

**A STUDY ON TUBERCLES AT THE ANTERIOR MARGIN OF THE FORAMEN MAGNUM**Md. Khaleel Ahmed<sup>1</sup>, Taqdees Fatima<sup>2</sup>, Priyanka M<sup>3</sup>, Kafeel Ahmed<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT:** The basilar process of occipital bone is formed by fusion of the first three primitive vertebrae (or occipitoblasts), the most caudal of which is so-called occipital vertebra or pro-atlas. The failure of distal occipitoblasts to fuse with others gives rise to abnormal bone formations on the external surface of skull around foramen magnum, phenomenon called as "manifestation of occipital vertebra". Bone anomalies related to failure of segmentation of the most caudal occipital sclerotomes are rare, but have been identified. The anomaly leads to abnormal bone formation in the region of anterior rim of foramen magnum, either in the midline and or laterally. The anomaly has been occasionally referred to as third condyle, remnants of occipital vertebra, un-formed bone masses on the anterior rim of foramen magnum and prebasi-occipital arch in combination with an odontoid bone. The basiocciput of 100 Indian adult human skulls were examined for the presence of precondylar tubercles, which are single or paired osseous formations anterior to the occipital condyles and foramen magnum. Out of these 100 skulls, one skull displayed unilateral tubercle and the other bilateral tubercles.

**KEYWORDS:** Skull, Basiocciput, Foramen magnum, Precondylar tubercle.

**INTRODUCTION:** Skull is the bony skeleton of the head and is the most complex osseous structure in the body. It is the modified part of the axial skeleton. The skull is supported by articulation with the vertebral column.<sup>1</sup> The foramen magnum is the large opening situated in the occipital bone, and transmits important neurovascular structures. Presence of tubercles in the foramen of the cranium has aroused the curiosity of anatomists. Such tubercles are clinically important as it may compress the vital structure 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<sup>2</sup>. Position of this tubercle may lead to traumatic medullar lesions of occipito-vertebral region. Tubercle on the anterior margin of the foramen magnum indicates the position of the apical ligament of dens formed of exostoses. Could be one of the "Manifestation of occipital vertebra".<sup>3</sup>

**MATERIAL AND METHODS:** A total of 100 adult human skull of unknown sex and age taken from the department of Anatomy and from the students of I phase MBBS, KBNIMS, Kalaburagi, Karnataka were studied over a period of 6 months (March-December 2014) for the presence of tubercle on the anterior margin of foramen magnum. The inferior aspect of basiocciput was examined for the occurrence of precondylar tubercle which consisted of bony elevations ranging from ridges near the anterior end of occipital condyles to larger median or paramedian projections along the anterior margin of foramen magnum. Their location, number, size, shape and presence of facet was noted. The size was evaluated and ridges, spines and processes are classified as type I, II and III respectively.

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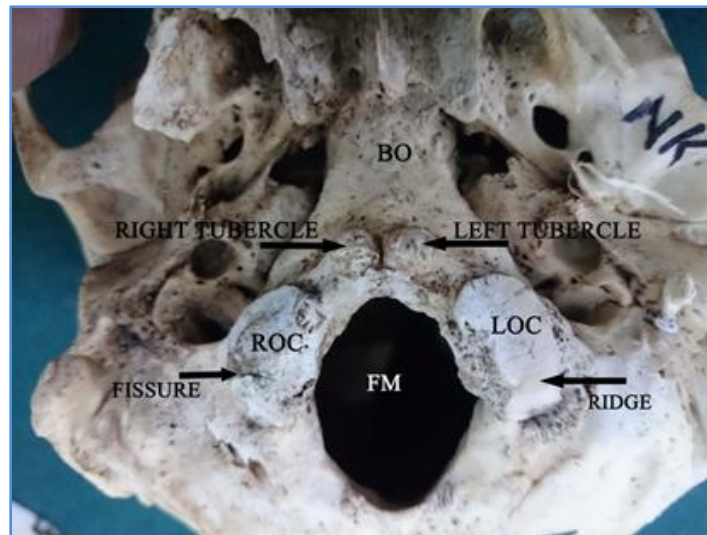
**OBSERVATIONS:** Out of 100 skulls that were examined, 2 skulls showed the presence of tubercle on the anterior margin of foramen magnum representing an incidence of 2%.

Skull1 showed the presence of two tubercles with the following findings:

- Right tubercle- Length: 7mm, Width at the base: 6mm and the tubercle were conical in shape.
- Left tubercle- Length: 5mm, Width at the base: 7mm and the tubercle were round in shape.
- Both tubercles were found on either side of midline in the precondylar area not projecting in the foramen magnum.
- There was a oval articular facet at the anterior margin of the foramen magnum in the midline extending on the base of the left tubercle measuring about 8mm transversely and 5mm in length.
- Right occipital condyle was divided by a fissure into 2 parts. Anterior facet was oval in shape with 15mm in length and 10mm in width. Posterior facet was roughly quadrangular with 8mm in length and 10mm width.
- Left occipital condyle was oblong in shape and was divided by a ridge. It was 23mm in length and 9mm in width.
- Both the occipital condyles were directed anteromedially.

**Skull 2 showed the presence of single tubercle with the following Findings;**

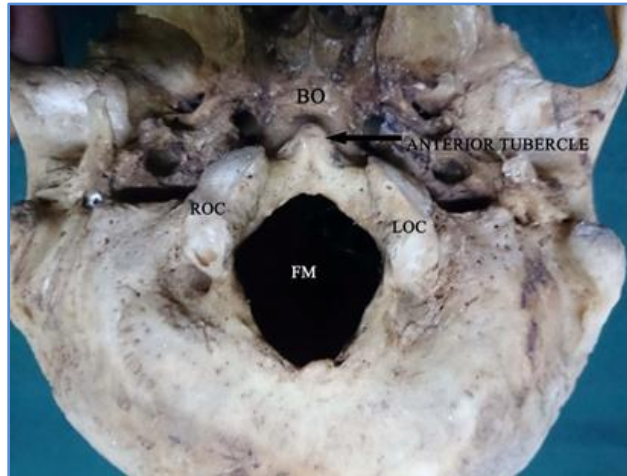
- Tubercle was conical in shape and measured about 9mm in length and 11mm in width. It was situated at the anterior margin of foramen magnum in the midline.
- Tubercle was not projecting into the foramen magnum.
- Both the occipital condyles were directed anteromedially and were constricted in the centre with the maximum width of the facet 11mm and length 30mm.



**Fig. 1: Skull showing two tubercles at the anterior margin of foramen magnum**

\*BO: Basiocciput, ROC: Right occipital condyle, LOC: Left occipital condyle, FM: foramen Magnum.

## ORIGINAL ARTICLE



**Fig. 2: Skull showing a midline tubercle at the anterior margin of foramen magnum**

\*BO: Basiocciput, ROC: Right occipital condyle, LOC: Left occipital condyle, FM: foramen Magnum.

S. NO	TUBERCLE			RIGHT OCCIPITAL CONDYLE			LEFT OCCIPITAL CONDYLE	
		LENGTH	WIDTH		LENGTH	WIDTH	LENGTH	WIDTH
SKULL I	LT	5mm	7 mm	AF	15mm	10mm	23 mm	9 mm
	RT	7mm	6 mm	PF	8mm	10mm		
SKULL II		9 mm	11 mm		30mm	11mm	30 mm	11mm

**TABLE 1: DIMENSIONS OF THE TUBERCLES AND OCCIPITAL CONDYLES**

LT: Left tubercle, RT: Right tubercle, AF: Anterior Facet, PF: posterior Facet.

**DISCUSSION:** The basilar process of occipital bone is formed by fusion of the first three primitive vertebrae (or occipitoblasts), the most caudal of which is so-called occipital vertebra or pro-atlas. The failure of distal occipitoblasts to fuse with others gives rise to abnormal bone formations on the external surface of skull around foramen magnum, phenomenon called as “manifestation of occipital vertebra”.<sup>4</sup>

The occipital bone is perforated by the foramen magnum with the squamous part behind the foramen, the condylar parts lateral and the basilar part in front. A transient mesenchymal hypochondrial bridge of the occipital vertebra along the anterior margin of foramen magnum between the occipital condyles was observed in human embryos of 12.5- 21. 0mm crown rump length which was completely absent by the 80mm crown rump length. Failure of complete disappearance of the Hypochondrial bridge during development may manifest as osseous formation in this craniocervical transition region.<sup>5</sup> Besides being of anthropological and ethnological interest, these variants may be important in a clinical context. Accessory vertebral elements along the anterior margin of foramen magnum interposed between the basiocciput and atlas may reduce the circumference of the foramen or cause asymmetry.<sup>6,7</sup>

## ORIGINAL ARTICLE

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Enlarged median or paramedian bony masses ventral to the foramen may form a pseudojoint with the apical segment of the odontoid process or anterior arch of the atlas, thereby affecting the kinetic anatomy and integrity of the atlantooccipital articulation.<sup>8</sup>

Romanes commented that the small bony tubercle on the anterior margin of the foramen magnum indicates the position of the apical ligament of the dens.<sup>9</sup> Romanes and Basmajian described the presence of a third occipital condyle that projects from the anterior border of the foramen magnum to articulate with the dens of the axis.<sup>9,10</sup>

A partly divided occipital condyle is also described by Bergman et al.<sup>11</sup> Its incidence has been reported to be 0.8%.<sup>12</sup>

**CONCLUSION:** Anatomically speaking, the location of a mere precondylar tubercle is not expected to produce neurological manifestations resulting from compression since it is located outside the circumference of foramen magnum. However, its association with other variations dictated by the embryological events should be considered as clinically significant.

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**AUTHORS:**

1. Md. Khaleel Ahmed
2. Taqdees Fatima
3. Priyanka M.
4. Kafeel Ahmed

**PARTICULARS OF CONTRIBUTORS:**

1. Assistant Professor, Department of Anatomy, KBNIMS, Kulaburagi, Karnataka.
2. Assistant Professor, Department of Anatomy, KBNIMS, Kulaburagi, Karnataka.
3. Assistant Professor, Department of Anatomy, KBNIMS, Kulaburagi, Karnataka.

4. Tutor, Department of Dentistry, KBNIMS, Kulaburagi, Karnataka.

**NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:**

Dr. Md. Khaleel Ahmed,  
Department of Anatomy,  
KBNIMS, Roza Buzurg,  
Kalaburagi-585104,  
Karnataka.  
E-mail: dr.mohammedkhaleel786@gmail.com

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