Penetrating knife injuries to the spine: Management considerations and literature review

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A B S T R A C T
Penetrating knife wounds to the spine are rare events. The appropriate treatment paradigm for such injuries is variable and is often predicated upon the degree of injury and the structures involved. We present a case where non-operative management was utilized for treatment without adverse sequelae. Deeply penetrating knife wounds to the spine can be appropriately managed with conservative measures.

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Introduction
Penetrating injuries to the spinal cord are rare events and their reports in the literature are scarce. A subset of penetrating spinal cord injuries are stab wounds to the spine which are generally inflicted in the setting of assault and produce a sharp, pointed pathway of damage. Injury can be both immediate from the direct trauma of the penetrating object and delayed as can occur with infection, spinal fluid leak, and chronic pain.

The inclination to treat these cases with operative intervention is predicated upon the need for direct repair of the tissues involved, removal of a foreign body, and concern for infection [1]. We present a case where non-operative management was employed for a patient with a penetrating knife wound to the thoracic spine. Our patient recovered significant neurologic function without associated complications.

Case report
A 31-year-old female presented to the emergency department via ambulance after being stabbed in the thoracic spine during a domestic dispute. She arrived on a stretcher in the prone position with a broken knife projecting from her thoracic spine – the handle of the knife had broken off during the time of penetration. Her wound and the knife were wrapped in gauze. She also had evidence for other knife wound injuries to the right eyelid and posterior left shoulder, all of which were superficial.

On exam, she was alert, oriented, and appropriate with the answering of questions. Her cranial nerve examination was unremarkable as was the strength and reflexes of her upper extremities. The strength and sensation of her right lower extremity was grossly intact. She had no movement of her left leg but reported patchy areas of normal sensation (ASIA B). She had full sensation in the perineal area and rectal tone was intact.

A CT scan of the spine was performed which revealed the knife had penetrated at the level of T6. The knife passed through the interlaminar space, through the mid-portion of the spinal cord parenchyma, and deeply into the vertebral body (Fig 1). There was no evidence for significant vascular injury. The knife measured 11 cm from the surface of the skin to the tip of the knife embedded into the vertebral body.

After returning to the emergency department, the patient was placed under conscious sedation while in the prone position. The area around the knife was irrigated and cleaned with an iodine solution. A vice grip was used to grasp the broken handle of the knife. The knife was then withdrawn from the spine, requiring significant force to do so. After removal, there was no evidence for CSF emanating from the wound nor was there significant bleeding. The area was again cleaned and closed with suture.

The patient’s neurologic function immediately after removal of the knife remained the same as it was before. The patient was admitted and treated empirically with antibiotics. Following 3 days of inpatient physical and occupational therapy, the patient was transferred to inpatient rehabilitation. During this time, the wound remained clear of infection and drainage. There were no reports of postural headache.
At the time of discharge from rehab, the patient was independent with her transfers, going up and down 12 stairs with supervision using safety belt and rails. She was ambulating greater than 160 feet with a rolling walker and mobilizing in a wheelchair greater than 300 feet independently. She was independent with toileting, bathing, and upper and lower body dressing.

A repeat MRI scan revealed only minor changes to the spinal cord parenchyma and surrounding soft tissues (Fig. 2). There were never indications for infection, CSF leak, or pseudomeningoele formation. Other than her residual neurologic deficits, there were no other complication of care (ie, DVT) related to her injury or treatment.

**Discussion**

The optimal management of penetrating spinal injuries remains controversial and reports within the literature on the topic are sparse and without consensus [1,2]. Imaging studies are necessary to locate the exact relationship of the foreign body to the anatomic structures through plain film x-ray or CT scans. MRI may not be practical due to the physical properties of the penetrating object. The amount of pathologic change to the spinal cord due to incomplete injury from a penetrating stab wound may not correlate with the amount of recovery one can expect. In most cases, the recovery of function is strikingly good. Significant recovery has been reported in 61% of stab wound injuries, a better prognosis than spinal cord injuries endured by gunshot wounds and motor vehicle crashes [3].

If preliminary imaging reveals possible large vessel injury, a digital subtraction angiogram should be performed with consideration of endovascular repair. The gold standard in the past has been catheter angiography for vertebral artery injuries but recent research has indicated that CT angiography has similar sensitivity and specificity [4]. This is particularly important in injuries that involve the cervical region due to a high incidence of vascular involvement.

Antibiotics are a standard recommendation for prevention of infection while the use of steroids is still debated [5]. Case reports exist where management with steroids produced good neurologic recovery after 2 months' time. A randomized prospective control trial suggested that high dose steroids in patients presenting with motor weakness in the setting of acute spinal cord injury may provide benefit if administered within 8 hours of injury. Controversy remains because other studies have shown no statistically significant evidence to support the use of steroids in the management of acute spinal cord injury and to the contrary have actually shown adverse effects on patient outcome due to their use [5].

**Conclusion**

Penetrating knife injuries to the spinal cord are relatively rare and few case reports exist in the literature. Concrete algorithms for appropriate treatment have not been established. In general, surgical intervention may be considered for the following indications: removal of a retained foreign body, infection and sepsis, acute cerebrospinal fluid fistula, hematoma formation, cord compression from a bony fragment or soft tissue, progressive neurological deterioration and persistent chronic CSF leakage. The immediate treatment of penetrating spinal cord injuries includes evaluation, resuscitation, CT and MRI imaging, followed by removal of the foreign object when deemed safe. Local wound debridement, tetanus prophylaxis, and prophylactic antibiotics should be implemented to prevent meningitis or local infection. Supportive interdisciplinary management with neurological rehabilitation and intense physiotherapy also provide an integral therapy for complete neurologic recovery.

**References**


