

## Minimally invasive synchronous dual intervention in a penetrating spinal trauma

*Penetran spinal travmada minimal invaziv senkron ikili girişim*

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### ABSTRACT

Penetrating spinal cord injuries towards the thoracic region may carry a high risk of additional vascular or organ injuries. In this article, we present a case of stab injury in the back, which was successfully treated via open laminectomy under thoracoscopy guidance by performing a minimally invasive method with a multidisciplinary approach.

**Keywords:** Minimally invasive surgery; penetrating; spinal cord; trauma.

Traumatic spinal cord injuries remain a major public health issue. This becomes more important in respect of the reported neurological deficit ratio of 76%.<sup>[1]</sup> Any penetrating object that may have part in a traumatic spinal cord injury carries the risk of damaging major vascular and other organs in addition to the spinal cord, thus creating combined injuries.

Herein, we report a case of posterior penetrating stab injury in the thoracic region, which was managed with a multidisciplinary stepwise approach with teams of both neurosurgeons and thoracic surgeons. The neurosurgical intervention was performed under the guidance of thoracoscopy in the same session to maintain a safe and minimally invasive approach.

### CASE REPORT

An 83-year-old female patient was admitted to the emergency department, immediately after being stabbed in her back. She was able to walk and her complaint was no more than some feeling of warmth in the upper and lower back. On physical examination, an oversized knife was observed perpendicular to

### ÖZ

Göğüs bölgesine olan penetran spinal kord yaralanmaları ek vasküler veya organ yaralanmaları açısından yüksek risk taşıyabilir. Bu yazıda, multidisipliner yaklaşımla minimal invaziv yöntem uygulanarak torakoskopi kılavuzluğunda açık laminektomi ile başarılı bir şekilde tedavi edilen bir sırtından bıçaklanma olgusu sunuldu.

**Anahtar sözcükler:** Minimal invaziv cerrahi; penetran; spinal kord; travma.

the coronal plane, 2 cm lateral to the midline with a 4 cm wide skin laceration in the back at the right upper thoracic level. No motor deficit was seen in the lower extremities but pain-temperature sensation between right T<sub>3</sub> and T<sub>6</sub> dermatomes was impaired and hypoesthesia was observed approximately in the same region. The initial examination revealed no additional pathologies. After examining the vital parameters and ensuring the stability of the patient, the radiological imaging methods, which included chest radiography and contrast enhanced computed tomography, revealed no thoracic injury or acute hemorrhage (Figure 1). The patient was admitted to the operation room and after general anesthesia was induced, endotracheal intubation with a single-lumen tube was applied with the patient in the prone position. A jugular venous catheter was placed to guarantee volume replacement in case of acute hemorrhage. Under ventilation with lower tidal volume, thoracoscopy was applied concurrently with the neurosurgical intervention in the semi-lateral decubitus position to facilitate any potential urgent thoracotomy requirement (Figure 2). T<sub>4</sub>, T<sub>5</sub>, and T<sub>6</sub> laminectomies were performed to maximize safety in



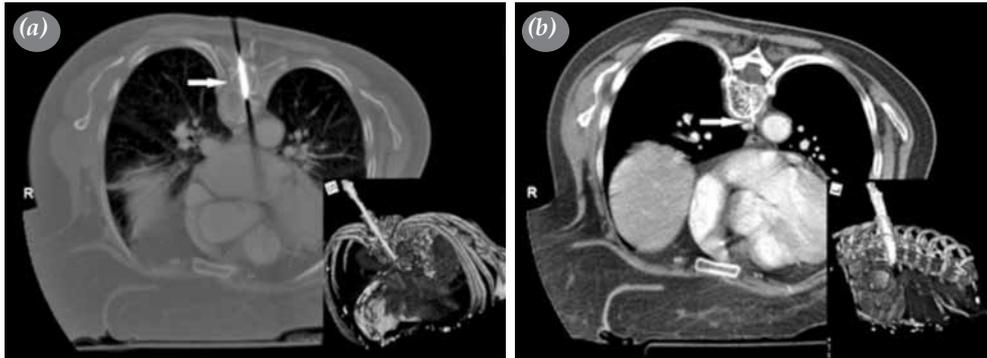
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**Figure 1.** Contrast enhanced computed tomography of chest with three-dimensional multiplanar reconstruction views demonstrate (a) route of blade through medulla spinalis and vertebral body and (b) tip of blade towards thoracic region (indicated by white arrow).

respect of any need for decompression and duraplasty. After the spinal cord penetration zone of the knife was clearly exposed, dural laceration and cerebrospinal fluid leakage were observed. The knife was removed gently under thoracoscopy guidance, and the dural laceration was repaired. No additional laceration or bleeding was determined during the exploration of the right hemithorax. After confirmation of the clinical and hemodynamic stability, thoracoscopy was ended with tube thoracostomy. The patient was followed up in the intensive care unit for one week. The chest tube was removed on the postoperative fifth day. The patient was discharged on the postoperative eighth day with no neurological deficits.

## DISCUSSION

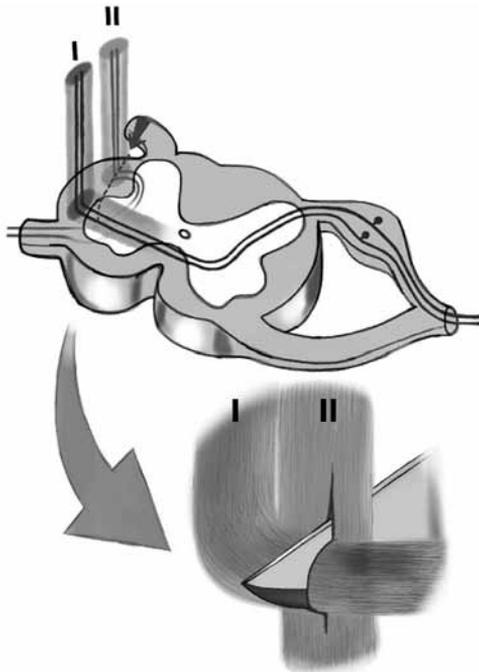
Penetrating spinal injuries remain an unclear area in respect of management and the extent of necessary interventions. The available data in the literature mainly consists of case report based information.



**Figure 2.** Synchronous dual intervention including open laminectomy and thoracoscopy was performed.

The majority of spinal injuries due to stab wounds have been reported to be located in the thoracic spine followed by the cervical spine and lumbar spine. The possible co-occurrence of multiple vascular or organ injuries should be underlined, where the overall mortality of thoracic aortic injuries has been reported to be higher than 90%.<sup>[2]</sup> This also reflects the necessity of a multidisciplinary approach. The relevant literature presents a wide range of recommendations regarding the management of such injuries. Venger et al.<sup>[3]</sup> reported that neurosurgical interventions did not improve the overall neurological outcome and it was also emphasized that such interventions could lead to a higher complication rate. Contrary to this suggestion, it has been reported that early surgical interventions not only are critical to the neurological outcome but also decrease the infection rate, cerebrospinal fluid fistula, and arachnoiditis.<sup>[4]</sup> In our opinion, the necessity to remove the instrument which has caused the stab injury is evident in every situation. It must be kept in mind that hemorrhage is a possible major complication that may be observed at any stage of the event or surgery.<sup>[3]</sup> Therefore, both thoracic surgeons, neurosurgeons, and even cardiovascular surgeons should work together for the worst-case scenario.

One of the striking clinical features of this patient from the physiological perspective that should be discussed in addition to the surgical management and intervention was her clinical status and neurological examination. There have been reports in the literature of such cases where there has been no motor dysfunction after the stabbing.<sup>[5]</sup> According to accepted physiological knowledge, no motor dysfunction in the lower extremities is not surprising. In the current study, there was no motor dysfunction as the blade was



**Figure 3.** Illustration explains pathophysiological mechanism of patient's neurological status. Fibers (I) are sensorial and fibers (II) are motor fibers.

“dissecting” the vertical fibers which are responsible for motor function in the lower extremities. In addition, the sensorial complaints and neurological signs of the patient were beyond the “cutting” sensorial fibers with a horizontal course (Figure 3).

Although chest tube insertion remains the basis of treatment in the majority of patients with chest trauma, it may be insufficient in certain cases. Thoracoscopy has great advantages as a minimally invasive diagnostic or therapeutic tool, which allows complete inspection of the thoracic cavity. Thoracoscopy is also associated with a reduced need for analgesics, better mobility, reduced wound and pulmonary complications, faster rehabilitation, and reduced length of hospital

stay.<sup>[6]</sup> However, thoracoscopic evaluation is not to be recommended for patients with indications for emergent thoracotomy or sternotomy with hemodynamic instability, suspected great vessels or cardiac injury.

In summary, in cases of penetrating spinal cord injuries with unexpected vascular or organ injury, not only the neurosurgeons, but also the thoracic and cardiovascular surgeons should be interested with this complicated clinical situation. Multidisciplinary management with sharing responsibility and keeping up the team spirit is the safest mainstay of diagnosis, treatment, and follow-up. Thoracoscopy may be considered as a surgeon-friendly minimally invasive guide for the management of selected patients with penetrating spinal cord injuries towards the thoracic region.

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