

## Non-missile penetrating spinal injuries

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### INTRODUCTION

Non-missile penetrating spinal injuries (NMPSI) are rare. Patients who present with retained foreign body fragments due to stabbings represent an even subset of NMPSI and their optimal management is unclear. Most often the weapon is withdrawn by the assailant; uncommonly however, the weapon may be retained in the spine either broken partly or intact. Management of these patients is quite challenging as removal of these may add neurovascular deficits. Besides this, positioning the patient and transportation may be difficult. The management of such patients is not outlined clearly. Authors present two patients who had stab injuries in spine with retained weapons and without any neurological deficits. The management of these patients and the relevant literature is discussed .

### CASE REPORT

#### CASE 1

Twenty one year old male was stabbed in the back while he was sleeping in the prone position with a knife. The knife was broken when an attempt was made to pull out by assailant. The man walked to the nearby hospital with the broken knife sticking out through the back and was then referred to tertiary centre. On arrival, he was hemodynamically stable and detailed neurological examination revealed no deficits. The knife had entered the lower dorsal paraspinal region on the right side. CT scan of spine showed retained 11 cm knife in the lower thoracic spine. The blade had entered through the 10-11 thoracic inter laminar space to cross the spinal canal on the right side of the midline just medial to the pedicle and tip was lying in the vertebral body. There was no hematoma seen in the canal or in the paraspinal region. As there was a suspicion of cord and dural injury, laminectomy and repair was planned.

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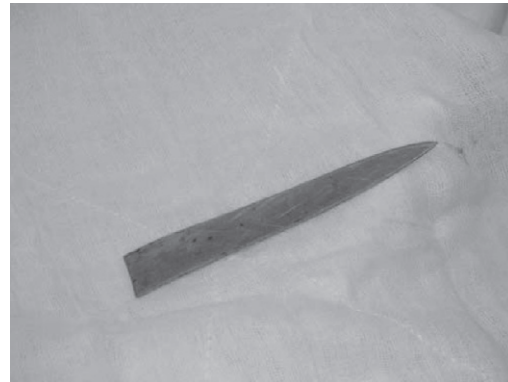


Fig 1: Knife blade

The patient was positioned between two trolleys in such a manner that the knife was between the trolleys and anaesthetised. Then patient was turned over prone on the operation table.. The stab wound was 3 cms wide. Incision was placed to include the stab wound. The skin flap was raised and paraspinal muscles were raised from laminae. The interlaminar space through which the knife entered the canal was well defined. The lamina on the left side of corresponding vertebrae was removed and then the lamina with knife was removed. The sharp convex side of the knife was facing laterally and it was entering the dural sac. The facet on the right side of the knife was also removed to free the object completely. The knife was removed under vision. There was bleeding

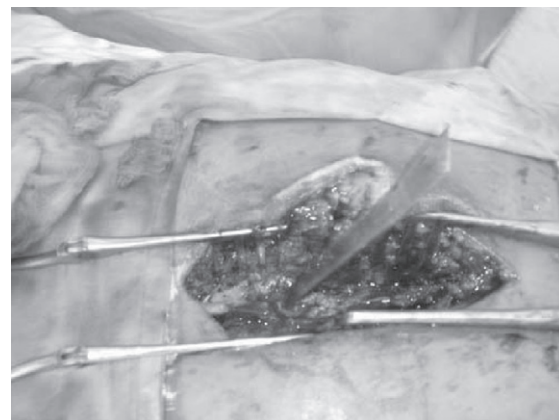


Fig 2: Operative exposure with knife blade in situ

from them epidural space anterior to the cord which was controlled with oxidized cellulose and pressure applied from lateral aspect of cord. The dural opening was on lateral aspect through which the cord was seen and a few nerve rootlets were seen pouting through the defect. The dural defect was difficult to repair primarily as it was extending anteriorly. The linear defect was patched with muscle graft and closed. Postoperatively, there was cerebrospinal fluid (CSF) leak from the wound which subsided on the seventh postoperative day. Also the entry wound showed signs of infection and healed with secondary intention. However there was evidence of meningitis in the form of neck stiffness, fever and somnolence. The CSF culture was positive and patient received appropriate antimicrobials despite which patient did not improve. Patient developed headache and drowsiness. A computed tomogram of the head was done which showed hydrocephalus. An external ventricular drain was inserted. Post-operative X-rays of spine revealed no retained foreign body. Finally patient succumbed to ventriculitis on day 21 after injury.

## CASE 2

22 year male was stabbed with ice-poker in the back after an altercation. Patient arrived to tertiary centre, emergency ward with the object in the back. There was no neurological deficit on clinical examination and CT scan of spine was done which revealed the poker to have entered through the 10-11 thoracic interlaminar space on left side through the left half of canal just medial to the pedicle. The tip was lying in the T11 thoracic vertebral body. No canal or paraspinal hematoma was found. As a dural injury was suspected, it was decided to do a laminectomy and repair of the dural wound.



Fig 3: Plain radiograph of thoracolumbar spine showing spine penetration by a screwdriver

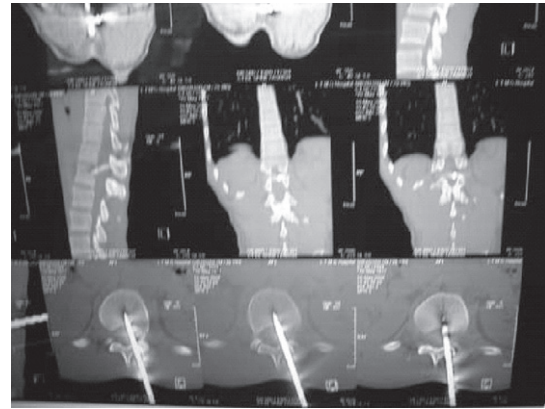


Fig 4: CT showing extent of penetration by screwdriver

The induction and initial steps were similar to the previous case report. T11 laminectomy was done initially on the right side, then around the poker on the left side. The poker was removed under vision and there was a dural breach through which CSF started flowing out. Breach could be seen on posterolateral surface of the thecal sac which was sutured after confirming that there was no cord damage. The anterior dural breach was left alone. There was no neurological deficit post-operatively, no CSF leak and patient was discharged on seventh day with a healthy postoperative wound.

## DISCUSSION

NMPSI mostly has been reported in younger men<sup>1,2,3,4</sup>. Most victims were stabbed once (incidence 65%)<sup>5</sup>, and the weapon is typically knife (incidence 72-84%)<sup>2,5</sup>. In the largest series from South Africa, assault with axes, screwdriver, bicycle, spokes, garden forks, sickles, and sharpened broomsticks have been reported<sup>2</sup>. Authors outside South Africa have reported stab wounds from a pencil<sup>6</sup>, sting ray spine<sup>7</sup>, splinter<sup>5</sup> and sewing machine thread holding rod<sup>5</sup>. NMPSI are typically inflicted from behind at the victim's thoracic level. The distribution likely reflects two aspects of the assault: assailants typically aim for neck or chest, and the cervicothoracic region is within the natural sweep of attacker's arm. Laterally directed horizontal stab can cause complete transection of cord as can pass between two vertebrae but stab from behind usually produce incomplete cord damage<sup>8</sup>.

In the largest South African series, 21% of the patients presented with complete spinal cord injury and 55% with a modified Brown – Sequard syndrome<sup>2</sup>. Neurological deficit may occur immediately or in delayed fashion. Immediate injury is caused by physical damage to the neural tissue, in-driven bone fragments, vascular

injury or countercoup mechanism<sup>2,5,9</sup>. Delayed neurological deficit may result from a retained weapon<sup>7,10,11,12,13</sup>, infection<sup>14,15</sup>, edema<sup>16</sup>, or CSF leak<sup>17</sup>. The chances of recovery are better than other forms of injury to the cord. NMPSI may be associated with injuries to bowel, aorta, inferior vena cava, solid organ or even airway if in cervical region.

The transportation of patients with retained weapons is important as it may be manipulated during the process and give rise to new neurovascular insult. No attempt should be made to remove the embedded weapon without proper exposure in the operation theatre. Manipulation or closed removal may be associated with neurological deficit, bleeding, CSF leak and infection<sup>15</sup>. Retained foreign body should be looked for if external examination reveals only entry wound.

CT scan is a good investigating modality for the patients with NMPSI considering its ability to detect retained foreign body, spinal or paraspinal hematoma and bony fragments. The metallic object may produce streak artifacts, however those occurring along with the axis of blades help localizing its tip. Although MR Imaging is a powerful tool for identifying the injury track, cord or root lesion and associated lesions including hematoma, disc herniation, and bone fragments, MRI is controversial as it may be associated with movement and heating of retained metallic objects<sup>8</sup>. Thakur et al treated 81% of these cases by doing surgical exploration with dural repair and removal of foreign body or simple exploration and irrigation<sup>5</sup>. However, others report no difference in outcome following surgical management in patients with complete or incomplete spinal injury<sup>3</sup>.

Most of the studies have suggested that surgical



Fig 5: Clinical photograph showing screwdriver stuck in the spine

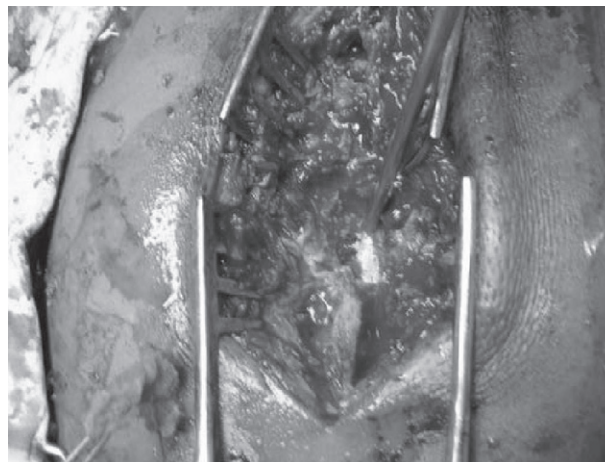


Fig 6: Operative exposure of the spine around the screwdriver

exploration should be considered in patients with progressive neurological deficits, when there is radiographic evidence of neural compression due to retained foreign material, bone fragment or soft tissue or persistent CSF leakage. Even patients of NMPSI with delayed presentation with retained foreign body may benefit with surgical exploration and non-intervention may give rise to delayed deficits<sup>18,19</sup>. Karlins<sup>11</sup> and Greon<sup>7</sup> has shown improvement in patients even with delayed intervention<sup>11</sup>. Retained foreign bodies set in an inflammatory reaction; the severity of which depends upon the kind of metal<sup>5</sup>. Peacock et al documented 4% spontaneous subsidence of CSF leak<sup>2</sup>. The consensus is that exploration is recommended in case of persistence of CSF leak beyond 96 hours as chances of pseudomeningocele and low pressure headache along with infection rises<sup>20</sup>. In both the cases described above, the foreign body was passing through the central canal and wedging into vertebral body. Trying to remove it without a formal surgical exploration could give rise to bleeding from epidural venous plexus, CSF leak as it was likely to have breached the dura and pulling it out would open up the dural breach which was plugged with the foreign body. Also as it was wedged into vertebral body, its removal would require manipulation and movement which endangered the presumably intact cord (as they had no neurological deficits). So laminectomy was done in both the cases with the intent of loosening the foreign body without handling the cord and achieve good dural repair and haemostasis. Without a dural repair, patients may present later with low blood pressure, headache and sixth nerve paresis as reported by Adams et al<sup>16</sup>. These injuries are generally stable and require no immobilization<sup>21</sup>.

## CONCLUSION

Transportation and induction of patient should be done in a manner which would not add to neurovascular deficit. Careful transportation to the hospital and delivery of basic trauma care upon arrival are essential for the optimal management of NMPSI. The presence of a retained or impaled object should not obviate the undertaking of a complete trauma assessment because these patients are at risk of serious associated injuries. Most patients with NMPSI with retained foreign body require surgical exploration to avoid further neurovascular insult and infection consequences. Intraoperative care of proper dural repair and haemostasis is of paramount importance. All patients should be closely monitored post operatively for evidence of delayed neurological deficits.

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