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Spinal stab injury with retained knife blades: 51 Consecutive patients managed at a regional referral unit

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ABSTRACT

Background: Spinal stab wounds presenting with retained knife blades (RKB) are uncommon, often resulting in spinal cord injury (SCI) with catastrophic neurological consequences. The purpose of this study is to report a single unit's experience in management of this pattern of injury at this regional referral centre.
Methods: Retrospective review of medical records identified 51 consecutive patients with spinal stabs presenting with a RKB at the Neurosurgery Department at Inkosi Albert Luthuli Central Hospital between January 2003 and February 2015. The data was analyzed for patient characteristics, level of the RKB, neurological status using the ASIA impairment scale, associated injuries, radiological investigations, management, hospital length of stay, complications and mortality.
Results: The mean age was 28 ± 10.9 years (range 14–69), with 45 (88%) males (M: F = 7.5:1). The median Injury Severity Score was 16 (range 4–26). RKB were located in the cervical [9,18%], thoracic [38,74%], lumbar [2,4%] and sacral [2,4%] spine. Twelve patients (24%) sustained complete SCI (ASIA A), while 21 (41%) had incomplete (ASIA B, C, D), of which 17 had features of Brown–Sequard syndrome. Eighteen (35%) patients were neurologically intact (ASIA E). There were 8 (16%) associated pneumothoraces and one vertebral artery injury. Length of hospital stay was 10 ± 7.1 days (range 1–27). One patient (2%) died during this period.
Conclusions: Stab injuries to the spine presenting with RKB are still prevalent in South Africa. Resources should be allocated to prevention strategies that decrease the incidence of inter-personal violence. All RKBs should be removed in the operating theatre by experienced surgeons to minimise complications.

Introduction

The vertebral column plays an important role in protecting the spinal cord from external injuries [1]. However, despite this protection, the spinal cord is still vulnerable to injuries from sharp objects, commonly knives, which can enter the spinal canal either through the interlaminar space or directly through the vertebrae [2]. Stabs to the spine are uncommon in developed countries, but continue to be a source of trauma burden in the developing world [3], particularly in the Province of KwaZulu-Natal (KZN), South Africa.

Even more uncommon is when patients present with a retained knife blade (RKB) following these assaults (Fig. 1). The blade is frequently lodged in the vertebral body, lamina, and or pedicle [4]. On review of the literature, RKBs in the spine have primarily been the subject of case reports [5–11], with no large series reporting on this entity. Small series examining retained foreign bodies anywhere in the body have included small numbers of such cases [12].

Penetrating injuries commonly occur as a result of inter-personal violence which is a major contributor to the incidence of trauma in KZN [13], with the World Health Organization (WHO) identifying inter-personal violence as one the leading causes of morbidity and mortality in young adults, and males in particular [14]. These injuries present in a dramatic fashion, as the impaled knife is visible to spectators and often results in acute spinal cord injury (SCI), which has a catastrophic emotional impact, with severe social and health care costs, since the majority of these victims are at the prime of their lives [15] and may be the sole breadwinner. The purpose of this study was to evaluate this unit's experience in managing stabs to the spine, presenting with RKB in a series of 51 consecutive patients admitted and treated at the

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Fig. 1. A male patient who sustained a stab to the spine and presented with a retained knife blade (RKB).

Neurosurgery Department located at Inkosi Albert Luthuli Central Hospital (IALCH), KZN, South Africa (SA).

Methods and materials

This retrospective study reviewed the medical charts of patients with stabs to the spine admitted from January 2003, until February 2015, at the Neurosurgery Department (ND), IALCH, Durban, SA. The ND has maintained a comprehensive database of all admissions since it was commissioned at IALCH in December 2002. Prior to this the ND was based at Wentworth Hospital located in the same province [16]. The medical charts are kept in a password-protected computer programme (Soarian®, Siemens, Germany) where the data was obtained and exported into an Excel®, spreadsheet (Microsoft Inc., WA, USA). Variables examined included patient characteristics, spinal level of the RKB, presence of SCI and whether this was complete or incomplete, associated injuries, radiological investigations performed, management, length of hospital stay, complications and mortality. Ethical approval was granted by the Biomedical Research Ethics Committee of the University of KwaZulu-Natal (Ref. BE 507/14).

Inclusion criteria were: all patients with RKB on presentation, while those where the blade was removed at the scene were excluded. The KZN province has a dedicated Spine Unit (SU) which is under the care of orthopaedic surgeons and is based in an off-site hospital. The SU also manages spinal trauma; however patients from this unit were not included in this study, since that unit mainly manages blunt spinal trauma.

The management of these injuries involves stabilizing patients in accordance with the Advanced Trauma Life Support (ATLS®) principles, and excluding all life threatening injuries. Tetanus toxoid is administered to all patients in the emergency department, unless already provided at the referring facility. Signs of acute SCI are assessed and documented as either complete or incomplete using the American Spinal Injury Association (ASIA) impairment scale. Complete SCI is defined as no motor and sensory function more than three segments below the level of injury in the cord, while incomplete SCI is defined as residual motor and sensory function more than three segments below the level of injury, including sacral sparing [17].

The local policy is to perform a computerised tomography (CT) scan of the spine with axial, coronal and sagittal views on all patients to assess the trajectory of the knife and its relation to important organs and major vessels, an example which is shown in Fig. 2.

X-ray or CT scan of the chest is performed if associated lung injury is suspected, while a contrast swallow is obtained to exclude oesophageal injury when suspected. Angiography is performed if the trajectory of the blade traverses an area of major blood vessels. Magnetic resonance imaging (MRI) of the spine is not routinely performed, especially if the blade is still in situ, but is performed only if there is progressive neurological deterioration or spinal abscess or empyema post removal of the blade.

All RKBs are removed in the operating theatre (OT) under general anaesthesia (GA), and a first generation cephalosporin antibiotic, namely cefazolin is administered at induction for prophylaxis. The procedure is performed in the prone position, the wound is extended and the tract explored the objective being to remove the blade under direct vision in-line with its original trajectory and to remove foreign debris that might have contaminated the wound. A laminectomy is performed, when indicated, to facilitate removal of blades that are resistant to simple withdrawal, taking care not to rock the blade, as this worsens tissue damage and SCI. Loose bony fragments in the canal are removed and the dura mater is explored for penetration and repaired in a watertight tight fashion under direct vision, if breached. A lumbar drain may be inserted in the same setting after dural repair; however this is at the discretion of the primary surgeon.

After debridement the wound is closed in layers and cefazolin administered for a period of 48 h if the dura is breached. Antibiotics of choice in patients with septic wound complications with associated meningitis are combinations of cloxacillin and ceftriaxone, which is used until microscopy, culture and sensitivity results are obtained from the laboratory and then directed therapy is instituted. Local wound care, deep vein thrombosis prophylaxis, pressure point care to prevent bedsores and bladder care to prevent urinary tract infection forms part of the standard post-operative management protocol in patients with SCI. Physiotherapy, occupational therapy and psychology consultations are sought post-operatively in patients with SCI as part of the multidisciplinary rehabilitation approach. Once patients are deemed stable they are discharged back to their local hospital for continuation of care.

Results

The ND at IALCH between January 2003 and February 2015 admitted a total of 338 patients with traumatic spinal injuries of whom 104 (31%) were as a result of stabs to the spine. Of those with stab wounds 51 (49%) presented with RKB (Table 1). Their mean age was 28 ± 10.9 (range 14–69 years). There were 45 (88%) males and 6 (12%) females giving a male to female ratio of 7.5:1. The median Injury Severity Score (ISS) was 16 (range 4–26), interquartile range (IQR) 5–25. The median New Injury Severity Score (NISS) was 16 (range 4–34), IQR 5–25.

In two females the injuries were following intimate partner violence (IPV). The spinal levels of RKB were cervical [9, 18%], thoracic [38,74%], lumbar [2, 4%] and sacrum [2,4%], examples of imaging is demonstrated in Fig. 3.

The neurological impairment on admission was documented using the ASIA impairment scale, the results of which are shown in Table 2. Twelve (24%) patients had complete SCI, while in 21 (41%) it was incomplete. Of the patients with incomplete SCI 17 (81%) had features of Brown–Sequard syndrome. Eighteen (35%) patients were neurologically intact at presentation and these were the