Cervical spine injuries: What emergency nurses need to know

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Frontline emergency personnel are often faced with the difficult task of managing cervical spine injuries. The potential outcomes involved with the improper handling of a patient with a cervical spine injury can be devastating. Canada has no readily available national emergency department statistics regarding cervical spine injuries (Bandiera et al., 2002). However, according to American statistics, it has been estimated that two to three per cent of all trauma patients suffer cervical spine trauma. Of those patients, between three and 25% suffer progression of injuries due to delays in diagnosis and improper manipulation in the emergency department (ED) (Banit, Grau, & Fisher, 2000). It can be surmised that the risks of developing or worsening a spinal cord injury are highly significant if cervical spine injuries (CSI) are not properly immobilized. The purpose of this article is to review what we know about dealing with CSIs and to explore possible solutions to the problem of immobilization of patients with suspected CSIs.

With the advent of improved emergency medical services (EMS), there has been a positive impact in the pre-hospital management of suspected CSIs (Banit et al., 2000). Blunt trauma patients are routinely placed in rigid spinal immobilization based often on mechanism of injury alone. A cervical collar is applied according to the accepted standard of treating a patient as if he or she has sustained a CSI until proven otherwise (Brooks, & Willet, 2001). Spinal immobilizations are performed based on the premise that this procedure will prevent or avoid exacerbation of spinal cord injury during the handling and transportation of field trauma patients. However, not all blunt trauma patients arrive at the ED in full spinal immobilization. It may be because EMS feels that the patient does not require full immobilization, or the patient arrives at the department via private vehicle. It now becomes the clinical judgment of the triage nurse to decide whether the patient warrants full spinal precautions or the application of a rigid cervical collar. Given the consequences of failing to immobilize a patient with a CSI, in most instances, health care professionals tend to err on the side of excess caution (Hoffman, 2001). However, placing all blunt trauma patients, no matter how minor, in spinal immobilization may place them in unnecessary discomfort and at risk for potential complications such as skin damage and respiratory compromise.

Currently, the literature supports the use of specific clinical criteria that allow emergency physicians to clear patients of CSIs without a radiograph (Domeier et al., 2002; Bandiera et al., 2002). Development of specific spinal immobilization protocols would definitely benefit EMS professionals and emergency nurses. These protocols could invariably avoid the time, discomfort, and medical costs associated with unnecessary spinal immobilizations.

Pathophysiology

There are many different types of cervical fractures. These fractures have been given unusual names according to their anatomical location. Upon presentation to the emergency department, patients with these fractures may or may not present with neurological deficits depending upon severity of the fracture and impingement on the spinal cord. Table One provides a brief listing of the fractures and main clinical findings.

Cervical spine injuries located at spine level C1 include the Jefferson fracture and Atlantoaxial subluxation (Blenkinsopp, Carter-Snell, & McLellan, 2002; Graber, & Kathol, 1999). The Jefferson fracture is considered to be a moderately unstable fracture. The C1 ring bursts due to axial load or vertebral compression. Atlantoaxial subluxation is considered highly unstable. This fracture mainly occurs in patients with a history of Down's Syndrome, rheumatoid arthritis and other destructive processes.

Cervical injuries common to spine level C2 are the odontoid fracture and the Hangman's fracture (Graber, & Kathol, 1999; Blenkinsopp, Carter-Snell, & McLellan, 2002). The odontoid fracture is a highly unstable fracture. Its occurrence is poorly understood, as the mechanism of injury remains vague. The Hangman's fracture is also considered a highly unstable fracture. This is a bilateral fracture through the C2 pedicles. It occurs with sudden deceleration (hanging) and hyperextension (motor vehicle collisions).

Flexion teardrop fractures, bilateral facet dislocation and unilateral facet dislocations can occur at any level of the cervical spine (Graber, & Kathol, 1999; Blenkinsopp et al., 2002). Flexion teardrop fractures occur when the large triangular segment is displaced from the anterior vertebral body. This is a highly unstable fracture and is due to sudden forceful flexion. Bilateral facet dislocations are highly unstable fractures due to flexion or combined flexion/rotation. This occurs when one or more cervical vertebrae are anteriorly displaced by 50% or more. Unilateral facet dislocations are unstable fractures that result from flexion or combined flexion and/or rotation of the cervical spine. The cervical vertebral body is anteriorly dislocated 25% to 33% over another.

Another very common fracture is the Clay Shoveler's fracture (Graber, & Kathol, 1999; Blenkinsopp et al., 2002). It is considered to be a very stable fracture and it occurs as result of flexion, such as when picking up and throwing heavy loads. It is an avulsion of the posterior aspect of the spinous process and can occur anywhere in the lower cervical or upper thoracic spine.

There is a special syndrome unique to children known as spinal cord injury without radiographic abnormality (SCIWORA). SCIWORA syndrome occurs when the elastic ligaments of a child's neck stretch during trauma resulting in neuronal injury or, in some cases, leading to complete severing of the cord (Graber, & Kathol, 1999; Blenkinsopp et al., 2002). This syndrome may account for up to 70% of spinal cord injuries in children and is most common in children under eight (Graber, & Kathol), patients may present with paralysis. However, up to 30% of patients have a delayed onset of neurological symptoms, which may or may not occur until up to four or five days after the injury. In most cases, children with SCIWORA have a full and complete recovery, especially if the onset is delayed.

Initial evaluation

The initial basic assumption in evaluating a patient with blunt trauma injury is that they have a cervical spine injury until proven otherwise (Banit et al., 2000; Domeier et al., 2002; Brooks, & Willet, 2001). CSI evaluation criteria include physical examination, mechanism of injury and patient history. However, these criteria apply only to adults without mental status changes, such as drug or alcohol intoxication, and no distracting injuries present.

In the pre-hospital setting, management of a patient with suspected CSI involves placing the patient in a rigid cervical collar and strapping the patient to a hard spinal board (Figure One). In the hospital setting, blunt trauma patients presenting to the triage desk are routinely fitted in a rigid cervical collar and placed on a stretcher lying flat. The primary goal of cervical spine immobilization is to achieve as normal anatomic alignment as possible, thus allowing for natural healing to occur (Webber-Jones, Thomas, & Bordeaux Jr., 2002). The next step is to "clear" the cervical spine through physical examination, radiographs, computed tomography (CT) and magnetic resonance imaging (MRI). The term "cleared cervical spine" means that the patient is clear of any cervical injury (Clancy as cited in Webber-Jones).

Figure One.

Nursing implications

In the United States alone, spine immobilization of trauma patients is one of the most frequently performed pre-hospital procedures with an estimated 1.9 to 2.4 million immobilizations performed yearly (Domeier et al., 2002). Due to the high number of immobilized patients coming through the ED doors, emergency nurses must be aware of the implications related to care of these patients. Improper handling and poor assessment skills can lead to devastating and irreversible injury to these patients.

Even though the majority of blunt trauma patients arrive at the emergency department via EMS in cervical spine immobilization, there is a small number of blunt trauma patients who arrive by private vehicle. Triage nurses must be able to act and use their best clinical judgment to decide whether to place a patient in full cervical spine immobilization. The nurse must weigh the complications of cervical spine immobilization against the consequences of not immobilizing a patient who has a CSI. Immobilizing patients can lead to development of pressure sores, respiratory compromise and pulmonary and deep vein complications (Domeier et al., 2002; Webber-Jones et al., 2002). Other negative aspects of immobilization include patient discomfort and undergoing unnecessary radiological evaluation. Conversely, neglecting to immobilize a patient with a CSI can lead to irreversible injury and possibly death.

The rigid cervical collar has been the mainstay of successful management of CSIs. However, there has been a false sense of security in terms of totally preventing additional and further spinal compromise and damage. Cervical collars restrict between 30% and 83% of neck motion when properly fitted (Askins, as cited in Webber-Jones et al., 2002) and they do not restrict axial loading. Other complications of the cervical collar include: skin damage, respiratory compromise, marginal mandibular nerve palsy with long-term sensory compromise, a potential increase in intra-cranial pressure, possible delayed extubation or difficulty weaning from the ventilator and potential exposure to blood-borne diseases (Webber-Jones et al., 2002).

Cervical spine clearance issues

Clearance of cervical spine injury in a blunt trauma patient should occur in a safe and timely manner. The sooner a patient is removed from cervical spine immobilization, the risk of complications decreases. However, logrolling of the patient can exhaust resources and can be dangerous if trained staff is not utilized. The presence of a hard collar has also been implicated in raising jugular venous pressure and reducing cerebral perfusion pressure and enforces a recumbent or semi-recumbent posture (Brooks, & Willet, 2001). Brooks and Willet concluded that failure to obtain early clearance of the

spine in patients with multiple injuries might be associated with significant morbidity secondary to prolonged immobilization.

Current studies have also supported the potential for clearance of cervical spinal injury by the emergency nurse by using set clinical criteria, such as the Canadian C-Spine Rule and the NEXUS Criteria (Bradshaw, Kelly, & Kerr, 2004; Charters, 2004; Sedlak, 2004). It was found that nurses with additional training in assessment of midline tenderness and range of motion could reliably apply the Canadian C-Spine Rule to effectively rule out cervical spine injury (Bradshaw et al., 2004). This practice would decrease prolonged immobilization of patients and identify those who do not require cervical spine immobilization.

Conclusion

Although the incidence of CSIs in blunt trauma patients is very low, the consequences of improper management of CSIs can have overwhelming consequences. The current trend is to reduce the number of cervical spine immobilizations while not compromising patient safety and care. For the near future, there will be no clear or absolute protocol that will determine which patients do and do not require cervical spine immobilization. Further investigation and research is needed in the area of CSIs but, due to patient safety concerns and ethical limitations, conclusive evidence may not be attainable. Health care professionals who are practising in the hospital or pre-hospital setting must adhere to current institutional and organizational protocols and utilize good clinical judgment when treating blunt trauma patients with suspected CSIs. As a result of the lack of consensus regarding definitive guidelines of suspected CSIs, emergency nurses must remain patient advocates and ensure their patients receive safe, quality and timely care.

Author's note: Website for Canadian C-Spine Rule (and other Canadian "rules" for patient diagnosis and management): http://www.ohri.ca/programs/clinical_epidemiology/OHDEC/clinical.asp

Table One: Cervical fractures

(from ACCN 4453 Emergency Nursing: Care of the Acutely Ill & Injured)

Name	Findings
Jefferson's Fracture	- bursting of the C1 ring with vertical compression - seen with open-mouth odontoid view
Hangman's	- bilateral fracture through C2 pedicles - associated with hyperextension in an MVC
Flexion Teardrop Fracture	- large triangular segment displaced from the anterior vertebral body - extensive anterior and posterior ligament damage and cord injury
Burst Fracture	- vertical compression injury that forces pieces of vertebral body into posterior spinal canal (related to flexion teardrop)
Extension Teardrop Fracture	- as for flexion teardrop but mechanism is extension
Clay (Coal) Shoveler's Fracture	- avulsion of C6, C7 or T1 with flexion or direct blows to spinous process
Bilateral interfacetal dislocation	- unstable flexion injury with an anterior displacement of 50% or more of vertebral body on the one below it
Unilateral facet dislocation	- combined flexion/rotation injury, potentially unstable dependent upon ligamentous disruption - anterior dislocation on lateral x-ray of 25% to 33% of one vertebra over another

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