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Morphometric Analysis of Tubercles at the Anterior Margin of Foramen Magnum

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ABSTRACT

The basilar part Occipital bone is formed by the initial three primitive vertebrae (or occiput blasts), the most caudal of which is alleged occipital vertebra . The peculiarity prompts anomalous bone arrangement in the region of the anterior edge of foramen magnum, either in the midline or potentially along the side. This peculiarity is known as the third condyle, remnants of occipital vertebra and is ossified with the odontoid bone. The aim of this study is to analyse the morphology of tubercles present at the anterior margin of foramen magnum. 72 south Indian adult unsexed human skulls were analyzed for the appearance of precondylar tubercles from the Department of Anatomy, Saveetha Dental College & Hospitals. The distance from both mastoid process, external occipital protuberance are measured by using vernier calliper. Out of these 72 skulls, 3 skulls showed unilateral midline tubercles. In this study, The occurrence of tubercle at the anterior margin of the foramen magnum is 4.16%.

KEY WORDS: FORAMEN MAGNUM ANOMALIES, TUBERCLE IN ANTERIOR MARGIN, OCCIPITAL VERTEBRAE.

INTRODUCTION

The skull has a pinnacle importance in the vertebral column.The foramen magnum is the huge opening in the occipital bone, and transmits significant neurovascular structures (Standring et al., 2005). Anomalies found around the foramen magnum may be of clinical significance as is closely related to vascular and nervous structures. Position of this tubercle may be related to traumatic medullary lesions of the occipito-vertebral region.

ARTICLE INFORMATION

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NAAS Journal Score 2020 (4.31) SJIF: 2020 (7.728) A Society of Science and Nature Publication, Bhopal India 2020. All rights reserved. Online Contents Available at: http://www.bbrc.in/ Doi: http://dx.doi.org/10.21786/bbrc/13.8/121 The tubercles within the foramen are significant as they could interfere with the sensitive structure that goes back and forth from the skull. It is very significant in the field of neurology that such structures may intervene in the development at the atlanto-occipital joint (Ahmed et al., 2015). It is additionally significant within the field of neurology that such structures may impede at the atlantooccipital joint (Prakash et al., 2011). Previously our department has published extensive research on various aspects of dentistry (Begum et al, 2017; Ganapathy, Kannan and Venugopalan, 2017; Jain, 2017a, 2017b; Ranganathan, Ganapathy and Jain, 2017; Ariga et al., 2018; Gupta, Ariga and Deogade, 2018; Anbu et al., 2019; Ashok and Ganapathy, 2019; Duraisamy et al., 2019; Varghese, Ramesh and Veeraiyan, 2019), this vast research experience has inspired us to research about morphometric analysis on the tubercles at the anterior margin of the foramen magnum.

MATERIAL AND METHODS

72 unsexed South Indian adult human skulls from the Anatomy Department of Saveetha Dental College were



examined for the presence of tubercle in the anterior margin of Foramen magnum. The skulls with tubercles at foramen magnum were examined further, parameters of the tubercles are measured. The distance from mastoid process, external occipital protuberance were measured using vernier callipers.

RESULTS AND DISCUSSION

From the research we found that 3 out of 72 skulls had tubercle at the anterior margin of the foramen magnum. The occurrence of tubercle at the anterior margin of the foramen magnum is 4.16%. The failure of distal occipitoblasts to intertwine with other bones creates an unusual bony appearance on the outer surface of skull around foramen magnum, an anomaly called as "appearance of occipital vertebra"(Lombardi, 1961). Failure in Hypochondrial ossification during development may show a rigid arrangement in that region, called tubercle (Fig.1)(Vasudeva and Choudhry, 1996).

Table 1. The table shows the length of the tubercle from the landmarks in the skull(mastoid process, external occipital protuberance).

Distance from Anatomical landmarks	Right Mastoid Process	Left Mastoid Process	External Occipital Protuberance
SKULL 1	4.57 cm	4.36 cm	6.62 cm
SKULL 2	5.48 cm	5.47 cm	6.55 cm
SKULL 3	4.86 cm	4.57 cm	7.56 cm

Figure 1: Shows the tubercle at the anterior margin of the foramen magnum



Besides being of anthropological and ethnological importance, these variations might be significant in a clinical setting. Protruding vertebral components along the anterior edge of foramen magnum intervened between the basiocciput and the atlas may decrease the periphery of the foramen or cause asymmetry (Nicholson and Sherk, 1968; Vinken and Bruyn, 1968). Extended middle or paramedian tubercle's ventral to the foramen may shape a pseudojoint with the apical section of the odontoid process, in this way influencing the important tracts passing through the atlanto-occipital articulation(Cagle, 1989).

Romanes and Basmajian in their research said that tubercles at the anterior margin can intervene in the important structures passing through the foramen magnum, A similar explanation is portrayed by Bergman et al (Bergman, Afifi and Miyauchi, 2018). In the research done by Naderi et.al, its occurrence has been accounted for to be 0.8% (Naderi et al., 2005). The frequency of tubercles at foramen magnum has been reported as 0.5-0.8% in the research done by Prakash B.S (Prakash et al., 2011). Lakhatia et.al has done a research in which, out of 422 skulls that were examined, 22 skulls the projection took the form of a tubercle measures 0.5-1.5mm in length, whereas in 32 skulls the tubercle is 2-2.5mm, 2skulls were 4mm. Tubercle was present in 15% of skulls examined (Lakhtakia et al., 1991). Out of 66 skulls studied 1.5% are with the tubercle in the research done by Blaszczyk et.al, all the skulls were mostly of Russian population (Błaszczyk, Kaszuba and Kochanowski, 1980).

In the research done by Lombardi et.al, the incidence of tubercles was of 0.28% mainly of the western world population (Lombardi, 1961). In the research done by Harrower et.al, 382 skulls have been studied, 1.3% incidence was found, It was from the population of South American people (Harrower, 1923). In the research done by Vasudeva et.al, Out of 265 skulls, 37 skulls showed tubercles at the anterior margin, 2% occurrence was found, it is from the northern part of India (Vasudeva and Choudhry, 1996). In the research done by Trotter et.al, Pre condylar and anterior marginal tubercles are formed in 2% of skulls of Negros, This research was done on skulls of South African population (Trotter, Broman and Peterson, 1960). In the research done by Vanquest et.al, 38 skulls out of 450 skulls showed the presence tubercle, which is 0.85% of incidence, it was mainly of European population (Pastor Vázquez, Gil Verona and García Porrero, 1999). Surendra et.al research concluded that " presence of tubercle at the anterior margin is not a normal incidence and is not found in all people" (Al-Motabagani and Surendra, 2006).

In the research done by P.K.Lakhatia (Lakhtakia et al., 1991) the percentage of tubercles found to be 15% which is higher than our study of 4.6% occurrence. In the researches done by Ahmed (Ahmed et al., 2015), Blaszczyk et.al (Błaszczyk, Kaszuba and Kochanowski, 1980), Haritha (Harrita and Santhanam, 2019), Broman. GE (Trotter, Broman and Peterson, 1960), Surendra (Al-Motabagani and Surendra, 2006) the percentage of tubercles found was less than the occurrence in our study. Limitations of the study are less number of skulls and restriction of sample to specific local region. Future extension lies in the field of orthopedics and neurology as such peculiarities may cause pressure of the neural structures and furthermore research may be needed.

CONCLUSION

Anatomically, the location of an insignificant precondylar tubercle may create neurological signs of pressure since it is situated outside the periphery of foramen magnum. Our report of incidence of 4.6% of tubercle in the anterior margin of foramen magnum would help neurologists and surgeons about anomalies in the region around foramen magnum.

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Conflict of Interest: The author declares that there is no conflict of interest in the present study.

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