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Conservative Management of Traumatic Brown-Séquard Syndrome: A Case Report

Authors' Contribution:

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Data Collection B
Statistical Analysis C
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Conflict of interest: None declared

Patient: **Male, 33-year-old**

Final Diagnosis: **Traumatic Brown-Séquard syndrome**

Symptoms: **Bilateral lower limb weakness • contralateral (right) hypoesthesia from the level of the nipple below • knee and ankle jerks both were 2 on the right side and 0 on the left**

Medication: **—**

Clinical Procedure: **Magnetic resonance imaging (MRI) of the cervical and thoracic spine • whole-body computed tomography (CT)**

Specialty: **Surgery**

Objective: **Unusual clinical course**


Background: Traumatic spinal cord injuries are quite common; however, a rare form of incomplete spinal cord injury is Brown-Séquard syndrome. Brown-Séquard syndrome is defined by the National Institute of Neurological Disorders and Strokes as “a rare neurological condition characterized by a lesion in the spinal cord which results in weakness or paralysis (hemiparaplegia) on one side of the body and a loss of sensation (hemianesthesia) on the opposite side.”

Case Report: A 33-year-old man was brought to the Emergency Department by Saudi Red Crescent with multiple stab wounds on the left upper thoracic and lower cervical regions. He was tachycardic, but otherwise vitally stable. His Glasgow Coma Scale score was 15. The patient presented with bilateral lower limb weakness, more on the ipsilateral (left) side, and contralateral (right) hypoesthesia from the level of the nipple below. Cervical and thoracic magnetic resonance imaging revealed ligamentous injury defect at the posterior dura and indicating a dural tear with minor cerebrospinal fluid leak. Focal hyperintense signal intensity was noted on the left side of the spinal cord, representing contusion. The patient was managed conservatively with daily physical therapy. Strength had improved substantially by the time of discharge and sensation was improving.

Conclusions: Brown-Séquard syndrome is associated with good prognosis. These patients require a multidisciplinary approach because it provides the best chance of recovery to pre-injury status. These injuries may cause disastrous neurological deficits; therefore, preventive strategies should be designated to decrease the incidence of such injuries.


Keywords: **Brown-Séquard Syndrome • Spinal Cord Injuries • Wounds, Stab**

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Background

Brown-Séquard syndrome is a rare type of incomplete spinal cord injury whereby hemisection of the spinal cord occurs, usually as a result of trauma [1]. For example, such injury could be caused by a sharp object, such as a knife, penetrating the soft areas around the spinal cord and affecting the spinal cord and the surrounding nerves. Even less common, the source of the injury, such as a knife blade, can remain lodged in the vertebral body, lamina, and/or pedicle of some patients at presentation [2]. The National Institute of Neurological Disorders and Strokes (NINDS) defined the Brown-Séquard syndrome (BSS) “as a rare neurological condition characterized by a lesion in the spinal cord, which results in weakness or paralysis (hemiparaplegia) on one side of the body and a loss of sensation (hemianesthesia) on the opposite side” [3]. Various mechanisms of injury can include direct trauma, tumors, ischemia, or infectious and inflammatory diseases, including tuberculosis and multiple sclerosis [3]. BSS is a clinical diagnosis that relies mainly on history and physical examination. Radiological investigations such as magnetic resonance imaging (MRI) and X-rays are used in cases in which traumatic injury or neoplasms are suspected. Laboratory investigations can be used when infectious causes are suspected [4]. It is essential to shed light on rare cases because care can be conservative while avoiding severe sequelae that can have a profound impact on the patient’s quality of life.

Case Report

A 33-year-old man brought to King Khalid University Hospital by Saudi Red Crescent had multiple stab wounds on the left side of the upper thoracic and lower cervical regions. On initial examination, he was able to talk, and his airway was intact and handling secretions. He had equal bilateral air entry and an O₂ saturation of 97% on room air, his blood pressure was 122/86 mmHg, his heart rate was 117 beats/min, and his pelvis was stable. He was conscious, alert, and oriented to time, place, and person, with a Glasgow Coma Scale (GCS) of 15/15. Upon further examination, the patient was found to have minor lacerations over the right lower limb. In addition, 2 lacerations were noted on the left anterior clavicular region, 1 laceration over the left posterior shoulder, and 2 more lacerations over each side of the upper back. Lower limb pulses were not palpable; however, they were audible on Doppler ultrasound. The patient received 1 L of intravenous fluids and 2 units of O+ packed red blood cells, 1 g of intravenous tranexamic acid, tetanus toxoid, and 2 g of intravenous cefazolin daily for 7 days. On initial neurological examination, the patient presented with weakness of both lower limbs with grade 0/5 for all actions on the left side and grade 1/5 for all actions on the right. He also had hypoaesthesia for pain and light touch sensation on the

contralateral side of injury from the nipple below the level of T5 with intact sensation on the left. Knee and ankle jerks both were +2 on the right side and 0 on the left. Whole-body computed tomography traumatic survey showed a small hematoma measuring 3×4 cm in the left lower neck. A few scattered air locules were noted within the spinal canal at the level of T1 and suprasellar region, which raised concern for a dural injury (Figure 1). However, no vascular injuries, contrast extravasation, or acute bone fractures were observed. MRI of the cervical and thoracic spine presented an interspinous ligamentous injury at the level of T3-T4, with a 0.4-cm defect at the posterior dura and small fluid collections indicating a dural tear with minor cerebrospinal fluid (CSF) leak (Figures 2, 3). Focal hyperintense signal intensity on T2-weighted images was noted on the spinal cord representing contusion at the level of T3-T4 (Figure 3). Based on the clinical and radiological features, the patient was diagnosed with BSS of the T4 neurologic level (American Spinal Cord Injury Association [ASIA] Impairment Scale Grade C) on the left side. The patient did not have any acute hemorrhagic lesions or cervical instability requiring surgical treatment. He underwent conservative treatment and was admitted to the hospital for 5 weeks with a daily rehabilitation program. Upon discharge, he had intact bilateral lower limb function with grade 5 in all actions, with the exception of left hip flexion, which was grade 3. Pain and light touch were improving but did not reach complete pre-injury status. Clonus was negative bilaterally. The patient was instructed on outpatient follow-up, but, unfortunately, contact was lost and the patient did not attend clinic appointments. He was contacted 6 months later by phone to check on his status, and he reported that he was back to his normal baseline function after multiple physiotherapy sessions.

Discussion

Multiple etiologies underlie BSS. The most common causes include traumatic injuries such as stab wounds, gunshots, unilateral facet fractures, and dislocations [5]. There are also nontraumatic causes, including tumors, disc herniation [6], vertebral artery dissection [7], and infections such as tuberculosis [3]. Patients with traumatic BSS present with neurological symptoms, including limb paralysis with different distribution [8,9]. Motor power can be diminished without complete paralysis, and impaired proprioception as well as impaired vibratory, pain, and heat sensation can occur depending on which spinal tract is affected. At the site of trauma, a watery discharge may indicate a CSF leak [9-11]. External CSF leakage from a stab wound to the spine is a rare occurrence [10]. In a review of 450 patients with stab wounds of the spinal cord, only 18 (4%) had external CSF leakage to the skin [8]. For the majority of these patients, the leakage stopped spontaneously with no surgical intervention, which also occurred in our case.

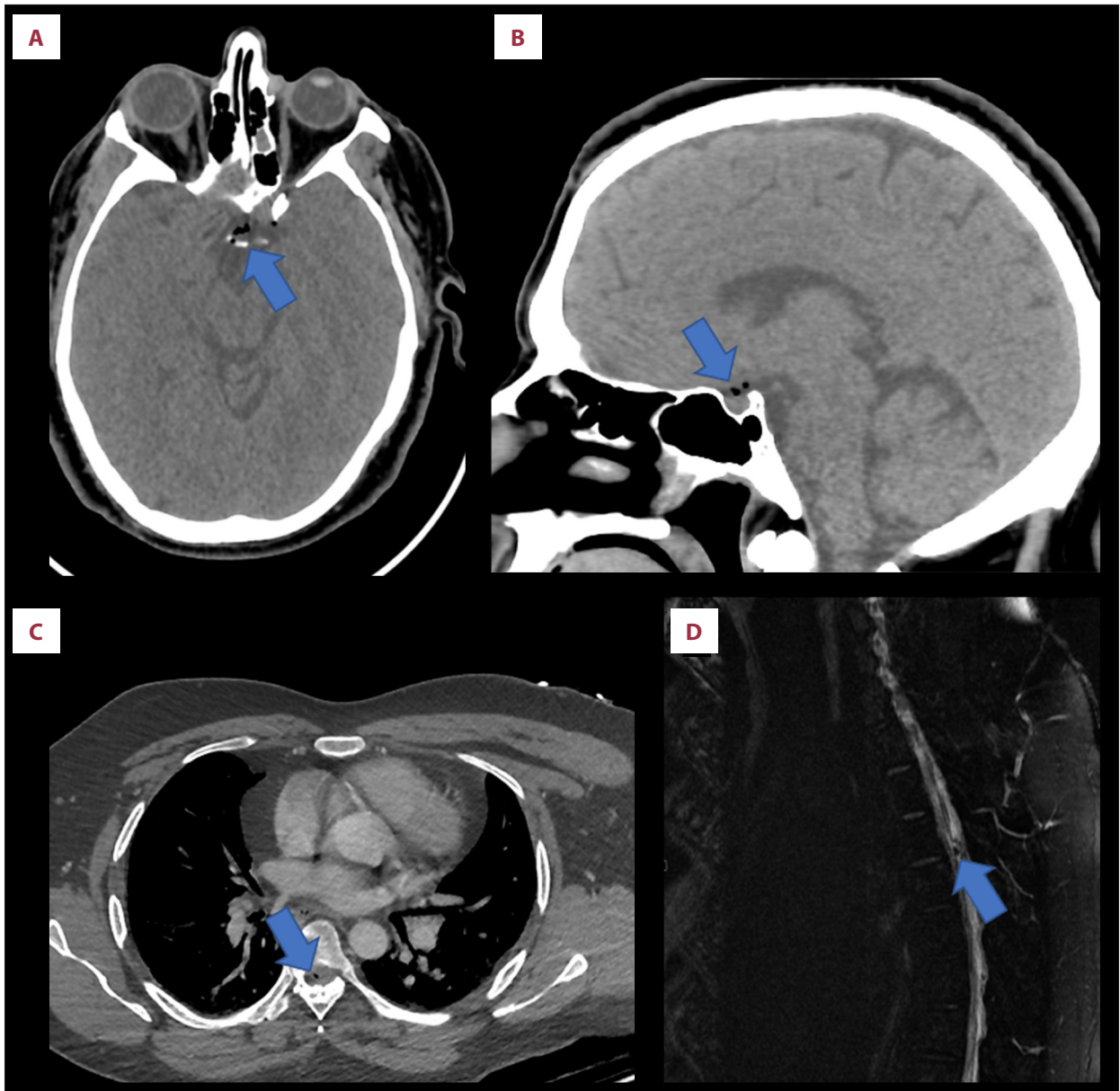


Figure 1. Initial trauma computed tomography (CT) scan. (A) Axial brain CT showing suprasellar air locules. (B) Sagittal brain CT showing suprasellar air locules. (C) Axial thoracic CT showing intradural air locule at the level of T3-T4. (D) Sagittal T2-weighted image showing a low signal intensity air locules at the level of T3-T4.

BSS is diagnosed through extensive neurological examination with regard to the anatomy and physiology of the spinal cord tract, and radiological assessment is used to evaluate the etiology and to exclude differential diagnoses such as stroke, epidural hematoma, and abscess [12]. In our case, the patient lost sensation of pain and fine touch, which represents injury to the spinothalamic and dorsal columns, respectively, on the right side. He also had bilateral lower limb weakness, which was more profound on the left side, due to corticospinal tract injury. MRI can clearly reveal an affected part of the spinal cord as well as any associated edema and soft tissue changes from

a knife wound [13]. However, MRI without a diffusion-weighted setting in acute presentation will be negative during the first 12-15 h of the onset of symptoms [14]. When an intradural etiology is suspected, a gadolinium or phase-contrast cine MRI scan can be helpful [15]. Other modalities such as angiography and nuclear medicine can help identify vascular malformations and infectious or inflammatory causes, respectively. If the knife blade is retained in the wound, it should be removed alongside wound debridement with antibiotic administration in the operating theater. Further complications, such as wound infection, meningitis, and sepsis should be treated

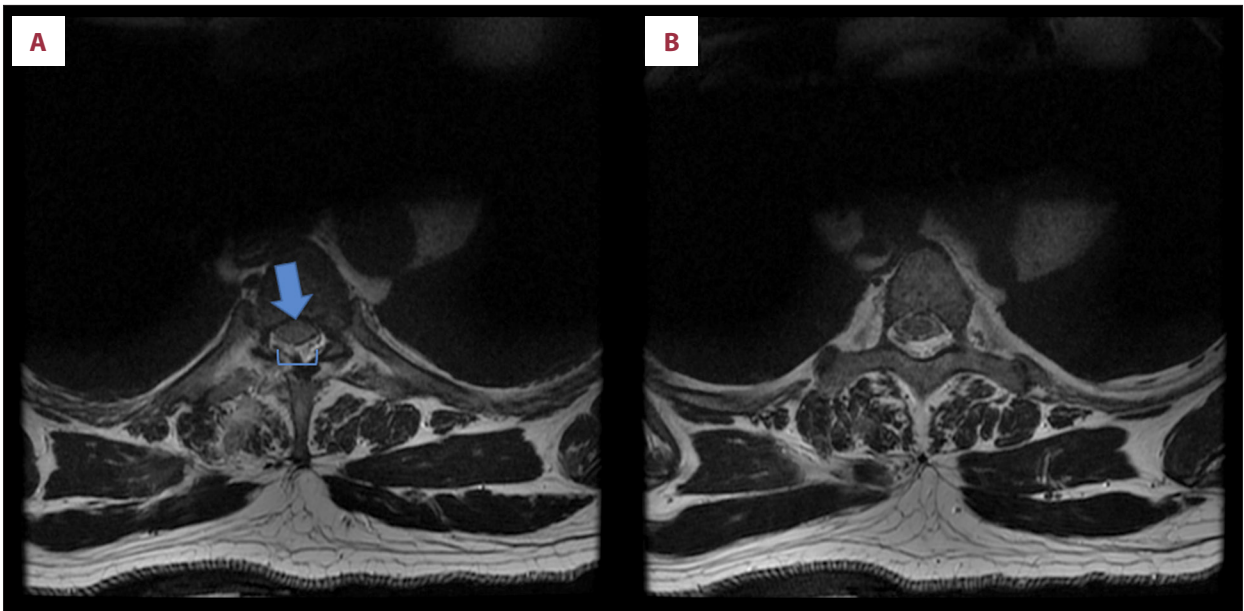


Figure 2. (A) Axial T2-weighted, non-fat-saturated image shows mild enlargement of the spinal cord at the level of injury with increased signal intensity, in keeping with the spinal cord contusion (blue arrow). A posterior dural sac defect was noted, in keeping with the dural tear (blue bracket). (B) The normal spinal cord above the level of injury is shown for comparison.

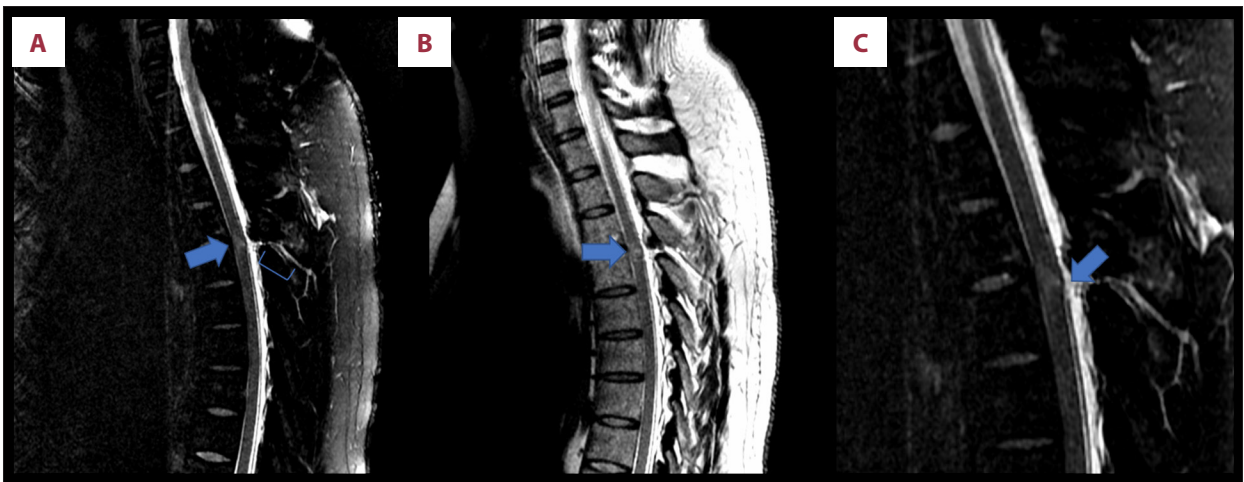


Figure 3. Thoracic magnetic resonance imaging (MRI). (A) Sagittal T2-weighted, fat-saturated image showing a focal spinal cord contusion at the level of T3-T4 (blue arrow) and interspinous ligament injury with cerebrospinal fluid leak at the level of T3-T4 (blue bracket). (B) A sagittal T2-weighted non-fat-saturated image confirmed the focal spinal cord contusion at T3-T4 (blue arrow). (C) Magnified sagittal T2-weighted image showing a posterior dural defect measuring 0.4 cm, in keeping with a dural tear (blue arrow).

accordingly [16]. However, Sakti et al [17] reported treating BSS associated with spinal cord injury without radiological abnormalities conservatively with a cervical collar, with dramatic improvements occurring within hours [17].

Management of BSS mainly depends on the etiology and possible complications, and treatment is generally divided into pharmacological, surgical, and physical therapy, singly or in combination. When BSS is caused by a traumatic injury, the

advanced trauma life support protocol must be followed, and if there is any evidence or suspicion of cervical injury or instability, cervical immobilization should be done at the scene. Furthermore, classification of spinal injury and the level of injury using the ASIA score can set a baseline neurological assessment for further follow-up as well as guide treatment [18]. As described in the literature, surgical intervention for traumatic spinal cord injuries is controversial and is primarily focused on spinal stability and decompression to prevent further injury to

the spinal cord [19]. This intervention was not necessary for our patient, but surgical intervention has been shown to decrease the length of hospital stay in patients with injuries classified as grade A and B in the ASIA classification [18]. The intervention of physiotherapy starts in the acute phase [20]. Its role is to maintain strength in neurologically intact muscles, maintain the range of motion of joints, and achieve mobilization as soon as possible to increase tolerance of the upright position [21]. These plans must take secondary complications such as pressure ulcers, urinary tract infections, and alteration in cardio-respiratory functions into consideration. More often than not, patients with BSS regain function in affected systems, and long-term therapy is unnecessary because BSS typically has a good functional prognosis. According to Kohno et al [22], 76% of patients have independent ambulatory status at discharge from rehabilitation. In this framework, an essential predictor for ambulation mainly depends on whether plegia predominantly affected an upper or lower limb. If an upper extremity was weaker, walking at discharge is more likely [22].

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Conclusions

BSS is associated with a good prognosis and a favorable improvement of neurological deficits. We aimed to highlight the use of conservative management and early physical therapy in treating cases such as ours. These patients require a multidisciplinary approach because it provides the best chance of recovery and return to pre-injury status. Traumatic spinal cord injuries can cause disastrous neurological deficits that affect the patient's quality of life; therefore, prevention strategies are needed to decrease the incidence of such injuries.

Conflict of Interest

None.

Declaration of Figures Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.