การเกิดภาวะไขสันหลังขาดโดยไม่พบการบาดเจ็บของกระดูกหรือข้อต่อกระดูกสันหลัง: กรณีศึกษา

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บทคัดย่อ

ภาวะไขสันหลังขาดพบได้ไม่บ่อย ส่วนใหญ่เกิดจากการบาดเจ็บที่รุนแรงและพบร่วมกับการหักหรือเคลื่อนของกระดูกสันหลังในระดับเดียวกับที่มีการฉีกขาดของไขสันหลังเสมอ

วัตถุประสงค์ของการศึกษาคือการรายงานกรณีศึกษาผู้ป่วยรายหนึ่งที่มีภาวะไขสันหลังระดับทรวงอกขาดโดยไม่พบการบาดเจ็บของกระดูกสันหลังร่วมด้วยและผู้วิจัยได้นำเสนอสาเหตุที่อาจทำให้เกิดภาวะดังกล่าว

ผู้ป่วยหญิงอายุ 33 ปี ถูกส่งตัวมารักษาที่โรงพยาบาลอุดรธานีด้วยประวัติหมดสติ มีการบาดเจ็บของอวัยวะภายในทรวงอกและช่องท้องร่วมกับร่างกายส่วนล่างอ่อนแรงภายหลังได้รับอุบัติเหตุทางจราจร ผู้ป่วยสูญเสียการทำงานระบบประสาทอย่างสมบูรณ์ของไขสันหลังตั้งแต่ระดับ T10 มีจุดกดเจ็บเล็กน้อยที่กระดูกสันหลังส่วนอกปล้องที่หกและเจ็ด แต่ไม่พบลักษณะผิวหนังผิดปกติหรือผิดรูปใดๆ ผลการตรวจ MRI พบไขสันหลังขาดเป็นช่องว่างในโพรงช่องสันหลังตั้งแต่กระดูกสันหลังส่วนอกปล้องที่สิบไปจนถึงปล้องที่สิบสอง การตรวจภาพถ่ายรังสีไม่พบว่ามีการหักหรือเคลื่อนตัวของกระดูกสันในทุกระดับ CT scan ของอวัยวะช่องอกและช่องท้องพบว่ามีการฉีกขาดของหลอดเลือดแดงใหญ่ที่ระดับใต้ต่อแขนงหลอดเลือดแดงที่ไปเลี้ยงไตขวา

ภาวะไขสันหลังขาดในผู้ป่วยรายนี้อาจเกิดได้จากสองสาเหตุคือ การฉีกขาดของ Adamkiewicz’s artery หรือการบาดเจ็บโดยการฉีกยืดตัวของกระดูกสันหลังตามกลไก flexion-distraction ทว่าสาเหตุที่แท้จริงของการบาดเจ็บในกรณีศึกษานี้ยังไม่กระจ่างชัด แพทย์ที่ให้การดูแลรักษาผู้ป่วยที่ได้รับบาดเจ็บควรตระหนักถึงโอกาสของการเกิดภาวะไขสันหลังขาดร่วมด้วยได้ในผู้ป่วยที่มีระบบประสาทผิดปกติแม้ว่าการตรวจภาพถ่ายรังสีเบื้องต้นไม่พบความผิดปกติใดๆของกระดูกสันหลัง

คำสำคัญ: ไขสันหลัง, ฉีกขาด, การบาดเจ็บ

Traumatic thoracic spinal cord transection without spinal fracture-dislocation or evidence of soft tissue injury: A case report

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Abstract

Background: Traumatic cord transection is uncommon. It is generally a result of high energy spinal trauma with associated vertebral body fracture or dislocation. The level of cord transection mostly corresponds to the level of vertebral injury. The objective of this article is to report a patient with thoracic spinal cord transection in the absence of evidence of fracture-dislocation of the vertebral column, and to purpose potential etiologies of the injury.

Case presentation: A 33-year-old female was referred to Udonthani hospital with history of alteration of consciousness, blunt chest and abdominal injury and acute paraplegia after a motor vehicle accident. The patient had complete paraplegia below the T10 level. Her back had no sign of localized skin lesion but mild tenderness over T6-7 level. MRI cervicothoracic spine revealed long segment spinal transection with gapping from lower T10 to lower T12. There was no associated spinal fracture-dislocation identified by plain radiographic evaluation of cervical, thoracic and lumbar spine. CT chest and abdomen resulted short segment aortic dissection from the level below right renal artery.

Conclusion: Although the etiology of this exceptional case is still unclear, the authors proposed two possible causes of pathology which include 1. Compromised Adamkiewicz's artery and 2. Chance type injury of flexion-distraction mechanism. Physicians providing patients' medical care need to keep the potential cord transection in any acute trauma patients in mind even though subtle radiographic abnormalities might be illustrated on plain films.

Key words: spinal cord, transection, traumatic

Background

Spinal cord injury is one of the most devastating injury following spinal trauma. The injury may range from simple cord edema to obvious transection. Traumatic cord transection is not common; however, it is the most severe as it results in complete and irreversible loss of all neural functions. Because of high magnitude of destruction, cord transection is generally a result of high energy spinal trauma with associated vertebral body fracture, traumatic spondylolisthesis or traumatic spondyloptosis. The level of cord transection almost always corresponds to the level of spinal fracture or dislocation.

The authors report a patient with thoracic spinal cord transection in the absence of evidence of fracture-dislocation nor ligamentous injuries of vertebral column and purpose potential etiologies of the injury. The study was approved by the Udonthani hospital ethics committee (registration number: I051/2562), and written informed consent was obtained from the patient.

Case presentation

A 33-year-old female was admitted in Udonthani hospital with history of alteration of consciousness, blunt chest and abdominal injury including inability to move both lower extremities. She had a motor vehicle accident and she was seen unconscious on scene. Initially she was transferred to a local hospital by a paramedic team before being referred to Udonthani hospital. She was unable to remind the accident when she gained consciousness. On arrival, the patient was not fully conscious with Glasgow Coma Score E3V5M6, hypotensive (BP 79/50 mmHg) and tachycardic (heart rate 142 beat/minute). She was not able to breathe spontaneously. Initial FAST was positive, and portable chest radiograph was bilateral hemo-pneumothorax. The resuscitative measures, which included fluid administration via large bore intravenous (I.V.) catheter, endotracheal intubation and mechanical ventilation with positive pressure after bilaterally Intercostal drainage, were provided. On neurologic examination, the patient had flaccid paralysis of both lower extremities, total loss of sensory level at T10 and below, no sphincter control nor rectal tone, an absent anal wink, no sacral sparing, and positive bulbocavernosus reflex. Neurological examination of cranial nerves and upper extremities was normal. Her back had no sign of localized skin lesion such as swelling or ecchymosis but she had mild tenderness over T6-7 level (mid scapular level). After clinically stable condition, diagnostic workups were implemented. CT chest and abdomen resulted bilateral hemo-pneumothorax with right 8th rib fracture. Grade III right lobe liver injury and grade IIsplenic injury were detected. Left renal laceration at the lower pole was identified. There was a short segment aortic dissection from the level below right renal artery, about 2.3 centimeter in length. MRI cervicothoracic spine revealed long segment spinal cord transection with significant gapping extended from lower T10 to lower T12 vertebral body. However, there was no associated spinal fracture-dislocation identified by plain radiographic evaluation of Cervical, thoracic and lumbar spine.

Figure 1. Patient's back had no local wound, ecchymosis nor swelling area. There was a mild tender point at upper to middle thoracic spine (at the center of tattoo area).

Figure 2. Cervical spine radiograph showed no fracture-dislocation with mild loss of lordosis alignment, intubation was seen due to alteration of consciousness.

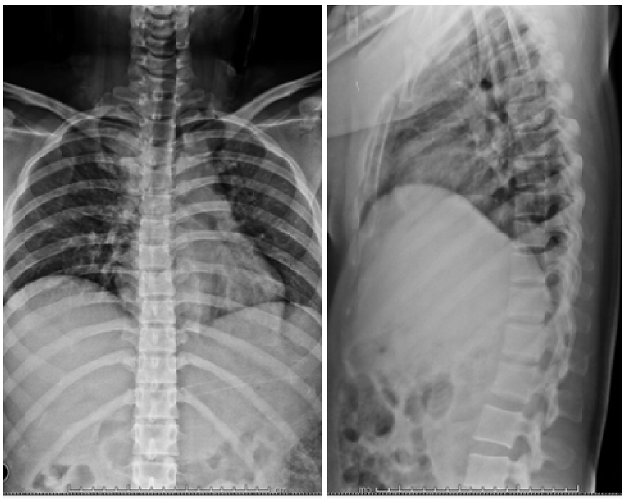

Figure 3. Thoracic spine radiograph demonstrated no obvious fracture-dislocation. Spinal alignment was normal.

Figure 4. Diffuse bulging disc with protrusion at C5-6 level causing mild spinal canal stenosis was shown by MRI cervicothoracic spine; however, the cervical spinal cord was normal with no signal change.

In the lower part of the MRI demonstrated spinal cord edema and contusion at the lower T5 to T8 with most enhancement at T7-8 disc level. Additionally, there was some degree of soft tissue enhancement of T7-8 interspinous area posetiorly. No intervertebral disc abnormality of thoracic spine was detected by MRI.

Figure 5. MRI thoracic spine clearly showed discontinuity of the spinal cord extended from lower T10 to lower T12 vertebra; spinal cord transection with significant gapping. Nevertheless, the alignment of thoracic vertebrae was normal without fracture, subluxation or dislocation. Paravertebral soft tissue along the cord transection site was normal.

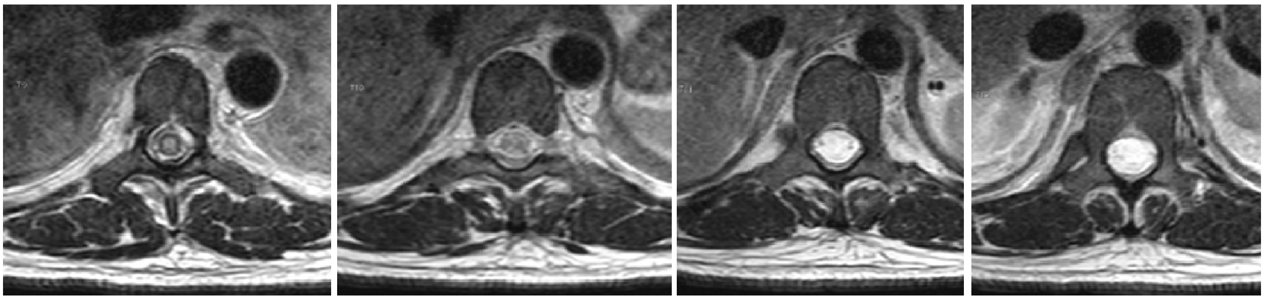

Figure 6. MRI Axial view (T9, T10, T11 and T12 respectively from left side) indicated loss of spinal cord at the level of T11 and T12 level). No para-spinal soft tissue, muscle and ligament injuries was detected at the level of T11-T12.

Figure 7. Emergency CT angiography demonstrated short segment of aortic dissection from the level beneath right renal artery, approximately 2.3 centimeter long. This level was corresponded to T12-L1 vertebral body which is close to Adamkiewicz's artery

Discussion

Traumatic spinal cord injury is a rare condition. The incidence of non-developed countries varied from 13 to 220 per million people[1,2] and the prevalence was 440 per million[3]. In Thailand, the incidence was reported 19.6 per 100,000 in 2011 and has been increasing every year. Mechanism of spinal cord injury differs between developed and developing countries. In the United States, spinal cord injuries are typically due to motor vehicle injuries (42.1%), falls (26.7%), violence (15.1%), sporting injuries (7.6%), and unknown events (8.6%)[4]. A majority of pathology of spinal cord injury is cord contusion as a consequence of localized mechanical compression by surrounding bony and soft tissue structures. On the contrary, cord transection is rare. One spinal cord injury model studied by Cheriyan and colleague described a full spinal cord transection model as complete disassociation between the caudal and rostral segments[5]. Etiologies of the transection can be laceration and transection following missile injury, severe dislocation, or sharp bone fragment penetration and direct stabbing injury[6]. Cord transection without vertebral fracture-dislocation has been reported by several studies, particularly in pediatric population[7,8]. This type of injury is mainly referred to SCIWORA (Spinal Cord Injury without Radiological Abnormality). This entity is seen almost exclusively in children due to the specific anatomical and functional properties, especially significant hyperelasticity, of pediatric spine[9]. On the other hand, an adult spine is more rigid and less flexible than a child's spine. Most cord transection cases are associated with major musculoskeletal injuries, such as vertebral fracture and or dislocation. MRI plays a crucial role in the assessment of spinal cord injury and provides both definite diagnosis and clinico-neurological outcomes. Transection of the cord shows discontinuity of the spinal cord on both T 1WI and T 2WI and appears on T 2W images as a high signal between the two disrupted ends of the cord[10,11,12].The case report in this study might be the only one case that has ever been reported. The problem is how this injury happened.

In the author opinion, there are two possible causes or mechanisms of the patient's cord transection. The first cause could be spinal cord ischemia following disruption of Adamkiewicz' artery. This patient had an evidence of dissection of aorta demonstrated in CT angiography. Additionally Thoracic MRI showed discontinuity of the spinal cord at lower T10 to lower T12 levels which corresponds to the watershed area of spinal cord. The artery of Adamkiewicz (The major radiculo -medullary artery or the arteria radicularis magna) is primary supply to the lower two-thirds of the spinal cord and enters spinal canal via an intervertebral foramen on the left from T9–L1[13]. Compromised artery of Adamkiewicz would present with signs of thoracic watershed ischemia, particularly paraplegia with relative sparing of the sacral roots. Infarction in the anterior spinal artery distribution results in dysfunction of the anterior two thirds of the cord, including the anterior horns, the spinothalamic tracts, and the corticospinal tracts and patients usually present with acute paraparesis and impaired bowel and bladder function[14]. Several previous studies have been reported an association between paraparesis or paraplegia and aortic pathology, which the prevalence of the studies varies from 33-44%[15,16,17,18,19,20,21]. However, there has been only one study reported that spinal cord infarction deteriorates into total spinal cord disruption. Berlot and colleague described delayed post-traumatic cervical cord transection in a spinal cord injury without radiologic abnormalities (SCIWORA). The initial MRI performed during acute phase in their study revealed only focal swelling of the spinal cord and several patch areas of cord contusions. Later on the lesion turned to be cord transection[22]. Even though delayed deterioration could occur, the process would probably take a certain period of time to happen after the injury.

The second potential etiology is an excessive distractivemechanismto spine and spinal cord. The patient's MRI Thoracic spine in our study illustrated enhanced soft tissue signal of posterior ligamentous complex, cord signal and posterior longitudinal ligament at the level of T7-8 (however, without presentation of obvious fracture-dislocation) which could be some degree of segmental instability. Such a finding is likely to be flexion-distraction injury (Chance injury) of the T7-8 spinal segment. This remote distractive force in spinal cord may transfertraction force to the spinal cord at the level T10-T12 level causing cord transection. This assumption seems to be reasonable; nevertheless, it appears to lack of any evidence support. Chance injuries are rare, the incidence among entire series of thoracolumbar fractures is reported from 5%[23] to 15%[24]. Pathology of this injury is a consequence of hyperflexion of the spinal column around the fulcrum placed in front of the abdomen[25]. The more anterior position of the axis of rotation, the greater distracting force acting on adjacent segments with a much lesser axial component[26]. Chance injuries of the spine are often accompanied by serious visceral injuries which should be proven by specific investigations in each and every case[27]. However, flexion-distraction injuries mostly produce localized ligamentous or bony injuries such as traumatic spondylolisthesis or traumatic spondyloptosis at the level of axis of rotation or fulcrum area. This case report; nonetheless, shows no evidence of bony nor soft tissue destruction surrounding the level of cord disruption at all. In terms of remote vertebral injury resulting cord transection, literature review found extremely limited results[28]. Toms and colleague published a case report in 2018 as the authors described the first case of thoracic cord avulsion following a traumatic grade II lumbar spondylolisthesis. Magnetic resonance imaging in the study demonstrated T11 cord transection with distal cord herniating into lumbar paraspinal soft tissues. Another study provided a similar result was published by Baliyan and colleague in 2016[29]. Their study reported a case of traumatic spinal fracture with severe grade III spondylolisthesis of L2 over 3. The MRI of the study revealed complete cord transection at the lower border of T11 vertebral body level and the distal cord segment was noted to be lying clumped up inferiorly at L2-L3 level. The report mentioned that traumatic traction force (originating from L2-3 high grade traumatic spondylolisthesis) plays a major role of the higher cord transection. Baliyan's study MRI finding seems to be similar to our case report; proximal end of cord transection is located at the level of T11 vertebra, our case report, though, had no remote obvious spinal (from occiput to sacral level) subluxation-dislocationat all. Although there are some differences of patient's clinical features and imagingresults among studies, this brings a concerned issue of vigorous traction force from remote area causing distant cord transection.

In terms of clinical applications, this case report demonstrates the evidence of cord transection without vertebral column injuries does exist. It emphasizes the importance of thorough investigations of not only spine injuries but also associated occult visceral and vascular injuries. Physicians providing patients' medical care need to keep the potential cord transection in any acute trauma patients in mind even though subtle radiographic abnormalities might be illustrated on plain films. Long term monitoring to identify a late segmental instability of the spine is necessary, particularly at the cord transection site and its proximity levels above and below.

Conclusions

This study describes an exceptional case of long segment spinal cord transection with no evidence of fracture-dislocation nor ligamentous injury at the level of disruption. The authors' proposed two possible causes of the pathology which include 1. Compromised Adamkiewicz's artery and 2.Tremendous traction force to spinal cord caused by occult soft tissue Chance type of flexion-distraction mechanism. However the real etiology is still inconclusive.Physicians should be concerned that traumatic cord transection in any acute trauma patients with neurological deficit is possible even subtle radiographic abnormalities on plain films.

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