

# CAS CLINIQUE / CASE REPORT

## INDIRECT GUNSHOT SPINAL CORD INJURY

### A Case Report

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**ABSTRACT** • Spinal cord injury from gunshot wounds represents 13% of spinal trauma cases. Myelopathy may not necessarily be caused by direct compromise of the spinal cord and canal, but instead can result from adjacent gunshot wounds through the transfer of energy to the cord causing underlying contusions. We present a case of paraplegia caused by a gunshot wound injury to the upper thoracic spine, causing evident myelopathy on magnetic resonance imaging (MRI) of the spine and confirmed by somatosensory evoked potentials (SSEPs), where there was no evidence of spinal canal compromise. In addition to this case, only seven such cases were reported in the literature. In this paper, we review and discuss the similarities and differences in all the reported cases.

Keywords: spinal cord injury ; gunshot ; myelopathy

#### INTRODUCTION

Spinal cord injury (SCI) has a mean incidence of 30 to 40 cases per million per year [1]. SCI is most commonly caused by road traffic accidents followed by a fall from height, which accounts for almost two-thirds of the cases [2]. Thirteen to 17 percent of spinal cord trauma cases were associated with gunshot wounds [3]. SCI associated with gunshot wounds usually occurs in military action and therefore young males between the ages of 15 and 34 years are the most affected [4]. In gunshot wounds, the vast majority of spinal cord injuries occur due to direct laceration compared to indirect injury, which is considered rare [3].

We present a case of indirect spinal cord injury following a gunshot to the neck resulting in paraplegia and compare it with reported cases in the literature.

#### CASE REPORT

A 44-year-old right-handed male soldier, known to have lumbar disc disease presented with a gunshot injury that occurred during a military operation, where he was shot

from a one-meter distance. He was transferred to our hospital where he was complaining of dyspnea and chest pain. The wound entry site was found at the right base of the neck along the sternocleidomastoid, while the exit wound was detected along the midline of the back at the level of T3. The patient was not hypotensive at any point and no vascular shock was documented during or after presentation.

Computed tomography (CT) of the chest showed a comminuted fracture of the right 2<sup>nd</sup> rib with pulmonary contusions leading to hemopneumothorax, as well as non-displaced fractures of T2 spinous process and T3 right transverse process. A chest tube was then inserted and the patient was stabilized.

Neurological consultation was obtained because the patient was noted to be paralyzed in his right upper extremity and both lower extremities. On neurological exam, he was awake and oriented with normal cranial nerves. He was only able to move his left upper extremity, which was limited by pain. Severe weakness was noted in the right upper and bilateral lower extremities (strength 0/5) which were flaccid and areflexic.

The pinprick sensory exam showed a level at T4 bilaterally, with preserved joint position sense in the lower extremities. He had urinary retention and an absent anal tone. Bilateral extensor plantar responses were observed.

Injury of the right brachial plexus was confirmed by magnetic resonance imaging (MRI) and electromyography/nerve conduction studies (EMG/NCS), which explained the weakness of his right upper extremity. MRI of the spine showed a high T2 signal within the spinal cord, faint but continuous, mainly affecting the central grey matter and extending around 5 vertebral levels (T1 down to T5, faint on sagittal cut, more prominent on axial cuts) (Figure 1) with no disruption of the spinal canal (Figure 2). Somatosensory evoked potentials (SSEP) were absent from both posterior tibial nerves and normal from the left median nerve.

One week later, the exam only showed improvement in the left lower extremity motor power in dorsiflexion and plantar flexion of 2/5. Symptomatic treatment was given and steroids were avoided.

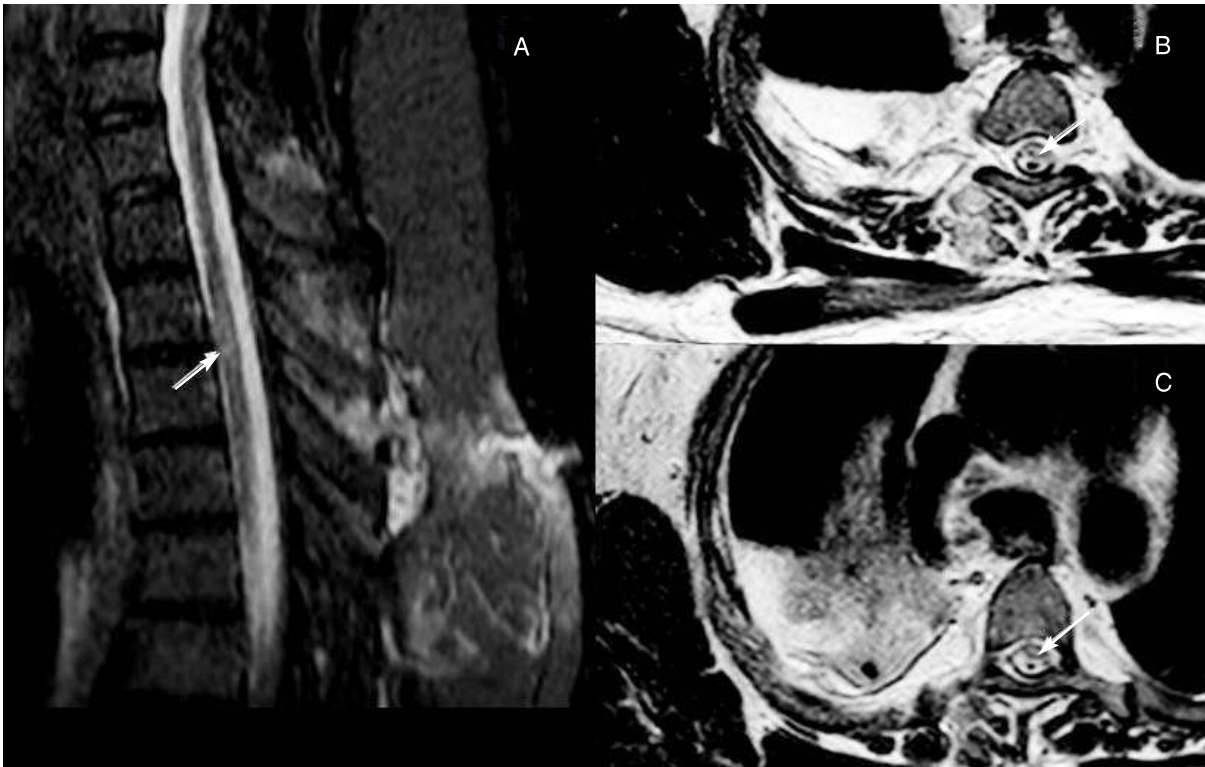
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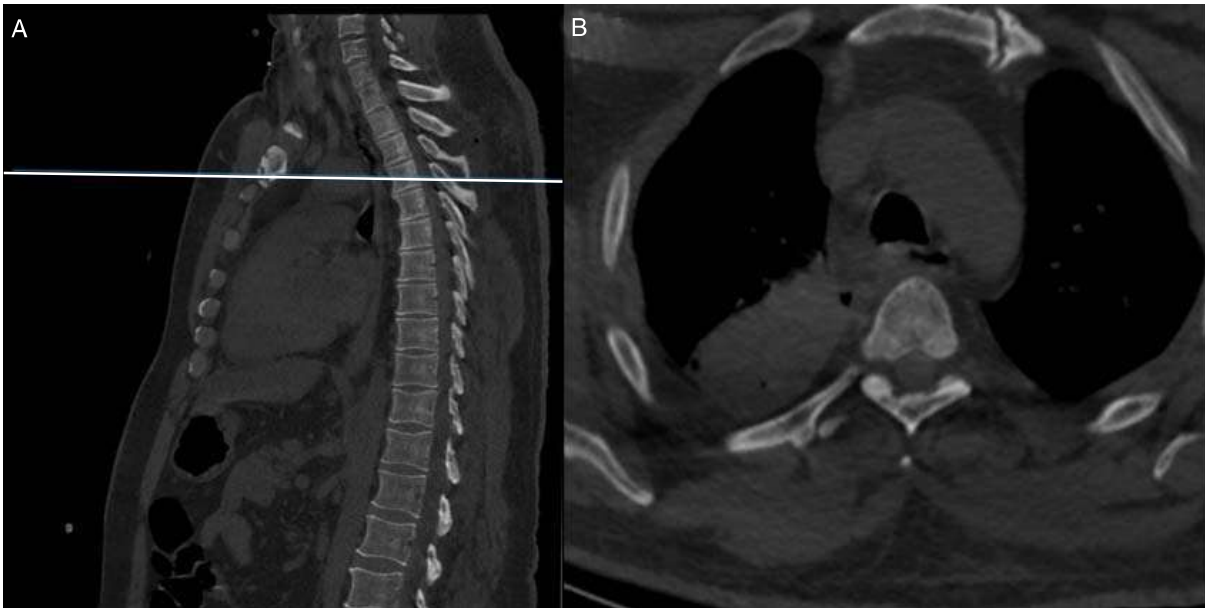
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**Figure 1.** Spinal cord lesion

MRI of the thoracic spine. (A) sagittal cut, T2-weighted short tau inversion recovery (STIR) sequence. (B) Axial cut at the level of the T3 vertebra, T2-weighted sequence. (C) Axial cut at the level of T4 vertebra, T2-weighted sequence. Arrows showing a hyper-intense signal in the spinal cord.



**Figure 2.** Absence of spinal canal compromise

CT scan of the thoracic spine in sagittal (A) and axial (B) views showing no signs of compromise of the spinal canal. The blue line indicates the T4 vertebral level.

Sural nerve engraftment for brachial plexus repair was done a month later and the patient was transferred to a rehabilitation center for aggressive physical therapy. Through a telephone call 11 months after the gunshot event, he described being able to walk with a cane without further assistance. Minimal movements in his right upper extremities were possible.

#### DISCUSSION

We present a case of indirect spinal cord injury. Only seven similar cases are described in the literature where the gunshot resulted in a myelopathy without any compromise of the integrity of the spinal canal [1,3,5-7]. Although it is the only one where the exam was similar to that of an anterior spinal cord syndrome, the physical exam in other cases was either not documented or lacked details of sensory exam that distinguish an anterior spinal syndrome from that of a complete cord transection. In fact, only two cases reported the presence of hemorrhagic shock which can be a major risk factor to develop an anterior spinal artery infarct [1,6].

Our patient had a thoracic insult associated with complications of hemothorax and pneumothorax. These complications were commonly seen in all the other similar cases in the literature.

The majority of cases had a bad prognosis and no recovery of any neurologic deficits within a two-year period. However, our patient was walking with a cane after 11 months.

No further investigations were done looking for an autoimmune myelitis that can be precipitated by trauma because the onset of the neurologic deficits was hyperacute.

The hypothesis behind the indirect injury is that the bullet transfers kinetic energy from the surrounding bone to the spinal canal. Since bone is much denser than the spinal cord, it can absorb a great amount of energy without damage [6]. The shockwave is thus reflected from the inner surfaces of the lamina, pedicle, and body of the vertebra to the spinal canal leading to contusion in the spinal cord [6]. The anterior spinal syndrome observed

in our case may suggest a vascular-ischemic etiology as well. A limitation to mention is that the patient did not do a follow-up MRI and physical exam 1 year later.

#### CONCLUSION

Gunshot injuries can cause myelopathy without spinal canal compromise when the bullet tract is adjacent to the spine. The mechanism is thought to be from the bullet's energy transfer to the spinal cord causing a contusion. Therefore, if myelopathy is clinically suspected after a gunshot injury, MRI of the spine and/or SSEP are recommended to detect an injury to the spinal cord.

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