



Case Report

## Traumatic atlantoaxial dislocation with a type III odontoid fracture: a rare and fatal injury

### *Tip III odontoid kırığı ile birlikte travmatik atlantoaksiyel dislokasyon: Nadir ve sıklıkla ölümcül bir yaralanma*

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#### ABSTRACT

Traumatic atlantoaxial dislocation with a dens fracture is very rare in children. In this case report, a 15-year-old woman presented at the emergency department after being hit by a motor vehicle as a bicyclist. CT scans showed a type III dens fracture with retropulsion of the posterior wall, resulting in significant stenosis of the spinal canal. A cervical transection and prevertebral hematoma were present. External immobilization can be applied conservatively. However, atlantoaxial dislocation may require surgical fixation to stabilize and prevent slippage. Here, posterior screw-rod fixation techniques can provide better results in terms of neurological outcomes, pain status and adverse events compared to other techniques. However, head and neck imaging should be performed to consider surgical intervention.

**Keywords:** *atlantoaxial dislocation, odontoid fracture, cervical trauma*

#### ÖZET

Travmatik atlantoaksiyel dislokasyon, bir çocukta dens kırığı ile birlikte çok nadir görülür. Bu vaka raporunda, bisiklet sürerken bir motorlu araç çarpması sonucu acil servise başvuran 15 yaşında bir kız çocuğu bulunmaktadır. Bilgisayarlı tomografi taramaları, spinal kanalda önemli daralmaya neden olan, posterior duvarın retrülsiyonu ile birlikte üçüncü tip bir dens kırığı tespit etmiştir. Servikal kesik ve prevertebral hematoma da mevcuttur. Dış immobilizasyon koruyucu bir şekilde uygulanabilir. Ancak atlantoaksiyel dislokasyonun, istikrarı sağlamak ve kaymayı önlemek için cerrahi sabitlemeyi gerektirebileceği unutulmamalıdır. Burada, posterior vida-çubuk sabitleme teknikleri, diğer tekniklere göre nörolojik sonuçlar, ağrı durumu ve olumsuz olaylar açısından daha iyi sonuçlar sağlayabilir. Ancak cerrahi müdahale düşünülmeden önce baş ve boyun görüntülemesi yapılmalıdır.

**Keywords:** *atlantoaksiyel dislokasyon, odontoid kırık, servikal travma*

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## INTRODUCTION

Traumatic atlantoaxial dislocation combined with a fracture of the dens or odontoid is rare, especially in children. Cervical trauma is becoming less prevalent in children. Road accidents have decreased, but sports-related accidents have increased (1). Spinal cord injury at this level is a feared and possibly fatal complication due to the proximity of the medulla oblongata (2). To our knowledge, there is only one pediatric case described with a type III odontoid fracture and atlantoaxial dislocation in the literature (3).

Injury patterns are unique because children's spines and biomechanics are different than adults. The prevalence of lesions also depends on the age of the child. Upper cervical lesions from occiput to C2 are most common in preadolescent children. Lower cervical lesions are more prevalent after the age of 9 (4-7). Following childhood, the process of skeletal maturation begins and continues until ossification is complete, typically between the ages of 12 and 13 years. However, even this older group of children is still at an increased risk for upper cervical and distraction injuries in comparison to adults as a result of their immature skeletons(8). The CARE guidelines were used for an accurate and transparent description of the case report(9).

## CASE REPORT

In this case report, a 15-year-old woman was struck by a motor vehicle as a bicyclist. The emergency service arrived on the scene. At arrival, the patient was in respiratory distress and suffered from hemoptysis. On physical examination, the Glasgow Coma Score was 3/15, and the patient had mydriatic fixed pupils. The patient was stabilized, and the airway was cleared of obstruction. The patient was ventilated, and oxygen was administered. She was then transported to the emergency department on a long backboard with a cervical collar, lateral head blocks and straps. At the emergency department, the lateral head blocks and straps were removed.

The medication use of the patient was unknown at the time of admission. At admission, a heart rate of 95 beats per minute was noted. She had a saturation of 98%. A cranial CT scan showed bilateral subarachnoid hemorrhage and extensive cerebral oedema with subsequent herniation. The CT scan of the cervical spine indicated a type III dens fracture (Anderson-D'Alonzo classification) through the massae lateralis with retro-

pulsion of the posterior wall and significant narrowing of the spinal canal (Figure 1). There was a high cervical transection of the spinal cord with retraction over a length of approximately 6 cm and an extensive prevertebral hematoma. CT angiogram showed dissection of the left carotid artery. A CT scan of the thorax was performed. There was a dissection of the ascending aorta (type A) and atelectasis of the left lower lobe. A CT of the abdomen showed a grade 2 or 3 lacerations of the liver. A blood pressure of 30/10 mmHg was noted. Later, the patient went into severe neurogenic and hemorrhagic shock, which did not respond to any treatment. The patient died four hours after admission.



**Figure 1.** CT scan portraying a type III dens fracture with posterior wall retropulsion, hyperflexion posture and hyperkyphosis suggestive of severe spinal cord injury. There is clear evidence for posterior ligamentous disruption as the space between C1 and C2 is enlarged.

## DISCUSSION

Treatment of atlantoaxial dislocation with an odontoid fracture is challenging due to the anatomical complexity. External immobilization with either a halo ring or cervical collar and vest can be used to achieve a bony union of the dens (2,4,10,11). This should be performed when the fracture is stable to prevent slippage of the bony structures. Lui et al. suggest fracture fusion in children with substantial neurological injury or frac-

ture displacement greater than half the diameter of the dens. However, odontoid screw fixation may be a better alternative if the fracture is fully reducible (10). One author performed atlantoaxial fusions using lateral mass screws at C-1, C-2 pars interarticularis screw fixation, and C-2 pedicle screw fixation (12). However, transarticular screw fixation is not always feasible due to anatomical differences. In such cases, bone anchors can be used (12). The contoured loop fixation utilizes a titanium loop (rod) and cables to provide stabilization. This is especially effective in young children who are unsuitable for screw fixation (12). A systematic review by Wignar et al. concluded that screw-rod fixation was most successful in terms of postoperative adverse events, rates of instrumentation failure and neurological outcomes compared to other techniques, such as posterior wiring/rods, hooks/rods, screws/plates, wires/plates, and posterior wiring with onlay graft(13). However, the systematic review did not differentiate between construct configurations among these groups. Irrespective of the approach employed in occipitocervical stabilization procedures, meticulous attention to the specific technique employed is essential. Precise anatomical placement is imperative when applying occipital screws, pedicle screws, lateral mass screws, and sublaminar wires. Surgical expertise and comprehension of the three-dimensional cervical spine anatomy are crucial in ensuring the accurate and safe insertion of appropriate instrumentation and mitigating potential adverse events associated with their use. Pediatric trauma data repositories emphasize the importance of understanding the interaction between the central nervous system and extracranial injuries. Hypotension and hypoxia resulting from associated injuries may adversely affect the outcome of intracranial injury(14). On this axis, bilateral restoration of pupillary reactivity shortly after trauma is crucial for survival. The observation of "dilated" fixed pupils at the scene indicates that the victim was likely suffering from severe traumatic brain injury (TBI). While the type III odontoid fracture is a severe injury, it is unclear whether it directly contributed to the patient's death. The patient's poor prognosis was primarily attributed to the accompanying brain injury and other polytrauma affecting vital organs. It is possible that the odontoid fracture played a role in the patient's overall condition and may have affected their ultimate outcome, but further investigation and analysis would be required to establish its exact contribution to the patient's death.

In severe cervical trauma, a critical management point in multiple trauma patients is early cervical stabilization at the scene and within the hospital before sur-

gical processing. Therefore, it is imperative to perform head and neck imaging before initiating major surgery with an unfavorable prognosis. Given the high detection rate of cervical spine injuries, a CT scan of the cervical spine should be conducted on any high-risk pediatric patient. The importance of early immobilization followed by surgical decompression and stabilization cannot be overstated in such cases. Typically, these injuries have a dismal prognosis, exacerbated if polytrauma affecting nearby neurological structures and other vital organs is present. Unfortunately, no surgical intervention could have improved the outcome of our patient.

#### Patient Consent Form / Hasta Onam Formu

The parents' of this patient consent was obtained for this study.

#### Conflict of Interest / Çıkar Çatışması

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