

Case Report

Intradural migration of a bullet following spinal gunshot injury

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Study design: Case report.

Objectives: To report a penetrating gunshot injury at L1 with migration within the spinal canal to S2.

Setting: Istanbul, Turkey.

Methods: A 44-year-old man was admitted with an entrance gunshot wound on the left upper quadrant. An emergency exploratory laparotomy with left nephrectomy and transverse colon repair were performed. He had complete spinal cord injury below the level of L1. Lumbar magnetic resonance imaging (MRI) revealed hemorrhagic areas in conus medullaris and L1 corpus. The bullet was lodged at the S2 level. S1–S2 laminectomies were performed for the removal of the bullet. The antibiotic therapy was given for 17 days.

Results: No meningitis or wound infection was observed after the operation. At discharge his neurological status was improved.

Conclusions: The present case presented the movement of an intraspinal bullet after a spinal gunshot injury. No signs of infection were detected postoperatively. Lumbar MRI was used safely without any change in neurological status or patient discomfort.

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Keywords: gunshot; spinal cord injury; migrating bullet; MRI

Introduction

Gunshot injuries to the spine are mainly caused by suicides, accidents and assaults. These vary in proportion depending on the geographical location. Although statistical data for civilian gunshot injuries are not well known in Turkey, an epidemiological study of 581 new cases in 1992 revealed the incidence of gunshot wounds to be 1.9% of all spinal cord injuries in Turkey.¹ Incidence of gunshot injuries perforating and trapped within the spinal canal is quite low and migration of a bullet through the spinal canal is reported rarely in the literature.^{2–6} Here, we present a penetrating spinal gunshot injury with the bullet migrating through the spinal canal.

Case report

A 44-year-old male was admitted to the emergency department after a gunshot injury to the abdomen. On arrival to the emergency room, he was noted to be pale and somnolent. His vital signs were consistent with hypovolemic shock. The neurological examination could not be assessed correctly because of his low level

of consciousness (Glasgow Coma Scale: 6/15) due to shock. The entrance wound of the missile was found on the left upper quadrant. There was no exit wound. His poor general medical condition and unstable vital signs did not allow for a polytrauma computed tomography (CT) scanning. So, after an immediate trauma workup, he underwent an emergent exploratory laparotomy. Left nephrectomy and transverse colon repair were performed. After the operation he was kept intubated in the intensive care unit (ICU) under sedation for 7 days with regard to his general medical condition. During this period, the ICU team was not aware of a spinal trauma owing to the sedation.

When he regained consciousness, a complete spinal cord injury below the level of L1 was detected (ASIA-A). A detailed workup for spinal injury was carried out as his general medical condition was stabilized. On lumbar X-rays (Figure 1), the bullet was seen lodged at the level of S2. Lumbar CT-scans (Figure 2) revealed the entrance of the bullet from the left anterior border of L1 corpus into the spinal canal. Bony fragments were also observed inside the spinal canal. Lumbosacral magnetic resonance imaging (MRI) (Figure 3) demonstrated subacute hemorrhagic areas in conus medullaris and within L1 corpus.

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Figure 1 Anteroposterior lumbar X-ray shows the bullet lodged within the spinal canal at the S2/3 level

As a result of delayed diagnosis in CT-scans, the patient was operated for removal of the bullet 10 days after the trauma. The dura overlying the missile was grayish-black in color after S1–S2 laminectomies were performed. The bullet was removed, the wound tract irrigated and the dura closed tightly. The antibiotic therapy was continued for 17 days. No complication was observed after the operation. The patient was discharged to be transferred to a rehabilitation unit. At discharge, his motor deficit was improved to 2/5 muscle strength on proximal lower extremities.

Discussion

Shotguns are low-velocity weapons and civilian gunshot wounds are considered low energy in most cases.⁷ The prognosis for subsequent improvement in neurological function and general condition is related with the level of spine affected. After a survey of 858 spinal cord injuries, Comarr *et al*⁸ concluded that cauda equina lesions recovered more frequently than spinal cord lesions. However, Yashon *et al*⁹ stated that the final



Figure 2 Axial CT scan demonstrates the entrance of the bullet from left anterolateral border of L1 corpus (arrow) and intracanalicular bony fragments are seen in the spinal canal

outcome in spinal cord bullet injuries is correlated with initial neurological status rather than with surgery.

In lumbar region gunshot wounds, another significant factor considering patient outcome is colonic perforation that occurs before the missile passes through the spine since it is associated with increased rate of spinal infection if not treated appropriately.¹⁰ In our case, the patient did not have any signs of meningitis although the bullet had moved through both urinary and gastrointestinal systems.

There are many reports about the movement of the bullet from paraspinous muscles and intervertebral disc space into the spinal canal^{10,11} in the literature. Kuijlen *et al*¹⁰ reported migration of a bullet from the paraspinous muscles at L3 level into the spinal canal. Conway *et al*¹¹ presented migration of a bullet from intervertebral disc space into the spinal canal. Neural deficit in those cases occurred months to years after the initial injury as late sequelae. Migration of a penetrating missile through the spinal canal is a rare condition. A review of the literature could reveal only five cases with intradural migration of missile within the spinal canal.^{2–6} Avci *et al*⁶ reported a case of an intradural bullet entering the spinal canal at S1 level and migrating to the L4 level in which this movement caused neurological deficit. Oktem *et al*⁵ demonstrated a case of migrating bullet traversing the length of spinal canal. The present case is an unusual one in which conus medullaris destruction was followed by intradural migration of the bullet to S2 level.

In the initial evaluation of spinal injury, lateral and anteroposterior radiographs can be obtained in conscious and neurologically intact patient. After plain films have determined the level of the bullet and/or fracture, CT-scans are obtained. This is considered as

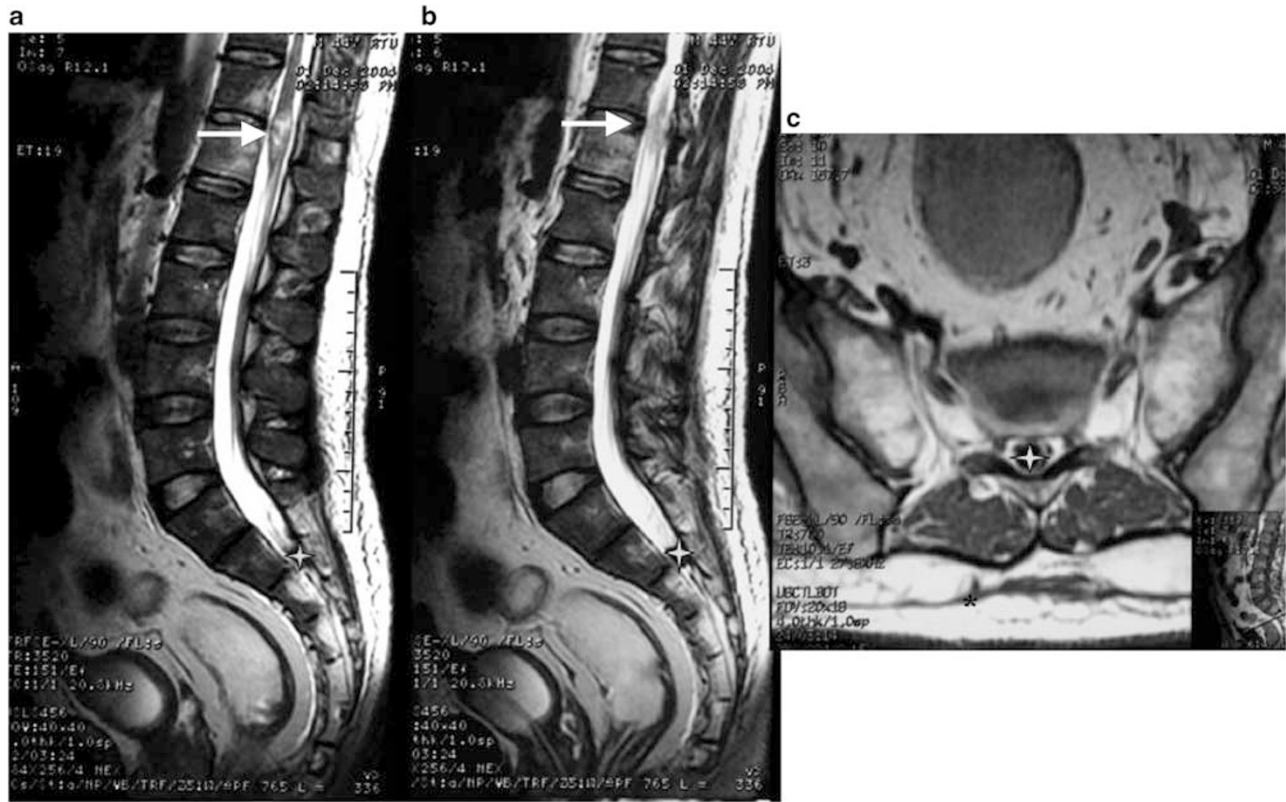


Figure 3 Sagittal T2-weighted MR images demonstrate homogenous hyperintense hemorrhagic areas in conus medullaris (arrows) (a, b). On an axial T1-weighted MR image, the bullet is seen lodged in the intradural space at the level of S2/3 (asterisk) (c)

advanced choice for spinal gunshot injury for detection of intraspinal fragments.⁷ Use of MRI to evaluate soft tissue damage in gunshot to the spine is stated as a relative contraindication in paralytic patients.¹² Bullet movement is related to several factors including ferromagnetism, duration of injury, mass and shape of bullet.¹³ Missiles used for low-velocity shotguns are usually copper jacketed, which do not have ferromagnetic properties. Therefore, MRI can be used in low-velocity shotgun injuries. On the other hand, bullets used for high-velocity shotguns are encased in steel, which is ferromagnetic. Since the missile is mostly destroyed before entering body in high velocity shotguns, MRI can also be used after confirmation of the absence of steel fragments in the spine by X-rays. In our case, the nonferromagnetic feature of the bullet allowed MRI to be an appropriate choice for investigation. The patient did not show any change in neurological status or any discomfort like increased heat sensation during the course of MRI study.

Progressive neurologic deficit associated with intraspinal blood, bullet or bone fragments is the indication for urgent decompression.⁷ Cybulski *et al*¹⁴ reported 88 patients with terminal spinal cord lesions in whom 47.7% overall improvement rate was observed after laminectomy. On the other hand, many authors recommend surgical removal of a missile due to the risk of lead intoxication or contact of a copper-jacketed

missile with the neural elements.^{15,16} Spinal cord necrosis around copper fragments implanted within the dura was shown in animal studies.¹⁶ It is also reported that effects of metal corrosion in CSF may be seen in the brain due to migration through the spinal canal.¹⁷ Since our patient had complete spinal cord lesion, there was no indication for immediate removal and the removal of the missile was performed to prevent toxic effects of copper and lead contained in the bullet.

In conclusion, the present case identified the possibility of movement of an intraspinal/intradural bullet after a spinal gunshot injury. Our case is also remarkable since no meningitis was detected despite the passage of the missile through gastrointestinal and urinary tracts. We also note that MRI can be used safely in low-velocity spinal gunshot injuries since the bullets used are copper jacketed and are therefore nonferromagnetic.

References

- 1 Karacan I *et al*. Traumatic spinal cord injuries in Turkey; a nation-wide epidemiological study. *Spinal Cord* 2000; **38**: 697–701.
- 2 Tekavcic I, Smrkolj VA. The path of a wounding missile along the spinal canal. A case report. *Spine* 1996; **21**: 639–641.
- 3 Gupta S, Senger R. Wandering intraspinal bullet. *Br J Neurosurg* 1999; **13**: 606–607.

- 4 Jeffery J, Borgstein R. Case report of a retained bullet in the lumbar spinal canal with preservation of cauda equina function. *Injury* 1998; **29**: 724–726.
- 5 Oktem I, Selcuklu A, Kurtsoy A, Kavuncu I, Pasaoglu A. Migration of bullet in the spinal canal: a case report. *Surg Neurol* 1995; **44**: 548–550.
- 6 Avci SB, Acikgoz B, Gundogdu S. Delayed neurological symptoms from the spontaneous migration of a bullet in the lumbosacral spinal canal: case report. *Paraplegia* 1995; **33**: 541–542.
- 7 Bono CM, Heary RF. Gunshot wounds to the spine. *Spine J* 2004; **4**: 230–240.
- 8 Comarr AE, Kaufmann AA. A survey of the neurological results of 858 spinal cord injuries. A comparison of patients treated with and without laminectomy. *J Neurosurg* 1956; **13**: 95–106.
- 9 Yashon D, Jane JA, White RJ. Prognosis and management of spinal cord and cauda equina bullet injuries in sixty-five civilians. *J Neurosurg* 1970; **32**: 163–170.
- 10 Kuijlen J, Herpers M, Beuls E. Neurogenic claudication, a delayed complication of a retained bullet. *Spine* 1997; **22**: 910–914.
- 11 Conway J, Crofford T, Terry A, Protzman R. Cauda equina syndrome occurring nine years after a gunshot injury to the spine. A case report. *J Bone Joint Surg* 1993; **75**: 760–763.
- 12 Grogan D, Bucholz R. Acute lead intoxication from a bullet in an intervertebral disc space. *J Bone Joint Surg* 1981; **63**: 1180–1182.
- 13 Smugar SS, Schweitzer ME, Hume E. MRI in patients with intraspinal bullets. *J Magn Reson Imaging* 1999; **9**: 151–153.
- 14 Cybulski GR, Stone JL, Kant R. Outcome of Laminectomy for Civilian Gunshot injuries of the terminal spinal cord and cauda equina: review of 88 cases. *Neurosurg* 1989; **24**: 392–397.
- 15 Linden M, Manton W, Stewart R, Thal E, Feit H. Lead poisoning from retained bullets. Pathogenesis, diagnosis, and management. *Ann Surg* 1982; **195**: 305–313.
- 16 Tindel N, Marcillo A, Tay B, Bunge R, Eismont F. The effect of surgically implanted bullet fragments on the spinal cord in a rabbit model. *J Bone Joint Surg* 2001; **83**: 884–890.
- 17 Furlow LT, Bender MB, Teuber HL. Movable foreign body within the cerebral ventricle: a case report. *J Neurosurg* 1947; **4**: 380–386.