



Case Report

Penetrating spinal cord injury: A case report and literature review

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ABSTRACT

Background: Penetrating spinal cord injury (pSCI) is uncommon in civilian settings. However, there is a lack of consensus regarding perioperative management and thresholds for operative intervention. This review explores the various trends in the management of pSCI along with a literature review.

Case Description: A 34-year-old male presented with a gunshot wound (GSW) to the left chest. Injuries included a pneumothorax, diaphragmatic injury, splenic injury, multiple small bowel injuries, transverse colon injury, and a bullet lodged at the L5 spinal level. The patient underwent chest tube placement, an exploratory laparotomy, splenectomy, diaphragmatic repair, multiple small bowel resections, and a transverse colon resection. Later on, the patient required a lumbar laminectomy for wound debridement and bullet excision.

Conclusion: The standards for the surgical management of pSCI are poorly defined. Older studies suggested that >7 days of antibiotics decreased the risk of infection associated with HVI while shorter regimens correlated with higher rates of spinal and neurologic infections (meningitis, paraspinal abscess, and osteomyelitis). Newer studies fail to confirm the benefit of extended antimicrobial therapy, noting no increased infections with 48 h or less of antibiotic use while suggesting increased risks of long-term antibiotic prophylaxis (i.e., antimicrobial resistance and Clostridium difficile infection). There is no current role for steroids in the treatment of pSCI, and routine operative management is no longer necessarily indicated.

Keywords: Antibiotics, Hollow, Penetrating, Spinal, Steroids, Viscus

INTRODUCTION

The optimal management of penetrating spinal cord injury (pSCI) with accompanying HVI is poorly defined. Older studies recommended >7 days of antibiotics to decrease the risk of infection.^[5] Alternatively, newer series found shorter regimens (≤ 48 h) did not result in higher rates of spinal and neurologic infections (meningitis, paraspinal abscess, and osteomyelitis) and would avoid complications (i.e., antimicrobial resistance and Clostridium difficile infection).^[4] Although there are now numerous specific operative indications for treating pSCI (e.g., spinal instability, neurologic deterioration in the setting of incomplete injury, cerebrospinal fluid fistula, bullets at risk for migration and toxicity), pSCI no longer mandates routine spinal surgery.^[5]

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CASE REPORT

Abdominal surgery and postoperative course

A 34-year-old male patient sustained a gunshot wound (GSW) to the left chest. The chest X-ray showed a left pneumothorax warranting placement of a 36F chest tube. The chest/abdominal computed tomography (CT) scans showed free fluid in the abdomen warranting an exploratory laparotomy; it revealed a large-volume hemoperitoneum. The patient required a splenectomy, repair of a 2 cm diaphragmatic injury, two small bowel resections/repairs, and resection/repair of a transverse colonic injury. He was placed on broad-spectrum antibiotics (Zosyn) for 24 h during the perioperative period (both preoperative and postoperative doses administered).

Postoperative wound infection

However, postoperatively, he developed a wound infection at the laparotomy site (despite being left open for drainage), requiring staple removal, debridement, and drainage. He went on to develop an abscess in the left upper quadrant, requiring percutaneous drainage and peripherally inserted central catheter line placement for long-term antibiotics. Antibiotics were administered for several weeks.

Lumbar spinal pathology

The patient also originally presented with the following neurological deficits: weakness of both lower extremities (extensor hallucis longus: left>right) and bowel and bladder incontinence. Pelvic X-rays revealed a projectile lodged in the lumbar spine at the L5 level, and the abdominal/lumbar CT showed a projectile within the spinal canal at the L5 level.

Lumbar spine surgery: No postoperative lumbar wound complications

On the following day, the patient was taken to the operating room by the spine team where he underwent a decompressive laminectomy at the L4 and L5 level, with durotomy for excision of a small caliber bullet. The durotomy was appropriately repaired. Postoperatively, the patient exhibited partial neurologic recovery, characterized by incomplete return of motor function in both lower extremities (3/5 on dorsiflexion); eventually, he was able to ambulate with assistance.

DISCUSSION

Epidemiology and injury pattern

Penetrating spinal trauma contributes to 13%–17% of all spinal cord injuries (SCI). The cervical and thoracic

spine are most commonly involved.^[2,3,5] 3% to 25%^[1,2] of patients present with injury to multiple spinal levels, and 8%–10% result in multicolumn injury with resultant spinal instability.^[1,2] SCI is accompanied by wounds to the GI tract in nearly 25% of pSCI cases.^[1,5]

X-ray and CT diagnostic studies

Plain films provide important initial information regarding the number, location, and trajectory of different projectiles.^[1] CT scans remain the study of choice, in the non-emergent setting, for the evaluation of the level of spinal injury, the intracanalicular location of bullet fragments/foreign bodies, and where they may be accompanying instability.^[2] Magnetic resonance imaging studies are typically not as helpful in pSCI and may be contraindicated due to the potential ferromagnetic content of foreign bodies.^[1,5]

Antimicrobials

Multiple studies document infectious complications in pSCI, including osteomyelitis, meningitis, and paraspinal abscesses, particularly in the setting of injuries to the stomach and colon.^[6,7] The presence of HVI further increases the risk factor for spinal and neurologic infections.^[4,7] The routine use of extended antimicrobials is no longer supported by the current literature.^[4]

Steroids

Historically, steroids have been used in patients following pSCI. However, a retrospective analysis conducted by Levy *et al.* concluded that there was no benefit regarding functional outcomes or length of hospital stay.^[3]

Surgical management

In the military setting, debridement with laminectomy and foreign body removal has been the preference of many surgeons.^[5] However, in the civilian setting, routine neurosurgical intervention for pSCI with or without a foreign body has shown no benefit for neurologic outcome.^[5,6] One exception is the presence of a spinal injury with progressive deficits, wherein early surgery (e.g., within 48 h of injury) has proven beneficial.^[1,8]

Outcomes and complications

A wide range of complications have been noted following pSCI including partial or complete neurologic deficits (e.g., 70% of cervical spine injuries result in complete deficit while 70% of lumbosacral injuries result in incomplete deficit, fistula formation, bowel and/or bladder incontinence, and chronic pain syndromes).^[1] Nevertheless, many patients

experience initial improvement in their spinal level of injury, likely due to decreased edema/inflammation following the initial injury.^[3]

CONCLUSION

A consensus regarding medical and operative management of penetrating spinal cord injury remains elusive. While extended antimicrobials have been used in the past their use can no longer be supported by the current literature. In addition, steroids have no role in the treatment of pSCI. Routine operative intervention has shown no benefits though specific indications exist.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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