

A Case Report

Condylus Tertius: A Case Report



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ABSTRACT

Background and Aim: The third occipital condyle (TOC) is an infrequent anatomical variation of the occipital bone that may imitate an occipital condyle (OC) fracture.

Case Presentation: Herein, we present an uncommon case of condylus tertius in a 33-year-old man with trauma with unilateral pain on motion (POM) and limitation of motion (LOM) of the head and neck without neurological deficits. The patient with a diagnosis of condylus tertius underwent conservative treatment with a Philadelphia collar and medical therapy. After two months of follow-up, he had a complete recovery of post-traumatic neck symptoms.

Conclusion: The TOC is an infrequent anatomical variation of the occipital bone that may imitate an OC fracture in trauma cases with good response to conservative treatment for post-traumatic symptoms and unknown effect of the occasional median joint of the TOC with C1 and or dens of axis as reinforcement of the craniocervical region or hampering the motions of the head and neck.

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Highlights

- Condylus tertius (also known as the TOC, the median occipital condyle, or the basilar tubercle) is a rare condition named by Merkel in 1815.
- Condylus tertius may imitate an OC fracture in a trauma case with good response to conservative treatment for post-traumatic symptoms.
- The effect of an occasional median joint of the TOC with C1 and/or dens of axis may be the reinforcement of the craniovertebral region or hampering the motions of the head and neck.

Plain Language Summary

Anatomists and clinicians are interested in abnormalities of the craniovertebral junction because many of these anomalies can create neurological symptoms, may prove fatal, and most of them involve the occipital bone. The fusion of the sclerotomes equivalent to the hypoglossal nerve roots creates the occipital bone. The proatlas is an isolated osseous element situated between the C1 and occipital bones and derived from the upper half of the first cervical sclerotome in lower vertebrates; in humans, it may produce anomalous structures around the foramen magnum, such as the median occipital condyle (OC). The third occipital condyle (TOC), also named as condylus tertius or the median OC, is situated between the tips of the OC and may present as a separate extra bony particle, or may exist with variable degrees of fusion to the occipital bone.

1. Background and Importance

The third occipital condyle (TOC) is an infrequent anatomical variation of the occipital bone found in approximately 0.5-2.5% of cases that may imitate an occipital condyle (OC) fracture and belongs to the spectrum of occipital vertebrae [1-3]. The differential diagnosis of TOC includes fracture fragment, os odontoideum, os terminale, and apical ligament calcification, which is more posterior than TOC and has a more indistinct, peaked bony spur at the apex of the dens [2]. TOC has been associated with os odontoideum [4]. A TOC is generally an accidental detection. When TOC forms an articulation with the apex of the dens and/or the ventral arch of the C1, it may disorganize the occipito-cervical articulation with the formation of a 3-column mechanism bearing the skull. It can create pain, limitation of motion (LOM) of the neck, or bony torticollis that may need operation [2-6]. A prominent TOC projecting postero-inferiorly may compress the neural tissue [6]. The size of TOC may range from barely noticeable to prominently hyperplastic [6]. The TOC presents as a midline osseous prominence below the clivus, at the ventral border of the foramen magnum [7].

2. Case Presentation

History and physical examination

The patient was a 33-year-old male who fell from about two meters in height with the chief complaint of neck pain. On physical examination, the Glasgow coma scale (GCS) was 15/15; vital signs were stable, except for low blood pressure due to external bleeding from the left lower limb; and on neurologic examination, there was no neurological deficit. The positive findings of examination were low blood pressure, LOM, and pain on motion (POM) of the right and left lower limbs because of a fracture of the right distal part of the femur in association with vascular injury and bleeding, and fracture of the right femur, and LOM and POM of the head and neck to one side.

Imaging studies

Computed tomography (CT) scan of the cervical spine showed an isolated ossicle at the ventral part of the foramen magnum below the clivus and above the dens of axis without any post-traumatic subarachnoid hemorrhage or hematoma at this region (Figures 1 and 2). On magnetic resonance imaging (MRI) of the cervical spine, there was a well-defined oval, corticated bony prominence at the ventral part of the foramen magnum, anterior to the basion, with normal bone signal intensity without any post-traumatic edema or signal changes, ruling out fracture (Figures 3, 4, and 5).

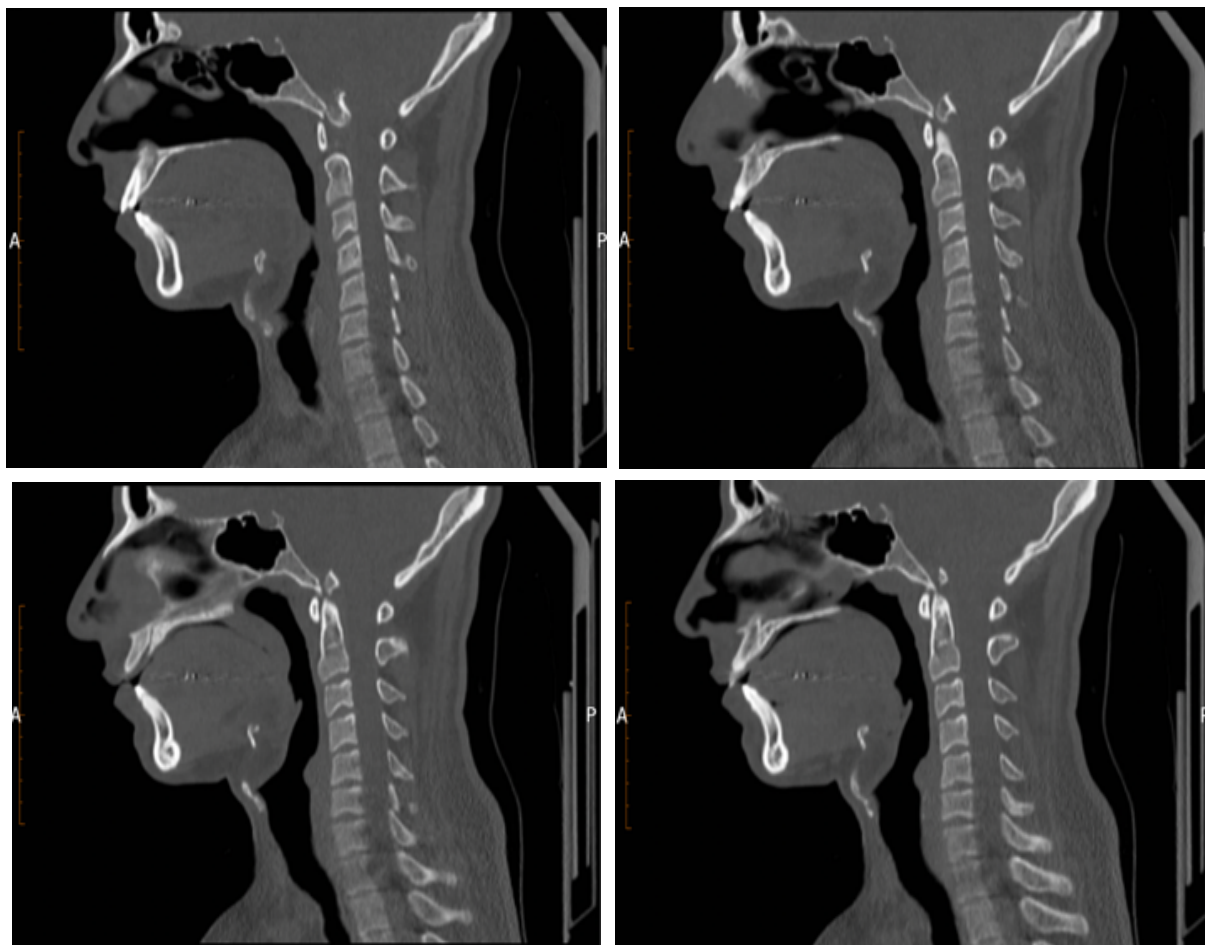


Figure 1. Sagittal reconstruction CT scan of cervical spine

Note: An approximately midline, oval, and bony ossicle is slightly attached to the basion, and to the anterior surface of the basioccipital bone at the margin of the foramen magnum in favor of condylus tertius (white arrow).

3. Discussion

OC are two prominent oval-shaped bony outgrowths that are situated below the outer parts of the occipital bone at the skull base. They are a significant portion of the cranio-vertebral junction that connects the skull to the upper cervical spine [8]. The long axis of OC points to the anterior and medial direction, with their front ends reaching towards the basilar part of the occipital bone and their back ends stretching to the posterior and lateral direction, and are situated about the midline part of the foramen magnum. The articular planes of the OC are rounded and connect to the upper facets of the C1 through the atlanto-occipital joint. This joint links the skull to the vertebral column with the upper articular fovea of the lateral mass of C1 [9, 10]. There is a joint capsule around each OC, and there is a coarse spot on their inner sides for attachment of the alar ligament. Above each OC, there is a bony channel called the hypoglossal canal that is located in the middle of the OC and

the outer part of the occipital bone and is a pathway for the hypoglossal nerve passage [11-13]. A few reports in the literature [11] indicates that TOC is rare and that clinicians should be aware of this anomaly. It is situated around the foramen magnum as an additional OC that is also named: median OC, basilar tubercle, and condylus tertius [11]. OC anomalies may be important from an anatomical viewpoint during operation and in reporting CT and MRI [9].

During the development of the human craniovertebral junction, several segments are involved. For the formation of the occipital bone, four to five somites are united. These somites encircle the foramen magnum with fusion to each other [14, 15]. Anomalous separations, fusions, and intercalated ossicles are uncommon and can occur [16]. Anomalous segmentation can create a TOC that is situated on the basion at the anterior and midline location to the foramen magnum.

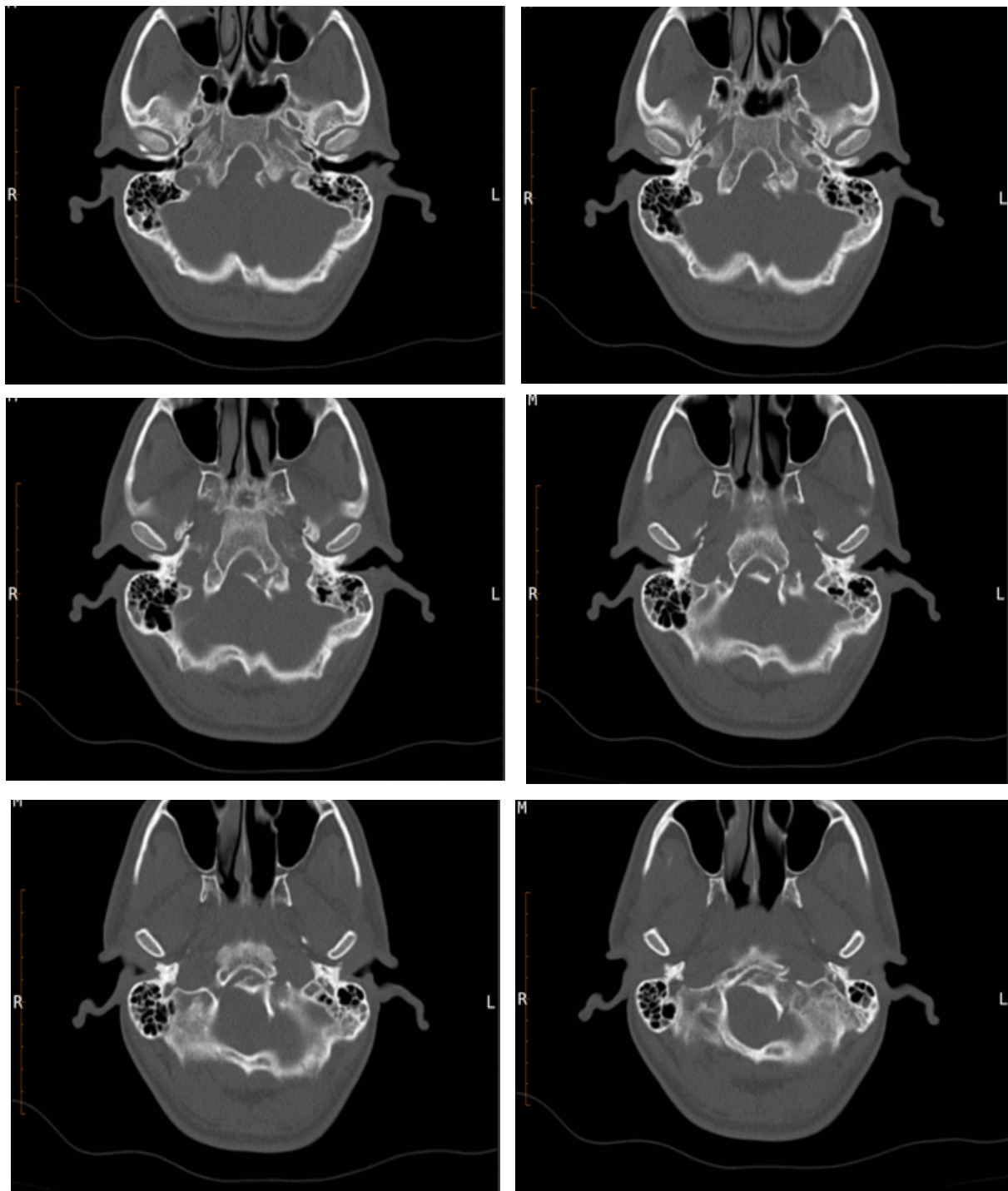


Figure 2. Axial view of CT scan of cervical spine

Note: A bony well corticated remnant presents at the anterior and midline part of the foramen magnum below the clivus that is extended to the lateral part of the foramen magnum on the left side (white arrow).

During human development, the pro-atlas neural arch splits into a ventral and a dorsal segment. The ventral part forms the OC, and the dorsal part creates a portion of the upper facet joints of the C1. Developmental disorders in the ventral segment can cause TOC. The

TOC may be a simple rounded tubercle or a well-developed condyle that forms a true diarthrosis with a facet joint connecting to the apex of the axis dens [17]. Lüdinghausen et al. [11] reported a case of TOC involving a complex joint between the basiocciput, the ventral

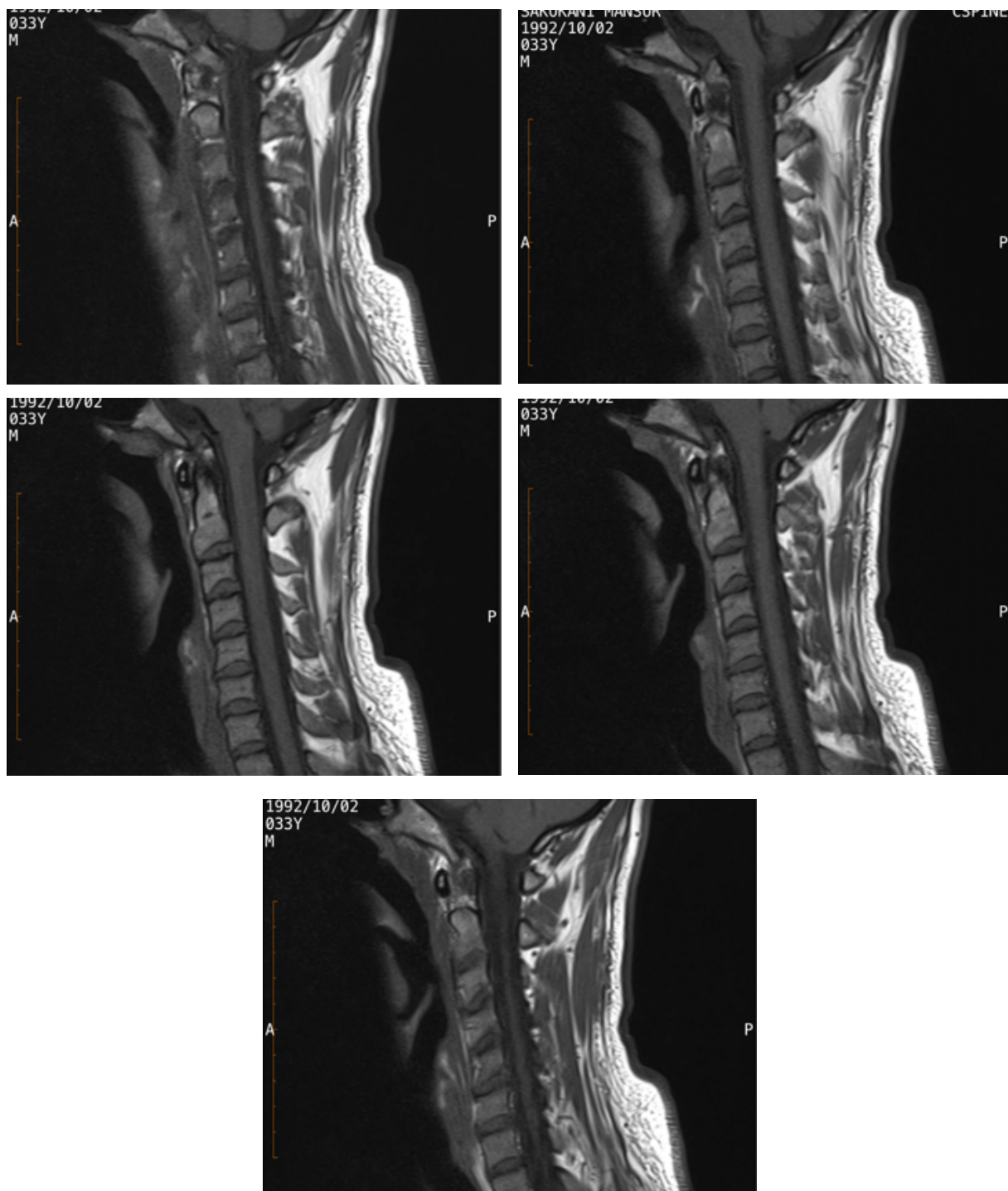


Figure 3. T1W MRI of cervical spine

Note: A fragment with bony intensity at the ventral margin of the foramen magnum, anterosuperior to the basion, and dense with intensity of bone without signal changes in favor of a traumatic lesion.

arch of C1, and the odontoid process of C2. Lang [18], in a study of 600 skulls, showed craniovertebral malformations, including a TOC, were present in fourteen percent of cases. Figueiredo [17] showed that, based on sensenig, the mammalian apical odontoid part is

phylogenetically equivalent to the proatlas in reptiles. Fusion of the proatlas with the occiput occurs in the vertebrates [19, 20]. The TOC is located along the intervertebral planes of the vertebral centers and is morphologically equivalent to the central part of a single

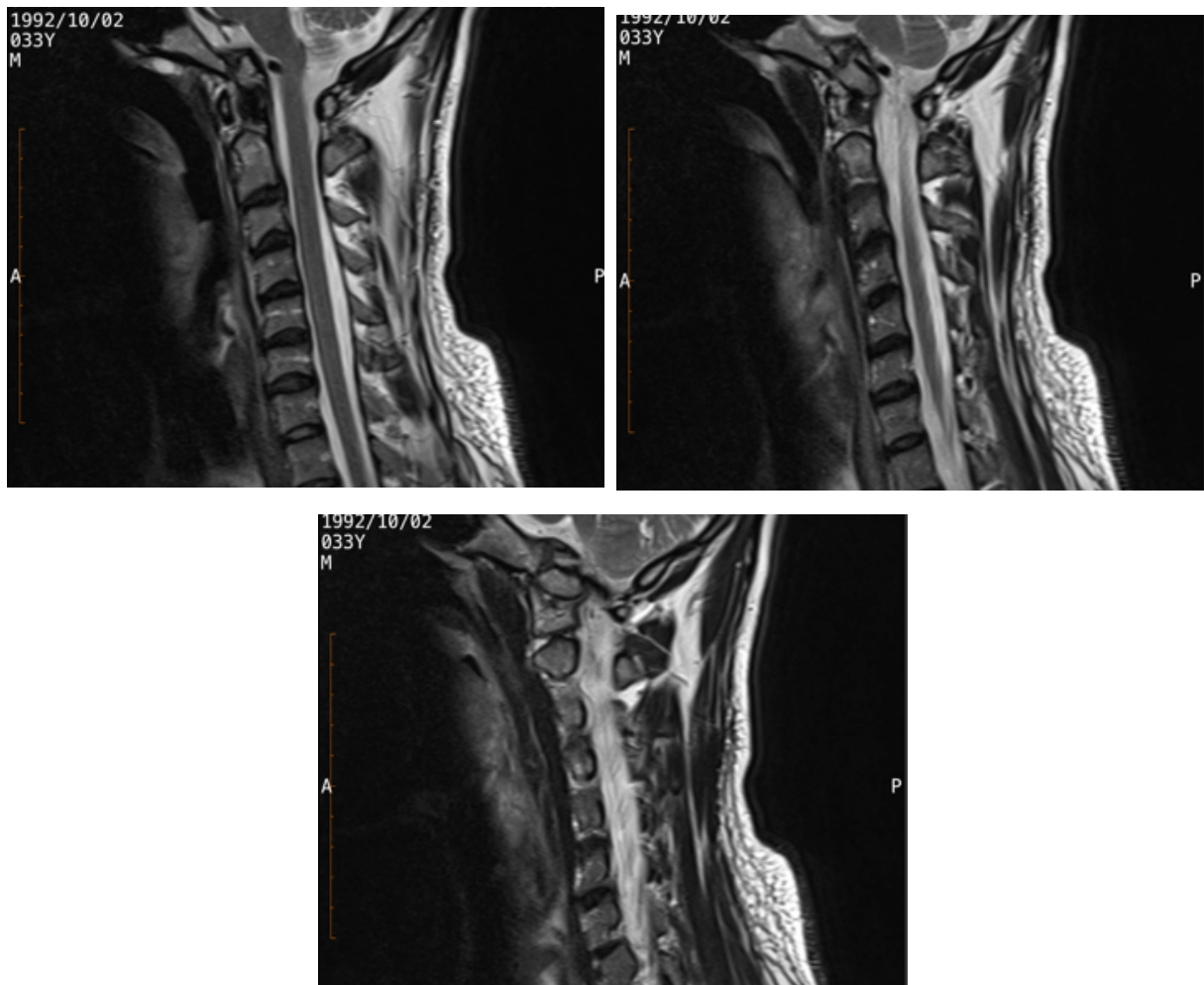


Figure 4. T2W MRI of cervical spine

Note: There is a pre-basioccipital arch osseous particle on the anterior rim of the foramen magnum and a well-defined oval corticated space-occupying lesion anterosuperior to the basion with intensity of bone without any post-traumatic edema or signal changes, in favor of a condylus tertius.

avian or reptilian condyle [19]. According to Allen [19], Meckel seems to have been the first person to report the TOC. On MRI, the TOC may mimic an odontoid fracture; however, there is no post-traumatic bone edema and signal change [17]. The association of TOC with laxity of the transverse ligament and resultant C1C2 instability and quadriplegia is possible [17]. Patient with TOC may present as: limb paresthesia, nuchal pain, backache, LOM of the head and neck in rotation because TOC lies in the midsagittal plane, insomnia, and constipation. Lombardi [21] showed that TOCs are usually asymptomatic; however, when well developed, they can cause LOM of the head and neck. The narrowing of the foramen magnum can occur following disordered bone formation that derives from the fusion of the proatlases with the occipital base, and because of the pressure effect on the structures passing

through the foramen magnum, neurological symptoms can occur. Pressure effect on the neural and vascular portions at the cervico-medullary junction can involve cervical roots, cranial nerves, spinal cord, brainstem (brainstem signs comprise nystagmus and respiratory problems), and vascular structures (because of the severe stretching of the vertebral and anterior spinal arteries that causes vascular symptoms like vertigo, altered sensorium, syncope, and temporary loss of vision) [22, 23]. McRae, based on radiological studies, showed that 38% of patients with syringomyelia and syringobulbia had osseous anomalies about the foramen magnum [24].

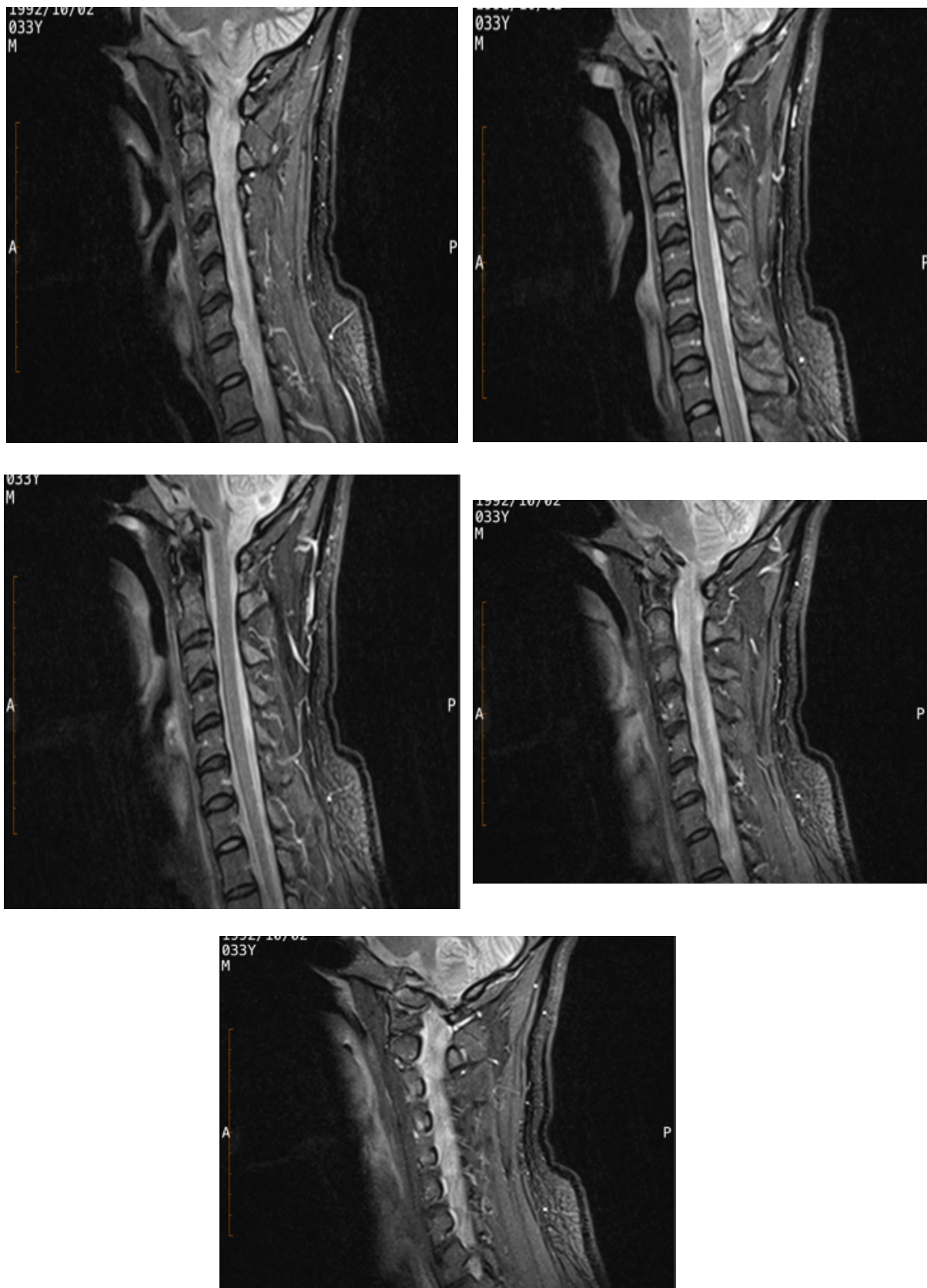


Figure 5. Short tau inversion recovery (STIR) MRI of cervical spine

Note: An ossicle with bony intensity at the ventral border of the foramen magnum above the clivus and dense without traumatic signal changes that looks like a fusion with the skull base (white arrow).

4. Conclusion

Knowledge of craniovertebral region anatomy will be helpful to neurosurgeons in the accurate detection and treatment of rare congenital anomalies of the craniovertebral region, including anomalies of the craniovertebral junction, such as condylus tertius, and may help in correlated radiological analyses. More conclusive studies are required to determine whether the median joint of the TOC with C1 and/or dens of the axis reinforces the craniovertebral region or hampers the motions of the head and neck.

Ethical Considerations

Compliance with ethical guidelines

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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Authors' contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the results and drafting of the manuscript. Each author approved the final version of the manuscript for submission.

Conflict of interest

The authors declared no conflict of interest.

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