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Morphology of the Paracondylar Process in a Dry Adult Human Skull: A Case Report

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Abstract: *The paracondylar process is a rare osseous process arising at the cervicooccipital region and belongs to a large and heterogenic group of developmental abnormalities of the craniovertebral junction. Two Stout cylindrical bony paracondylar processes (PCP) were found arising from the jugular process of the occipital bone in an adult male human dry skull. They projected downwards and medially; they were located postero-lateral to the occipital condyles and medial to the mastoid processes. The PCP were extending caudally towards the transverse process of the atlas; and were located just lateral to the posterior arch of atlas. Awareness of this paracondylar process, its topographical relations and its attendant problems is of importance to clinicians, radiologists, surgeons and chiropractors.*

Keywords*: Paracondylar process; Occipital bones abnormalities; Exostoses ; Cervical vertebrae abnormalities*

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I. Introduction

The craniovertebral region is said to be an area of the spine with a high level of variability; there are several types of craniovertebral fusion. We present one of those, the paracondylar processes (PCP). A PCP is described an enlarged bony process of the cranial base which projects caudally toward the transverse process (TVP) of the atlas. It is considered as an incidental finding on radiographic examination. In extreme cases it is said that the PCP can fuse to the TVP of the atlas causing functional limitations in neck movement and may cause clinical symptoms due to alterations in posture and restricted range of motion.

The PCP is a rare osseous process arising at the cervicooccipital region that belongs to a large and heterogenic group of developmental abnormalities of the craniovertebral junction. Although this entity is usually asymptomatic, it is rarely associated with symptoms such as headache and limited range of motion. It can often alarm the young patient or their parents, pose a diagnostic problem for clinicians and even hinder performance of special surgical operations in the area. Thus correct identification of this variant is essential [1].

II. Case report

The left and right stout cylindrical bony paracondylar processes (PCP) were found arising from the respective jugular processes of the occipital bone in an adult male human dry skull. They projected downwards and medially with a slight concavity on their medial side; they were located postero-lateral to the occipital condyles and medial to the mastoid processes (Fig. 1- 5). Superiorly, the PCP had slightly broadened base merged with the jugular processes while a constriction was seen forming a ‘‘waist’’ 5 mm below; inferiorly they ended as rounded to oval tips (Fig. 1-5). The right PCP was 8.01 mm and left PCP 9.16 mm long; their diameter at the base was 6.68 mm and 7.97 mm and the diameter at the tip 3.90 mm and 5.50 mm respectively. The PCP was extending caudally towards the transverse process of the atlas; and they were located just lateral to the posterior arch of atlas. Transverse foramen of the atlas was almost very close on the right sided PCP. No articulation or fusion was found between the above structures; no facets were found on the PCP. This abnormality was consistent with a paracondylar process, a very rare normal variant of the craniovertebral junction.

III. Discussion

The paracondylar process is a broad-based cone shaped bony mass arising medially to the mastoid process that projects down from the posterolateral aspect of the occipital condyle toward the transverse process of the atlas [2]. The paracondylar process belongs to a heterogenic group of congenital anomalies of the craniovertebral junction. This group of osseous abnormalities covers a broad spectrum from minor anatomic variations to major true malformations, as a result of developmental errors of the craniovertebral region [3]. The

craniovertebral junction constitutes a unique part of the somite-derived axial skeleton and it is an embryologically unstable, ‘‘ontogenetically restless’’ zone, and thus susceptible to many variants, anomalies and malformations, as may occur in other transitional zones such as the lumbosacral junction [4, 5]. The paracondylar process seems to be considered as a type of occipital vertebra [1].

The variant may be shaped as a small hump; in that case it is called the paracondylar tuberculum and often tends to be bilateral. Alternatively, it may exist as a free-ended process or may be connected or fused with the transverse process of the atlas forming a synovial joint [6].

The paracondylar process is a rare developmental anomaly with only a few cases reported in the medical literature. The frequency of this anomaly has been reported in anthropology with relatively high incidence, X-ray and anatomical studies. The high incidence of this trait in the anthropological literature could be contributed to the small tubercles, which are not always visualized radiologically [1]. More developed cases are rarer than the minor forms, the former being responsible for signs and symptoms seeking attention [4]. In an article based on roentgen examination of 4,000 consecutive patients, 5 cases of paracondylar processes were reported (0.125%) [6]; in an anatomical study by Srisopark, only a slightly higher frequency was reported, with 2 cases in 692 specimens (0.29 %). However, other studies have reported that the frequency of a paracondylar process may be as high as 2 or 4% [6].

The paracondylar process, as a general rule, is considered innocuous and of little or no clinical significance and has been classified as a minor mesodermal asymptomatic anomaly [3]. In most cases, it represents an incidental finding on radiographic examination of the craniovertebral junction [7]. In larger processes, and in cases with articulation or fusion to the transverse process of the atlas, symptoms may be produced. Protracted incapacitating headache (with a unilateral predominance), postural alterations, limited range of head motion especially on rotation towards the symptomatic side or even an osseous torticollis have been identified and are frequently associated with previous minor head trauma [4].

From a surgical point of view, the paracondylar process is situated at the insertion of rectus capitis lateralis and may exist at the expense of this muscle, which can then be diminished or absent [4]. The rectus capitis lateralis is one of the individual suboccipital muscles that are especially significant in identifying the neural, vascular, and osseous structures involved in the far-lateral exposure and its modifications, primarily the paracondylar approach. This muscle extends upward from the transverse process of the atlas to attach to the jugular process just behind the jugular bulb. The muscle is located medial to the site, where the occipital artery enters the retromastoid area by passing between the rectus capitis lateralis and posterior belly of the digastric. The identification of rectus capitis lateralis allows the estimation of the position of the jugular foramen and facial nerve, which exits the stylomastoid foramen during paracondylar exposure [8.9]. In cases where the rectus capitis lateralis is replaced by the paracondylar process, the loss of this important surgical landmark may result in disorientation and iatrogenic trauma [1].

Congenital anomalies such as the paracondylar process should be considered in cases of persisting headaches or neck pain in young patients. In cases of conservative treatment failure or symptomatology progression, surgical intervention may be considered [10]. Thus, awareness of this process, its topographical relations and its attendant problems is of importance to clinicians, radiologists, surgeons and chiropractors.

Consideration of congenital anomalies of the craniovertebral junction is of importance for the evaluation of a palpable mass in the cervicooccipital area. Radiologic imaging is needed to access osseous abnormalities such as the paracondylar process that is often first detected, not later than the second decade of age. Although plain films and/or CT scan are the usual imaging methods used, MRI is proved to be an efficient method for the identification of such anomalies in young patients, as it does not involve exposure of the child to ionizing radiation [1].

Embryology

The paracondylar process would have formed from a maldevelopment of the first cervical sclerotome around the 4th week of development in utero [11]. The occipital bone is derived from basioccipital, exoccipital and supraoccipital portions which all surround the foramen magnum [12]. The basiocciput goes on to develop into four occipital somites. The caudal portion of the 4th occipital somite goes on to fuse with the cranial portion of the 1st cervical somite to form the proatlas. The proatlas is assimilated into the occiput to form the articular condyles and the tip of the odontoid process. The caudal half of the 1st cervical somite and the cranial part of the second cervical somite go on to form the atlas and the odontoid process of the axis [11]. A paracondylar process represents vestiges of the cranial half of the first cervical sclerotome [2].

IV. Conclusion

A large PCP may articulate or fuse with the lateral transverse process of atlas producing symptoms. It is generally detected on radiographic examination of the neck. However, when small it may be of no clinical significance and even be overlooked on radiological imaging. Thus, awareness of this process, its topographical relations and its attendant problems is of importance to clinicians, radiologists, surgeons and chiropractors.

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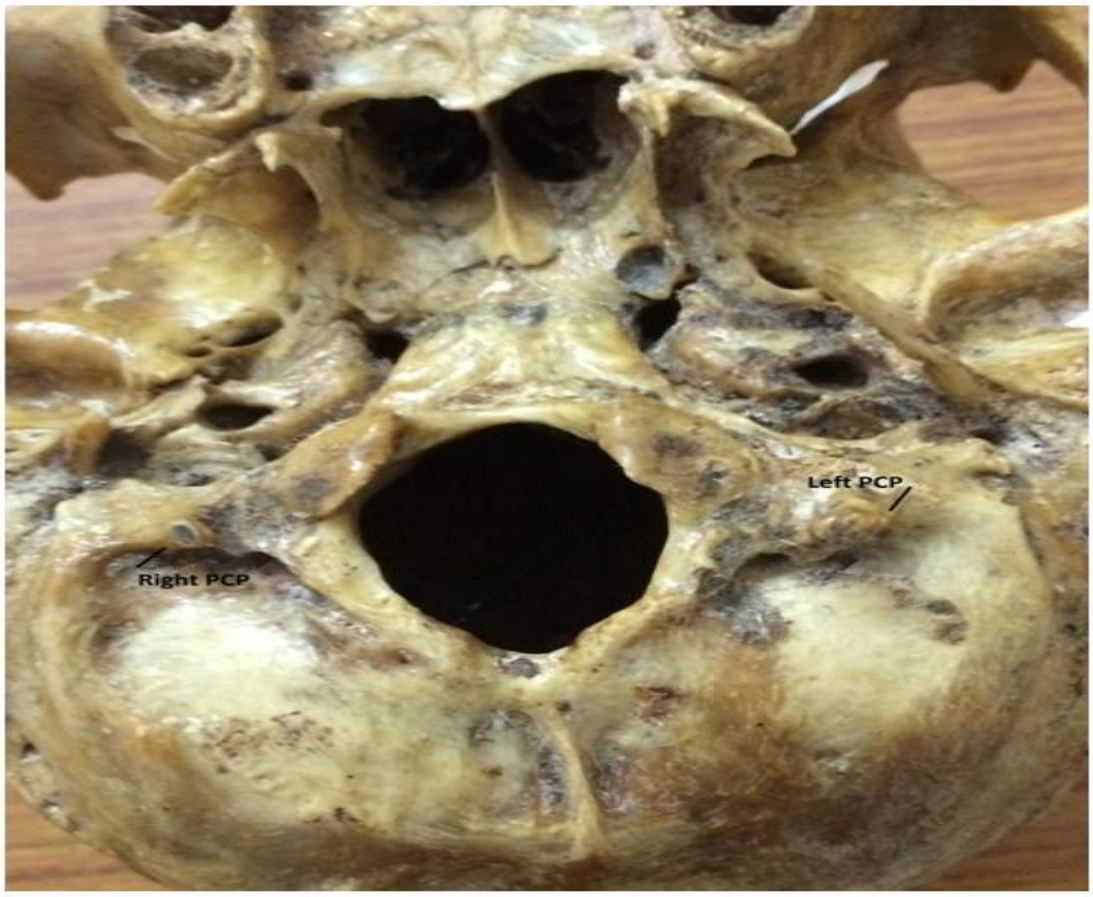

Fig 1 Showing left and right PCP and the asymmetric foramen magnum

Fig 2 Showing left and right PCP

Fig 3 Showing right PCP with its relation to Atlas

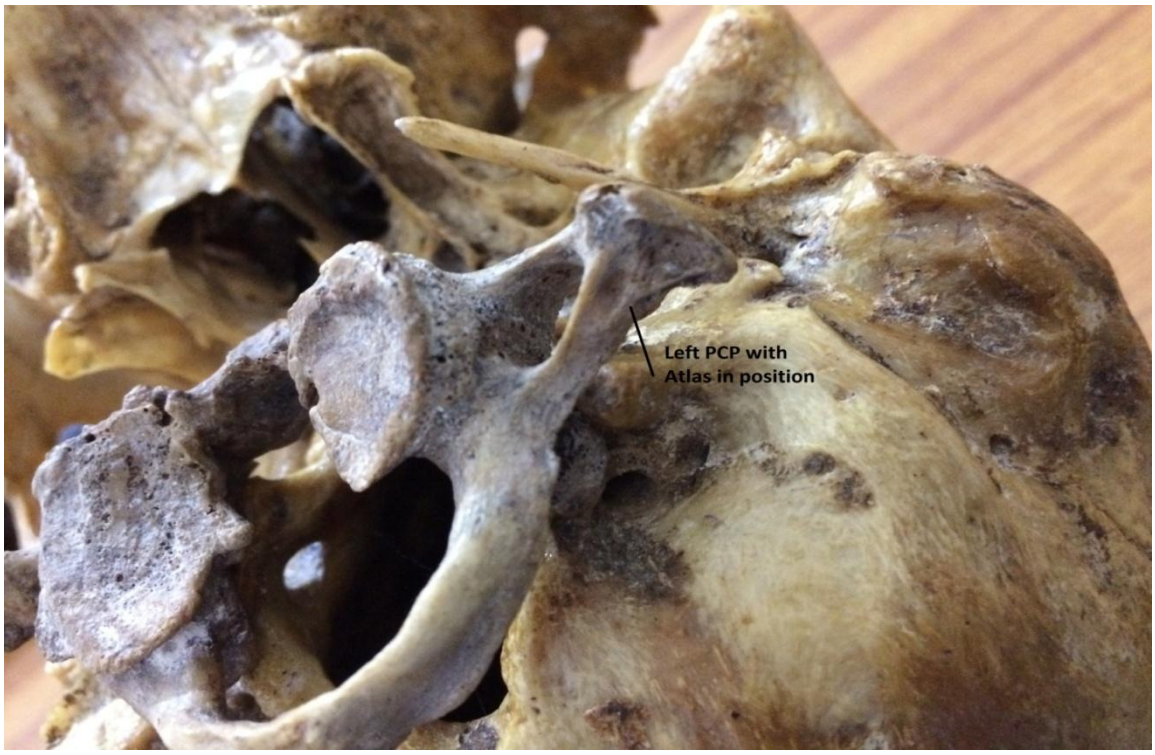

Fig 4 Showing left PCP with its relation to Atlas transverse process and transverse foramen

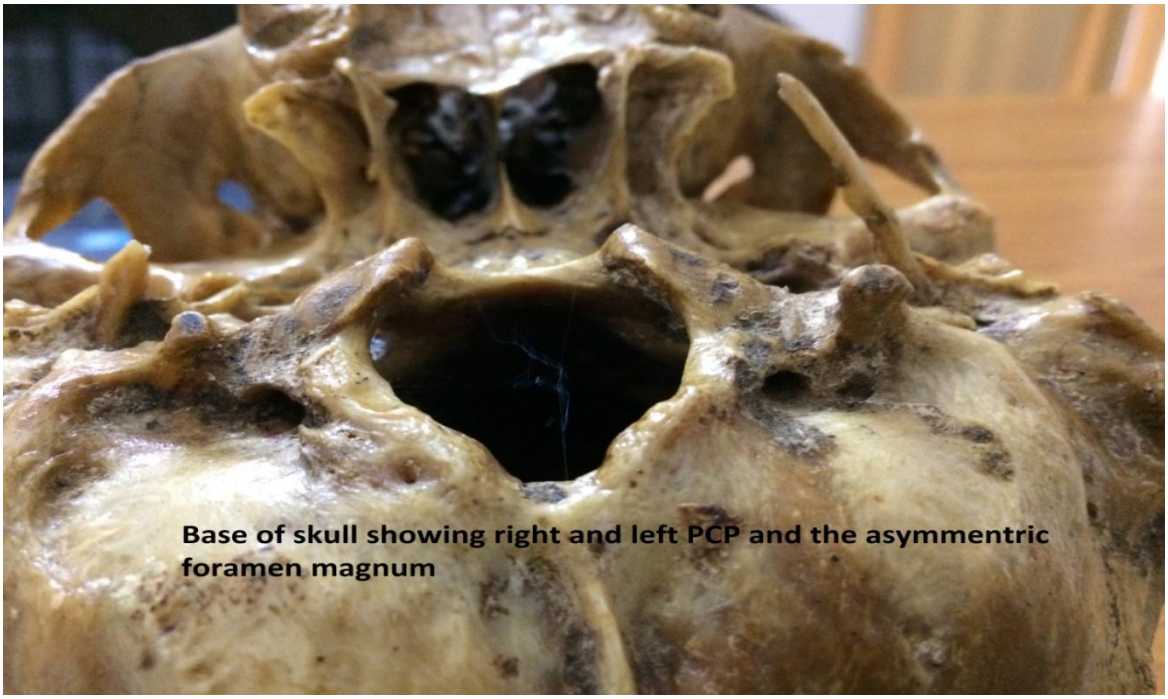

Fig 5 Showing right and left PCP and the asymmetric foramen magnum

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