Available online at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.elsevier.com/locate/pjnns

Case report

# When the bullet moves! Surgical caveats from a migrant intraspinal bullet

Ali Genç [a,*], Murat Imre Usseli [b], M. Necmettin Pamir [c]

[a] Department of Neurosurgery, School of Medicine, Marmara University, Istanbul, Turkey
[b] Department of Neurosurgery, Acibadem University, Istanbul, Turkey
[c] Department of Neurosurgery, School of Medicine, Acibadem University, Istanbul, Turkey

ARTICLE INFO

*Article history:*
Received 2 May 2016
Accepted 23 June 2016
Available online 2 July 2016

*Keywords:*
Gunshot injury
Mobile bullet
Intradural
Ultrasonography

ABSTRACT

Rarely, spinal gunshot injuries result in migrating intraspinal bullets. Use of MRI is controversial and other radiographic imaging might mimic an extradural bullet, even though it is intradural and migratory. Here, we present a case of spinal missile injury resulting in an intraoperatively mobile intradural bullet. The challenges faced during diagnosis and surgical removal are described. We also show that intraoperative ultrasonography may be useful in clarifying whether the bullet is intradural. A 32-year-old male presented with weakness and paraesthesia in his right leg following an accidental gunshot injury to his spine. Facet joint destruction and an intraspinal bullet were detected. Immediate surgical removal and transpedicular instrumentation was performed. The surgical procedure was complicated by lack of an identifying dural perforation at the bullet entry point and a gliding bullet inside the spinal canal during surgery. Gliding of the bullet was caused by the pushing effect of the bone rongeur and further gliding was avoided by performing the next laminectomy with an electric drill. Where other modalities indicated for a possible extradural location, intraoperative USG clearly showed the intradural position of the bullet and provided clear images without major artifacts. Surgical treatment of a mobile intradural bullet is challenging and open to surprises. Location of the bullet may shift as result of surgical procedure itself. Laminectomy should be performed with a power drill. Where fluoroscopy was inadequate and MRI not available, intraoperative USG proved useful in ascertaining the intradural versus extradural position of the bullet and allowed for a tailored dural opening.



## 1. Introduction

Rarely, spinal missile injuries (SMI) result in bullets that enter and travel caudally along the path of the spinal canal [1,2]. With intraspinal gunshot injuries, it is difficult to assess the damage merely by evaluating the symptoms. The use of magnetic resonance imaging (MRI) is controversial and is generally avoided. Other radiographic imaging might mimic an extradural bullet, even though it is intradural and migratory [2]. Furthermore, removal of a mobile intradural bullet may prove some surgical challenges. Here we report a case of SMI

* *Corresponding author at*: Mustafa Kemal Mh. Fahriye UcokCd. 16, Iskenderun, Hatay 31200, Turkey. Tel.: +90 212 8030976; mobile: +90 533 2177725.
E-mail address: draligenc@gmail.com (A. Genç).

http://dx.doi.org/10.1016/j.pjnns.2016.06.006

resulting in a mobile intradural bullet with confusing radiological and intraoperative findings. We describe the surgical challenges faced during removal and show the usefulness of ultrasonography (USG) in locating an intradural mobile projectile where other modalities failed.

## 2. Case description

A 32-year-old male patient presented at the ER following an accidental gunshot injury to his back. He complained of pain and a burning sensation in the right knee along with numbness over his right leg. He was conscious, oriented and cooperative. The bullet entry site was above the right iliac crest and no exit wounds were noted. The movements of the right leg were painful and limited. His neuroexam was also notable for severe weakness on right knee extension and paraesthesia over the front of his right thigh. There was also no patellar reflex on the right.

The abdominal and thoracic CT revealed no intra-abdominal injury. However, lumbar XRs and CT scan revealed a fragmented right L3 pedicle with disruption of the L2-3 facet joint and indentation on the dural sac (Fig. 1A and B). However, the bullet was located inside the spinal canal at the S1 level, just beneath the lamina giving the impression of a possible epidural location. No disruption of bony structures between the spinal entry site and the final resting position of the bullet was found.

Surgical treatment for dural decompression, transpedicular instrumentation and bullet extirpation were planned and the patient was moved to the OR immediately. An L2 laminectomy was carried out and the fragmented L2-3 facet joint was removed. The bony spicules indenting the dural sac and the L3 nerve root were also cleared and the compression was relieved. No cerebrospinal fluid (CSF) fistula or dural perforations were noted, strengthening the idea of the bullet traversing in the epidural space down the spinal canal. Then, under C-arm fluoroscopic guidance, the location of the bullet under the S1 lamina was confirmed (Fig. 2A). Using a Kerrison bone rongeur, an S1 laminectomy was carried out. After the procedure however, the bullet was not found. Re-check with C-arm, located the bullet beneath the L5 lamina, this time. Therefore, the bullet was thought to be pushed cranially with each Kerrison rongeur bite, during laminectomy. Therefore, to avoid further shift in the position of the bullet, L5 laminotomy was performed using an electrically powered surgical drill. For another surprise, the bullet was still not found. Repeat C-arm once more confirmed that the bullet was still at the L5 level. However, to avoid an unnecessary dural opening, the possibility of the bullet being in the epidural space had yet to be ruled out. Out of an instantaneous improvisation, we decided to use intraoperative ultrasonography to ascertain the bullet's intradural location. The intraoperative ultrasound probe (Sonoline G60S ultrasound system, Siemens, VF13-5SP intraoperative transducer, frequency bandwith 5–13 MHz) was introduced into the laminectomy area and the dural surface was scanned in the horizontal plane (Fig. 2B). The sonograms clearly defined the intradural location showing the bullet as a distinct, roundly shaped circular mass underneath cauda equina fibers (thin arrows) incased in the dural sac (thick arrow) (Fig. 2B). The bullet's outer shell left a regular circular hyper-echoic impression containing a hypo-echoic core as well as some inner details. Therefore, the dural sac was opened with a more tailored midline incision. The bullet was found underneath the caudal fibers surrounded by a clear CSF. The bullet was removed (Fig. 2c) and hemostasis was achieved. Following dural closure, L2-3-4 transpedicular instrumentation was performed sparing the right L3 pedicle (Fig. 3). Postoperatively, the patient reported a complete relief of pain in his right leg. Recovery of the patient was uneventful. He was asked to use a lumbar brace for two weeks and started on physiotherapy. Complete recovery of motor function was achieved in two weeks.

## 3. Discussion

Intraspinal missile migration usually occurs between T10 and S1. Generally, the relative narrowing of the spinal canal at T10 level limits the migration of the bullet in both directions [3,4]. The primary factor for the migration of the bullet is gravitational forces [3]. It was suggested that the respiratory changes and physiological cerebrospinal fluid circulation might assist in the migration of the bullet [5]. In addition, fluoroscopy and intraoperative observations suggest that the patient's position affects the direction of the

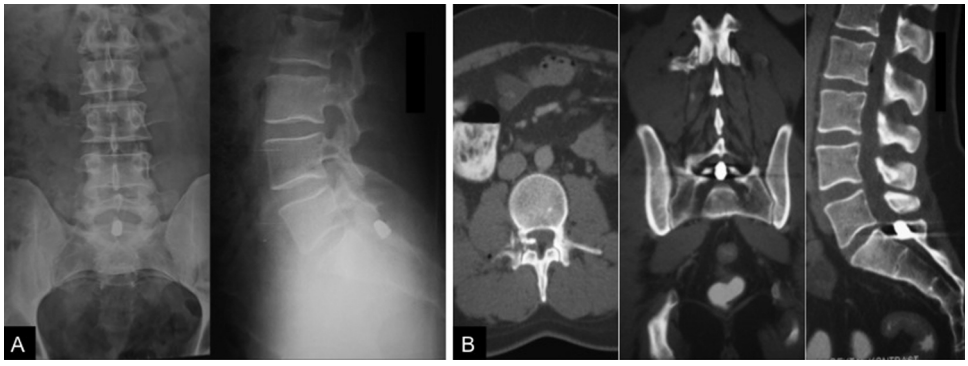


**Fig. 1 – (A) Preoperative lumbar X-ray shows a fragmented right L3 lateral process and the bullet lodged at the S1 level. (B) Preoperative lumbar CT-scan. Axial image shows the fragmented right L3 pedicle and L2-3 facet joint. Note the spicules of bone indenting the dural sac. On coronal and sagittal images the bullet's resting position is seen at S1 inside the spinal canal.**