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Case Report

On The Edge of Life: A Life-Threatening High Cervical

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Abstract

Cervical trauma is a life-threatening condition that may result in severe sensory and motor deficits. High cervical injuries are particularly associated with respiratory compromise due to impairment of the diaphragm, intercostal muscles, and accessory respiratory musculature. A Case Report, 17-year-old female patient came with complaints of weakness in all four limbs after falling from a motorcycle. Physical examination found loss of motor nerve function in all extremities and decreased sensory function to as high as C5. The results of the MSCT examination showed compression fractures and dislocations with translation of the C5 vertebral corpus to the posterior with disruption of the posterior ligamentum complex. This case highlights the unique and unpredictable clinical course of high cervical spine injury in an adolescent patient, particularly the occurrence of acute respiratory and hemodynamic deterioration before surgical stabilization. It underscores the importance of early recognition, continuous respiratory monitoring, and multidisciplinary management in patients with high cervical trauma. This case adds to the scientific literature by emphasizing that severe respiratory compromise can occur early in young patients with cervical spine injuries, even before operative treatment, and should be anticipated to optimize patient outcomes.

Keywords: Cervical Injury, Spinal Cord Injury, Respiratory Depression

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All relevant data are within the paper and its Supporting Information files.

Introduction

Spinal cord trauma is a condition of neurological deterioration due to trauma which is known to have a high level of morbidity and disability. [1] The upper level spinal cord trauma such as the cervical region, can cause approximately 40% of cases of tetraplegia, respiratory disorders, speech disorders, increased risk of lung infections and a reduction of approximately 10 years in life expectancy.[2] Mortality rate is estimated at 48% in the first 24 hours and about 80% of cases die at the scene. The highest morbidity rate is in cervical injuries with the most common levels at C5, C4, C6, T12, L1 and T10. Etiologically, approximately 90% of spinal cord trauma cases are due to traffic accidents, violence, sports or falls. In terms of prevalence, this case occurs more often in men than women with a ratio of 2:1. In women, the risk of spinal cord trauma is highest at the age of 15-19 years and age 70 years.[3]

The spinal cord is a collection of nerve fibers located in the spine. Motor nerve fibers are located in the anterior and media parts of the spinal cord. Motor nerves play a role in the movement of the muscles they

innervate. Disorders in this area cause weakness of the innervated organ. Meanwhile, sensory nerve fibers are located in the anterior and posterior parts of the spinal cord. Damage to this area can cause loss of the ability to feel and sense the innervated organ.[4] The sensory and motor areas of the body including muscles and myotomes can be divided according to their dermatomes.

The assessment of spinal cord injury can be assessed using the Frankel scale and the American Spinal Injury Association (ASIA) assessment. The Frankel assessment divides patients based on the neurological damage experienced. Total sensory and motor impairment (grade A), total motor impairment, only some sensations are felt (grade B), decreased motor function (grade C), motor function can still function well (grade D) and no neurological deficit/total recovery (grade E). In addition to using the Frankel scale, the degree of spinal cord injury assessment often uses the ASIA assessment. The ASIA assessment has a scale that is almost the same as the Frankel scale.[5]

High cervical spinal cord injuries (SCI) are well-recognized for their profound impact on respiratory function and are associated with significant morbidity and mortality due to compromised diaphragmatic and intercostal muscle function, resulting in frequent respiratory complications such as delayed weaning, pneumonia, and ventilator dependence. Recent literature highlights that predictors of respiratory complications in cervical SCI include complete motor impairment and high injury levels, which correlate with prolonged hospitalization and increased mortality risk, underscoring the critical need for early recognition and tailored respiratory management protocols.[6] However, acute preoperative respiratory and hemodynamic deterioration in adolescent patients with high cervical trauma, occurring prior to definitive surgical stabilization as presented in this case, remains distinctly underreported. This report therefore contributes to the scientific literature by illuminating a rare clinical trajectory of early respiratory compromise before surgical intervention, reinforcing the necessity for heightened clinical vigilance and multidisciplinary strategies in managing high cervical trauma in young patients to improve prognostic outcomes and expand current understanding beyond established adult-focused studies.[7]

Case

A 17-year-old female patient came with complaints of weakness in all four limbs since 4 days before entering the hospital after falling from a motorcycle. The patient admitted to having fallen with her head and neck hitting the road first. There was no history of seizures, no vomiting, no bleeding from the ears and nose. At first, patient complaint about the difficulty of moving her feet dan hands, but she still feel the sensory that given. The patient complained of bloody urine since the last 1 day and said that she did not feel any defecation.

The patient was taken to the hospital with a VAS pain scale of 2-3, blood pressure of 77/46 mmHg, pulse rate of 58 beats per minute, and respiration rate of 30 breaths per minute. She still responded to the examination. Neurological status of isochoric pupils of 2mm/2mm, direct and indirect light reflexes were positive. The extremities felt warm, motor skills showed tetraplegia and sensory assessment showed paresthesia below C5. Sacral sparring assessment showed no perianal sensation, no anal wink, no toe extension and no Bulbocavernosus reflex. The results of the digital rectal exam (DRE) showed absent anal sphincter tone. Babinski assessment was negative. Examination of the spinal region showed tenderness, no swelling and no visible lesion.

Radiological examination of cervical AP + Lateral found Dislocation to posterior corpus vertebrae C5 against C4 **(Figure 1)**. Non-contrast MSCT cervical AP + Lateral showed posterior dislocation of the C5 vertebral body towards C4. The results of this examination were clarified by a contrast-enhanced cervical MSCT scan which showed a compression fracture and dislocation with translation of the C5 vertebral body posteriorly with disruption of the posterior ligamentum complex (Thoracolumbar Injury Classification and Severity Score [TLICS] = 6). **(Figure 2)**.

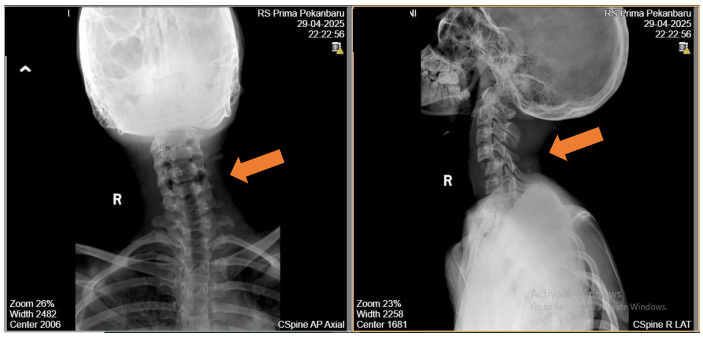

Figure 1. Cervical AP + Lateral X-Ray showed posterior dislocation of vertebrae C5 toward C4

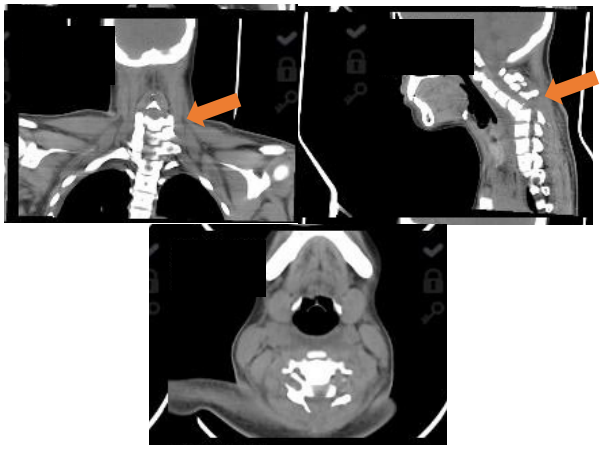

Figure 2. MSCT cervical AP + Lateral with Contrast showed compression fracture and dislocation with translation at C5 to posterior with disruption of posterior ligamentum complex

The patient was given treatment in the form of installing a Philadelphia collar neck Ceftriaxone 2 x 1 gr IV, Methylprednisolone therapy 4 x 125 mg IV, Pregabalin 1x75 mg PO, Ranitidine 2 x 50 mg IV, and Mecobalamin 3 x 500 mg IV. The patient was treated in the ICU to get advanced medical treatment and planned to perform decompression and stabilization surgery. The patient was planned to laminectomy lateral mesh screw surgery but the next day of treatment, patient experienced hypotension so dobutamine therapy was given and the patient experienced respiratory problems to respiratory arrest.

Discussion

Spinal cord trauma is a traumatic condition that can cause significant neurological deficits and limitations in the sufferer's neurological function in the long term. The severity of the trauma is an important assessment to determine the patient's prognosis. With the ASIA assessment, 94% of injuries classified as ASIA A remained complete from admission to discharge.[1,8]

In this case, it is explained that the patient experienced trauma due to a motorcycle accident that caused a compression fracture and dislocation with translation of the C5 segment. The patient was also said to have decreased sensory and motor function below C5 marked by loss of motor ability (tetraplegia) and loss of sensory ability until respiratory depression was found.

The causes of spinal cord trauma can be classified based on the type of fracture and dislocation. At the time of trauma, compression fractures often occur due to the hyperflexion mechanism when trauma occurs. While a burst fracture is a serious condition of spinal cord trauma that causes spinal fragments. Another condition of spinal cord trauma is subluxation of the vertebrae caused by abnormal movement of the spine. Dislocation is a condition when the ligaments supporting the spinal cord and spine are damaged due to trauma. This condition is usually accompanied by a fracture of the vertebrae which results in a permanent change in the position of the spinal cord.[9]

In determining the degree of neurological damage, it is important to evaluate whether the spinal cord trauma experienced is a complete or incomplete type of trauma. Incomplete spinal cord trauma is divided based on the ASIA scale which is assessed according to sensory or motor function or both, which affect more than 3 segments below the neurological damage. In addition, incomplete lesions are also characterized by decreased motor function on 1 side. Meanwhile, complete spinal cord trauma is defined as loss of sensory or motor abilities below the sacral segment.[4,5] In this case, the patient experienced loss of neurological function in both sensory and motor abilities which explains complete spinal cord damage.

In addition to using the two scores above, the assessment of spinal cord trauma, especially in the cervical region, can be estimated using the AO (Arbeitsgemeinschaft für Osteosyn- thesefragen, German for “Association for the Study of Internal Fixation”) spine Subaxial Cervical Spine Injury Classification (SLIC) scoring system. This system aims to determine whether the patient needs surgical or non-surgical treatment. This classification divides the cervical into 4 areas: the upper-per cervical spine (till C2), subaxial cervical spine (C3–7), thoracolumbar spine (T1–L5), and the sacral spine (S1–5, with coc- cyx). Fractures are classified into compression injuries (A), tension band injuries (B), and translational injuries (C), with additional descriptions for facet injuries. Neurological status is graded according to a 5-part system. (**Figure 3**).[10] In this patient, it was known that there was total posterior disruption (grade B2) and translational injury to the vertebra (grade C).

Trauma that occurs in the cervical area and spinal cord above the thorax can disrupt the function of the diaphragm, intercostal muscles, respiratory function and abdominal muscles. This can be proven by the decrease in respiratory function in this patient which then causes respiratory arrest. Initially, the patient will experience a decrease in the volume of inspiratory and expiratory air, a decrease in the ability of the respiratory muscles to cough or clear secretions which results in atelectasis and lung infection. This condition will further increase the risk of patient morbidity and mortality.[11]

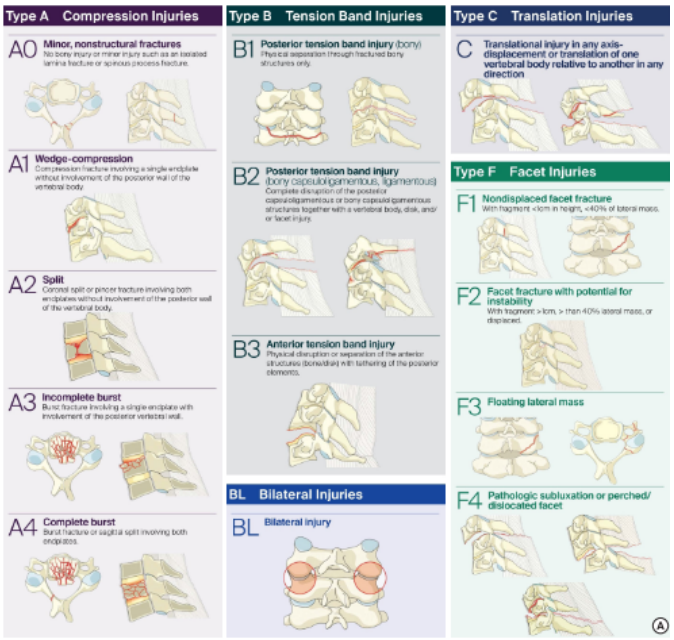

Figure 3. AO Spine classification system

Neurological function decline in spinal cord trauma patients usually appears 72 hours after trauma. Based on the mechanism, primary spinal cord trauma is known to occur in sudden trauma to the spinal cord that causes fracture and dislocation of the vertebrae. After trauma, the injured spinal cord will experience the first phase, namely the phase of neural parenchymal destruction, axonal injury disruption, bleeding and glial membrane disruption. This phase affects the prognosis of neurological dysfunction. The second phase is the biochemical, mechanical and physiological changes that occur in neuronal tissue.[1]

Steroids such as methylprednisolone are known to have benefits as prevention of inflammatory responses. In addition, the use of non-steroidal anti-inflammatory drugs (NSAIDs) can also reduce the inflammatory process by suppressing prostaglandins in the cyclo-oxygenase (COX) pathway. The type of NSAID that is often used is ibuprofen. Administration of antibiotics to patients with spinal cord trauma is carried out especially in patients with respiratory muscle disorders that allow colonization of bacteria that cause pneumonia. [8,12]

The prognosis of spinal cord trauma patients is said to have a mortality rate of 42.8% within 1 week, 68.3% within 2 weeks and 90.5% within 4 weeks. In the other hand, based on the location of trauma, the patients can survive until 3 years since injury, 68.2% for c6-c8; 58.9% for c5; 51.9% for c4; and 49.9% c1-c3 lesions. Almost 60% the causes of death are respiratory failure. This explains that airway management is an important part of increasing life expectancy and quality of life for patients.[13,14]

The strengths of this case approach include early recognition of a high-energy cervical spine injury, prompt immobilization, comprehensive neurological examination, and appropriate use of multimodal imaging that confirmed an unstable C5 fracture with dislocation at posterior ligamentous complex disruption, justifying surgical intervention. The clinical findings were consistent with complete cervical spinal cord injury accompanied by spinal shock and neurogenic shock, aligning with well-established descriptions in the spinal cord injury literature. However, important limitations were present, including delayed definitive airway protection despite a high cervical injury, and challenges in hemodynamic management of neurogenic shock, which may have contributed to secondary deterioration. In addition, the use of high dose methylprednisolone remains controversial in current literature, with inconsistent evidence regarding neurological benefit and well documented risks. The conclusions in this case are based on the correlation between mechanism of injury, neurological deficits, radiological instability, and subsequent autonomic and respiratory failure, which are widely supported in traumatic spinal cord injury studies.

This case highlights that traumatic cervical spinal cord injury, particularly at the C5 level, carries a high risk of rapid neurological, autonomic, and respiratory compromise even when initial consciousness is preserved. Early recognition of neurogenic shock, proactive airway and ventilatory support, and timely surgical stabilization are critical determinants of outcome. Complete spinal cord injury may initially present with spinal shock, masking upper motor neuron signs and delaying prognostication. The primary take away lesson in this case is that in high cervical trauma, aggressive multidisciplinary critical care including vigilant respiratory management and hemodynamic stabilization is as essential as definitive surgical planning to prevent fatal secondary complications.

Conclusion

Spinal cord trauma in high cervical injuries can cause life threatening condition that leads to immediate death if not treated with emergency management. These injuries can result in respiratory failure, cardiovascular instability, and severe neurological deficits due to disruption of vital neural

pathways. Early recognition, rapid stabilization of the airway, breathing, and circulation, as well as timely definitive management, are crucial to reduce mortality and improve patient outcomes.

Ethics approval

Not required.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

The underlying data supporting the findings of this study are available from the corresponding author upon reasonable request. Written informed consent was obtained from the patient for publication of this case report and any accompanying images and clinical information and can be provided upon request.

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