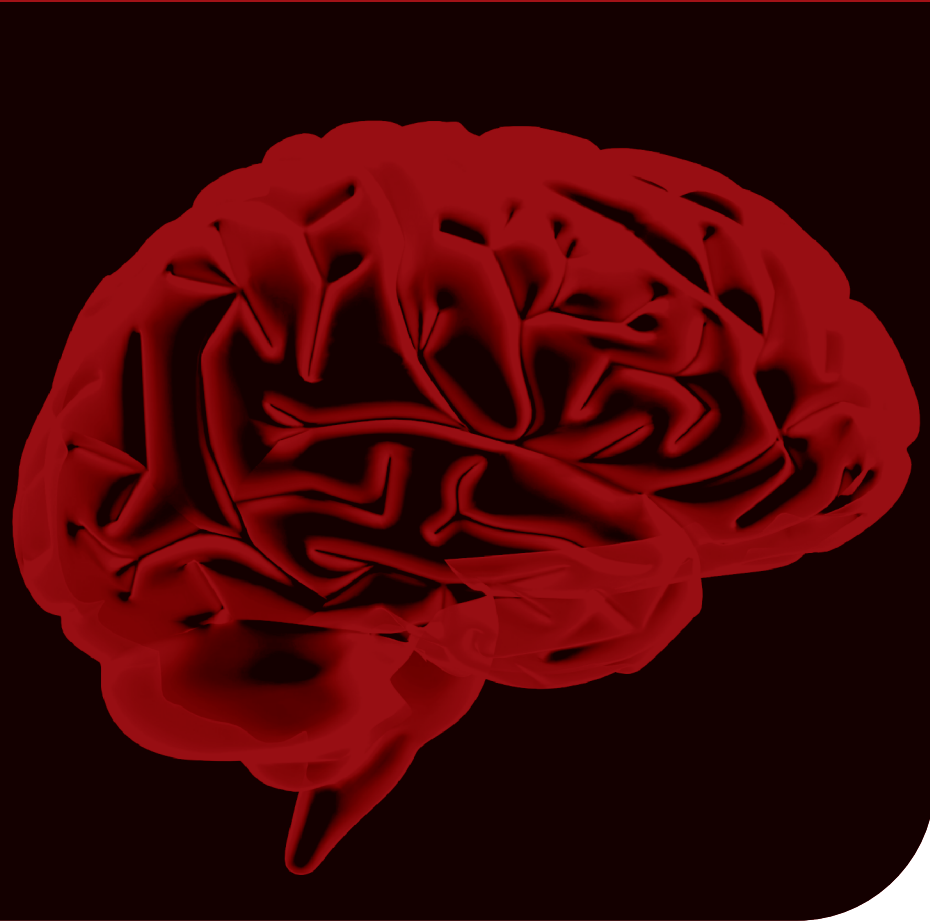


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process [Figure 2]. Coronal reconstruction CT clearly demonstrated vertical odontoid fracture [Figure 3]. Three dimensional CT (3D CT) scan directly define the relation of the atlantoaxial joint and vertical odontoid fracture [Figure 4]. In order to decide the treatment option, cervical magnetic resonance imaging (MRI) was taken. There were no hyperintensities in the alar ligaments and C1-2 articular capsules in T2-weighted and short TI-inversion recovery (STIR) MRI. On the basis of these findings we opted for conservative treatment with rigid cervical collar and in one month he had improvement of torticollis.

Pediatric upper cervical spine injuries are rare and constitute between 0.6% and 9.5% of all cervical spine injuries.^[1,2] The pathophysiology of AARS is still unclear. It is believed that muscle contracture following upper respiratory tract infection might be a factor for AARS.^[3] Sinigaglia *et al.* suggested that disruption

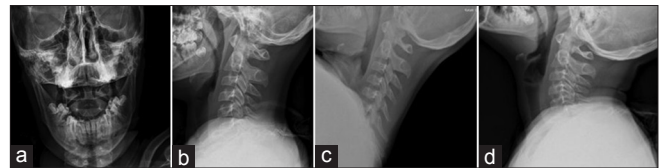


Figure 1: (a) Open mouth X-ray did not determined dens clearly because of superposition of skull base on upper cervical spine. (b-d) shows lateral neutral and functional X-rays, which were normal, and there was no findings of pathology

Report of an unusual upper cervical spine injury: Traumatic atlantoaxial rotatory subluxation with vertical odontoid fracture in a child

Sir,

A 14-year-old male was admitted to the emergency department after a fall from 15 meter height. Neurological examination was normal. He had a linear vertex injury with torticollis. Cervical X-rays [Figure 1] and cranial computed tomography (CT) were normal. Axial upper cervical CT demonstrated suspicion of type I atlantoaxial rotatory subluxation (AARS) with fracture line in odontoid

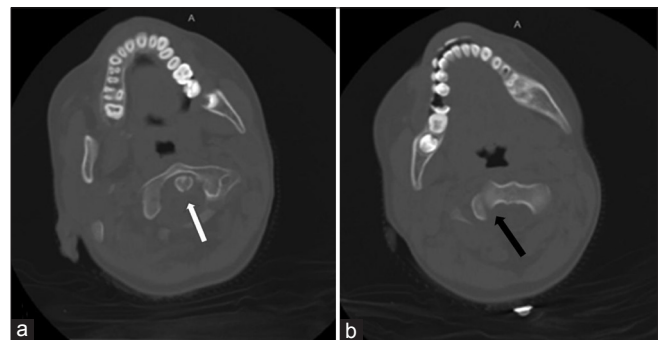


Figure 2: (a) Axial upper cervical CT determined suspicious fracture line in odontoid process (white arrow) with (b) Type I AARS (black arrow)

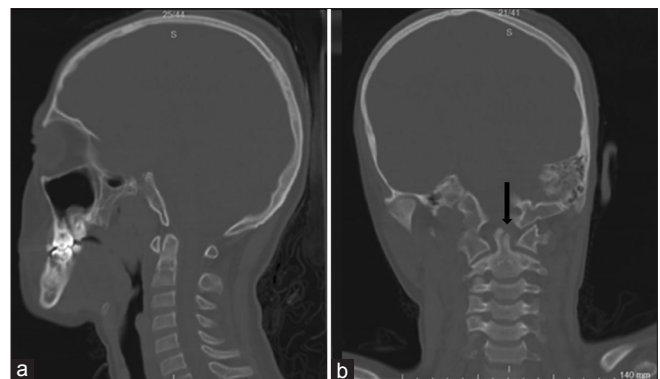


Figure 3: (a) While sagittal reconstruction of cervical CT was normal (b) Coronal reconstruction demonstrated vertical odontoid fracture clearly (black arrow)

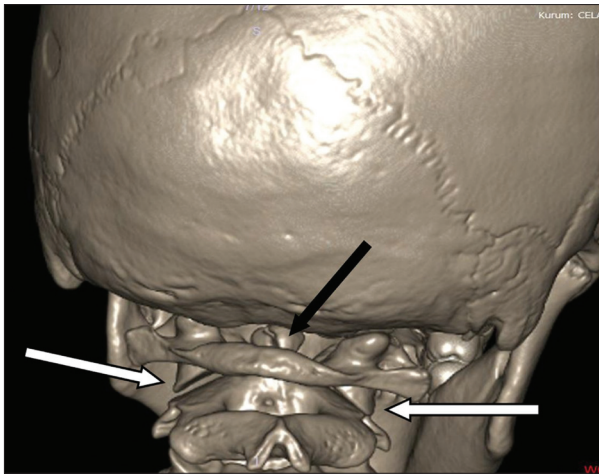


Figure 4: Three dimensional CT scan showing the right lateral translatory subluxation of the atlas over the axis (white arrows) and vertical odontoid fracture (black arrow)

of the facet joints followed by both alar ligament disruption causes AARS.^[4] AARS has been divided into four sub-types:^[3,4] Type I_ rotatory fixation (RF) with no anterior displacement; Type II-RF with anterior displacement of the atlas by 3_5 mm; Type III_RF with anterior displacement of the atlas >5 mm; and Type IV_ RF with posterior displacement.^[1,3] Type I and II are the most common and also most difficult to diagnose.^[3]

Dens fractures account approximately 9% of all fractures of the cervical spine^[5] and are classified into three types: Type I- an oblique fracture through the upper part of the odontoid process itself; Type II- fracture at the junction of the odontoid process with the vertebral body of the axis; and Type III- total fracture through the body of the atlas.^[6] Vertical fracture is an uncommon type of fracture affecting odontoid process, the fourth type of odontoid fracture and its incidence is unknown. The mechanism for vertical dens fracture is probably due to extension and axial loading.^[5] Our patient had Type-I AARS with vertical dens fracture, probably due to axial loading on the anterior lip of the foramen magnum striking the apex of the dens and AARS due to rotatory forces during the injury.

Diagnosis of both Type I AARS and vertical odontoid fractures is difficult. Rotatory subluxation Type I does not have widened atlantodental interval so, the diagnosis is not completely accurate and may be suspicious or missed diagnosis with roentgenographic examination.^[3,7] Not only in AARS, but also in vertical odontoid fractures, plain X-ray may not always determine fracture because of skull superposition on the upper cervical spine.^[8] Castillo *et al.* reported that they were not able to identify the vertical fractures on plain radiographs,^[5] but these are clearly seen in CT scans.^[3,5,7,8] According to Duan *et al.* three dimensional (3D) CT clearly and directly define the spatial relation of the atlantoaxial joint.^[7] Three dimensional CT images give a global view of the cervical

deformity and aid in demonstrating subluxation.^[8] While AARS and dens fracture could be seen in axial plane, we determined dens fracture in coronal reconstruction clearly, because fracture line was perpendicular to axial plane and parallel to sagittal plane. MRI helps to direct visualize tear or avulsion of the transverse ligament.^[8] Our patient's cervical MRI determined intact transverse ligament, which means stable injury.

Treatment of AARS include immobilization with conservative care, traction, manual reduction, and surgery.^[8,9] Conservative treatment is the first step if transverse ligament is intact.^[9] Surgical approach is needed for cases of AARS with unstable spinal injuries, neurological involvement, and failure to maintain reduction by conservative treatment.^[8,9] Rahimi *et al.* reported that AARS most often spontaneously reduces with the use of a rigid cervical collar or with 48-72 hours of traction followed by using of a cervical collar.^[10] According to functional cervical X-rays and cervical MRI findings, our patient's injury was stable. Considering the patient's normal neurological status, we decided to manage his injury with rigid cervical collar.

Published cases with odontoid vertical fracture in literature are all found in adults; it is interesting to see this pathology in a child with combination of AARS. For suspected upper cervical spine injuries, CT scans and 3D CT reconstructions can diagnose AARS and vertical odontoid fractures. In combination of Type I AARS and vertical odontoid fracture, conservative treatment should be the option if transverse ligament is intact.


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