skull shape. we also found absence of sagittal suture accidentally with no evidence of scaphocephaly.

Fig 4- shows intact coronal suture.

Conclusion:
- In this case I have found absence of sagittal suture which was of normal shape with no saphocephaly.
- As India is a country with warm climate, there can be absence of any cranial suture as stated by Celsus in First century A.D. From above it can be concluded that Absence of the sagittal suture does not result in scaphocephaly and due to hot climate in India there can be absence of any cranial suture.

References:


16. Cf. Herodotus, IX.83, where a skull is said to have been found on the battlefield of Plataea which had no sutures at all.
