Penetrating spinal injury: reports of two cases

Kesici ve delici spinal yaralanma: İki olgu sunumu

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Penetrating spinal cord injuries caused by stab wounds are rare. Such injuries may result from a direct lesion of the neural elements of the spinal cord, cord infarcts or, more rarely, intradural or epidural hematoma. In the present study, two cases with spinal cord and L4 root injuries caused by a knife are presented. The first case, a 22-year-old male, referred to our emergency outpatient clinic with a stab wound injury at the mid-section of his back. Neurological examination of this patient showed paraplegia, and spinal MRI displayed a total spinal cord lesion at the T7-T8 level. The wound was primarily sutured; however, during follow-up, CSF (cerebrospinal fluid) leakage continued and the patient was operated. The ruptured dura mater was primarily sutured in a surgical intervention that involved T7-T8 total laminectomy. The second patient referred to our emergency outpatient clinic with a torso injury caused by a sharp knife. The knife was embedded 2-3 cm deep at the wound site at the L3 level and the handle was broken. The patient was immediately operated and the broken and embedded metallic part of the knife was extracted.

Key Words: Penetrating spinal cord injury; stab wound; spinal cord.

Delici ve kesici aletle olan penetran spinal kord yaralanmaları seyrek görülür. Bu yaralanmalarda spinal kordun nöral elamanlarının doğrudan hasarı, kord infarktı ve nadiren de intardural veya epidural hematoma olabilir. Bu yazıda, bıçakla spinal kord ve L4 kök yaralanması olan iki olgu sunuldu. Birinci olgu 22 yaşındaki erkek hasta, sırt bölgesinin ortasından bıçakla yaralanma şikayeti ile acil polikliniğimize başvurdu. Nörolojik muayenesinde paraplejik olan hastanın spinal MRG incelemesi ile T7-T8 seviyesinde total spinal kord lezyonu saptandı. Yara primer dikilmesine edilmesine rağmen, takibinde beyin omirilik sıvısı sızıntısının olması nedeniyle ameliyata alındı. Ameliyatta T7-T8 total laminektomi yapılarak yırtılmış olan duramater primer olarak dikildi. İkinci hasta, belinde bıçakla yaralanma sonrası acil polikliniğimize başvurdu. Hastanın L3 seviyesindeki yara yerinde sap kısmı kırılmış bıçak 2-3 cm'lik derinlikte görüldü. Hasta acil olarak ameliyata alınarak kırılan ve metalik kısmı içeride kalmış olan bıçak çıkartıdı.

Anahtar Sözcükler: Delici ve kesici spinal yaralanma; bıçak yaralanması; spinal kord.

Penetrating spinal cord injuries caused by piercing and cutter tools such as knives are scarce and are seen less frequently when compared to injuries caused by firearms. The incidence is more frequent among youngsters in South Africa, but it is reported to be less frequent in developed countries.[1,2] Knife injuries account for 7-26% of the injuries also known as "penetrating spinal cord injuries". Neurological deficits may accompany the injury in many cases. The objective of surgical treatment is to decompress the spinal cord, remove the foreign object and avoid cerebrospinal fluid (CSF) leakage.[3,4]

CASE REPORTS

Case 1

A 22-year-old male was referred to our emergency outpatient clinic with a stab wound injury to his back. His physical examination showed a regularly contoured 2-3 cm wound at the T7-T8 level, without any signs of CSF leakage. Neurological examination revealed paraplegia at the lower extremities. Sensorial examination showed anesthesia under the T7-T8 dermatome and symmetric reflexes were absent. No pathological finding was encountered on spinal plain graphs while spinal

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magnetic resonance imaging (MRI) demonstrated a total spinal cord injury at the thoracic T7-T8 level (Fig. 1). A methylprednisolone-loaded dose was initiated as medical treatment, after which medical therapy was continued at a maintenance dosage. The patient's wound was primarily sutured, but the patient was operated due to CSF leakage that began on day 3 of his hospitalization. The damaged dura mater was primarily sutured by total laminectomy at the T7-T8 level with a watertight closure. No CSF leakage was observed during the follow-up, but dramatically, no improvement was seen in his paraplegic condition. The patient was referred for rehabilitation and then discharged from our hospital.

Case 2

A 25-year-old patient referred to our emergency outpatient clinic with a stab wound injury at his torso. During examination, a metallic object was found embedded in a 2-3 cm wound located at the L3 level. Neurologically, a 3/5 left foot inversion and a 2/5 motor power in dorsal flexion were present while the patellar reflex on the same side was found hypoactive. A metallic object was observed on the lumbar plain graph extending to the transverse process (Fig 2a). Lumbar computerized tomography (CT) showed a metallic object embedded at the vertebrae transverse component of the left side at the L3 level (Fig. 2b); however, the mentioned object failed to extend too far into the bony matter. The patient was immediately operated and the broken and embedded metallic part of the knife was extracted. No preoperative or postoperative complications occurred but no significant improvement was observed in the motor deficit that involved the foot dorsal flexion.

DISCUSSION

Penetrating spinal cord injuries caused by piercing and cutter tools such as knives are scarce and are seen less frequently than injuries caused by firearms. The incidence is more frequent among youngsters in South Africa, but it is reported to be less frequent in developed countries. The majority of spinal cord injuries occur at the thoracic region. Acute neurological deficits may occur after a spinal stab wound and could result from a direct lesion to the neural elements of the spinal cord, to direct penetration and to spinal infarct, or rarely, to spinal epidural hematoma. In reported cases of direct penetration to the spinal cord, commonly incomplete cord damage may remain stable, whereas most are typical Brown-Séquard variants.[5-7]

The stab wound usually enters the spinal canal by passing through the interlaminar space that extends throughout the anatomical gap occurring at the sagittal plane due to the spinal process and at the coronal plane due to the transverse process.[7,8] In Case 1, it was observed during surgical intervention that the stab wound passed through the spinal extensions, and we assume this was the cause of the total spinal cord injury. This demonstrates that in incomplete

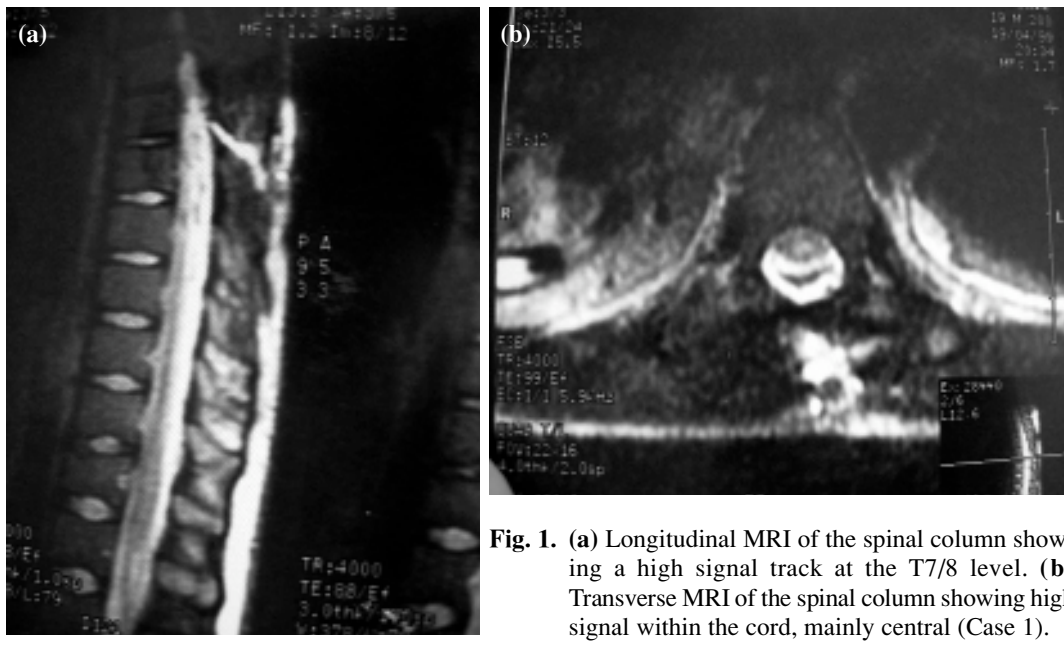

Fig. 1. **(a)** Longitudinal MRI of the spinal column showing a high signal track at the T7/8 level. **(b)** Transverse MRI of the spinal column showing high signal within the cord, mainly central (Case 1).

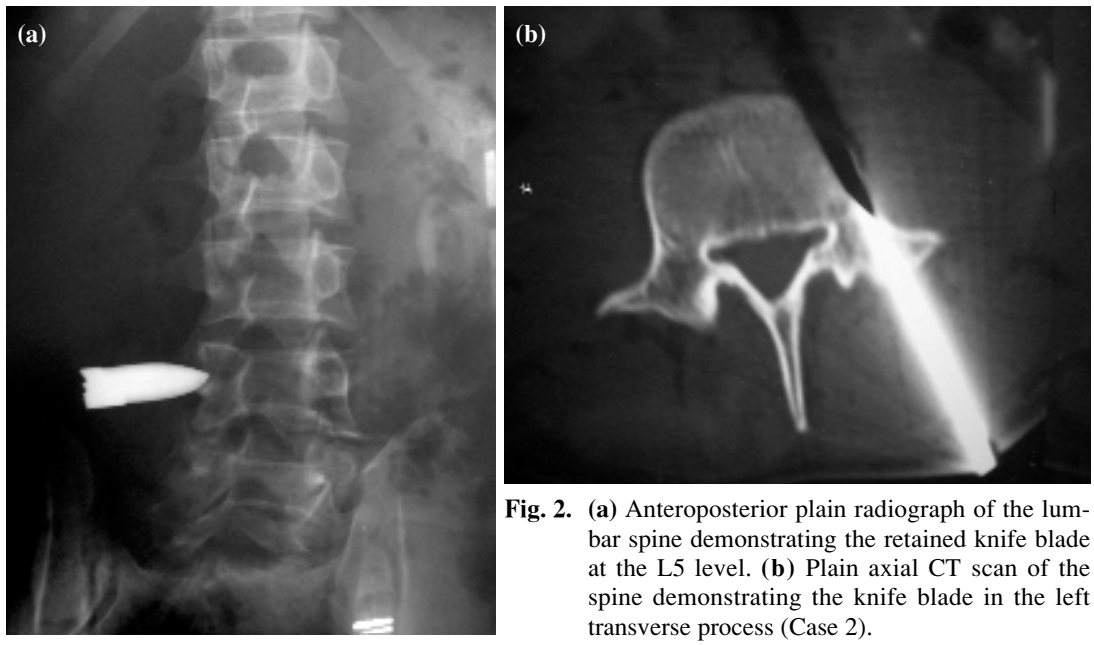

Fig. 2. **(a)** Anteroposterior plain radiograph of the lumbar spine demonstrating the retained knife blade at the L5 level. **(b)** Plain axial CT scan of the spine demonstrating the knife blade in the left transverse process (Case 2).

injuries, the cutter tool reaches the spinal cord at an interlaminar space.

In Case 2, it was observed during surgical intervention from the stab wound's traces that a blunt type trauma occurred with the knife's entry to the root's foramen. We assumed that the direction of force, shape of the knife and structure of the bones played a significant role in this event. A postoperative electrophysiological study was found compatible with selective L5 root injury as shown during surgical intervention. No previous cases were found in the literature that reported selective root injuries due to cutter tools.

Generally, cord infarct occurs when there is penetration into the Adamkiewicz artery, which provides the majority of the blood support to the lower spinal cord region. In such an event, penetration to the spinal cord is unnecessary to cause infarct. The Adamkiewicz artery is the major anterior radicular artery of the thoracolumbar cord and originates near the intervertebral foramen located at the spinal cord laterally.[4,9,10] The occurrence of a spinal infarct may be accelerated by secondary systemic hypotension due to the trauma. Spinal epidural hematoma is a rare complication that can be observed in spinal injuries due to knives and can present with minimal symptoms.[9,11] Plain graphs must be obtained in order to diagnose a spinal knife injury, in which case it is necessary to primarily locate the foreign object. However, this is also very useful to explain the relationship between the lesion's level and the spinal canal and to evaluate the bony structures. Despite the metallic artifacts, spinal CT may be especially useful to display bony structures. However, MRI may be used only when metallic fragments are not displayed in plain graphs. MRI is a particularly worthwhile method to display space-occupying lesions in the spinal canal such as an infarct and hematoma. Rarely, MRI can be dangerous if a metallic fragment is present since magnetic waves are likely to jeopardize the site of the metallic fragment and cause an increase in the neurological deficit.[4,7,12]

When a progressive neurological deficit is present, it is mandatory to apply surgical intervention to remove any fragment remaining in the spinal canal, as recommended in a study carried out by the Authors.[13,14] However, if neurological deficit is absent, then the removal of the fragment becomes controversial; the general opinion is to perform surgical treatment. If a CSF fistula is present, it must be restored surgically due to the risk of an infection. Nevertheless, the infection ratio in cases where a CSF fistula is present is reported to be low. Prophylactic antibiotic administration must be immediately started in patients suffering from penetrating spinal injuries and tetanus prophylaxis must also accompany the treatment regimen.[6,8,9]

In general, for patients with incomplete spinal cord injuries secondary to stab wounds, good func-

tional recovery has been reported in 50% to 60% of cases. The prognosis for stab wounds is generally better than it is for patients with blunt spinal cord injury or gunshot injuries of the spine, as most of the patients may present only incomplete spinal cord injuries. There are only a few cases reported in the literature, which are mostly related with complete spinal injuries, and as in Case 1, the prognosis of such injuries is reported as poor.[6,9,15]

In conclusion, this study emphasizes that spinal penetrating injuries caused by stab wounds may directly cause spinal cord injuries, but interestingly, they may also cause root injuries selectively. Additionally, in such cases, the preliminary neurological examination will be very helpful to carry out a detailed physical study to determine the presence of a CSF fistula and to consider appropriate approaches that may be needed during the diagnostic phase. It will be beneficial to determine the necessary approaches regarding treatment of such patients and to carefully emphasize the location of metallic fragments.

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