

**OLGU SUNUMU / CASE REPORT****Traumatic craniocervical junction ligamentous and brain stem injuries and retroclival hematoma: unusual combination of craniocervical junction injuries**

Travmatik kranioservikal bileşke ligamanlarının, beyin sapı oluşumlarının yaralanması ve retroklival hematoma: kranioservikal bileşke yaralanmalarında nadir görülen kombinasyon

Bilal Egemen Çifçi¹, Gökçen Çoban Çifçi¹, Mahmut Gökdemir¹, Enes Duman¹

¹Baskent University Faculty of Medicine, Department of Radiology, Konya, Turkey

Cukurova Medical Journal 2017;42(3):560-563

Abstract

Cervical spine injuries are common in pediatric population and usually seen in craniocervical junction due to the anatomical and physiological differences. Combination of rapid hyperextension/hyperflexion traumas due to high-speed motor vehicle accident are known to be the reason of ligamentous injury and retroclival epidural hematoma. Our aim is to describe a rare combination injury of the the apical ligament, retroclival epidural hematoma and the suspicion of brain stem slits, due to rapid hyperextension/hyperflexion and rotational trauma with high-speed motor vehicle accident in a 3 year 8 month old girl. The cervical spine was immobilized with a Philadelphia collar. She is still under treatment in the pediatric intensive care unit with a Glasgow Coma Scale of 8 for six months.

Key words: Retroclival hematoma, apical ligament injury, subarachnoid hemorrhage.

Öz

Servikal spinal yaralanmalar pediatrik grupta sık görülmektedir ve anatomik, fizyolojik değişiklikler nedeniyle genellikle kranioservikal bölge etkilenmektedir. Araç içi trafik kazalarında hızlı hiperekstansiyon/hiperfleksiyon travması ligamentöz hasarların ve retroklival epidural hematomun bilinen nedenlerindedir. Amacımız 3 yaş 8 aylık çocuk hastada araç içi trafik kazasında hiperekstansiyon/hiperfleksiyon ve rotasyon travmasına bağlı oluşan, bir arada nadiren görülen apikal ligaman hasarı, retroklival hematoma ve şüpheli beyin sapı laserasyonu bulgularını sunmaktır. Hastanın servikal bölgesi Philadelphia boyunluğu ile immobilize edildi. Glasgow Koma Skalası 8 olan hasta 6 aydır pediatrik yoğun bakım ünitesinde tedavi görmektedir.

Anahtar kelimeler: Retroklival hematoma, apikal ligaman hasarı, subaraknoid kanama.

INTRODUCTION

Traumatic craniocervical junction ligamentous injuries and retroclival epidural hematoma (RCEH) are infrequent complications of traumas. Motor vehicle accident (MVA) is the mainly cause of these kind of injuries. Pediatric population is mostly at risk of craniocervical junction injury¹.

The anatomical and physiological differences of the craniocervical junction in pediatric population predispose to injuries in this region. The muscles are

weak, head is relatively large, the occipital condyles are smaller and the ligamentous structures are laxer in the pediatric population. In the line with these factors the mobility of the craniocervical junction improves. Due to hypermobility of the craniocervical junction the risk of injuries will increase in pediatric population. Combination of rapid hyperextension/hyperflexion traumas are known to be the reason of ligamentous injury with RCEH².

Craniocervical junction ligamentous injuries may

Yazışma Adresi/Address for Correspondence: Dr. Bilal Egemen Çifçi, Baskent University Faculty of Medicine, Department of Radiology, Konya, Turkey E-mail: drecifci@gmail.com
Geliş tarihi/Received: 23.08.2016 Kabul tarihi/Accepted: 12.01.2017

cause instability without any cervical bone fracture in pediatric population. In these kind of cases magnetic resonance imaging (MRI) is the most important imaging modality to describe the soft tissue and ligamentous structures of the craniocervical junction.

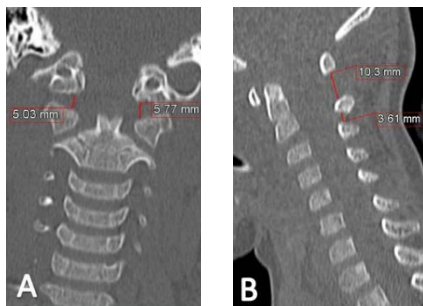


Figure 2 a-b: On coronal (a) and sagittal (b) MIP CT images. The dens–basion and basion– axial intervals are in normal limits. The occipital condyle and the atlas joint diameter is asymmetric and greater than 4 mm (Fig. 2a). C1–C2 inter-laminar space ratio (C1–C2:C2– C3) is greater than 2.5 (Fig. 2b). There is no bone fracture.

Our aim is to describe a rare presentation of multiple craniocervical junction ligamentous injuries with retroclival epidural hematoma and the suspicion of brain stem slits due to high-speed motor vehicle accident in a 3 year 8 month old girl. Radiologist should alert the clinician in terms of craniocervical junction ligamentous injuries in patients with RCEH on brain MRI in the presence of accompanying traumatic accidents.

CASE

A 3 years 8 month girl was admitted to our emergency department after a high-speed motor vehicle accident. On admission, she was intubated, unconscious with fixed and dilated pupils and a Glasgow coma scale (GCS) of 3. She was referred to the radiology department to obtain radiographs and computed tomography (CT) scans of the head, cervical spine, thorax and abdomen. Radiographs were normal. Chest CT revealed pneumo and haemothorax with pulmonary contusion. On abdomen CT there was liver laceration and mild intraabdominal fluid. On head CT there was 10 mm thick retroclival epidural hematoma, scattered subarachnoid hemorrhage, quadrigeminal cistern, and left intraventricular hemorrhage (Figure 1a-1d),

but no bone fracture. There was no bone fracture on cervical spine CT imaging, the dens–basion (DB) and basion–axial intervals (BAI) were in normal limits. The occipital condyle and the atlas joint diameter was asymmetric and greater than 4 mm (Figure 2a), and also C1–C2 inter-laminar space ratio (C1–C2:C2–C3) was greater than 2.5 (Figure 2b).

On the 5th day of admission CT was repeated and there was a significant increase of ventricular sizes. An external ventricular drainage was placed to control hydrocephalus. To evaluate the craniocervical junction, cervical and brain magnetic resonance imaging were performed on the 15th day of admission, after providing hemodynamic stabilization. On MR imaging, there was prominent cerebrospinal fluid between the anterior atlantooccipital and tectorial membrane and C0-1 and C1-2 interlaminar space (Figure 3a) and tectorial membrane stretching (Figure 3b,3c). The apical ligament was disrupted (Figure 3a). The anterior and posterior longitudinal ligaments were adjectave and in normal shape.

Diffusion imaging revealed the diffusion restriction in bilateral perirolandic cortex, posterior parietal-occipital cortex and basal ganglia due to hypoperfusion. There were focal hyperintensities on the ventral ponto-medullary junction (Figure 3a) and the right caudal cerebellar peduncle suspicion of focal slits (Figure 3c, 3d) due to combination of rapid hyperextension/hyperflexion trauma. The cervical spine was immobilized with a Philadelphia collar. She is stil under treatment in the pediatric intensive care unit with a GSC of 8 for six months.

DISCUSSION

Our aim is to describe a rare combination injury of the the apical ligament, retroclival epidural hematoma and the suspicion of brain stem slits, due to rapid hyperextension/hyperflexion trauma with high-speed motor vehicle accident in a 3 year 8 month old girl. RCEH is a very infrequent hematoma type in children, only 1% of all posterior fossa epidural hematomas are located in the retroclival epidural space ^{3,4}. Cervical spine injuries are common in pediatric population and usually seen in craniocervical junction due to the anatomical and physiological differences. The muscles are weak, head is relatively large, the occipital condyles are smaller and the ligamentous structures are laxer in this age group. In the line with these factors the

hypermobility of the craniocervical junction improves the risk of injuries in pediatric population. Combination of rapid hyperextension/hyperflexion traumas due to high-speed motor vehicle accident are known to be the reason of ligamentous injury and retroclival epidural hematoma as seen in our case². Some authors reported the combination of craniocervical junction instability and spinal cord

injury^{2,5}. In our case, in addition to RCEH there were focal hyperintensities on the ventral ponto-medullary junction and the right caudal cerebellar peduncle suspicion of focal slits (Fig. 3a, c-d). All these additional changes in the ligamentous and brainstem structures may be explained by the hypermobility of the craniocervical junction without any cervical bone fracture.

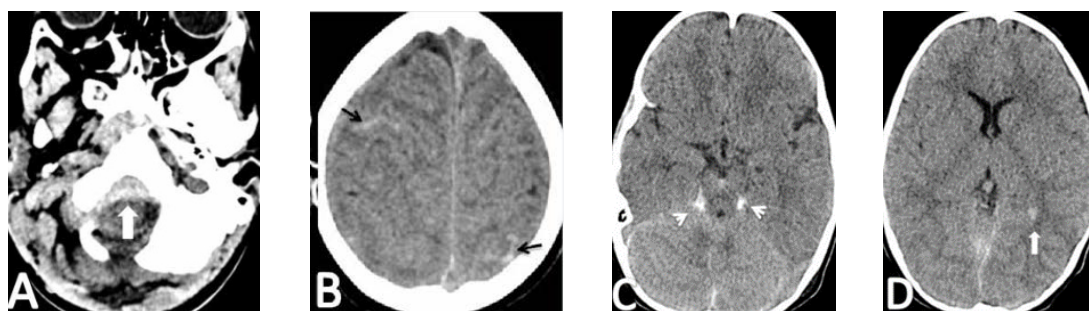


Figure 1 a-d: On axial head CT images. There is 10 mm thick retroclival epidural hematoma (thick white arrow, Fig. 1a), scattered subarachnoid hemorrhage (black arrows, Fig. 1b), quadrigeminal cistern (white arrow heads, Fig. 1c), and left intraventricular hemorrhage (thin white arrow, Fig. 1d).

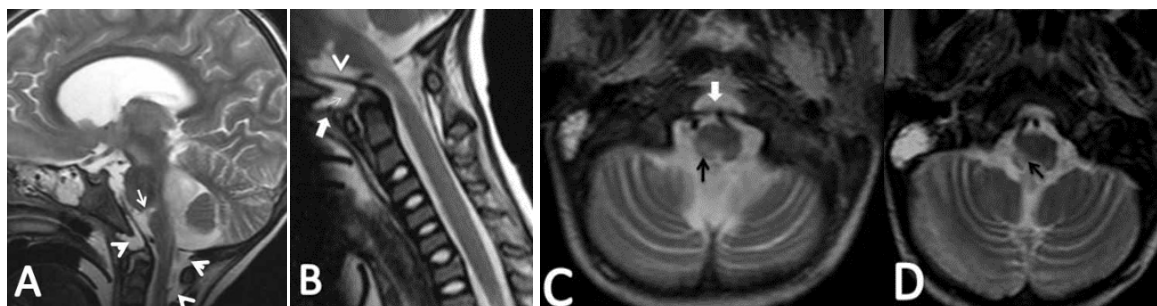


Figure 3a-d: On sagittal (a-b) and axial (c-d) MR images. There is prominent cerebrospinal fluid (white arrow heads, Fig. 3a) between the anterior atlantooccipital (thick white arrow, Fig 3b) and tectorial membrane (white arrow head, Fig 3b) and C0-1 and C1-2 interlaminar space (posterior placed white arrow heads, Fig.3a) and tectorial membrane stretching (white arrow head, Fig. 3b and white arrow, Fig 3c). The apical ligament (thin white arrow, Fig. 3b) is disrupted. There are focal hyperintensities on the ventral ponto-medullary junction (thin white arrow, Fig 3a) and the right caudal cerebellar peduncle suspicion of focal slits (black arrows, Fig. 3c-d).

CT is the first option to evaluate the brain and bone structures in the setting of trauma. The expected finding of the hemorrhage on CT is hyperdense material located in extraaxially or intraaxially. The images should include both axial and sagittal planes of bone structures for better evaluation. However MR is the best modality to evaluate the soft tissue and ligamentous structures of the craniocervical junction. Some studies have discussed treatment modalities as surgically or conservatively^{6,7}. The

primary treatment is conservative in patients without fractures, but close follow-up imaging is important in these cases. We applied Philadelphia collar for immobilization to our patient and close follow-up imaging. Most of the patients with craniocervical junction injury have neurological deficits⁸. Due to share injuries in the brainstem and hypoperfusion sequelae areas in bilateral perirolandic areas, our patient is still under treatment in the pediatric intensive care unit with a GSC of 8 for six months.

Radiologist should alert the clinician in terms of craniocervical junction ligamentous injuries in patients with RCEH on brain MRI in the presence of accompanying traumatic accidents.

REFERENCES

1. Adams JH, Graham DI. Diffuse brain damages in non-missile head injury. In *Recent Advances in Histopathology*. (Eds PP Anthony, RNM MacSween): 241-57. Edinburgh, Churchill Livingstone, 1984.
2. Ahn ES, Smith ER. Acute clival and spinal subdural hematoma with spontaneous resolution: clinical and radiographic correlation in support of a proposed pathophysiological mechanism. *J Neurosurg*. 2005;103:175-9.
3. Cordobés F, Lobato RD, Rivas JJ, Muñoz MJ, Chillón D, Portillo JM et al. Observations on 82 patients with extradural hematoma: comparison of results before and after the advent of computerized tomography. *J Neurosurg*. 1981;54:179-86.
4. Fisher CG, Sun JC, Dvorak M. Recognition and management of atlanto-occipital dislocation: improving survival from an often fatal condition. *Can J Surg*. 2001;44:412-20.
5. Kwon TH, Joy H, Park YK, Chung HS. Traumatic retroclival epidural hematoma in a child: case report. *Neurol Med Chir*. 2008;48:347-50.
6. Marks SM, Paramaraswaren RN, Johnston RA. Transoral evacuation of a clivus extradural haematoma with good recovery: a case report. *Br J Neurosurg*. 1997;11:245-7.
7. Meoded A, Singhi S, Poretti A, Eran A, Tekes A, Huisman TA. Tectorial membrane injury: frequently overlooked in pediatric traumatic head injury. *AJNR Am J Neuroradiol*. 2011;32:1806-11.
8. Sun PP, Poffenbarger GJ, Durham S, Zimmerman RA. Spectrum of occipitoatlantoaxial injury in young children. *J Neurosurg*. 2000;93:28-39.
9. Tubbs RS, Griessenauer CJ, Hankinson T, Rozzelle C, Wellons JC 3rd, Blount JP et al. Retroclival epidural hematomas: a clinical series. *Neurosurgery*. 2010;67:404-6.