



Case report

Successful Removal of a Bullet from the Spinal Canal of a GSW Victim in the Level of L5: Case Report

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ABSTRACT

Introduction and importance: Gunshot wounds (GSWs), for increasing violence in urban areas globally and especially among the young population, have been significant causes of morbidity and mortality. These are the most common cause of spinal cord injuries, followed by traffic accidents. The priority of the therapeutic team is to save the victim and then minimise the permanent neural deficits. The indications for lumbosacral decompressive spinal surgery have remained challenging.

Case presentation: A 25-year-old man victim of a gunshot in his left flank presented to the emergency department in hemodynamic shock and lethargy status. Resuscitating with fluids, he underwent damage control surgery (DCS). Sources of 2.5 l of intra-abdominal blood were detected of multiple intestinal and mesentery perforations beside the left ureter complete cut. The left psoas muscle was through and through perforated, too, and the bullet was stuck between the vertebrae. On the fifth day after DCS, the bullet surgical removal of the bullet was done in which L2-S1 laminectomy approaching the crushed Conus terminalis was completed. After the operation, his left foot drop and walking ability were improved.

Clinical discussion: Surgical treatment for gunshot wounds in the spinal column is controversial, but the emphasis is on providing advanced trauma life support. Definite treatment of such lesions mainly focuses on maintaining spinal stability, decreasing neurologic deficits as much as possible, and preventing complications.

Conclusion: A patient indicates neurological surgery who is young with incomplete or progressive neurology deficits, unstable spine, or complete injury with persistent neural compression.

1. Introduction

By increasing violence in urban areas globally, GSWs, especially among the young, are significant causes of morbidity and mortality in the population [1], especially paradoxical prevalence during the Corona disease 2019 (COVID-19) in some crowded United States cities. In some surveys, GSWs accounted for the most common causes of spinal cord lesions, followed by traffic accidents [2–5]. However, the incidence of spinal cord injuries caused by gunshots varies, depending on the country, ranging from 13 to 44 % [6–8]. Low-velocity guns apply damage effects by direct mass effect on the cord, bullet invasion, or osseous fragments into the spinal canal [9]. A typical victim is usually a young

male under 30 years of low socioeconomic status, and many suffer from persistent neurological deficits [10]. Multiple factors determine the severity of the injury. Some of them are the presence of spinal contusion and vascular damage, besides the bullet's distance, size, and trajectory [11]. Cervical lesions in 70 % of the cases lead to complete neurological deficits [12].

In contrast, this rate is about 30 % among the lesions of the cauda equina and at the lumbosacral levels [13]. We have reported a case of spinal column GSW at the level of L5 in a 25-year-old man that recovered his walking ability after the successful removal of the bullet and duraplasty. This work has been reported in line with the SCARE criteria [14] (Fig. 1).

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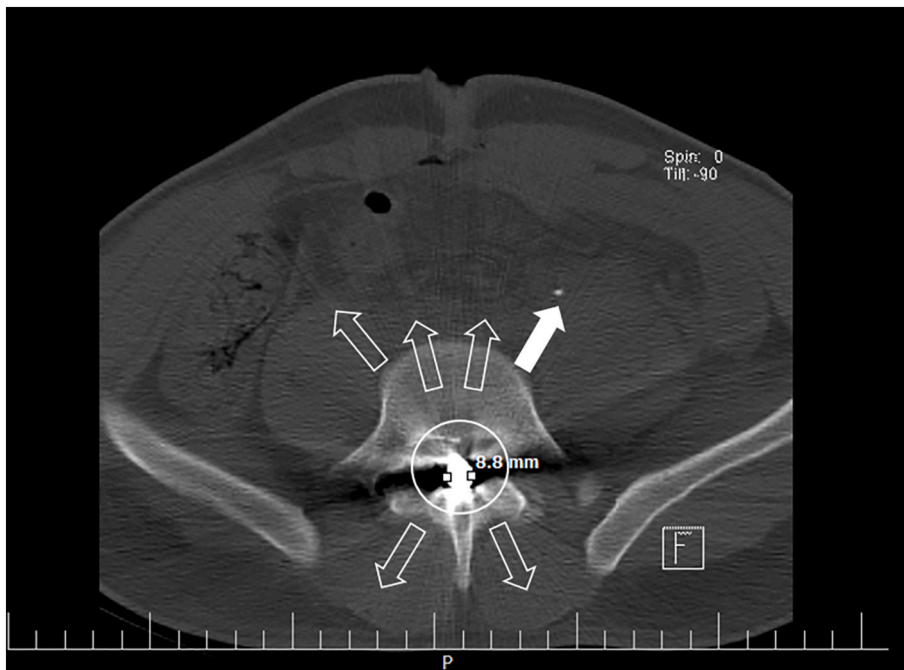


Fig. 1. Axial CT scan sequence of the patient after first surgery at the L5 vertebral level showing the bullet placed into the spinal canal in a circle measuring about 8.8 mm in diameter. There are no multiple osseous fragments present at this level. The hollow arrows represent the metal artefact. A section of double J tube into the left ureter is also seen (solid arrow).



Fig. 2. Sagittal reconstructing of the CT scan revealing the bullet in the level of L5 (circle) and another cut of double J tube (arrow).

2. Presentation of case

A 25-year-old Iranian man from a low-socioeconomic status, a gunshot victim in his left flank, presented to the emergency department in hemodynamic shock and lethargy status by pre-hospital emergency medical service. On arrival, his blood pressure was 100/60 mmHg, and his pulse rate was 110 a minute. Apparently, there was no ongoing bleeding from his wound or any other concomitant trauma. There was also no past medical or surgical surgery. Hemodynamically resuscitated, the patient was transferred to the operating room by the general surgeon for his urgent condition, in which, after laparotomy, about 2.5 l of blood was evacuated from the abdominal cavity. Then the surgical team noted a jejunum laceration in two-thirds of its diameter at 10 cm of the Treitz ligament beside three similar lacerations adjacent to each other in the middle of the jejunum. The mesentery also had tearing which caused bleeding. In two layers, the damaged intestinal segments were resected and repaired by end-to-end anastomosis. An expanding hematoma was also in the left flank. After exploration, the ureteral rupture between the proximal one-third and the distal two-thirds was detected. After Debriding the necrotic tissues, the anastomosis was performed in the ureter. The bullet had passed through the psoas muscle and was stuck between the vertebrae. Two drainage tubes were prepared then the patient was sent to the intensive care unit (ICU). The patient had hemodynamically improved, but his left foot drop in his neurologic examination remained. After surgery, his muscle force scores were 3/5 and 4/5 in the left and right extremities. The CT scan demonstrated the bullet's accurate position between the fifth lumbar and the first sacral vertebrae, and on day 5, after damage control surgery, the neurological surgeon scheduled the surgical removal of the foreign body. After the lower midline incision, the laminectomy of the L2-S1 vertebrae was performed in the prone position. A hematoma had covered the damaged conus medullaris; after opening the dura and evacuating and irrigating the hematoma, the bullet appeared in the vertebral column in level L5. A crush injury accompanied by a gunshot into the cord was present too. After the careful removal of the bullet, a drainage tube was prepared, and the layers were repaired. The next day, the patient could walk with a lumbar brace, and the neurological deficits disappeared. He advised wearing the brace for at least a month. The recovery and 4-month follow-up period were uneventful (Fig. 2).

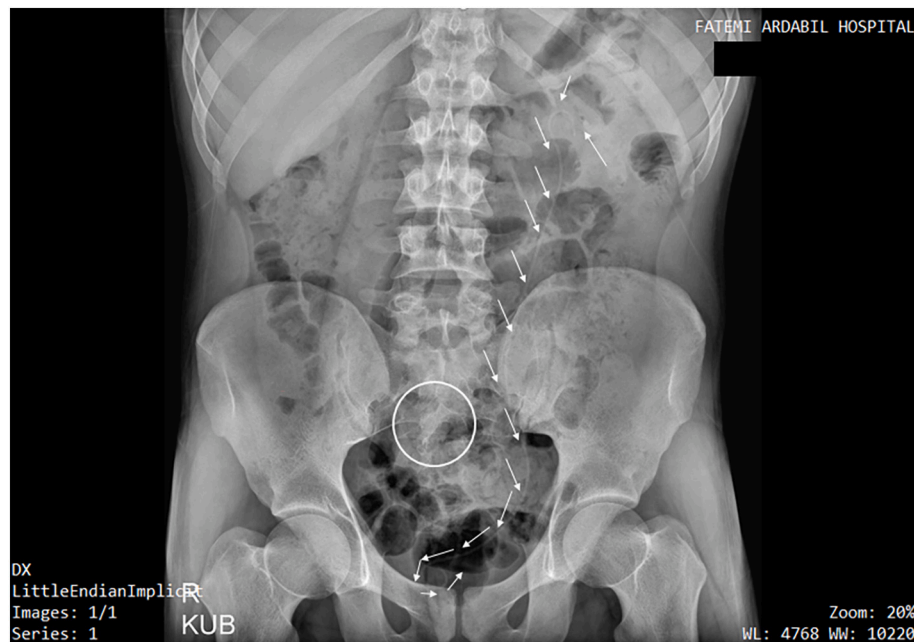


Fig. 3. A kidney, ureter, and bladder X-ray after the second surgery revealing the proper double J tube placement (order of arrows), successful removal of the bullet and pieces of evidence of laminectomy (circuit).

3. Discussion

Trauma is counted as the most common cause of death and among the top leading causes of mortality and morbidity in industrialised nations [15]. Penetrating trauma accounts for about 30 % of trauma-related deaths and encompasses a wide range of mechanisms that can be divided into ballistic (gunshot wounds) and non-ballistic trauma (stab and other puncture wounds). Thoracic, thoracoabdominal, and abdominal regions are the most common sites of injury [16]. There were 182,000 deaths from firearms and 500,000 nonfatal firearm-related trauma in the United States from 2013 to 2017 [17]. The large ratio of the abdomen to the body and numerous vital systems make it vulnerable to various injuries. This place lodges the gastrointestinal, cardiovascular, urologic, gynecologic, orthopaedic, and even neurologic systems. No one can guess the damage path to organs or systems from the appearance of a wound on the abdomen or the site of trauma. Among these, the small intestine is the most common injury site in blunt and penetrating traumas [18]. Hemodynamic instability is the fundamental indication for exploratory laparotomy without further evaluation. Damage control surgery (DCS) provides a staged management approach for injured patients who present with severe physiological compromise and require emergency surgical intervention [19]. This approach gives the patient in critical status time to be improved. Attempts to control blood loss and contamination in the abdomen and resuscitation of physiology are involved in the principles of DCS [20]. Intestinal tearing from four points ruptured intestinal mesentery, and expanding left flank hematoma had made our case hemodynamically unstable. Thus, the therapeutic team approached a DCS. Surgical treatment for gunshot wounds in the spinal column is controversial, but the emphasis is on providing advanced trauma life support [10]. Neurosurgical decompressive interventions for lumbosacral spinal GSWs are not well clarified since limited data is available. However, it is typically performed on patients with progressive neurologic deficits, cerebrospinal fluid leaks or fistula, and even those who have retained bullet or osseous fragments within the spinal canal [9,21–24]. Conus medullaris, cauda equina, bony vertebrae, nerve roots, and their branches accompanied by paravertebral ganglia are vulnerable structures [25]. The two critical issues the therapeutic team faces are the progression of neurological deficits and the potential of bullet migration. Early decompression also improves the prognosis of

cauda equina syndrome, especially in migratory bullets or lesions of low levels of the spinal canal [26]. For the migration risk and the best determining of the bullet's location, an interval between imaging and surgery should be as short as possible, or intraoperative fluoroscopy is recommended [27].

Contrary to belief, the literature indicates that most spinal gunshot injuries are not significantly improved after decompressive surgeries. However, some studies show the incentive of bullet removal to establish improved motor function [28,29]. Although four decades ago, a study about terminal spinal cord and cauda equina GSWs treated by laminectomy at Cook County Hospital, United States, preferred non-operative management for patients with complete or non-progressive injuries [30]. In another study a few years after, the authors claimed victims of civilian GSWs from the T12 to L4 who had a bullet or significant fragment retained in the spinal canal undergone fragment removal operation had statistically significant improvements according to the American Spinal Injury Association (ASIA) motor score at follow-up [31]. The extent of damage to the cord determines the recovery. Paraplegia or quadriplegia is devastating conditions with no cure yet. Thus, there is general agreement that surgical intervention has no added benefit in patients with complete spinal injury (Fig. 3).

4. Conclusion

Hemodynamic resuscitation and DCS prioritize definite treatment in cases of spinal cord gunshots. Thus, not all victims require surgical removal of the bullet(s). In a nutshell, a patient who is young with incomplete or progressive neurology deficits, an unstable spine, or a complete injury with persistent neural compression needs neurological surgery. However, there is a lack of sufficient information to support surgical or non-surgical treatment options.

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Ethical approval

This issue has been raised and approved by the ethics committee of Ardabil University of Medical Sciences, Iran.

Consent

The consent in which the patient has allowed to use medical records and therapeutic information is attached to the medical document. The authors testify the patient privacy maintenance. On request, a copy of the written consent is available for review by the Editor-in-Chief of this Journal.

The authors ensure that all the images/figures/photos are suitably anonymised with no patient information or means of identifying the patient.

Author contribution

Jafar Ghobadi, the acute care physician, visited the patient initially and prepared him for the surgery.

Mirsalim Seyyed Sadeggi, the general surgeon, performed damage control surgery.

Nasrin Pourhajshokr, the neurosurgeon who removed the bullet from the vertebral column, suggested publishing the surgery method in the role of supervision and conceptualisation.

Ali Samady Khanghah, a hospital research committee member, prepared the manuscript and pursued the submission process.

Hamed Ezzativand helped redact the manuscript.

Research registration

Since this case report does not contain any new surgical technique or equipment, it has no Research Registry UIN.

Guarantor

Ali Samady Khanghah accepts full responsibility for the work and approves the whole process from designing the study to publication.

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Declaration of competing interest

The authors declare there are no conflicts of interest.

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