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CASE REPORT

Delayed presentation of deep penetrating trauma to the subaxial cervical spine

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Abstract
Purpose To present a rare case of deep penetrating neck trauma in which a retained foreign body in the cervical spine (a broken knife blade) resulted in delayed radicular injury. We describe the surgical management using a retrojugular approach.
Case report Our patient sustained a stab wound to the supraclavicular triangle from a small pocketknife. He was initially managed in a local hospital by simple primary wound closure without any radiological examinations, and was discharged home. The patient re-consulted in a delayed fashion with mild local persistent neck pain. Subsequent radiological investigations revealed a foreign body (the broken blade of a pocket knife) embedded in the left neural foramen between the C6 and C7 vertebrae penetrating the disc space. The blade was lying between the left C7 nerve root and the ipsilateral vertebral artery (VA) at the transition of V1 and V2 segments. Initial neurological evaluation was normal. Some days later, the patient developed a delayed left C7 radicular deficit. We undertook urgent exploration along the wound corridor through a retrojugular, transforaminal approach with successful removal of the blade.
Discussion To our knowledge, this is a unique case where a retained foreign body penetrated the soft tissues of the neck, embedding deep in the vertebral column without vascular, aerodigestive or significant primary neurological injury, while causing delayed neck pain and delayed onset radicular injury. We describe our surgical management for removal of the retained blade. The retrojugular approach gives excellent access to all of the important anatomical structures of the neck from an anterolateral approach.

Keywords Penetrating neck trauma · Foreign body · Delayed injury · Retrojugular approach · Cervical spine

Introduction

In treating penetrating neck injury, a rapid and systematic evaluation has been advocated [1, 2]. Despite potentially devastating injury to vital structures, the entry wound can often be innocuous and thus easily overlooked or underestimated during the initial evaluation. Careful clinical and radiological diagnostic evaluations are necessary for planning potential surgical intervention, but also to avoid unnecessary surgical exploration [1, 3, 4]. For surgical exploration, the choice of approach depends on the localization of the injury as well as which structures require surgical repair. It may often require a multi-disciplinary surgical team.

We describe an unusual case of delayed presentation of deep cervical penetrating trauma in which a retained broken knife blade resulted in delayed radiculopathy. The details of surgical technique using a retrojugular approach are described.

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Case report

A 30-year-old male was involved in an altercation and sustained a stab wound to the left side of the neck. He presented at a local hospital in an intoxicated state. Physical examination was unremarkable. A small entry wound in the posterior triangle of the neck about 3 cm above the clavicle on the left side was sutured without radiological examination. The patient was discharged home. Sutures were removed a week later. On the 10th day after the assault, the patient had mild but increasing neck pain with movement, and returned to the hospital. The wound showed no signs of infection or inflammation (Fig. 1a). Standard X-rays of the cervical spine this time revealed a retained knife blade penetrating the C6/7 disc space, embedded in the left neural foramen between the C6 and C7 vertebrae (Fig. 1b). CT angiography (CTA) excluded a vertebral arterial injury (Fig. 2a–e). The blade was lying between the left C7 nerve root and the ipsilateral vertebral artery (VA) at the transition of V1 and V2 segments. The patient was transferred for further evaluation to our clinic.

On arrival, the cervical spine was immobilized with a Philadelphia collar. Neurological examination was normal. The laboratory investigations were unremarkable. Surgical exploration was recommended to the patient. The day before the planned surgery, the patient was found to have radicular pain and new onset left triceps weakness with diminution of the left triceps reflex, strongly suggesting a delayed left C7 radicular injury. Due to new onset neurological deficit, emergent surgery was performed.

Surgical technique

We undertook exploration along the wound corridor through a retrojugular, transforaminal approach. After intubation the patient was carefully positioned supine with the head placed on a horse-shoe holder, slightly turned to the right with neck extension. Neurophysiological monitoring was used throughout the surgery. An "L" shaped skin incision was made as shown (Fig. 3a). Subplatysmal flaps were raised anteriorly to the midline and posteriorly up to the trapezius. The sternocleidomastoid muscle was mobilized to expose the carotid sheath and its contents. Using a retrojugular approach as previously described [5–7], the longus colli muscles overlying the transverse processes and also lateral aspect of the body of the lower cervical vertebrae were exposed (Fig. 3b). The V1 segment of the ipsilateral vertebral artery (VA) was dissected out and controlled proximally with a vessel loop. The V2 segment of the VA was controlled distally between the foramen transversaria of C5 and C6 using a vessel loop, but was not transposed. The pharynx and larynx were mobilized anteriorly to expose the pre-vertebral cervical fascia. The blade was not visible but a lateral X-ray confirmed our level. Resection of a segment of the overlying longus colli muscles, and anterior retraction of the VA at the distal V1 segment enabled us to identify the broken off "stump" of the blade which was embedded in the C6/7 disc space (Fig. 3c). After dissection and identification of the extraforaminal C7 nerve root by direct stimulation, the blade was gently extracted from the C6/C7 disc space across the C7 neural foramen (Fig. 3d). Posterior traction on the exiting nerve roots and the inferior trunk of the brachial plexus were unavoidable for "inline" removal of the blade along its axis of entry and to avoid "wanding" of the blade tip towards the thecal sac or towards the VA during extraction. Careful inspection of the intervertebral foramen did not reveal any CSF leak. However, inspection of the right C7 nerve root showed signs of minimal laceration of the epineurium and perineurium by the blade. These were sutured in two layers. After hemostasis, the wound was closed in multiple layers. Post-operatively the patient showed a mild C7 paresis, slightly worse than before surgery. Surgical manipulation of the already injured nerve root is the likeliest explanation for this. At 3 months follow-up, the triceps weakness had improved slightly.

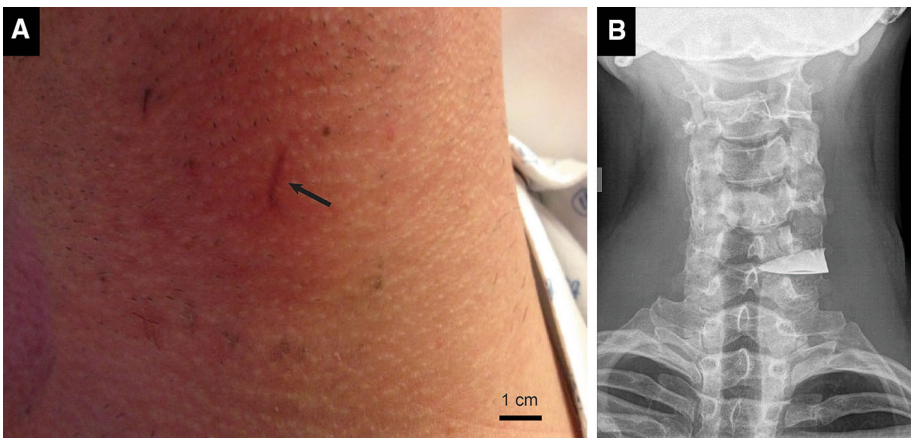

Fig. 1 **a** Macroscopic appearance of the entry wound, 10 days after injury. **b** Cervical X-ray showing the broken off knife blade embedded in the C6/7 disc space

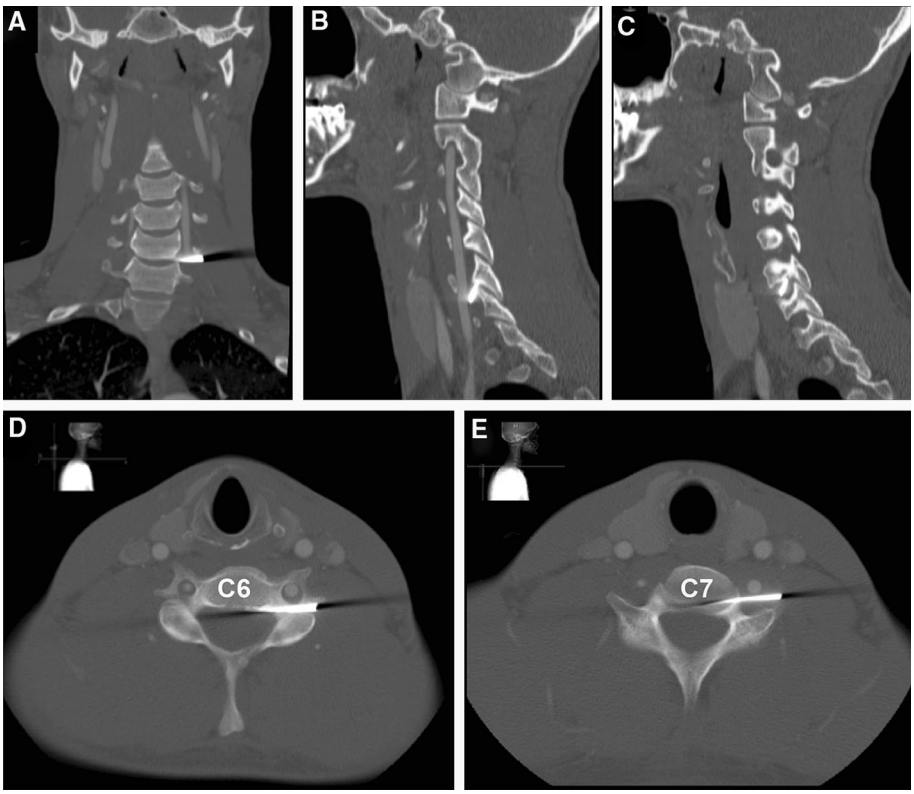

Fig. 2 **a** Coronal CT angiography. **b**, **c** Sagittal CT angiography showing vertebral artery in relation to knife tip inside neuroforamen. **d**, **e** Transverse CT angiography through C6 and C7

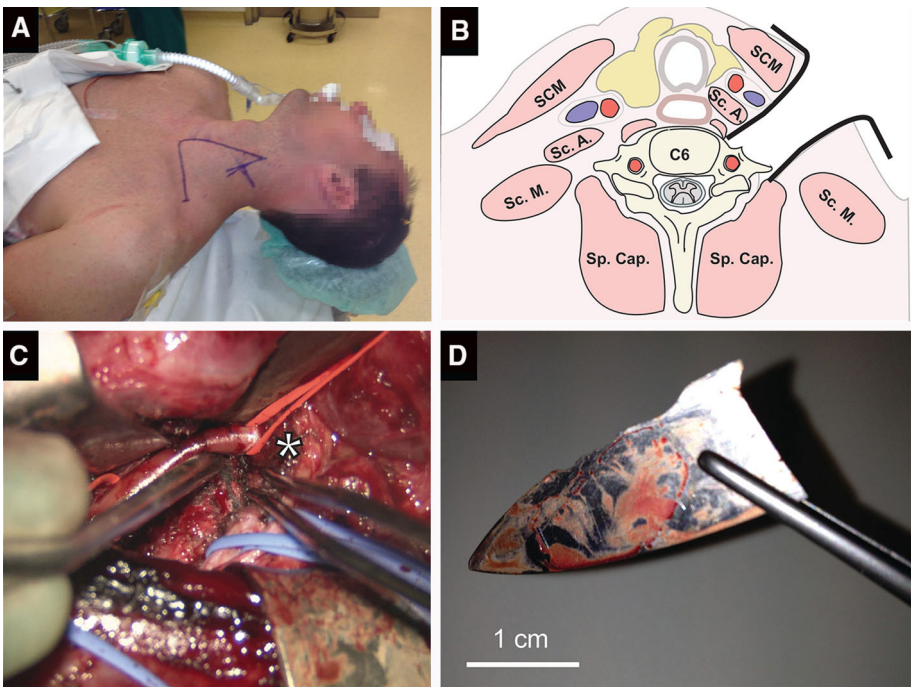

Fig. 3 **a** Surgical patient positioning and planed incision. **b** Schematic surgical dissection through the transverse plane. **c** Per-operative blade visualization after proximal mobilization of vertebral artery (*asterisk*). **d** Extracted foreign body

Discussion

Because of its high mortality and morbidity, penetrating neck injury requires emergent clinical and radiological evaluation to ascertain the integrity of the vital anatomical structures that are contained in the neck [1, 2]. Current management guidelines vow for guiding treatment through thorough physical examination and a low threshold for radiological examination. Mandatory surgical exploration has been abandoned in favor of a selective approach [3, 8].

Any signs and symptoms of penetration injury to the respiratory tract, esophagus, vessels and/or neural structures should be investigated further and treated surgically when indicated. The approach is thus based primarily on clinical findings and a low threshold for CT angiography [3, 4, 9–12]. Further radiologic and endoscopic investigations are mandatory if there is suspicion of injury to the esophagus or trachea [13]. The goal is to avoid overlooking potentially life-threatening injuries, which might present in a delayed fashion.

There are reports about delayed neurological and vascular injuries in similar situations but these describe thoracic penetrating trauma and delayed medullary injury, or cervical trauma with immediate nervous, aerodigestive and/or vascular damage [14–17]. Our case is unique in that it involved the cervical spine, where the blade avoided the major blood vessels, airway, digestive tract, spinal cord and nerve trunks (except for a delayed minor laceration of the exiting left C7 nerve root) on its way to embed into the C6/7 disc space. It is also unique, as mechanical pain and 10 days delayed radicular deficit were potential indicators of blade micromovements and secondary injury. Coursing such a pathway of extraordinary anatomic brinksmanship, from skin to disc space, without serious injury to any of these structures seems a highly unlikely outcome. It challenges the surgeon to navigate around and between the same structures without causing further injury.

In cases of penetrating injury to the supraclavicular triangle, the retrojugular approach gives excellent access to all of the important anatomical structures of the neck from a lateral approach. Furthermore, it facilitates the early control of the VA and exploration of the neural foramina [6]. If necessary, this approach can easily be extended medially to have access to the anterior spine.

This case illustrates that the absence of clinical signs does not exclude serious injury in penetrating wounds of the neck, even with a delay in presentation, as in this case. Such wounds, even seemingly banal, require careful evaluation and appropriate investigations as described.

Conflict of interest The authors declare no financial conflict of interest.

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