Unusual penetrating injury of lumbar spine with no vascular and no abdominal visceral injury: Report of a rare case

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Abstract

Penetrating Spinal injuries are very rare occurrence. They are often associated with intra-abdominal visceral damage and neurodefecit. Every type of penetrating spinal injury has its own presentation, sighs, symptoms and outcomes. Each case has to be
individualized and treated accordingly. Here we present a very unusual mode of injury causing penetrating spinal injury with a good outcome.

**Introduction**-

Occurrence of penetrating spinal cord injuries is very rare. The incidence of penetrating spinal cord injuries varies from country to country. Highest incidence of 25% has been reported in South Africa in youngsters, while in United states it constitutes 1% of all low back and spinal injuries\(^1,2\). In the study by Peacock et al\(^2\) 84% of the penetrating spinal cord injuries were caused by sharp object most common being stab injury with knife. Most of these penetrating spinal cord injuries are accompanied with neurodeficit due to cord trauma or hemisection.\(^2\) Delayed complications like infection, delayed onset neurological deficit and poor functional outcomes are present apart from acute onset neurodeficit and other visceral injuries.\(^3\) As penetrating spinal cord injuries are rare and each injury is typical in its presentation, standard management strategies and treatment protocol are still controversial.\(^4\)

Here we report a very rare type of lumbar penetrating spinal cord injury, treated successfully caused by a blunt object, with unusual type and mode of trauma in a 45 year old healthy male.

**Case Report –**

A 45 year old man working as a security guard at a chemical firm slipped from edge of the truck while checking a consignment and fell on an upturned tripod iron stool. Following the fall a leg of rusted tripod stool pierced his back. With the metal rod lodged in his back, he arrived at our institute with vitals stable. Patient was conscious all along. Patient typically had right lower limb monoparesis in distribution of L1 and L2 nerve supply. Patient had Grade 0 power in L1 and L2 Distribution with 80 % hypoesthesia. Bladder Bowel was not involved. He immediately underwent hematological investigations, radiological tests, including CT plain and contrast of abdomen and pelvis with screening of the abdomen vessels.

Pre-operative CT scans showed no pneumoperitoneum, no free fluid noted in abdomen and pelvis. There was fracture of L1 vertebra with a metallic rod seen traversing through it to the retro-peritoneum abutting abdominal aorta, however aorta appeared normal. No impingement inside the spinal canal. The pedicles were fractured at L1 and L2 levels on the right side. There was a small retroperitoneal hematoma noted in para-aortic region.
which was not causing mass effect in adjacent structures. Rest all vital organs were normal and vasculature showed normal flow.

A team of Doctors consisting Orthopedics, Surgery, Anaesthesia and Cardiovascular-thoracic came together to operate. Primary aim of surgery was to first remove the penetrating metallic object, remove all free fragments of bones and remove all the fragments abutting aorta. Next aim of surgery was to decompress the canal (if needed) and repair the neural structures damaged. So it was decided to first operate the patient from standard left sided antero-lateral approach so that primary aim can be achieved and then to open the spine posteriorly so as to repair the neural structures. Patient was intubated in lateral position using fibre-optic laryngoscope. Position of the patient on the operating table was floppy lateral (45 degrees to horizontal) with use of sandbags or bean bag to hold the patient at angle and tilting of table. Spine was approached using standard left sided anterolateral(retroperitoneal approach). On opinion of vascular and general surgeon, due to the peculiar position and proximity to vital structures like Aorta, Inferior Vena Cava, kidneys & adrenals with spinal cord, a decision to explore this patient in left lateral position with a left loin to groin incision at the level of 12th rib bed was taken. If approached from right side removing fractured fragment indenting the aorta and inspection of entire aorta would not have been possible due to interference of liver.

We opened his abdomen and tracked the tip of the object. The distal most tip of the rod was identified to be 0.5 cms from the aorta with no injury to surrounding structures with a bone chip lying close to the aorta indenting the aorta. What was noteworthy was that the shirt of the patient that had indented with the rod had formed a protective sleeve with the rod, forming a sort of cushioning effect and decreasing the severity of damage to the surrounding vital structures.

The aorta was safeguarded by a mop and the rod retrieved followed by a thorough search again for any missed damage to the vessels, kidney, adrenal. Then the bone fragment abutting the aorta was removed. The wound was closed after a thorough wash & a tube drain in the retroperitoneum. After this was achieved, the patient was made prone and spine was opened posteriorly, through the entry wound with through debridement. Canal was approached through interlaminar space and all loose fragments in canal were removed. Some CSF leak was present but it was repaired using 4.0 prolene. The pedicles were fractured at L1 and L2 levels on the right side. The nerve roots that were damaged were right sided L1, L2. The rod had traversed the interpedicular space between right L1 and L2 shattering the L1 vertebral body stopping beyond the anterior margin of the L1 vertebra just short of the aorta. The posterior spinal elements of L2 were disrupted but only on right side. Anterior, Middle and posterior elements of L1 and L2 were intact on left side. The right sided torn and crushed nerve roots were repaired using end to end repair with 4.0 prolene (epineurium to epineurium). There was no instability of the spine. Epidural drain to bypass CSF leak
was inserted at level higher than that of injury to let the dural repair heal and drain tube removed from a separate site on the skin in the left mid axillary region. The wound was given a thorough wash. The exposed spinal cord, repaired dura and nerve roots were covered with gel foam and then the posterior wound closed in layers.

Post operatively patient was stable and survived the entire incident. Patient was discharged at day 14 after suture removal. Patient at his last follow up at 3 months post-operatively showed grade 2 power in L1 and L2 nerve supply with only 30% hypoesthesia.

Discussion –

35 patients per million is the estimated annual incidence of traumatic spinal cord injury worldwide. Thoracic region is most commonly involved in non-missile penetrating spinal injuries and the majority has neurologic deficits. The management of patients who lack neurologic deficits is controversial due to the risk of neurologic status alteration intraoperatively. However, failure to intervene increases the risk of infection, delayed onset of neurologic deficits, and worsening functional outcome. Cervical spine penetrating injuries are the most fatal. In our case the main area affected was lumbar spine with main concern of compression over aorta caused due to fragment of vertebral body.

Management of a patient with a penetrating spinal cord trauma depends on the mechanism and duration of injury. When dealing with significant penetrating trauma, such as stab wounds, 61% of patients typically have significant neurologic recovery. Surgical intervention is critical to neurologic outcome regardless of initial neurologic status. Early intervention decreases rate of infection, arachnoiditis and cerebro-spinal fluid fistula. We in our case report did not come across any such complications.

The essential component of surgery was to identify the exact location of metal rod, other viscera damaged, status of adjacent vascular structures and then choosing the appropriate approach with standby general surgeon and cardio-vascular surgeon. In cases with suspected spinal cord injury due to stabbing, x-ray radiographs are recommended to detect the level of lesion and penetration into the spinal canal. CT is recommended for further evaluation to detect the bony fragment and the relation between the knife and the spinal cord. Preoperative MR is not recommended in cases that involve metal material because of the risk of movement due to the strong magnetic field that may worsen the neurological deficit. Although late complications such as myelopathy, intramedullary abscess, progressive neurological deficit and symptomatic pseudomeningocele have been reported due to foreign material, no spinal instability has been reported. We had very short follow up of patient, but within that period patient showed significant improvement with no evidence of spinal instability.
Management of a spinal stab injury must be individualized, and must be undertaken with utmost care in order to avoid undue injury during surgery. In particular, movement of the fragment must be minimized, and electrocautery must not be used. Moreover Dura around the spinal cord must be closed watertightly in order to avoid CSF leakage\(^3\). In our case, lumbar drainage was installed for the prevention of CSF fistula. If no CSF leakage was confirmed by absence of additional subcutaneous accumulation of fluid at the operative site, postural headaches, clinical signs of pseudomeningocele formation and cutaneous leakage of CSF at increased level of lumbar drainage, it should be removed as soon as possible for the prevention of catheter related infection. Also we confirmed no CSF leakage at elevated height of lumbar drainage and removed lumbar drainage catheter carefully.\(^{10,11}\)

Acute neurologic symptoms can be due to direct penetration of spinal cord neural elements, spinal cord infarction, and epidural hematoma. When direct penetrating injury occurs, the patient may present with typical Brown-Sequard variants. Artery of Adamkiewicz injury can cause spinal cord infarction, which can be exacerbated by systemic hypotension. Epidural hematoma was a very rare complication of spinal stab injury. Some patients present with delayed neurologic symptoms. Remaining fragments in the spinal canal may cause slow, progressive damage.\(^{11}\) Hence in our case report we again opened the spine from posterior approach to decompress the fragment and remove the bony fragment and repair the neural structures.

Advantages of intubation in the lateral position are prevention of laryngeal structures from collapsing and decreases obstruction in patients with sleep apnea. Disadvantages are, it is technically more difficult compared with the supine position and requires longer overall intubation time.\(^3\) In our case anaesthetists had intubated patient using fibreoptic laryngoscope in lateral position.

In general, for patients with incomplete spinal cord injuries secondary to stab wounds, good functional recovery has been reported in 50% to 60% of cases. The prognosis for stab wounds is generally better than it is for patients with blunt spinal cord injury or gunshot injuries of the spine, as most of the patients may present only incomplete spinal cord injuries.\(^{12}\) In our case despite root being injured badly, patient showed some recovery at 3 months post-operatively.

To conclude every penetrating spinal cord injury is typical and characteristic in itself. Treatment has to be individualized. Fragments abutting, indenteding vital structures inside the body must be dealt with aggressively. Spinal canal decompression and neural repair is mandatory irrespective of the neurology status of the patient. It needs a good team of doctors of various specialities to give proper treatment and outcome for the patient.

**Conflict of interest** – None

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**Ethics** – All rules of International ethics were followed and written, informed valid consent has been taken from patient and his family for this case report.

**Figure Legends** –

Figure 1: – A –D – Images showing the penetrated leg of Tripod iron stool from various angles. The animated image shows the mode of injury.

Figure 2: - A- Xray showing penetrated Metallic object.
B,C,D- Sagittal and axial cuts showing penetrated metallic foreign object in spine with fracture L1 vertebral body through inter-pedicular zone fracturing L1 and L2 Pedicles. It also shows bony fragment indenting aorta.

E and F- 3 D reconstruction showing penetrated metallic foreign object in spine with fracture L1 vertebral body through inter-pedicular zone fracturing L1 and L2 Pedicles. It also shows bony fragment indenting aorta.

Figure 3- A – image showing Anterolateral approach to spine.
B- Image showing Spine and tip of metallic object being approached through antero-lateral approach.
C- Image showing aorta being examined and abutted fragment removed. Tubular structure just below the suction pipe seen is aorta.
D- Image showing the metallic object being removed.
E- Abutted bony fragment of aorta, after its removal
F- Final post-operative image of the removed metallic object with intermingled Shirt at its Tip.

**References** -


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