



Role of Whole-Body Computed Tomography Scan to Avoid Missed Foreign Body in Patients with Multiple Stab Injury: A Rare Case of Retained Impaled Knife Blade with Intact Neurology

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Abstract

Nonmissile penetrating spine injury (NMPSI) is usually encountered in young men, secondary to knife-inflicted injuries. Such injuries often present with complete or incomplete neurodeficit. We hereby report a case of NMPSI (due to impaled knife blade) in the cervical spine, who presented with intact neurology. She was managed by foreign body removal, dural repair, and cerebrospinal fluid (CSF) diversion with lumbar drain. We performed postoperative magnetic resonance imaging with diffusion tensor imaging and tractography to ascertain the cord status. The case highlights the importance of whole-body computed tomography in patients with multiple stab wounds and the use of CSF diversion in such situations.

Keywords

- ▶ impaled knife
- ▶ penetrating spine injury
- ▶ whole-body CT scan

Key Message

Whole-body computed tomography (WBCT) scan is a useful investigation in patients with multiple stab wound. Exploration under aseptic precautions and removal gives an opportunity to debride and explore the wound thoroughly and address the dural injury.

Introduction

Penetrating spine injuries (PSI), caused by firearm or non-missile penetrating objects, are uncommon entities faced by spine surgeons worldwide. Nonmissile penetrating spine injury (NMPSI) are usually encountered in young men secondary to knife-inflicted injuries. Such injuries often present with complete or incomplete neurodeficit.¹

We hereby report a case of NMPSI (due to an impaled knife blade) in the cervical spine, who presented with intact neurology. The patient was managed by foreign body (FB) removal, dural repair and cerebrospinal fluid (CSF) diversion with subarachnoid lumbar drain. We also performed postoperative magnetic resonance imaging (MRI) with diffusion tensor imaging (DTI) and tractography to ascertain the status of the cord. The case highlights the importance of whole-body computed tomography (WBCT) in patients with multiple stab wounds and the use of CSF diversion in such scenarios.

Case History

A 31-year-old woman presented to our emergency department with multiple stabs wound and hypovolemic shock,

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approximately 5 hours after an alleged assault with a knife. She complained of a sharp pain shooting down her back and bilateral upper extremities. On examination, there were multiple incised wounds over her back, neck, abdomen, face, scalp and extremities. There was a transverse incised wound over the left side of the neck. Her initial motor examination (of extremities) revealed a power more than or equal to Medical Research Council (MRC) grade 4/5 and sensations were intact (2/2).

She underwent WBCT which showed an impaled broken knife blade passing from the posterior aspect of the neck, through C5 lamina, across the spinal canal onto C6 vertebral body (**Fig. 1**). She also had an associated grade IV right renal injury. MRI was deferred due to the presence of the metallic object.^{2,3}

The decision was made to conservatively manage her renal injury. She was planned for wound exploration and

FB removal under general anesthesia. Under prone position, an incision was made by extending the stab wound and deeper dissection was performed around the knife blade to expose the C5, C6 lamina on the left side (**Fig. 2A**). The knife passed through the inferior edge of C5 lamina (**Fig. 2B**). Laminotomy was performed around the metallic remnant and the FB was carefully removed. The broken piece of knife transgressed the cord and the meninges. While the posterior dural rent was sutured with 5-0 Prolene, the anterior rent was not accessible for repair (**Fig. 2C**). It was then decided to perform a CSF diversion with subarachnoid lumbar drain (restricting the CSF flow to < 10 mL/hour or 250 mL/day).

Postoperatively, she was electively intubated overnight in the intensive care unit and started on broad-spectrum antibiotics. Her neurological examination on a postoperative day (POD) 1 was normal (motor power—MRC 5/5, intact

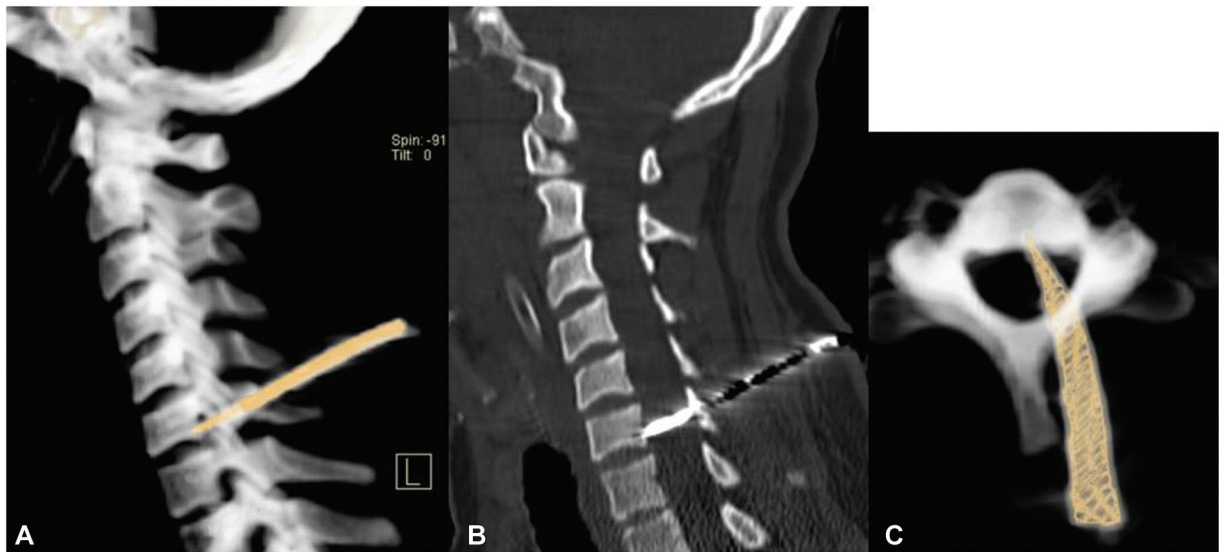


Fig. 1 Computed tomography cervical spine: (A, B) Sagittal images showing the path of impaled knife passing through C5 lamina, across the spinal canal onto C6 vertebral body. (C) Axial image showing knife resting over C5 vertebral body passing through the canal.

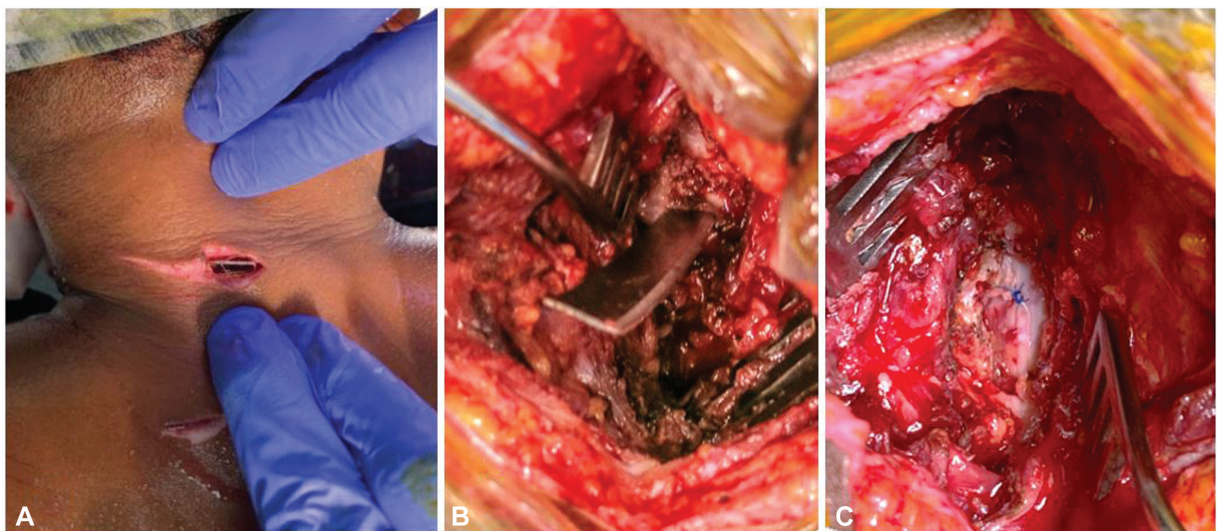


Fig. 2 Intraoperative images showing (A) incised wound over the posterior aspect of the neck with a visible broken knife blade below the skin, (B) wound exploration around knife blade that was passing through the inferior part of C5 lamina, (C) status of dura after closure.

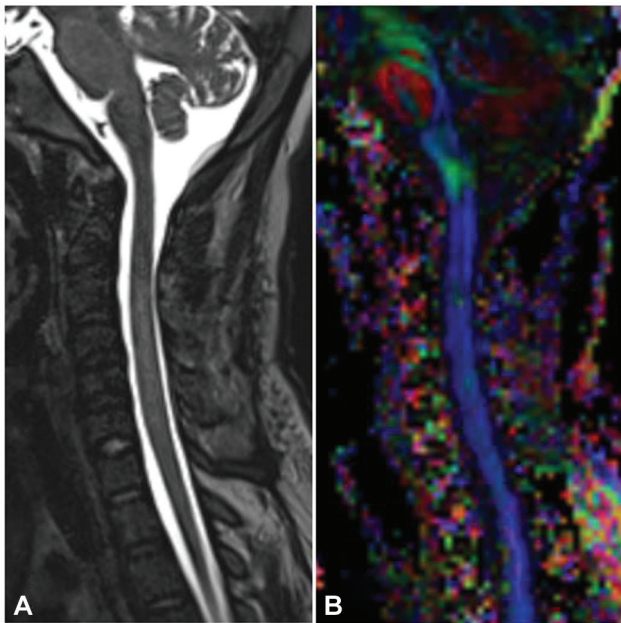


Fig. 3 Postoperative magnetic resonance imaging: (A) Sagittal T2-weighted sequence with normal cord without evidence of cerebrospinal fluid leak and (B) diffusion tensor imaging tractography with intact tract continuity and thickness.

sensation [2/2]). The lumbar drain was removed on POD4. The postoperative period was uneventful. On POD5, she underwent MRI of the cervical spine with DTI and tractography. There were no signal intensity changes in the cord on T1 and T2-weighted imaging and CSF flow was intact. There was no evidence of CSF leak or collection (► **Fig. 3A**). On DTI, fractional anisotropy (FA) at C2 (proximal), C5 (injured), and C7 (distal) levels were 411, 379.2, and 446, respectively. Tractography showed maintained thickness and density of tracts throughout the cervical cord (► **Fig. 3B**).

Discussion

Penetrating injuries to the spine broadly include missile PSI (caused by a firearm) and NMPSI (caused by a sharp object). The prevalence of NMPSI usually reported to be less than 1%.^{4,5} The most common cause of NMPSI is an assault with a knife and it involves the thoracic spine in a majority of cases.^{1,4-11} NMPSI with impaled object occurs when the assailant finds it difficult to remove the object or when it breaks at the handle.

In NMPSI, hemisection or complete transection of cord has been reported and approximately two-thirds of patients present with incomplete neurodeficit (especially Brown-Sequard syndrome).^{1,4,5,11,12} The other causes for neurodeficit include cord impingement by osseous fragment, cord ischemia,¹³ or hematoma.¹⁴ Our patient presented with intact neurology and sharp pain radiating down the back and upper extremities.

Patients with multiple stab wounds have high chances of associated injuries.^{11,15,16} In cases of neck NMPSI, associated catastrophic injuries to major vessels, trachea, esophagus, or brachial plexus have been reported.¹⁵⁻¹⁷ It is not common for the impaled objects to be missed on the initial examination, as they may be concealed under the soft tissues. WBCT is the

best modality to evaluate such patients, as it not only delineates the impaled metal or retained fragments but also provides information on associated injuries. Even in our patient, WBCT was valuable in identifying the associated renal injury as well as clearly defining the impaled weapon.

The standard treatment for retained FB includes exploration, debridement, FB removal, and closure. It may be emphasized that these aforementioned steps are performed under direct vision (after laminotomy).¹⁸⁻²⁰ Such an approach is safer, as it not only enables a careful removal of the sharp object without any further damage to neural elements but also facilitates a thorough closure of the injured meninges.²¹⁻²³ Wide exploration, thorough debridement, and generous irrigation may also mitigate the risk of infections in these penetrating injuries.^{16,24}

The use of CSF diversion with the help of subarachnoid lumbar drain in patients with traumatic dural laceration is an effective strategy to reduce the intradural pressure, decrease CSF outflow, and thereby aid in timely wound healing.^{1,11} Postoperative MRI with DTI tractography are the best modality to evaluate the cord status and tract injuries in such scenarios.²⁵⁻²⁷ These sequences provide superior visualization of the damaged cord and have been demonstrated to correlate with neurodeficit, histologic axonal injury, and functional recovery.²⁸

Conclusion

We would like to emphasize the role of WBCT in the preoperative evaluation of patients with NMPSI. The management of these patients includes thorough wound exploration and removal of the impaled object under direct vision (after laminotomy). Such an approach not only enables a safer removal of the FB but also facilitates an effective repair of dural rents. It is advisable to consider CSF diversion especially in patients with irreparable dural tears.

Funding

None.

Conflict of Interest

None declared.

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