Original Research Paper

Anatomy

International St	TUDY OF OCCURRENCE OF THE ANTERIOR TUBERCLE IN THE MARGIN OF THE OCCIPITAL FORAMEN IN BIHAR STATE REGION
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ABSTRACT

Hospital, Patna (Bihar). Background: The presence of structures that pass along the anterior margin of the occipital foramen interposed between the basilar part of the occipital and the atlas may reduce the circumference of the

foramen causing compression of the spinal cord and leading to signs and symptoms of neurological deficits due to its asymmetry. The aim of this study was to determine the incidence of anterior tubercle at the occipital foramen margin. Out of 50 skulls, 2 (4%) skulls shows occurrence of the anterior tubercle in the margin the occipital foramen/foramen margin. Out of 50 skull, 2 (4%) skulls shows occurrence of the anterior tubercle in the margin the occipital foramen/foramen margin. Out of 52 (two) skull, The incidence of occipital tubercle, probably formed by the apical ligament exostosis of the dens, was 04%. In 1st case the tubercle had a triangular shape, was situated at the midpoint of the anterior margin of the foramen, with its apex facing back toward the occipital foramen and measuring about 4mm in the anterior posterior direction and 3 mm in the transverse. In 2nd case a pyramidal projection was found at the anterior margin of foramen magnum, with the apex directed backwards towards the posterior margin of foramen magnum. The tubercle measured 3.5 mm antero-posteriorly and 2mm transversely. The knowledge of the presence of the occipital tubercle is of great clinical importance, as it may lead in many cases to compression of the neurovascular structures.

KEYWORDS : occipital bone, anatomic variation, foramen magnum, skull base, atlanto- occipital joint, anterior tubercle, precondylar tubercle.

INTRODUCTION

Occipital foramen/Foramen magnum is located in the the floor of posterior cranial fossa. It provides a communication between posterior cranial fossa and vertebral canal and its margins provides attachment to various structures. Presence of tubercles in the foramina of the cranium has aroused the curiosity of anatomists. The foramen magnum is the large opening situated in the occipital bone, and transmits important neurovascular structures. Such tubercles are clinically important as it may compress the vital structures that goes to and fro from the brain. It is also important in the field of kinesiology that such structures may retard the movement at the atlanto-occipital joint. The occipital foramen is an extremely important region, due to the passage of several neurovascular structures, such as accessory nerves, spinal, bulb (or medulla oblongata), and vertebral arteries.^{1,2,19,20} However, the presence of a tubercle in the margin of this foramen, may cause locks and compression of these structures.^{2,21}

Osteoarthritis of the atlanto-axial joint leading to basilar invagination and periodontal ligament degeneration^{3,4} as well as cranio-cervical instability.¹ The occurrence of the anterior tubercle in the margin of the occipital foramen varies from 1.3% to 15%;⁵⁻⁸ and has been attributed to the ossification of the apical ligament of the odontoid process of the axis.^{9,10} The aim of this study was to determine the incidence of tubercle the margin of the occipital foramen margin.

Aim Of Study

The aim of this study was to determine the incidence of tuber at the occipital foramen /foramen magnum margin.

METHODS

During routine study of skull in the department of Anatomy at Nalanda Medical College & hospital, Patna, Bihar, India. We analyzed 50 occipital foramen/foramen magnum of human dry skulls . In all the skulls the occipital foramen were preserved and were identified according to sex and age.

RESULTS

Out of 50 skulls, 2 (4%) skulls shows ocurrence of the anterior tubercle in the margin the occipital foramen with different antero-posterior and transverse measurement . In 2 (two) cases of the tubercle was found in the anterior margin of the occipital foramen, representing an incidence of 04%. In 1st case, the tubercle had a triangular shape, was situated at the midpoint of the anterior margin of the foramen, with its apex facing back toward the occipital foramen (Figure 1), measuring about 4mm in the antero-posterior direction and 3 mm in the transverse. In 2nd case a pyramidal projection was found at the anterior margin of foramen magnum, with the apex directed backwards towards the posterior margin of foramen magnum. The tubercle measured 3.5 mm antero-posteriorly and 2mm transversely.



Figure 1: Photograph Showing The Anterior Tubercle At Anterior Margin Of Foramen Magnum.

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FL, foramen lacerum; CC, carotid canal; OC, occipital condyle; OF, occipital foramen; AT, anterior tubercle, FO, foramen ovale. Red arrow head, the tubercle.

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DISCUSSION

Embryologically, the occipital bone originates from the junction of the 4th and 5th somites, but in man they do not merge, that is, scletotome 4 give rise to the basilar part of the occipital and the sclerotome 5 form the apex and the apical ligament of axis dens, as well as the occipital condyles.¹¹The development of the odontoid process is complex. The dens apex develops from the proatlas, which is the cranial half of the first cervical sclerotome and the remainder of the dens of the caudal half.^{12,13}

The body and the neural arches of the axis develop from the second cervical sclerotome.^{14,15} The proatlas also forms the anterior margin of the occipital foramen, occipital condyles, and the third condyle of the occipital bone. Therefore, odontoid dysgenesis is frequently associated with abnormalities of the basiocciput and the atlas.¹⁶

The apical ligament of the odontoid process extends from the uppermost point of the process to the posterior face of the anterior margin of the occipital foramen. Proposed to be vestigial, the ligament was absent in 20% of the specimens examined' and is not sufficiently relevant to cause changes in the physiological movements of flexion or extension.¹⁷ The anterior atlanto-occipital membrane joins the anterior tubercle of the atlas to the basilar occiput and is continuous with the joint capsule, contributing little or nothing to the stability of the cranio-cervical joint.¹⁰ Accessory vertebral elements along the anterior margin of the occipital foramen interposed between the basio-occiput and the atlas may reduce the circumference of the foramen causing compression of the spinal cord, leading to signs and symptoms of neurological deficits because of asymmetry.¹⁸ This tuber is not comparable from the phylogenetic point of view, to the medial condyle of birds and reptiles, because it does not participate as a joint surface in the cranium-vertebral joint.^{6,18}Few studies have reported the frequency of tubercles in the occipital foramen. In our study we found a frequency of 04% , differently from the several authors, in which they found a frequency varying from^{1,3} to 15%,^{25,6,8} even studying similar numbers of skull. The antero-posterior length and transverse width of the anterior tubercle were 4 and 3mm respectively. This is also consistent with that found by Lakhtakia et al.⁵ and Prakash et al.¹⁸ where the length ranged from 4 to 5mm and the transverse width of 3mm.^{5,18} For Tubbs et al.⁷ and Ahmed et al.² the length of the antero-posterior tubercle and transverse width were more than double, while for Patil et al.¹ these dimensions were approximately half of that found in our study. It is therefore important to know not only its occurrence but also its dimensions, since tubercles later directed to the occipital fibres in extreme flexion of the head.⁵

CONCLUSION

The anterior tubercle in the margin of the occipital foramen is clinically important in most situations, and may lead to extensive neurovascular damage, or even lead to an important clinical picture in the case of traumatic lesions, especially when associated with other manifestations of the pro atlas. In addition, the knowledge about variations in the region of the occipital foramen will be useful for the various professionals working in this area, especially for physicians who routinely visualize images or manage clinical problems of the cranio-cervical junction which may lead to the compression of the neural structures.

Abbreviations:

FL, foramen lacerum; PB, basilar part occipital bone; CC, carotid canal; OC, occipital condyle; OF, occipital foramen; Red arrow head, the tubercle.