A REVIEW OF THE USE OF SPHENO-OCCIPITAL SYNCHONDROSIS AS AN AGE INDICATOR AND ITS IMPLICATIONS FOR SRI LANKA

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INTRODUCTION

A spheno – occipital synchondrosis is a cartilaginous joint, a growth centre found in the base of the skull between the basilar part of the occipital bone and the body of the sphenoid bone joining them together with a hyaline cartilage. This joint is important in cranio facial development for both vertical axis and horizontal plains resulting in the increase of facial height and width. The hyaline cartilage as usual is gradually replaced by bone with age and this very process has been used as a method to estimate the age of an unknown victim in forensic practice.

This paper attempts to review the existing literature on the use of spheno-occipital synchondrosis as an age indicator in forensic practice with a view to identify its strengths, weaknesses and possible challenges one may face in using it for practical purposes in Sri Lanka.

Although there are numerous other anthropological parameters such as cranial sutures, dental development chronologies, symphysis pubis surface used for estimating the age of an unknown, the use of spheno occipital synchondroses has also been attempted by many. The need for studying any potential entity in estimating the chronological age of an unknown in a forensic context will be useful as there are variations and competing views observed in every method available. Further, in instances where only the skull is available and perhaps when the teeth are missing due to various reasons, the use of spheno occipital synchondrosis can be helpful to substantiate evidence to estimate the age of the victim. The basis of using this marker in estimating the age is the degree of closure, which has been detected as described below using varying methods.

METHODS

Researchers have used several methods to analyse the spheno-occipital synchondrosis with a view to estimate the age of fusion. The most oldest and commonest method that has been used is the direct inspection of the joint ectocranially and endocranially. In this process the researchers have either being binary in their assessment which means that they have indicated whether the joint is fused or not. In other instances the researchers have used a scoring system and indicated either not fused /open (0), partially fused (1) and then fused/closed (2). For example Shirley and Janz (2011) analyzed spheno-oipital joint macroscopically from outside and inside and gave a scoring for the degree of fusion.

Another common method that is used to study the spheno-occipital synchondrosis is the high resolution CT (Computer Tomography). In this method, which is known to provide a more detailed visualization of the joint than the direct method, the joint is analyzed and a scoring system is normally indicated to represent the degree of fusion. For example, El-Sheikh and Ramadan (2002) analysed skulls of an Arabian population using CT scans to estimate the age of closure of the spheno-occipital joint. Although CT image provides a detail information about the joint, in forensic practice, not everyone is equipped with such facilities. In this situation, some

researchers have attempted the use of radiological methods (X-rays), for example Sahni et al (1998) studied an Indian sample using X-rays. Further, histological studies especially using decalcification and then preparation of slides have also been attempted by researchers such as Tilander (1973) to visualise the spheno occipital joint under a microscope.

DISCUSSION

Different authors seem to provide different age limits for the fusion of spheno-occipital synchondrosis. The reasons for these varying predictions can be attributed to numerous reasons ranging from population variations, methodological differences, sample size differences, subjective elements in categorizing the degree of fusion either through direct method or using imaging techniques.

This joint has been noted to be important in forensic practice for reasons inter alia that it closes towards the latter part of adolescence. However, some authors for example Thilander (1973) and then Okomoto (1996) have indicated that the age of closure can even be towards as early as thirteen years. However the researches who used dry and direct inspection methods have suggested the closure of the joint takes place towards late adolescence. Krogman and Iscan note that the closure of spheno-occipital synchondrosis occurs between 18 years to 23 years while Gray's Anatomy text book suggests that the fusion completes by twenty five years. Some researchers who had used laminographs have suggested that the closure can occur between 13 years to 16 years. These differences of opinions on the age at which the closure occurs stems mainly from the methods they have used. In other words, the opinion on the age at which the spheno-occipital synchondrosis closes depends on the way one visualises the joint. For example those who examines the joint macroscopically directly will have an age range close to late adolescence as Krogman suggests while those who uses high resolution CT imaging and histo-morphological methods will observe a younger age in which the said joint fuses. The reasons for this perhaps may be that the high resolution CT and histological methods provide more detail appearance of the joint whereas the direct method more or less provides a superficial appearance to which the examiner variation and subjectivity can also be added. It is important to note that Elshark et al's study where they used high resolution CT imaging, the researchers have observed complete closure even at 11 years of age of the individual.

Further, researchers have observed that there is a gender difference at which the fusion of the joint occurs. Thilander et al (1973) observed that in females the spheno-occipital joint closes about two years earlier than that of a male. This means that it is important to have norms of closure of spheno-occipital synchondrosis of males and females separately and that it is not desirable to apply the closing age of a male to a female or vice versa. Further, researchers have observed different age limits of fusion of the said joint in different populations. This suggests that it is important to have average data of closing times of the joint for different populations. As Krishan and Kanchan(2013) suggests different ethnic groups in India have shown different ages of closure of the spheno-occipital joint.

The literature suggests that the fusion of the joint begins endocranially and extends to ectocranial surface. This means that there can be age difference between the times of fusion observed macroscopically at ectocranial and endocranial surfaces. Further, as indicated above there is a significant variation observed on the age of fusion among males and females. Additionally researchers have observed variations of the age of fusion of spheno-occipital synchondrosis between various ethnic groups. While there is marked evidence in the literature to suggest variations of the age of fusion using the same method, the use of different methods by different researchers have shown even more significant differences of the fusion times of the spheno-occipital joint. As shown above those who used high resolution CT images and

histological methods have observed lower ages of fusion compared to those who have used macroscopic direct methods to observe fusion.

The macroscopic observation of fusion or the detection of the degree of fusion to an untrained eye can be challenging so that the opinion can be subjective. The concern as to what degree of fusion one takes as 'complete' and whether total obliteration or total absence of a demarcation at the spheno-occiput junction one takes as 'complete' are also concerns one needs to consider especially when one uses the macroscopic direct observation methods.

Some researchers have attempted to evaluate the degree of fusion rather than depending on the binary outcome at the end – fused complete or unfused/open. In evaluating the degree of fusion many have attempted to score the degree of fusion. There is no uniformity in the scoring system across the research published. Some have tried to provide a binary outcome as complete/fused and unfused/incomplete. Others have attempted to provide a process where as they have given scores for complete/fused, then fusing/partially fused and then unfused/open.

The sample sizes of the studies published vary significantly. Some studies have as less samples as twenty one. There is unequal distribution of sex among these samples. Then, it is important to consider if these results are in fact represent the populations they come from to make a generalised idea about the populations they derived from. Despite the fact that populations can significantly vary based on their ethnicities, genetics, nutritional patterns and geographical locations, it seems that some attempt to extrapolate and apply results of published studies without having their own standards for each populations with adequate amount of sample size.

Despite many efforts, it was not possible to find any research conducted in Sri Lanka on Sri Lankan population evaluating the spheno-occipital synchondrosis for age estimation. As Sri Lankan population is a unique one, it is necessary that we in Sri Lanka survey main ethnic groups for the closing times of this joint if at all practitioners would want to use it as an indicator for age assessment of the unknown.

CONCLUSION

The above review and discussion indicates that the spheno-occipital synchondrosis is not a very reliable indicator of the age at death. However, if one attempts to use it in the absence of other reliable parameters or to substantiate the age with other parameters, it is important to consider the method the researchers have used, the gender of the sample population, the sample size used in the study, the population from which the same of the original study. If these concerns are not considered, the outcome opinion of the age can be misleading.

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