Is spinal immobilisation necessary for all patients sustaining isolated penetrating trauma?

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Abstract

Introduction: Previous work suggests that patients with isolated penetrating trauma rarely require spinal immobilisation. This study aimed to identify the incidence of mechanically unstable, or potentially mechanically unstable, spinal column injuries in penetrating trauma patients. The study also aimed to identify the incidence of spinal cord injury as a result of penetrating trauma in Scotland.

Design: Retrospective analysis of prospectively collected data from the Scottish Trauma Audit Group (STAG).

Methods: Study patients were identified from the period 1992–1999. Patients coded for both penetrating trauma and spinal column or spinal cord injury were included. Case records, theatre notes and post mortem information were also examined.

Results: 34,903 patients were available for study. Twenty-seven patients were coded as having had penetrating trauma and concurrent spinal injury. 15 were excluded as they also had a major blunt mechanism of injury or had no actual injury to the spinal cord or column. In the remaining 12 patients, four cervical, one combined cervical and thoracic and seven thoracic spinal cord injuries were identified. 11 were male and 11 were assaulted. One assault was due to a gunshot wound; 10 resulted from sharp weapons. Four complete cord transections and nine partial cord lesions were identified. All 12 patients with spinal cord injury associated with isolated penetrating trauma either had obvious clinical evidence of a spinal cord injury on initial assessment or were in traumatic cardiac arrest. All had spinal immobilisation.

Conclusion: Fully conscious patients (GCS = 15) with isolated penetrating trauma and no neurological deficit do not require spinal immobilisation.

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1. Introduction

It has been suggested that full spinal immobilisation is rarely, if ever, required for patients with isolated penetrating trauma [2,6]. The advanced trauma life support (ATLS®) student manual does not make the distinction between blunt and penetrating trauma with regard to spinal injury [1]. It emphasises the need for full and continuous spinal immobilisation in any patient with a suspected spinal cord or column injury until a fracture has been excluded radiologically. This refers predominantly to blunt trauma of the spinal cord and spinal column.

This approach has significant implications for pre-hospital care. Time may be a crucial factor in determining outcome in severe penetrating trauma. In critically injured patients, it has been estimated that for every 10 min of delay in definitive treatment, survival drops by 10% [7]. Therefore, in this study we aimed to determine if there were any mechanically unstable or potentially mechanically unstable spinal column injuries requiring formal spinal immobilisation in isolated penetrating trauma patients in Scotland. We also examined the incidence of spinal cord injury due to penetrating trauma in Scotland.

2. Methods

The Scottish Trauma Audit Group (STAG) was established in 1991 to evaluate the management of major trauma in individual Scottish hospitals [3]. It utilises TRISS methodology, which combines the injury severity score (ISS) and the revised trauma score (RTS) in addition to the patient’s age, to generate a probability of survival for each patient. [4] Currently 25 hospitals contribute to the national database. At the time of writing, data had been collected prospectively on more than 35,000 patients. The entry criteria for patients onto the database are all trauma patients who are in-patients for three days or more, patients who die as a result of trauma, or patients who are transferred to a regional or national specialist service. This
captures approximately 98% of seriously injured patients in Scotland.

Study patients were identified from the period 1992–1999. Patients coded for penetrating trauma and spinal column or spinal cord injury were included in the study. Copies of the original STAG forms were made available for data collection and, if further information was required, it was obtained from individual case records, theatre notes and post mortem information.

3. Results

There were 34,903 trauma patients available for study; 32,974 (94.5%) had sustained blunt trauma and 1929 (5.5%) penetrating trauma. Twenty-seven patients were coded as having penetrating trauma and concurrent spinal injury. Fifteen patients were excluded either because initial review clearly showed that there was a major blunt mechanism of injury also coded which unequivocally caused the spinal trauma, or because the spinal component of the injury was trivial. Patients were also excluded if there were discrete injuries affecting the peripheral nerves and nerve roots distal to the spinal column but where there was no injury to the spinal cord or column identified.

In the remaining 12 patients there were four cervical and seven thoracic spinal cord injuries. One patient had both a cervical and thoracic cord injury. There were no documented injuries to the lumbosacral spine. Eleven patients were male and all but one had been assaulted, the other being an industrial accident. One assault was due to a gunshot wound (GSW) and the others resulted from sharp weapons.

Four complete transections of the spinal cord were identified along with nine partial cord lesions. Three of these patients presented with a classic Brown–Séquard syndrome: lateral hemisection of the spinal cord producing ipsilateral paralysis (corticospinal tract) and loss of joint position sense (posterior column) below the lesion with contralateral loss of pain and temperature sensation (spinthalamic tract). All 12 patients who sustained spinal cord injury associated with isolated penetrating trauma had either obvious clinical evidence of a spinal cord injury on initial assessment or were in traumatic cardiac arrest \((n = 2)\). All had full spinal immobilisation instituted.

4. Discussion

In 1929 cases of penetrating trauma, the only patients with spinal cord lesions had clear evidence of this at initial presentation or were in cardiorespiratory arrest. This suggests that spinal column or spinal cord injury resulting from isolated penetrating trauma can be excluded in fully conscious patients without neurological symptoms or signs at presentation.

Contemporary teaching on trauma does not make any distinction between blunt and penetrating trauma in terms of the need for full spinal immobilisation. Recent studies have questioned the importance of full formal spinal immobilisation in patients with isolated penetrating trauma \([2,6,8,10]\). This is based on the belief that spinal stabilisation in the pre-hospital setting would prolong on scene times and make airway manoeuvres unnecessarily difficult. Demetriades et al. compared 4865 emergency medical services (EMS, i.e. ambulance transported) patients with 926 non-EMS (friends, relatives, bystanders or police transported) patients \([7]\). The two groups had similar mechanisms of injury. Subgroup analysis showed that ISS > 15 patients in the EMS group had a mortality of 28.8% versus 14.1% in the non-EMS group. The authors concluded that patients with severe trauma transported by private means in this setting were more likely to survive and that longer pre-hospital times in the ambulance group may have been an important factor in this. It is suggested that patients brought in by bystanders reach the hospital for definitive treatment more than 30 min earlier than those brought in by EMS methods.

Lerer and Knottenbelt in a report from South Africa demonstrated that the survival rate following penetrating chest trauma was better in patients from poorer socio-economic areas \([11]\). The authors of the study speculated the use of more readily available private transportation to reach the hospital among poorer patients might explain the outcome difference. This observation appears particularly true for penetrating cardiac injuries \([5,9]\).

Recently, there have been concerns expressed on the value of pre-hospital interventions made by paramedics on patients and the appropriateness of prolonged on scene times incurred \([7,12]\). Cornwell et al. further analysed the patient group identified by Demetriades et al. and observed that there was not even one, of more than 3000 patients with penetrating trauma in this study, who even theoretically benefited by formal thoracolumbar immobilisation \([6]\).

Kaups and Davis, in a study investigating the appropriateness of cervical spine immobilisation and evaluation in patients with traumatic gunshot wounds to the head, concluded that indirect (blunt or fall related) spinal injury does not occur in patients with gunshot wounds to the head \([10]\). Their figures showed that unsuccessful attempts at intubation were closely associated with patients in cervical spine immobilisation. They concluded that protocols mandating cervical spine immobilisation after a GSW to the head were unnecessary and may compromise airway management.

This theory was reinforced by Barkana et al. \([2]\). In a retrospective study of 44 military casualties with a penetrating neck injury over a 4.5 year period, they found no cases where surgical stabilisation of a mechanically unstable cervical spinal column injury was required. They concluded that it is extremely rare for a penetrating injury to result in a mechanically unstable cervical spine. It was noted that of the 44 cases studied most injuries were due to projectiles or bullets. This contrasts with our study where the majority of
injuries to the spinal cord (10 out of 12 patients) were from sharp weapons in assaults.

Barkana et al. also highlight that life threatening complications of penetrating neck injury (large or expanding haematoma, tracheal deviation, subcutaneous emphysema and diminished or absent carotid pulsation) are often manifest as visible or palpable signs in the neck and that these may be missed if the neck is obscured by a device such as a semi-rigid collar. In their study, 22% of trauma victims developed one or more of the above signs either in the pre-hospital or emergency department setting.

However, a further study by Demetriades et al. showed that 8% of a population of 247 patients with a GSW to the face also had a cervical spine injury [8]. The authors suggest that formal spinal immobilisation is indicated in patients with a GSW to the face if there is any suspicion of the bullet trajectory traversing the neck, if no exit wounds are evident, or if the patient has focal neurological deficit suggestive of spinal cord injury.

These conclusions appear equally valid when applied to GSWs to the head [10], although our data does not allow us to comment on the risks of spinal cord injury associated with GSWs as we had only one such case in this series. Our study also found that the majority of patients who had a definite spinal cord injury had neurological symptoms or signs suggestive of a spinal lesion at presentation. The remainder were in traumatic cardiac arrest.

Barkana et al. analysed the definitions of mechanical spinal instability and the stability scoring systems applied to determine the extent of spinal integrity (two- and three-column theories) [2]. Although these systems were designed for blunt trauma, if they are applied to penetrating trauma, it is very rare to find a biomechanically unstable spinal injury. The authors propose that it is unlikely for penetrating injury to cause substantial spinal damage leading to instability without completely destroying the cord, causing a permanent, irreversible neurological deficit.

Our study agrees with the evidence above and therefore, we suggest making distinctions between recommendations for the management of spinal immobilisation in blunt and penetrating trauma. This would avoid excessive pre-hospital times and unnecessary difficulties with emergency airway interventions in patients with isolated penetrating trauma.

Spinal immobilisation is not required in fully conscious patients (GCS = 15) with isolated penetrating trauma unless there is any obvious neurological deficit at presentation.

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References