



ORIGINAL RESEARCH

Cervical Spine Immobilisation Following Stab Wounds to the Neck Is Unnecessary

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ABSTRACT

Objective: This study reviews our experience with penetrating neck injury (PNI) secondary to a stab wound (SW) to clarify the incidence of cervical spinal injury (CSI) and to interrogate the role of cervical spinal motion with cervical collar in these patients.

Methods: A retrospective review of a prospectively captured data set was conducted at the Pietermaritzburg Metropolitan Trauma Service in South Africa from December 2012 to December 2022. All patients who presented with a PNI due to a SW were included.

Results: There were 1249 cases of PNI over the 10 year study period. 1028 were due to a SW and 90% were male. The mean age 30 years. The zonal distribution of the external wounds was 329 (32%) in zone 1, 469 (46%) in zone 2, 164 (16%) zone 3 and 162 (16%) in the posterior triangle of the neck. In eighty two (8%) cases a CSI was sustained. In none of these cases was the CSI unstable. Twenty two (22) patients sustained a spinal cord injury and presented with a neurological deficit.

Conclusions: While there is a significant incidence of spinal cord injury after a cervical SW, there is a very low incidence of cervical spine instability requiring spinal fixation. The routine application of cervical collar following a SW to the neck is unnecessary.

1 | Introduction

Restriction of cervical spinal motion (ROCSM) following trauma to the neck is a central tenet in the management of the acutely injured patient. Further uncontrolled movement of the neck in a patient with a spinal injury may exacerbate the injury to the cord, and this must be prevented. Traditionally this was achieved by in line immobilisation of the spine by application of a cervical collar, to restrict neck movement. More recently, there has been a move away from the use of cervical collars towards the use of head restraints. This has been driven by the realisation that cervical collars in themselves may cause morbidity. The indiscriminate use of cervical collars

in penetrating neck injury (PNI) can obscure important life-threatening clinical signs such as an expanding haematoma, hamper accurate physical examinations and increase the difficulty of endotracheal intubation [1]. The vast majority of neck trauma encountered is blunt in nature and the experience from the management of blunt trauma has been extrapolated to the care of PNI. There is an increased understanding that penetrating and blunt trauma are not analogous and must be managed according to independent algorithms. A study from Los Angeles County and the University of Southern California Medical Center on 1069 cases of PNI, found that no unstable cervical spine injury (CSI) was identified in 606 cases of stab wound (SW) [2]. Our trauma centre manages a high volume of

penetrating injuries to the neck each year and the aim of this study was to review the incidence of spinal injury following a SW of the neck and to use this information to inform current pre-hospital management algorithms.

2 | Materials and Methods

2.1 | Clinical Setting

This was a retrospective study undertaken at the Pietermaritzburg Metropolitan Trauma Service (PMTS), Pietermaritzburg, South Africa. The PMTS provides definitive trauma care to the city of Pietermaritzburg, the capital of KwaZulu Natal (KZN) province. It is one of the largest academic trauma centres in the province and covers a catchment population of over 3 million. Annual admission to our trauma centre exceeds 4000 patients, of which over 50% of which are penetrating injuries. The hybrid electronic registry (HEMR) collects comprehensive in-patient data on all patients managed by our trauma centre. Ethics approval for the maintenance of this registry has been granted by the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu Natal (UKZN) (Ethics board approval number: BCA 221/13).

2.2 | The Study

A retrospective review was conducted on all patients who presented with a PNI between December 2012 and December 2022 using anonymised data from HEMR. Data including demographics, injury pattern, body region injuries, diagnostic imaging, operative interventions and clinical outcome from the time of the patient's index presentation were reviewed. In this study, PNI was defined as any penetrating injury which violated the platysma located anatomically between the clavicle and the skull base. We restricted our study population to isolated SWs to the neck.

2.3 | Current Management

All patients who sustain a PNI are managed in accordance with the Advanced Trauma Life Support (ATLS) principles including primary survey and clinical examination for CSI. The management of PNI at our institution follows the 'No Zone' approach. Those with hard signs of a vascular injury and where bleeding cannot be controlled or temporised are expedited from the resuscitation room to the operating theatre. All other patients who are stable or have been stabilised are subjected to computed tomography (CT) with angiography (CTA). Additional investigations are obtained as indicated. These include oesophagogastrroduodenoscopy (OGD), or contrast swallow study. All images are reviewed by two consultant radiologists at the time of admission. Cervical spine immobilisation is not routinely applied unless the patient has a neurological deficit, in which case, cervical spinal motion is restricted where feasible. A CSI was considered unstable based on the presence of neurological signs and the opinion of the consultant spinal surgeons. Figure 1 shows our standard management algorithm for SW to the neck.

3 | Results

3.1 | Overview

Over the 10-year period, there were 1249 cases of PNI managed at our institution. Ninety per cent of patients were male and the mean age was 30 years. Eighty-two per cent of the mechanisms (1028/1249) were SWs and the remaining 18% were gunshot wounds.

3.2 | Spectrum of Injuries

There were 329 (32%) zone 1 wounds, 469 (46%) zone 2 wounds, 164 (16%) zone 3 wounds and 162 (16%) posterior triangle wounds. In 122 (12%) patients there were multiple wounds to more than one zone. This is shown in Table 1.

A total of 844 (82%) patients had a CTA. CTA identified an arterial injury only in 108 patients, a venous injury only in 63 patients and a combined arterial and venous injury in 25 patients.

In total, there were 216 vascular injuries (21%), 100 airway injuries (10%) and 24 digestive tract injuries (2.3%). A

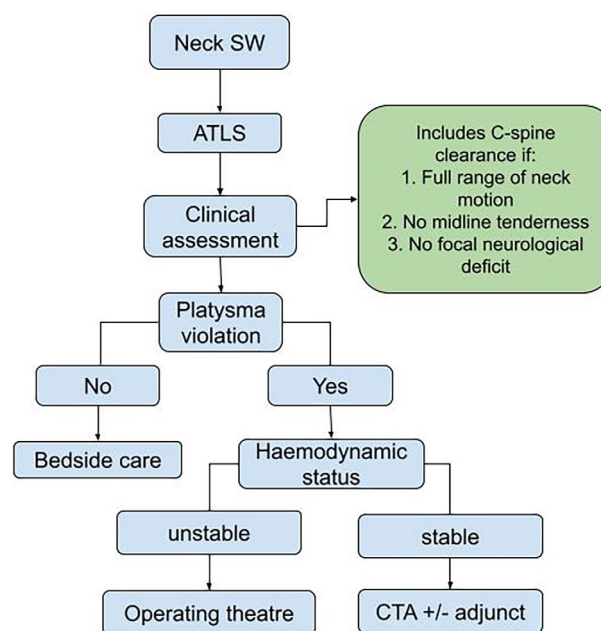


FIGURE 1 | Management algorithm for stab wound to the neck at Pietermaritzburg Metropolitan Trauma Service.

TABLE 1 | Locations of stab wounds based on anatomic zones.

Anatomic zone	Number (%)
Zone 1	329 (32)
Zone 2	469 (46)
Zone 3	164 (16)
Posterior triangle	162 (16)
Multiple zones	122 (12)

pneumothorax or haemothorax was present in 234 (23%) patients. This is shown in Table 2.

3.3 | Cervical Spine Injuries

There were 844 patients who were investigated with CT scan. The C-spine was clinically cleared in the remaining 184 cases. CSI was noted in 8% (82/1028) of cases. The prevalence of CSI was stable over the study period. All cervical spine injuries were characterised on CT imaging. Magnetic resonance imaging (MRI) was used selectively. The location of injury is summarised in Table 3. None of the 82 cases of CSI were considered unstable and none required surgical stabilisation. All patients with spinal cord injury presented with a neurological deficit. In no patients did the neurological deficit progress during their hospital admission.

3.4 | Clinical Outcomes

Overall, 181 (18%) patients required surgery. Four patients (0.4%) proceeded to emergency surgery for vascular injury prior to imaging- this did not result in delayed diagnosis or complications. ICU admission was required in 6% of patients (65/1028). The overall morbidity was 9%. There were: 36 respiratory, 30 wound related, 21 neurological, 11 cardiac, 2 abdominal and 2 renal related complications. The overall mortality was 1% (14/1028).

4 | Discussion

The application of a rigid or semi rigid cervical collar to restrict cervical spinal motion (ROCSM) is commonly practiced worldwide. Despite the ongoing debate regarding its clinical efficacy, it remains widely practiced in both the prehospital and hospital setting. The current ATLS teaching considers ROCSM necessary in all trauma patients at risk of spinal injury until a spinal injury has been excluded by appropriate radiographic adjuncts and clinical evaluation [3]. In the presence of a potential spinal injury, excessive manipulation and inadequate restriction of spinal motion can exacerbate neurological damage and worsen the patient's outcome. While ROCSM in blunt trauma patients has merit, the role of ROCSM in PNI is controversial. The application of a rigid collar post trauma, to restrict movement of the cervical spine and prevent exacerbation of a spinal cord injury is the gold standard in the acute management of trauma patients [4]. Over the last 20 years this strategy has been questioned. Cervical collars can restrict venous drainage of the head and neck and

can obscure wounds which need attention. In addition, a rigid cervical collar can increase the difficulty of intubation. The realisation that application of a spinal collar is not without morbidity has made many commentators' question the role of routine cervical collar in trauma patients [1, 2]. Most of this work has focused on patients who sustained blunt neck trauma. PNI is less common than blunt trauma to the neck, and the two mechanisms are not analogous. There are two major penetrating mechanisms of neck trauma namely stab wounds (SW) and gunshot wounds (GSW). These two mechanisms have very different injury patterns. SWs are relatively low velocity, and the damage is confined to the tract of the injury. GSWs impart a greater destructive force to the tissue and have a variable and unpredictable trajectory. The overall incidence of acute CSI following a SW to the neck in our current study was 8%. The relevant literature, which mostly emanates from the USA is summarised in Table 4. This shows lower rates of CSI, and this may reflect cultural factors including social circumstances around assault and choice of weapon used [2, 5–10]. This result however does not mandate the routine application of a rigid collar as many of these injuries are not complex fractures of the bony structures of the cervical spine and none were an unstable CSI. The group of patients with a documented spinal cord injury all presented with a neurological deficit and had a clear indication for ROCSM. Our data supports the growing consensus that cervical collars are superfluous in the acute management of SW to the neck.

One of the limitations of our study is the lack of follow up beyond discharge. Due to social economic challenges in our environment, follow up in our environment is extremely difficult. Patients who remain well beyond discharge return to their normal activity and seldom see the need to attend follow up, in large part due to the perceived time off work and fear of redundancy.

TABLE 3 | Injured region of vertebra for cases of cervical spine injury.

Cervical spine injury	Number (%)
Spinal cord injury	22 (27)
Vertebral arch (pedicle and lamina)	27 (33)
Transverse process, spinous process or articular process	23 (28)
Vertebral body	10 (12)

TABLE 4 | Research articles on stab wound injury to the neck.

Author	Year	No. of SWs	No. of CSI (%)	No. of unstable CSI
Kong	2025	1028	82 (8%)	0
Schubl	2016	120	1 (0.8%)	0
Lustenberger	2011	606	9 (1.5%)	0
Vanderlan	2009	116	0 (0%)	0
Rhee	2006	7483	11 (0.2%)	3

TABLE 2 | Injuries from stab wounds based on organ.

Organ injury	Number (%)
Thoracic (pneumothorax and hemothorax)	234 (23)
Vascular	216 (21)
Airway	100 (10)
Oesophagus	24 (2.3)
Cervical spine	82 (8)

Our database therefore does not track patients beyond hospital discharge. However, we are the only hospital in the region and if patients have further issues, they almost invariably re-present to our hospital.

5 | Conclusion

While there is a significant prevalence of spinal cord injury following a SW to the neck, the prevalence of cervical spine instability and the need for spinal fixation is very low. The routine application of a cervical collar in this scenario appears to be unnecessary.

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Ethics Statement

Ethics approval for conducting this study has been granted by the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu Natal (UKZN).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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