

Through-and-through stab wound of the cervical spinal canal with retained weapon but no neurological repercussions: an exceptionally rare injury and the case for direct withdrawal. Illustrative case

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BACKGROUND Nonmissile penetrating spinal injuries are rare and potentially debilitating. Such injuries can sometimes be complicated by the retention of a foreign body, which is usually part of the assailant's weapon, making their management even more problematic.

OBSERVATIONS We present a unique case of stab wound to the neck with a retained ice pick, traversing the spinal canal from one intervertebral foramen to the other, yet with no ensuing neurological damage to the patient. After carefully analyzing the weapon's trajectory on computed tomography and ruling out vertebral artery injury via catheter angiography, the ice pick was successfully withdrawn under general anesthesia and intraoperative neurophysiological monitoring, averting the need for a more invasive surgical procedure.

LESSONS Stab wounds of the spinal canal with a retained foreign body can occasionally be managed by direct withdrawal. Whether this simple technique is a safe alternative to open surgical exploration should be determined on a case-by-case basis after careful review of spinal and vascular imaging. The absence of significant neurological or vascular injury is an absolute prerequisite for attempting direct withdrawal. Moreover, preparations should be made for possible conversion to open surgical exploration in the rare event of active hemorrhage, expanding hematoma, or acute neurological deterioration.

<https://thejns.org/doi/abs/10.3171/CASE2219>

KEYWORDS cervical spine; retained foreign body; spinal cord; stab wound; vertebral artery

Nonmissile penetrating spinal injuries (NMPSIs) are uncommon, representing only 0.3%–2.1% of all spinal injuries in the Western population,^{1–5} and predominantly affect young men.^{3,5–8} The majority of such injuries are sustained posteriorly and aggressors generally aim for the neck or chest.^{3,7,9} Given the protective effect of spinal bony structures, neurological injury is rare, with a Brown-Séquard syndrome being the most common mode of presentation in neurologically impaired patients.^{4,6–8,10,11} In addition to neurological injury, NMPSIs can also result in visceral and vascular injuries, especially the vertebral artery in penetrating neck trauma.^{3,5,7,12,13}

During an assault leading to an NMPSI, a fragment of the weapon can sometimes be retained in the victim.⁹ There is no general consensus regarding the optimal management strategy in these rare instances.^{1,3–5,14} While many argue that such patients should undergo immediate surgical intervention,^{1,15} a more conservative

approach can at times be attempted, including direct withdrawal of the retained foreign body, especially in patients with little or no signs of neurological injury.^{5,13,14,16,17} Irrespective of the method used, removal of a retained foreign body from the spinal canal can be challenging and may lead to further neurological injury.⁸

We report a unique case of through-and-through NMPSI of the cervical spine with a retained ice pick, but no significant neurological or vascular injury, which was successfully managed via direct withdrawal, averting the need for open surgical exploration.

Illustrative Case

A 37-year-old man was stabbed in the right side of his neck, resulting in a retained ice pick blade exiting the skin. Neurological examination was unremarkable. Computed tomography (CT) of the

ABBREVIATIONS CT = computed tomography; NMPSI = nonmissile penetrating spinal injury.

INCLUDE WHEN CITING Published April 4, 2022; DOI: 10.3171/CASE2219.

SUBMITTED January 12, 2022. **ACCEPTED** February 10, 2022.

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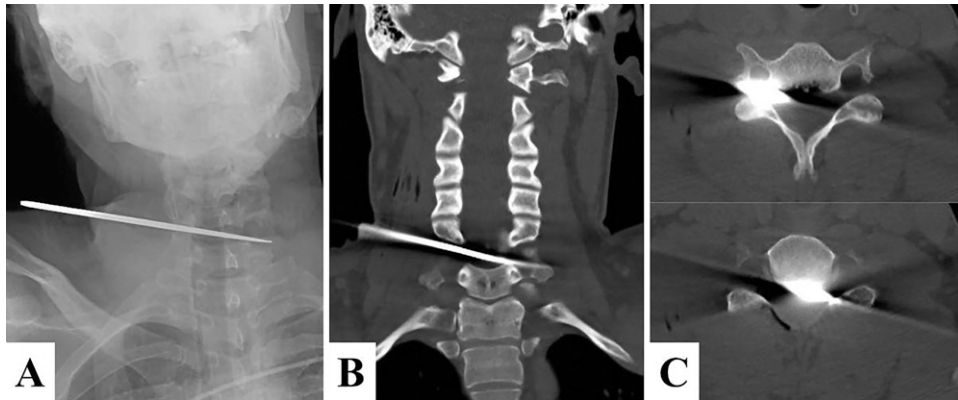


FIG. 1. Anteroposterior radiograph (A) and CT of cervical spine (B and C) demonstrate a retained blade traversing the spinal canal at C6-C7. Note the retrovertebral blade trajectory anterior to the spinal cord and its proximity to the right vertebral artery in the foramen transversarium.

cervical spine revealed a through-and-through trajectory into the spinal canal at C6-C7, including entry through the right C6-C7 intervertebral foramen and an intraspinal trajectory along the posterior border of the vertebral body of C6, just anterior to the spinal cord, with the tip of the blade being lodged into the left superior articular process of C7 (Fig. 1). CT angiography of the neck showed an uninjured and patent left vertebral artery, but was concerning for possible right vertebral artery involvement, blurred by the presence of substantial metal streaking artifact. Catheter cerebral angiography was thus performed, demonstrating that the blade had nearly missed the right vertebral artery, which appeared angiographically normal (Fig. 2). Given those findings and the absence of neurological impairment, it was felt that the blade had fortunately followed an unlikely extradural and juxtavascular trajectory through the spinal canal.

Consequently, it was decided to attempt direct withdrawal of the retained blade. Notwithstanding, the patient was warned of the possibility of conversion to an open surgical approach, should any unforeseen complications occur, including active hemorrhage, expanding neck hematoma, or acute neurological deterioration. The patient was taken to the operating room where, under general anesthesia, direct fluoroscopic guidance, and intraoperative neurophysiological monitoring, the blade was successfully withdrawn from the spinal canal, with the assistance of large forceps (Fig. 3). No significant hemorrhage or cerebrospinal fluid leak occurred. The entry wound was primarily closed with a simple interrupted suture.

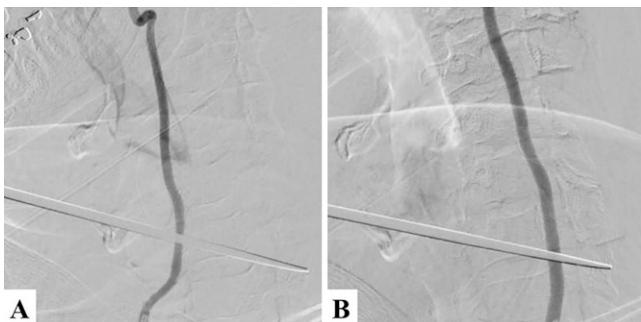


FIG. 2. Right (A) and left (B) vertebral artery angiograms reveal uninjured, intact vessels bilaterally.

Despite a transient drop in motor evoked potentials on the right side of the body, the patient was rapidly awakened from anesthesia and found to have a normal neurological examination. He had an uneventful postoperative course and was discharged from the hospital the following day. At his 1-month follow-up, he remained asymptomatic and his neurological examination was unremarkable.

Discussion

Observations

We present an exceptional case of cervical through-and-through NMPSI with a retained sharp object traversing the entire spinal canal, from one intervertebral foramen to the other, after assuming a retrovertebral trajectory along the anterior aspect of the cervical spinal cord. This case is unique in two ways. First, despite the blade's trajectory, the patient remained neurologically intact, suggesting a likely extradural

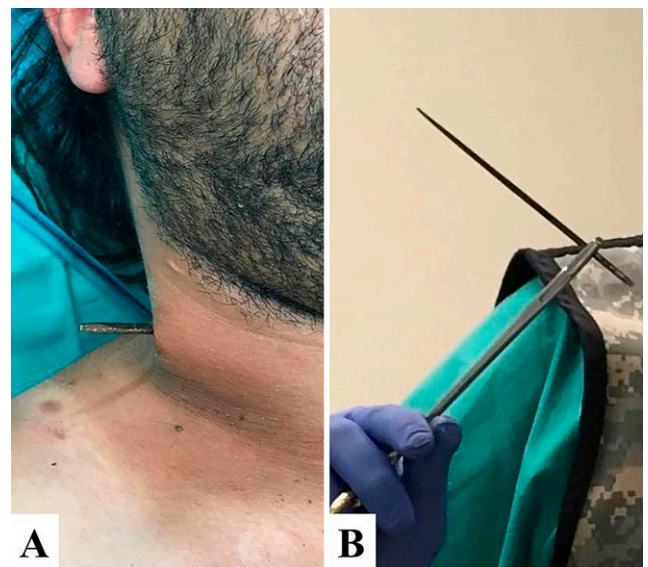


FIG. 3. Intraoperative photographs show the retained ice pick blade exiting the patient's neck on the right side (A), which was successfully withdrawn using large forceps (B).

path respecting the integrity of the anterior spinal dura, with a highly unlikely but fortunate near-miss of both vertebral arteries. Second, to the best of our knowledge, successful direct withdrawal of a retained foreign body from the cervical spinal canal has not been previously reported. Hence, the importance of this technical case report to help raise awareness about this simple and noninvasive alternative to open surgical exploration for a well-selected subset of NMPSI with a retained intraspinal foreign body. As stated above, a normal neurological examination and the absence of significant neurovascular injuries along the path of the penetrating object are an absolute prerequisite for any attempt at direct withdrawal. For this reason, careful analysis of preoperative spinal and vascular imaging is paramount, including a low threshold for catheter cerebral angiography if needed.

Cervical NMPSIs are generally rare, with the majority of such injuries, 63.8% in the largest series to date,⁷ occurring in the thoracic spine. In contrast to gunshot wounds, complete spinal cord injury or transection is rare in NMPSI, given the presence of a solid bony shield. Brown-Séquard syndrome and partial transection is more common.^{4,6–8,10,11} Visceral and vascular injuries are also commonly associated with NMPSIs.^{5,7,12} Specifically, in the cervical region, there is a high risk of injury to the carotid and vertebral arteries^{8,12} and the airway.^{3,7} While knives remain the most common weapon used in NMPSIs, bicycle spokes, screwdrivers, axes, and other sharp objects have also been occasionally used.^{3,7,9}

In some rare cases, the weapon or part of it becomes retained in the victim's body. Given the rarity of such injuries, there is no consensus or guidelines regarding the optimal management strategy.^{1,4,13,15–17} In fact, the literature on this topic is very scarce, consisting largely of small case series and case reports.^{1,4,5,13,16–19} While many authors tend to resort to open surgical exploration, in order to atraumatically remove the retained foreign body and minimize the risk of secondary neurovascular injury,^{1,4,6,15,18–20} a few others have successfully achieved direct foreign body withdrawal, averting the need for more elaborate surgical procedures.^{5,6,13,14,17} However, in all such cases with the exception of one,¹⁴ patients had to have a normal preoperative neurological examination, and there was no evidence of direct neurovascular compromise by the retained object in any reported case of direct withdrawal.^{5,6,13,17}

Lessons

Open surgical exploration to remove a retained foreign body after NMPSI may not always be necessary. Occasionally, in patients without neurovascular compromise, simple direct withdrawal can be attempted. Preoperative spinal and vascular imaging should always be reviewed in detail and the trajectory of the foreign body analyzed. In all such cases, the surgeon should be prepared to convert to an open surgical procedure in the event of active hemorrhage, expanding hematoma, or acute neurological deterioration.

References

1. Agarwal P, Burke JF, Abdullah KG, et al. Stab wound to the intramedullary spinal cord: presurgical and surgical management options for a retained blade to optimize neurological preservation. *Surg Neurol Int.* 2016;7(Suppl 42):S1096–S1098.
2. Alkan A, Baysal T, Saras K, Sigirci A, Kutlu R. Early MRI findings in stab wound of the cervical spine: two case reports. *Neuroradiology.* 2002;44(1):64–66.
3. Goyal RS, Goyal NK, Salunke P. Non-missile penetrating spinal injuries. *Indian J Neurotrauma.* 2009;6(1):81–84.

4. Prasad BC, Vemula RC, Varaprasad G. Nonmissile penetrating spinal injury with an impaled knife: case report. *Indian J Surg.* 2013;75(3):237–238.
5. Yoon J, Efendy J, Szkandera B, Redmond M. Non missile penetrating spinal injury. *J Clin Neurosci.* 2019;67:239–243.
6. Enicker B, Gonya S, Hardcastle TC. Spinal stab injury with retained knife blades: 51 consecutive patients managed at a regional referral unit. *Injury.* 2015;46(9):1726–1733.
7. Peacock WJ, Shrobsree RD, Key AG. A review of 450 stabwounds of the spinal cord. *S Afr Med J.* 1977;51(26):961–964.
8. Skadorwa T, Cizek B. Pediatric arrowshot injury to cervical spinal cord-sagittal cord transection with no neurological deficit and good outcome: case report and review of literature. *Childs Nerv Syst.* 2013;29(10):1933–1939.
9. Thakur RC, Khosla VK, Kak VK. Non-missile penetrating injuries of the spine. *Acta Neurochir (Wien).* 1991;113(3-4):144–148.
10. Al-Janabi T, Nayeem N, Smallman W. Stab wound to the neck—a rare presentation. *Eur J Emerg Med.* 2001;8(1):55–56.
11. McCann MR, Villamar MF. Two classical neurological syndromes following a stab wound. *Eur J Intern Med.* 2018;54:e3–e4.
12. Rahme R, Hamilton JF. Vertebral artery injuries in penetrating neck and cervical spine trauma. In: Ecklund J, Moores L, eds. *Neurotrauma Management for the Severely Injured Polytrauma Patient.* Academic Press; 2017:103–113.
13. Sakar M, Dogrul R, Niftaliyev S, Bayri Y, Dagcönar A. Direct withdrawal of a knife lodged in the thoracic spinal canal in a patient with normal neurologic examination: is it safe? *Spinal Cord Ser Cases.* 2016;2(1):16009.
14. Smith C, White JB. Penetrating knife injuries to the spine: management considerations and literature review. *Interdiscip Neurosurg.* 2014;1(1):3–4.
15. Shahlaie K, Chang DJ, Anderson JT. Nonmissile penetrating spinal injury. *J Neurosurg Spine.* 2006;4(5):400–408.
16. Moldovan K, Telfeian AE, Fridley JS, Gokaslan ZL, Aghion D, Oyelese AA. Minimally invasive approach to non-missile penetrating spinal injury with resultant retained foreign body: a case report and review of the literature. *Clin Neurol Neurosurg.* 2019;184:105405.
17. Villarreal-García FI, Reyes-Fernández PM, Martínez-Gutiérrez OA, Peña-Martínez VM, Morales-Ávalos R. Direct withdrawal of a knife in the lumbar spinal canal in a patient without neurological deficit: case report and review of the literature. *Spinal Cord Ser Cases.* 2018;4(1):48.
18. Li X, Curry EJ, Blais M, Ma R, Sungarian AS. Intraspinal penetrating stab injury to the middle thoracic spinal cord with no neurologic deficit. *Orthopedics.* 2012;35(5):e770–e773.
19. Xia X, Zhang F, Lu F, Jiang J, Wang L, Ma X. Stab wound with lodged knife tip causing spinal cord and vertebral artery injuries: case report and literature review. *Spine (Phila Pa 1976).* 2012;37(15):E931–E934.
20. Rubin G, Tallman D, Sagan L, Melgar M. An unusual stab wound of the cervical spinal cord: a case report. *Spine (Phila Pa 1976).* 2001;26(4):444–447.

Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Willis, Rahme. Acquisition of data: Willis. Analysis and interpretation of data: Parsons, Fluss, Rahme. Drafting the article: Parsons, Fluss. Critically revising the article: Parsons, Rahme. Reviewed submitted version of manuscript: Parsons, Willis, Rahme. Approved the final version of the manuscript on behalf of all authors: Parsons. Statistical analysis: Rahme. Study supervision: Rahme.

Supplemental Information

Previous Presentations

The abstract was accepted for presentation at the American Association of Neurological Surgeons 2020 Annual Scientific Meeting, April 25–April 29, 2020; virtual meeting.

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