

Original Research Article

MORPHOMETRIC STUDY OF CEPHALIC INDEX AND ITS IMPORTANCE IN PAEDIATRICS

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ABSTRACT

Background: Cephalic index is an objective and highly useful parameter for determining the skull shape. It is of use for surgeons and neurosurgeons, for assessing the pre- and postoperative correction of skull deformations. It is easy to determine and is highly repetitive. The index is indispensable for planning a surgical procedure and assessment of its effectiveness. Development of a child's head depends upon the development of the brain. The brain reaches 90% of its size until the first year of age, while its complete development ends when the child turns 7. Anomalies related to the shape of skull may develop in prenatal period or in the postnatal period, chiefly up to 2-3 years of age. Among the deformations that develop in prenatal period or within the first months after birth, there are craniosynostoses. The present study was conducted to find out cephalic index of adult day skulls.

Materials and Methods: We have observed all the skulls carefully and we have identified skulls according to gender 61 skulls as male and 26 skulls as female. We have studied for the craniometric analysis. We have not included damaged skulls in our study, only fine and hygienic condition skulls were included.

Results: In present study found maximum cranial index was 85.36 mm and 71.12mm was minimum. The mean cranial index was 80.12+6.62mm, in males it was 81.84+4.66mm and 75.12+5.26 mm in females.

Conclusion: A cephalic index in infants is a measurement used to assess the shape of a baby's head by calculating the ratio of its width to its length, essentially giving a numerical value that indicates whether the head is more rounded or elongated, and is considered important for identifying potential abnormalities in skull development, particularly when monitoring for conditions like craniosynostosis which can affect brain growth; it is also used to plan and evaluate corrective surgical procedures if needed. Knowledge of cranial parameters and cranial index is essential in evaluating age, gender, and racial differences in clinical applications and forensic applications.

Keywords: Cranial index, Skull, Face, Infants.

INTRODUCTION

Craniosynostosis or premature atresia of cranial sutures is a developmental disorder classified among the so-called bony face deformations. They may occur in isolated form or as part of syndromes. Reduction of cranial cavity capacity may lead to compression of the normally developing child's brain. The plan of effective treatment in craniosynostoses comprises surgical treatment of skull deformation. For that purpose, the knowledge of skull dimensions of children with normal brain

development is indispensable. One of the useful indicators for assessment of child's head shape is the determination of cephalic index, defined as percentage of width to length in any skull. The cephalic index may be determined applying anthropometric methods, dry skull measurements, and radiological methods. When analysing the child's head shape, it is important to tell the abnormal shape caused by positioning from that caused by pathologic processes, such as cranial sutures atresia. Flattening and asymmetry may have numerous reasons, the skull shape varies between

individuals, being a combination of genetic and environmental factors. The reasons may range from uterine walls compressing foetus head to external reasons that occur after the birth, to which the newborn and infant are particularly exposed. Numerous authors point out that cranial deformations may result from the fact that infants, especially newborns, are invariably arranged in the same position when they are about to sleep. Babies call for intensive medical care; premature infants are particularly prone to such changes in skull shape. According to Hummel and Fortado,^[4] CI values in newborns in dorsal position are between 86 and 88, while in case of lateral recumbent position, the value is between 76 and 81. CI values exceeding 81 mean shortening of the anteroposterior diameter, what results in brachycephaly. It should be remembered that infant's skull is highly plastic, and change of recumbent position may change and also improve the skull shape.^[5] Graham et al. and Cartwright indicate that normal CI range for infants is 76–81, whereas for infants sleeping in dorsal position CI values much exceed 81.^[6] Collett et al. assessed the shape of cranial basis and its asymmetry in infants from the day of their birth to one year of age. The studies indicated that the most frequent forms of deformation are plagiocephaly and brachycephaly, as well as their combinations.^[7,8] In connection with the above, when analysing skull shape, particularly of young children, one should take into account the skull shape changes that are not due to pathologies. The cephalic index is an assessment scale to measure the skull size. The analysis of the cephalic index states another aspect of development and growth of the skull, likewise allows critical assessment of unusually small or large heads. Cephalic index also called as cranial index or Index of breadth is one of the important parameter that helps to differentiate between different human races. The most important of cephalometric dimension are height and breadth of head that they used in cephalic index determination. Cephalic index is very useful anthropologically to find out racial and sexual differences. The human body dimensions are affected by ecological, biological, geographical, racial, sex, and age factors. The cephalic index (CI) is calculated as the breadth of the skull multiplied by 100 divided by the length. Cephalic index is classified in three broad categories- dolichocephalic (<75), mesaticephalic (75-80) and brachycephalic (>80). Currently, cephalic index is commonly used to portray individuals' appearances and for roughly calculating the age of the foetuses for obstetrical and legal reasons. So, it can be widely used in various investigations in forensic labs. Comparison of changes in cephalic index among offspring, parents, and siblings may give a hint to the genetic transmission of the inherited characters. Cephalic index is the jargon used in anthropology for having an easy identifying module or the numerical to differentiate the given individual, either into sex or race or even as the identity of the individual.^[9,10,11]

The present study was conducted to find out cephalic index of adult day skulls and to note importance of in paediatrics.

MATERIALS AND METHODS

We have conducted this study with 87 adult dry skulls, which were collected from department of anatomy, forensic medicine and Dr VRK Women's Medical College Aziznagar Moinabad, we have observed all the skulls carefully and we have identified skulls according to gender 61 skulls as male and 26 skulls as female. We have not included broken skulls in our study, only intact skulls were included in study. We have studied for the craniometric analysis. We have not included damaged skulls in our study, only fine and hygienic condition skulls were included.

RESULTS

Cephalic index is calculated by dividing the maximum head width by the maximum head length and multiplying by 100. In present study found maximum cranial index was 85.36 mm and 71.12mm was minimum. The mean cranial index was 80.12+6.62mm, in males it was 81.84+4.66mm and 75.12+5.26 mm in females.

DISCUSSION

Craniometry helps to assess growth and is used in various clinical practices in paediatrics, forensic medicine, plastic surgery, oral surgery, and dentistry for diagnostic purposes. Various factors, such as ecological, geographical, racial, gender, and age, affect the dimensions of the human body. Head shapes can be categorised as dolichocephalic, mesaticephalic, brachycephalic, and hyperbrachiocephalic or cranial indices based on the cephalic index. The study showed mesocephaly among normal Indians, but brachycephaly has been observed in mentally disabled individuals. The cephalic index is an accurate tool to determine the shape of the skull, enabling the neurosurgeon to assess pre-and post-operatively, and paves the way for planning for surgery. Quantitative analysis of the human skull's growth, shape, and size, especially the foetal skull, is important. Efforts have been made to associate these craniometric variations to characterise different races geographically. Several metric parameters were used to compare the shapes and sizes of the skulls. One such craniometrical parameter is the Cranial Index. The Cranial Index or Cephalic index as a percentage of the width to length of the skull. Width is the distance between the most prominent points on the side of the skull. The length is the distance from the glabella and the most prominent point at the back of the cranium, mainly the occipital protuberance.^[12,13,14]

In present study found maximum cranial index was 85.36 mm and 71.12mm was minimum. The mean cranial index was 80.12±6.62mm, in males it was 81.84±4.66mm and 75.12±5.26 mm in females. According to the Bhargava L and Kher,^[15] study from the central India cephalic index was 76.98 in Bhils groups and 79.8 in Bareals group. In a study by Shah and Jadav cephalic index was 80.81.^[16] Anupama M et al,^[17] reported in his study that cranial index of most of the Punjabi students fall in Brachycephalic group. In S.D Desai et al,^[11] study from India majority of the skulls were mesocephalic. In study of V.A. Kesavan,^[18] found the average cranial index observed in both males and females in our study was 75.72, in study of Padala SR,^[19] where the mean cranial index was 75.21.10 Interestingly, studies conducted among the North Indian and Nigerian populations showed, slightly lower mean cranial indices of 72.56 and 72.54, respectively.^[20,21] In study of V.A. Kesavan,^[18] the mean cranial index was 75.09 for males and 76.77 for females. in study of Padala SR,^[19] from the Telangana population, where males had a mean cranial index of 75.32 and females had 75.42. In study of Anil Kumar,^[22] the mean cephalic index was higher in females compared to males. Among the male skulls, the mean cephalic index recorded to be 73.75±3.56 whereas in females it was 75.22 ± 5.15. There was a statistically significant difference in the mean of the cranial indices in male and female skulls, the mean cephalic index in female was 75.22±5.15

CONCLUSION

Cephalic index is a useful and indispensable tool used for assessing skull shape in children, especially for the purpose of pre- and postoperative correction of skull deformations. Regular cephalic index measurements can help monitor for potential head shape abnormalities, especially in infants with risk factors like prolonged lying on their back. A significantly asymmetrical cephalic index can indicate deformational plagiocephaly, where the head is flattened on one side. If a baby is diagnosed with plagiocephaly, the cephalic index can help guide the design and effectiveness of corrective measures like cranial molding helmets.

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