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Spinal Trauma

DND Primary Care Paramedicine

Module: 05

Section: 09

Lecture Outline

- Introduction
- Pathophysiology
- Assessment
- Management

Introduction

- Spinal cord injuries (SCI) can:
  - Threaten life
  - Result in lifelong disability
- 1500 new SCI/yr
  - Highest incidence is to individuals in the age range of 20 – 30 (more prevalent in males)
  - MVCs 42.8%
  - Falls 43.2%

Introduction

- Spinal cord consists of highly specialized neural tissue
  - Does not repair itself
  - Injury interrupts communication pathways
  - Paraplegia, quadriplegia
  - Affects control over internal organs and internal environment
- Lifelong care for spinal cord injury victim exceeds $1 million
- Best form of care is public safety and prevention programs

Mechanisms of Injury

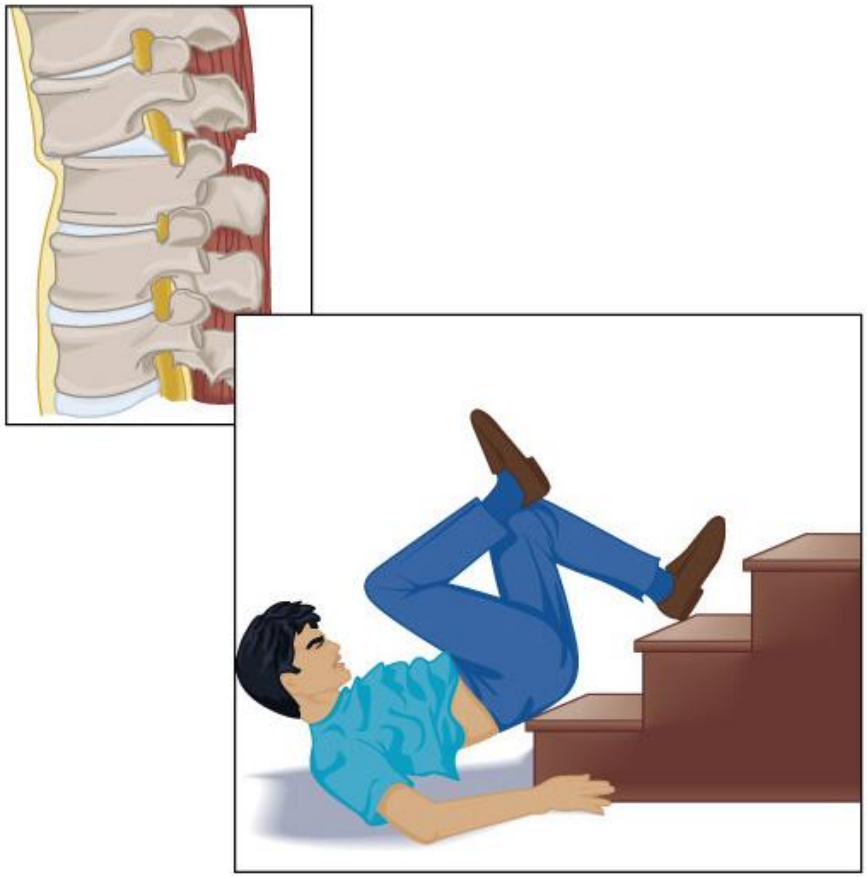
- Extremes of motion
  - Flexion, extension, rotation, lateral bending
- Stresses along the axis of the spine
  - Axial loading, distraction
- Directly from blunt or penetrating trauma
- Indirectly from an expanding mass that compresses the cord
  - Hemorrhage or edema

Extremes of Motion

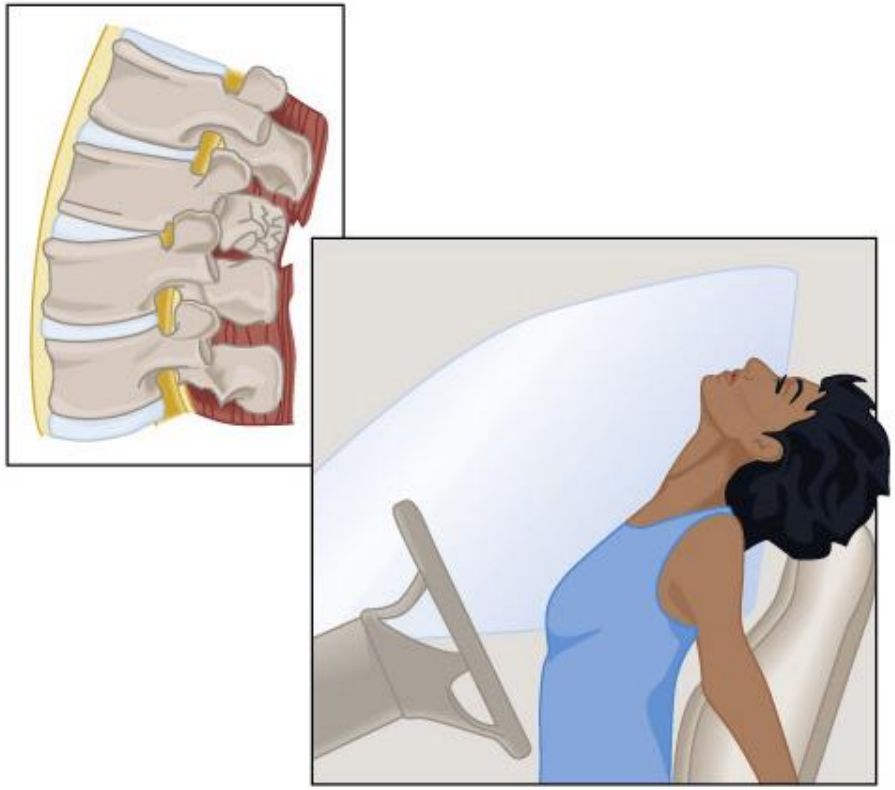
- Hyperextension and hyperflexion
  - Bend the spine forcible
  - Commonly at cervical and lumbar regions
- Hyperextension
  - Rear end MVC, upper torso moves forward, head move backward
- Hyperflexion
  - Frontal impacts, upper torso restrain, head continues to move forward

Extremes of Motion

FLEXION INJURY



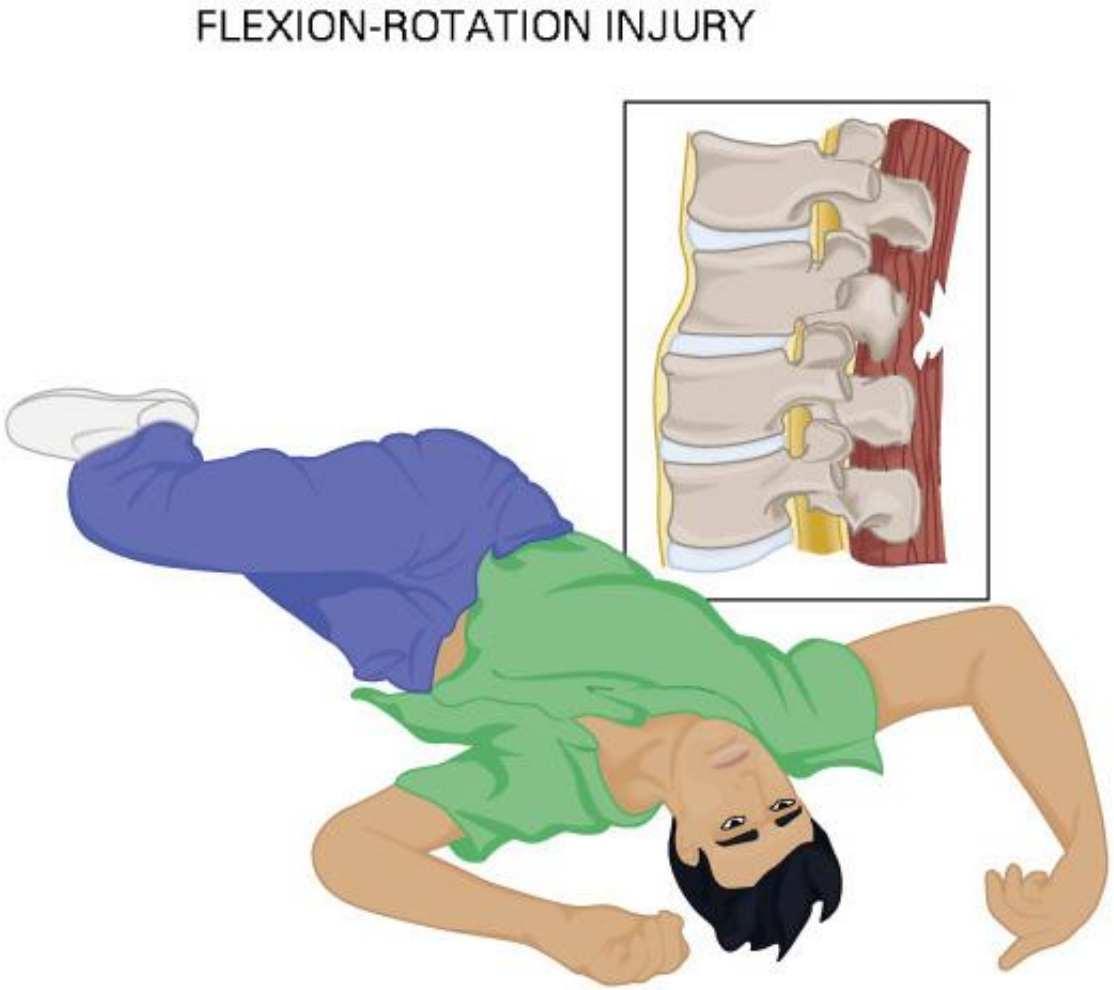
HYPEREXTENSION INJURY



Extremes of Motion

- Rotation
  - Usually affects upper cervical spine
  - Lateral impact
- Lateral bending
  - May take place along entire vertebral column
  - Generally less forces needed to induce injury

Extremes of Motion

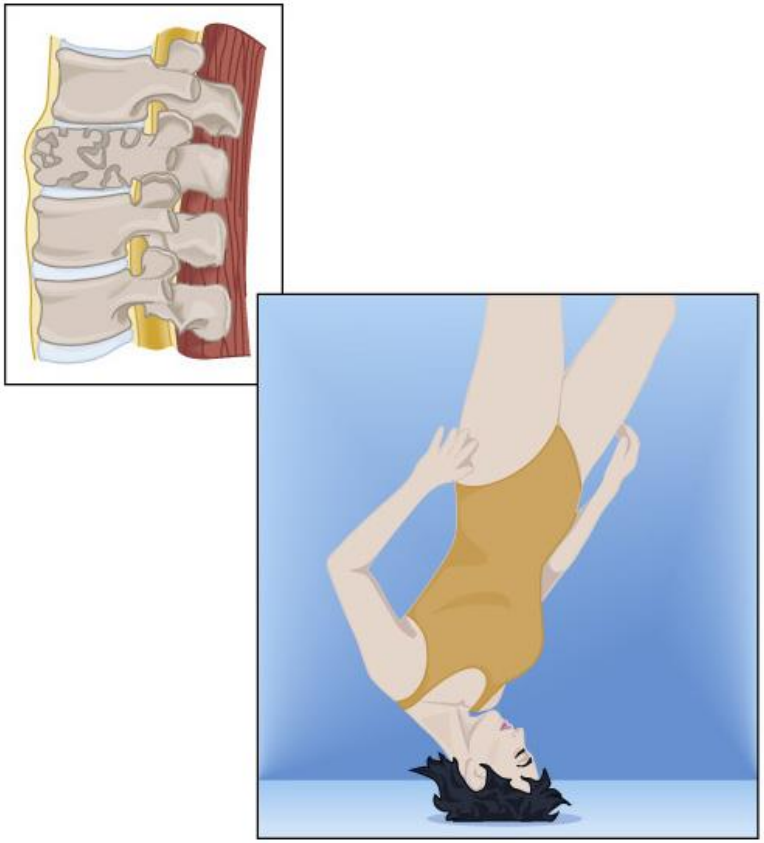


Axial Stress

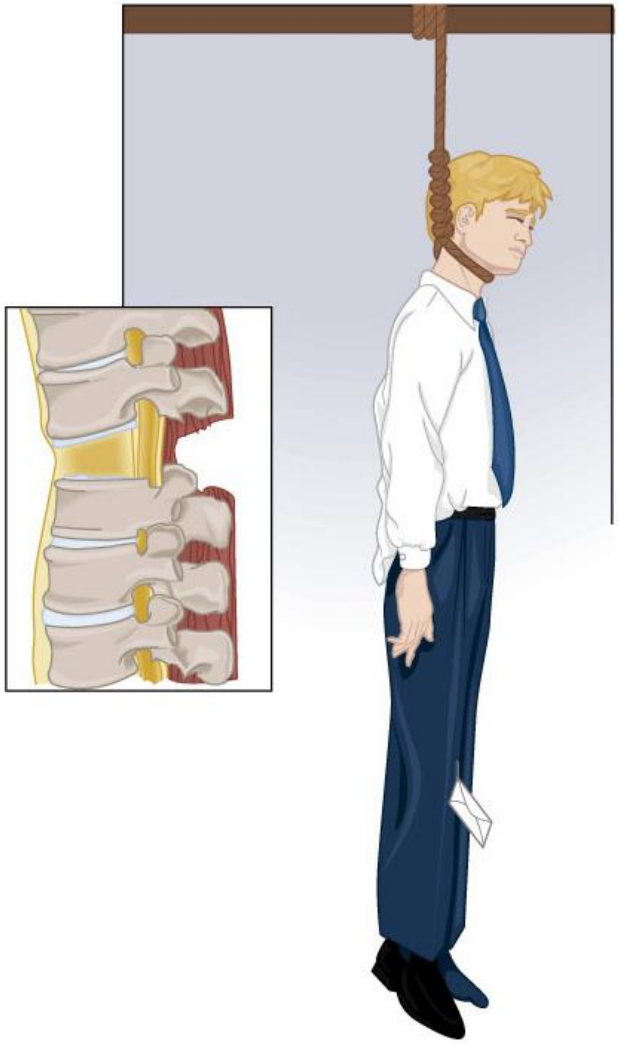
- Axial loading
  - Compressional stress along axis of spine
  - Transmitted up or down spine
  - Dive into shallow water
- Distraction
  - Opposite of axial loading
  - Force that stretches spinal column
  - Hanging, bungee jump
- Combinations
  - Distraction/rotation, compression/flexion

Axial Stress

COMPRESSION INJURY

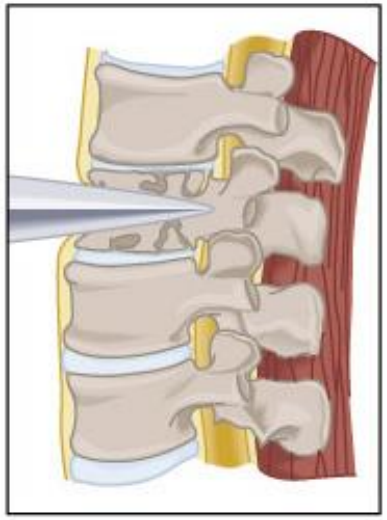


DISTRACTION INJURY



Other Mechanisms

- Blunt or penetrating trauma
  - Direct effects of trauma
- Indirect mechanisms
  - Hemorrhage or edema may compress circulation
  - Ischemia and compromise of function
- Electrocution
  - Result of extreme muscle contractions



Column Injury

- Movement of vertebrae from normal position
  - Subluxation or dislocation
- Fractures
  - Spinous process and transverse process
  - Pedicle and laminae
  - Vertebral body
- Ruptured intervertebral disks
  - Common sites of injury:
  - C-1/C-2: Delicate vertebrae
  - C-7: Transition from flexible cervical spine to thorax
  - T-12/L-1: Different flexibility between thoracic and lumbar regions

Cord Injury

- Concussion
  - Similar to cerebral concussion
  - Temporary and transient disruption of cord function
- Contusion
  - Bruising of the cord
  - Tissue damage, vascular leakage and swelling
- Compression
  - Secondary to:
    - Displacement of the vertebrae
    - Herniation of intervertebral disk
    - Displacement of vertebral bone fragment
    - Swelling from adjacent tissue

Cord Injury

- Laceration
  - Hemorrhage into cord tissue, swelling and disruption of impulses

  Caused by:
  - Bony fragments driven into the vertebral foramen
  - Cord may be stretched to the point of tearing
- Hemorrhage
  - Associated with contusion, laceration or stretching

Transection

- An injury that partially or completely severs the spinal cord
- Complete transection
  - No impulses below site of injury
  - Cervical spine
    - Quadriplegia
    - Incontinence
    - Respiratory compromise
  - Thoracic spine
    - Paraplegia
    - Incontinence

Incomplete Cord Transection

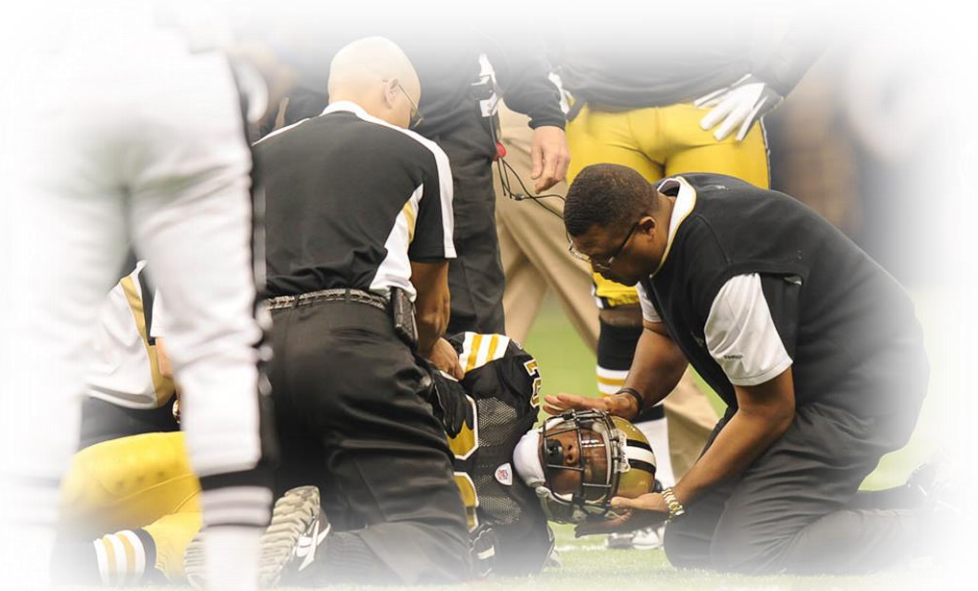
- Anterior cord syndrome
  - Anterior vascular disruption
  - Loss of motor function and sensation of pain, light touch, and temperature below injury site
  - Retain motor, positional and vibration sensation
- Central cord syndrome
  - Hyperextension of cervical spine
  - Motor weakness affecting upper extremities
  - Bladder dysfunction

Incomplete Cord Transection

- Brown-Sequard's syndrome
  - Penetrating injury that affects one side of the cord
  - Ipsilateral sensory and motor loss
  - Contralateral pain and temperature sensation loss

Signs and Symptoms of Spinal Injury

- Extremity paralysis
- Pain with and without movement
- Tenderness along spine
- Impaired breathing
- Spinal deformity
- Priapism
- Posturing
- Loss of bowel or bladder control
- Nerve impairment to extremities
- Deformities (rare)



Spinal Shock

- Temporary insult to the cord
- Affects body below the level of injury
- Affected area
  - Flaccid
  - Without feeling
  - Loss of movement (flaccid paralysis)
  - Frequent loss of bowel and bladder control
  - Priapism
  - Hypotension secondary to vasodilation

Spinal Shock

- Temporary form of neurogenic shock
  - Hypotension
  - Bradycardia
  - Signs of cord injury

Neurogenic Shock

- Injury to the spinal cord disrupts the brain's ability to control the body
- Loss of sympathetic tone
  - Dilation of arteries and veins
  - Expands vascular space
  - Results in relative hypotension
  - Reduced cardiac preload
  - Reduction of the strength of contraction
  - Frank-Starling reflex

Neurogenic Shock

- ANS loses sympathetic control over adrenal medulla
  - Unable to control release of epinephrine and norepinephrine
  - Loss of positive inotropic and chronotropic effects
- Signs and symptoms:
  - Bradycardia
  - Hypotension
  - Cool, moist and pale skin above the injury
  - Warm, dry and flushed skin below the injury
  - Priapism

Autonomic Hyperreflexia Syndrome

- Associated with the body's resolution of the effects of spinal shock
- Commonly associated with injuries at or above T-6
- Presentation:
  - Sudden hypertension
  - Bradycardia
  - Pounding headache
  - Blurred vision
  - Sweating and flushing of skin above the point of injury

Other Causes of Neurologic Dysfunction

- Any injury that affects the nerve impulse's path of travel
  - Swelling
  - Dislocation
  - Fracture
  - Compartment syndrome

Assessment

- Scene assessment
  - Special emphasis on mechanism of injury
  - When in doubt, assume cord injury
    - Head injury
    - Intoxicated patients
    - Injuries above the shoulders
    - Distracting injuries
- Primary assessment
  - Immediate manual immobilization
  - Maintain neutral alignment if possible

Assessment

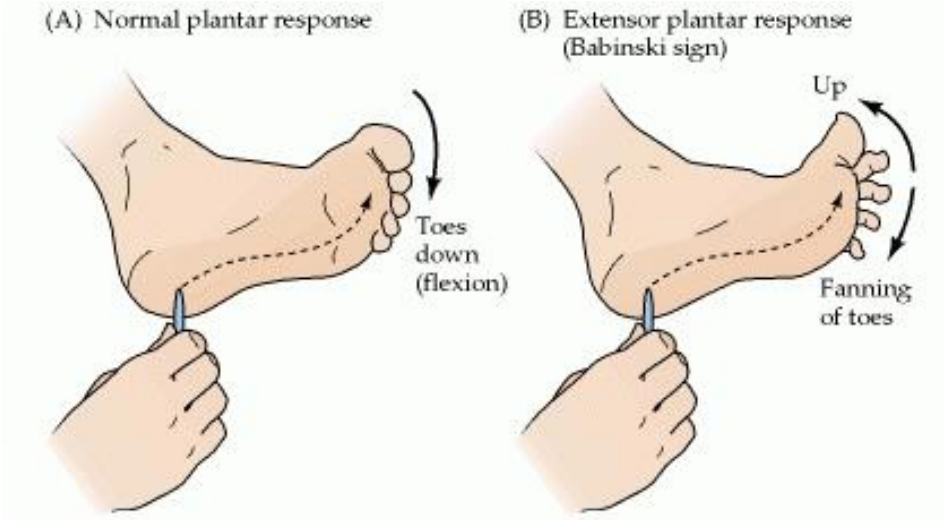
- Neck
  - Deformity, pain, crepitus, warmth, tenderness
- Bilateral extremities
  - Finger abduction/adduction
  - Push, pull, grips
  - Motor and sensory function
- Dermatome and myotome evaluation
- Babinski sign test
- Hold-up position

FIGURE 24–4 Compare grip strength bilaterally.

FIGURE 24–5 Compare lower limb strength bilaterally.

Babinski's Sign

- Stroke lateral aspect of the bottom of the foot
- Evaluate for movement of the toes
- Fanning and flexing (lifting)
  - Injury along the pyramidal (descending spinal) tract



Vital Signs

- Caution with patients with bradycardia
  - Especially in suspected hypovolemia and shock
- Potential for spinal cord injury increased with
  - Low blood pressure
  - Absent, diaphragmatic or shallow respirations

Management

- Spinal alignment
- Manual cervical immobilization
- Cervical collar
- Immobilization and movement

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C-Spine Clearance

The Canadian C-Spine Rule

Please check off all choices within applicable boxes:

1. Any One High-Risk Factor Which Mandates Immobilization?

No	Yes	
O	O	Age ≥ 65 years
		OR
O	O	Dangerous mechanism *
		OR
O	O	Numbness or tingling in extremities

O Yes → O C-Spine Immobilization

O No ↓

2. Any One Low-Risk Factor Which Allows Safe Assessment of Range of Motion?

No	Yes	
O	O	Simple rearend MVC **
		OR
O	O	Ambulatory at any time at scene
		OR
O	O	No neck pain at scene when asked
		OR (answer "yes" if no pain)
O	O	No pain during midline c-spine palpation (answer "yes" if no pain)

O No → O C-Spine Immobilization

O Yes ↓

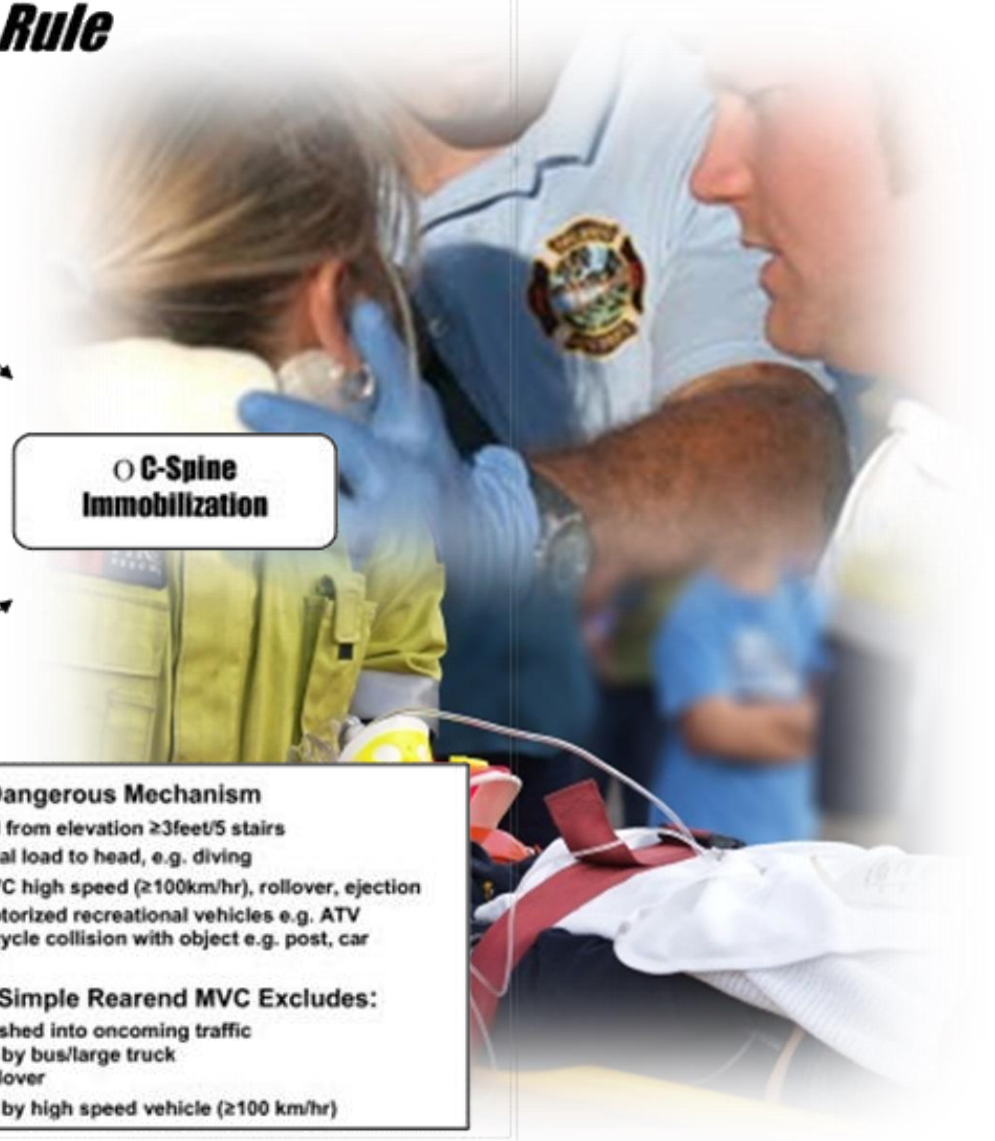
3. Patient Voluntarily Able to Actively Rotate Neck 45° Left and Right When Requested, Regardless of Pain?

No	Yes
O	O

O Unable → O C-Spine Immobilization

O Able ↓

O No C-Spine Immobilization ***



*** Dangerous Mechanism**

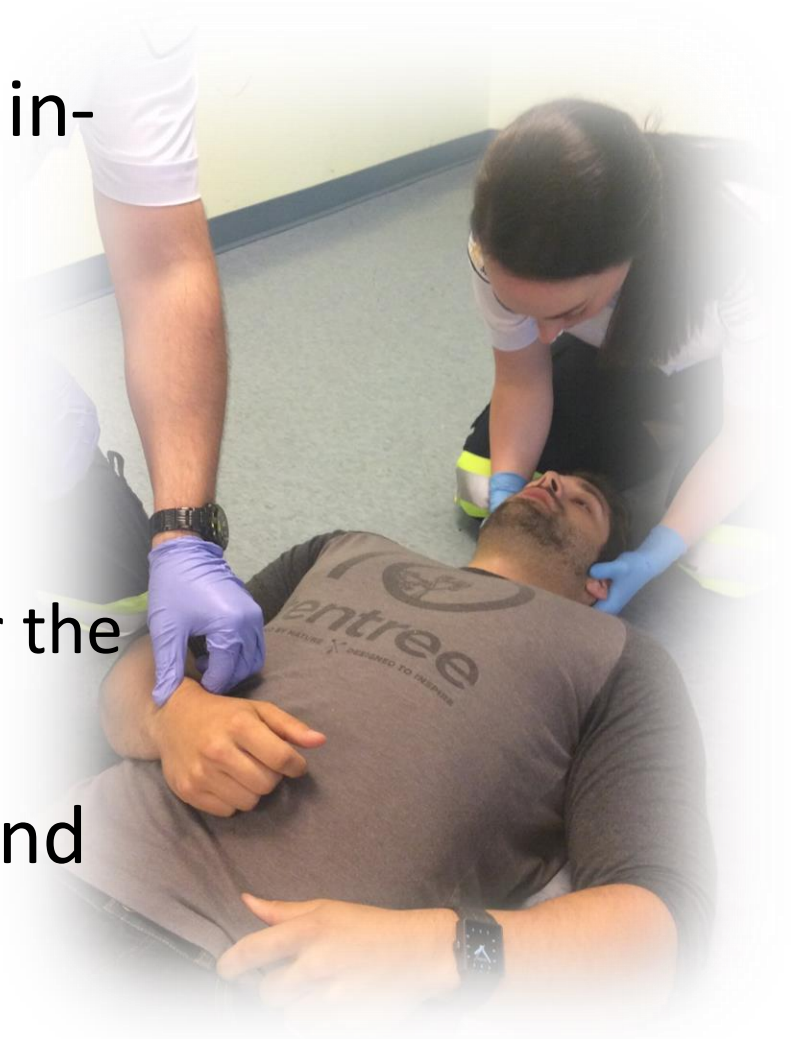
- -fall from elevation ≥3feet/5 stairs
- -axial load to head, e.g. diving
- -MVC high speed (≥100km/hr), rollover, ejection
- -motorized recreational vehicles e.g. ATV
- -bicycle collision with object e.g. post, car

**** Simple Rearend MVC Excludes:**

- -pushed into oncoming traffic
- -hit by bus/large truck
- -rollover
- -hit by high speed vehicle (≥100 km/hr)

Spinal Alignment

- Move patient to a neutral, in-line position
  - Position of function
  - Hips and knees should be slightly flexed
  - Place a rolled blanket under the knees
- Always support the head and neck



Spinal Alignment

- Contraindications to neutral position
  - Movement causes a noticeable increase in pain
  - Noticeable resistance met during procedure
  - Increase in neurological deficits occurs during movement
  - Gross deformity of spine
- Less movement is always best

Manual Cervical Immobilization

- Seated patient
  - Approach from front
  - Assign a care giver to hold gentle manual traction
    - Reduce axial loading
  - Evaluate posterior cervical spine
  - Position patient's head slowly to a neutral, in-line position
- Supine patient
  - Assign a care giver to hold gentle manual traction
  - Adult
    - Lift head off ground 1-2": neutral, in-line position
  - Child
    - Position head at ground level: Avoid flexion

Cervical Collar Application

- Apply the c-collar as soon as possible
- Assess neck prior to placing
- C-collar limits some movement and reduces axial loading
- Does not completely prevent movement of the neck

Cervical Collar Application

- Size and apply according to the manufacturer's recommendation
  - Size collar before application
  - Collar should fit snug
  - Collar should not impede respirations
  - Head should continue to be in neutral position
- Do not release manual control until the patient is fully secured in a spinal restriction device

Helmet Removal

- Indications:
  - Helmet does not immobilize the patient's head within
  - Cannot securely immobilize the helmet to the long spine board
  - Helmet prevents airway care
  - Helmet prevents assessment of anticipated injuries
  - Present or anticipated airway or breathing problems
  - Removal will not cause further injury

Helmet Removal

- 2 Rescuers
  - Have a plan and communicate
  - Remove face mask and chin strap
  - Immobilize head
    - Slide one hand under back of neck and head
    - Other hand supports anterior neck and jaw
  - Remove helmet
    - Gently rock head to clear occiput
    - All actions should be slow and deliberate
  - Transport the helmet with patient

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Helmet Removal

FIGURE 24-12 Helmet removal.

Movement

- Any movement must be coordinated
  - 4 count is a desirable cadence
- Move patient as a unit
  - Avoid lateral pushing
  - Move patient up and down to prevent lateral bending
- Rescuer at the head calls all moves
- All moves must be slowly executed and well coordinated
- Consider the final positioning of the patient prior to beginning move

Types of Moves

- Log roll
- Straddle slide
- Rope-sling slide
- Orthopedic stretcher
- Vest-type immobilization
- Rapid extrication
- Final patient positioning
- Long spine board
- Diving injury immobilization

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The Four-Person Log Roll

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Kendrick Extrication Device
(Vest-type Immobilization Devices)

Kendrick Extrication Device
(Vest-type Immobilization Devices)

- The vest-type immobilization device is not intended for lifting the patient but for pivoting them

Rapid Extrication

- Rapid extrication of a patient with a spinal injury

Immobilization

- Immobilization of a spinal injury patient to a long spine board with a cervical immobilization device in place

Coming to a Consensus

Recent evidence has called into question long-held treatment of potential spinal trauma

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Coming to a Consensus

Pre-hospital spinal immobilisation: an initial consensus statement

D Connor,[1] I Greaves,[2] K Porter,[3] M Bloch,[4] On behalf of the consensus group, Faculty of Pre-Hospital Care

INTRODUCTION

Spinal injuries are thankfully relatively uncommon but have the potential to cause very significant morbidity and mortality. It is reported that between 0.5% and 3% of patients presenting with blunt trauma suffer spinal cord injury (SCI).[1 2] The incidence varies globally and time has yielded increased numbers of injuries annually. American figures estimate an incidence in the region of 40 cases per million per year.[3] In the UK, the majority of traumatic SCI are attributable to land transport (50%), followed by falls (43%), then sport (7%).[4] Of those fractures causing SCI, half involve fractures of the cervical spine, with 37% due to thoracic spine injury and 11% due to lumbar spine injury. Of the C-spine, 50% occur at the C6/7 junction and a third at C2.[5] Data show a crossover rate in the region of 10%–15% of patients with a confirmed cervical fracture also having a thoracolumbar fracture.[6] It is well recognised that immobilisation is not without harm but the 'number needed to treat' in order to include one actual injury is high.

SCI occurs when unstable spinal fractures (only diagnosed by imaging in hospital) cause direct mechanical damage as a result of traction and compression, following which ischaemia and cord swelling ensues. Unstable fractures are those where there is disruption of two or three vertebral columns. The anterior column is formed by the anterior longitudinal ligament and the anterior half of the vertebral body, disc and annulus, the middle column by the posterior half of the vertebral body, disc and annulus and the posterior longitudinal ligament and the posterior column by the facet joints, ligamentum flavum, the posterior elements and the interconnecting ligaments.

Immobilisation is based on the logical premise that preventing movement should decrease the incidence of SCI or further deterioration of existing damage. This is undertaken by, in effect, adding external supports to the body, preventing secondary injury during extrication, resuscitation, transport and evaluation.

Immobilisation is a routinely performed procedure in the prehospital environment. Its potentially serious adverse sequelae and the litigious nature of modern medicine have seen the development of an extraordinarily conservative approach to immobilisation where it is applied in many cases in which neither the mechanism of injury nor the clinical findings would support its use.

Methods vary and research has drawn together consensus opinion on immobilisation techniques. Common practice involves the use of a rigid cervical collar, head blocks with straps or tapes and a long board with straps. A number of organisations use the orthopaedic scoop stretcher or Kendrick Extrication Device. The scoop stretcher is of value in reducing the amount of handling to which victims of trauma are subjected and the Faculty of Pre-Hospital Care is shortly to issue consensus guidance regarding *minimal handling protocols* in trauma. The vacuum mattress is indicated in prolonged transportation to minimise the risks explained below. A pelvic sling should therefore be placed in the correct position in the vacuum mattress and the patient transferred in the scoop onto the mattress and the pelvic binder fastened appropriately. Once on a vacuum mattress, the scoop can be removed in such prolonged transfers.

SEARCH STRATEGY

Prior to the Faculty meeting in March 2012, a review of the published literature was undertaken using PubMed to search the Medline database. Secondary searches were made using UK PubMed Central and Google Scholar. The search terms included prehospital, out-of-hospital, spinal immobilisation, cervical collar and c-spine clearance. A tertiary search analysed the references of retrieved articles to identify further sources.

THE DEBATE

Immobilisation is a key concept in most trauma guidelines. The ATLS course recommends that all trauma patients considered to be at potential risk of spinal injury have immediate neck immobilisation.[7] This guidance is founded upon expert opinion rather than definitive evidence and current protocols have a strong historical rather than scientific precedent. In the practice's favour, Reid in 1987 reported that secondary neurological injury occurred in 1.4% of patients with spinal injury diagnosed in the ED whereas the secondary neurological injury rate was 10.5% in those in whom a diagnosis of spinal injury was missed.[8]

However, a full review undertaken by Kwan and colleagues concluded that there is no high-level evidence quantifying the effect of immobilisation versus no immobilisation on adverse effects.[9] They commented that the low prevalence of SCI would mean 50–100 patients would need to be immobilised for every patient at risk of SCI. Opinions are increasingly being expressed that the practice is overused and needs review since the procedure itself is not benign. It is uncomfortable; takes time and delays initiation of specialist treatment in time-critical patients; raises intracranial pressure; increases aspiration risk and the risk of decubitus ulceration; and also potentially reduces airway opening and respiratory efficacy.[9] Indeed, the latter two risks refute an axiom of prehospital care where airway maintenance takes precedence over other considerations. Kwan concludes her review by stating that, "*…the possibility that immobilisation may increase mortality and morbidity cannot be excluded.*"

Hauswald's biomechanics have been published several times.[10 11] His group surmises that injury is done at the time of impact by forces of greater magnitude than those encountered in subsequent movement, which is generally not sufficient to cause further damage. They comment that the alert patient will develop a position of comfort with muscle spasm protecting a damaged spine.

A 2009 review also concluded that the alert, cooperative patient does not require immobilisation even if a clinical decision rule is positive, unless their conscious level deteriorates.[12] They state that muscle spasm is a superior method to an artificial procedure. The College of Emergency Medicine guidance emphasises the need for large-scale studies[13] while acknowledging

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"Opinions are increasingly being expressed that the practice is overused and needs review since the procedure itself is not benign" (Connor et al., 2013).

"Validation of the Canadian C-Spine Rule in the prehospital setting has been undertaken and its reliability proven. Qualitative studies have shown that paramedics are comfortable using it" (Connor et al., 2013).

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Coming to a Consensus

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Pre-Hospital Care Management of a Potential Spinal Cord Injured Patient: A Systematic Review of the Literature and Evidence-Based Guidelines

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Abstract

An interdisciplinary expert panel of medical and surgical specialists involved in the management of patients with potential spinal cord injuries (SCI) was assembled. Four key questions were created that were of significant interest. These were: (1) what is the optimal type and duration of pre-hospital spinal immobilization in patients with acute SCI?; (2) during airway manipulation in the pre-hospital setting, what is the ideal method of spinal immobilization?; (3) what is the impact of pre-hospital transport time to definitive care on the outcomes of patients with acute spinal cord injury?; and (4) what is the role of pre-hospital care providers in cervical spine clearance and immobilization? A systematic review utilizing multiple databases was performed to determine the current evidence about the specific questions, and each article was independently reviewed and assessed by two reviewers based on inclusion and exclusion criteria. Guidelines were then created related to the questions by a national Canadian expert panel using the Delphi method for reviewing the evidence-based guidelines about each question. Recommendations about the key questions included: the pre-hospital immobilization of patients using a cervical collar, head immobilization, and a spinal board; utilization of padded boards or inflatable bean bag boards to reduce pressure; transfer of patients off of spine boards as soon as feasible, including transfer of patients off spinal boards while awaiting transfer from one hospital institution to another hospital center for definitive care; inclusion of manual in-line cervical spine traction for airway management in patients requiring intubation in the pre-hospital setting; transport of patients with acute traumatic SCI to the definitive hospital center for care within 24 h of injury; and training of emergency medical personnel in the pre-hospital setting to apply criteria to clear patients of cervical spinal injuries, and immobilize patients suspected of having cervical spinal injury.

Key words: pre-hospital care; spinal cord injury; systematic review

Introduction

GREAT CARE MUST BE TAKEN when providing medical care to an acutely injured patient prior to arrival at hospital. About 2% of all blunt trauma patients will have sustained a spinal cord injury, and these rates are higher in the setting of severe closed head injury (Crosby, 1992, 2006). Patients with acute spinal cord injury (SCI) are at risk of neurologic deterioration due to secondary injury to the spinal cord (Fehlings and Louw, 1996). A potential cause of secondary injury is through inadvertent manipulation of the spinal cord in setting of an unstable spinal column injury (Crosby, 1 Eismont et al., 2004; Fehlings and Louw, 1996; Fernstrom 1995). Minimizing the chances of secondary injury can challenging in the pre-hospital setting due to the local transport environment, a lack of resources, and heterogen in health care providers and their skill sets (Hauswald et 2000). Furthermore, treatments initiated prior to arrival a hospital can lead to significant morbidity in other body gions, such as sacral and occipital ulcers (Cordell et al., 1

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[5]Department of Emergency Medicine, and [6]Department of Emergency Medicine, Surgery and Community Health and Epidemiol Dalhousie University, Halifax, Nova Scotia, Canada.

"If patients met all the criteria, paramedics could transport them without spinal immobilization. They found that there was a 33% reduction in the utilization of spinal immobilization compared to pre-study data" (Muhr et al., 1999).

"patients should be transferred off the hardboard on admission to a facility as soon as is feasible to minimize time on the hardboard" (Ahn et al., 2009).

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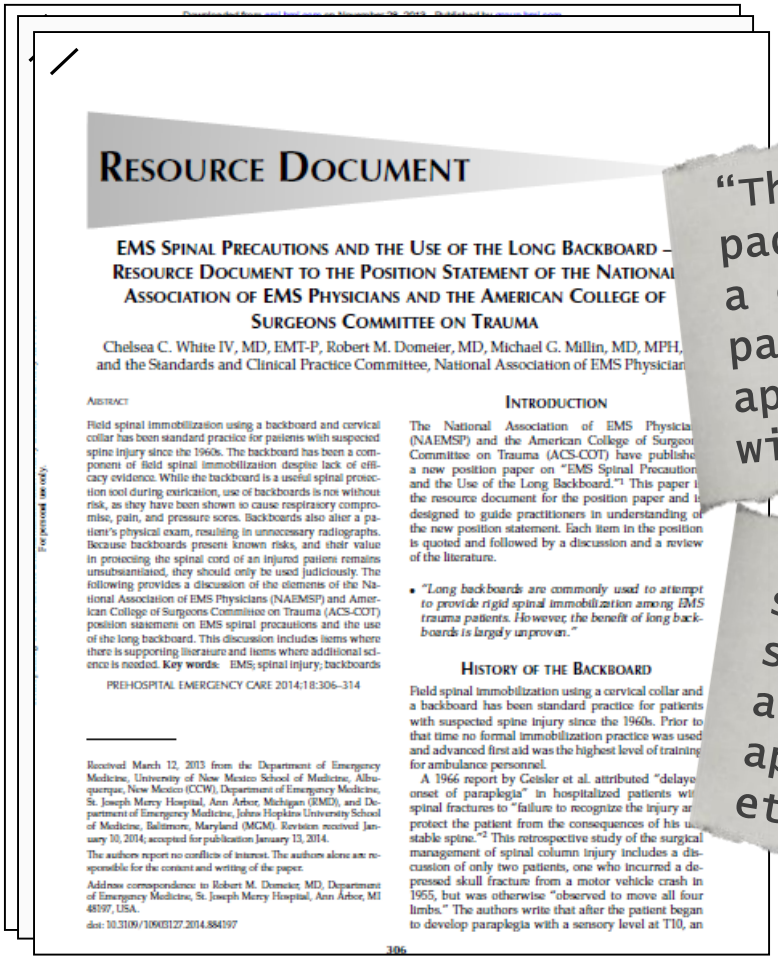
Coming to a Consensus



RESOURCE DOCUMENT

EMS SPINAL PRECAUTIONS AND THE USE OF THE LONG BACKBOARD – RESOURCE DOCUMENT TO THE POSITION STATEMENT OF THE NATIONAL ASSOCIATION OF EMS PHYSICIANS AND THE AMERICAN COLLEGE OF SURGEONS COMMITTEE ON TRAUMA

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ABSTRACT

Field spinal immobilization using a backboard and cervical collar has been standard practice for patients with suspected spine injury since the 1960s. The backboard has been a component of field spinal immobilization despite lack of efficacy evidence. While the backboard is a useful spinal protection tool during extrication, use of backboards is not without risk, as they have been shown to cause respiratory compromise, pain, and pressure sores. Backboards also alter a patient's physical exam, resulting in unnecessary radiographs. Because backboards present known risks, and their value in protecting the spinal cord of an injured patient remains unsubstantiated, they should only be used judiciously. The following provides a discussion of the elements of the National Association of EMS Physicians (NAEMSP) and American College of Surgeons Committee on Trauma (ACS-COT) position statement on EMS spinal precautions and the use of the long backboard. This discussion includes items where there is supporting literature and items where additional science is needed. **Key words:** EMS; spinal injury; backboards

PREHOSPITAL EMERGENCY CARE 2014;18:306–314

INTRODUCTION

The National Association of EMS Physicians (NAEMSP) and the American College of Surgeons Committee on Trauma (ACS-COT) have published a new position paper on "EMS Spinal Precautions and the Use of the Long Backboard."[1] This paper is the resource document for the position paper and is designed to guide practitioners in understanding of the new position statement. Each item in the position is quoted and followed by a discussion and a review of the literature.

- *"Long backboards are commonly used to attempt to provide rigid spinal immobilization among EMS trauma patients. However, the benefit of long backboards is largely unproven."*

HISTORY OF THE BACKBOARD

Field spinal immobilization using a cervical collar and a backboard has been standard practice for patients with suspected spine injury since the 1960s. Prior to that time no formal immobilization practice was used and advanced first aid was the highest level of training for ambulance personnel.

A 1966 report by Geisler et al. attributed "delayed onset of paraplegia" in hospitalized patients with spinal fractures to "failure to recognize the injury and protect the patient from the consequences of his unstable spine."[2] This retrospective study of the surgical management of spinal column injury includes a discussion of only two patients, one who incurred a depressed skull fracture from a motor vehicle crash in 1955, but was otherwise "observed to move all four limbs." The authors write that after the patient began to develop paraplegia with a sensory level at T10, an

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"The ambulance stretcher is in effect a padded backboard and, in combination with a cervical collar and straps to secure the patient in a supine position, provides appropriate spinal protection for patients with spinal injury" (White et al., 1999).

"Patients who are ambulatory or able to self-extricate without causing undue pain should be encouraged to move themselves to a supine position on the EMS cot, after application of a cervical collar" (White et al., 2014).

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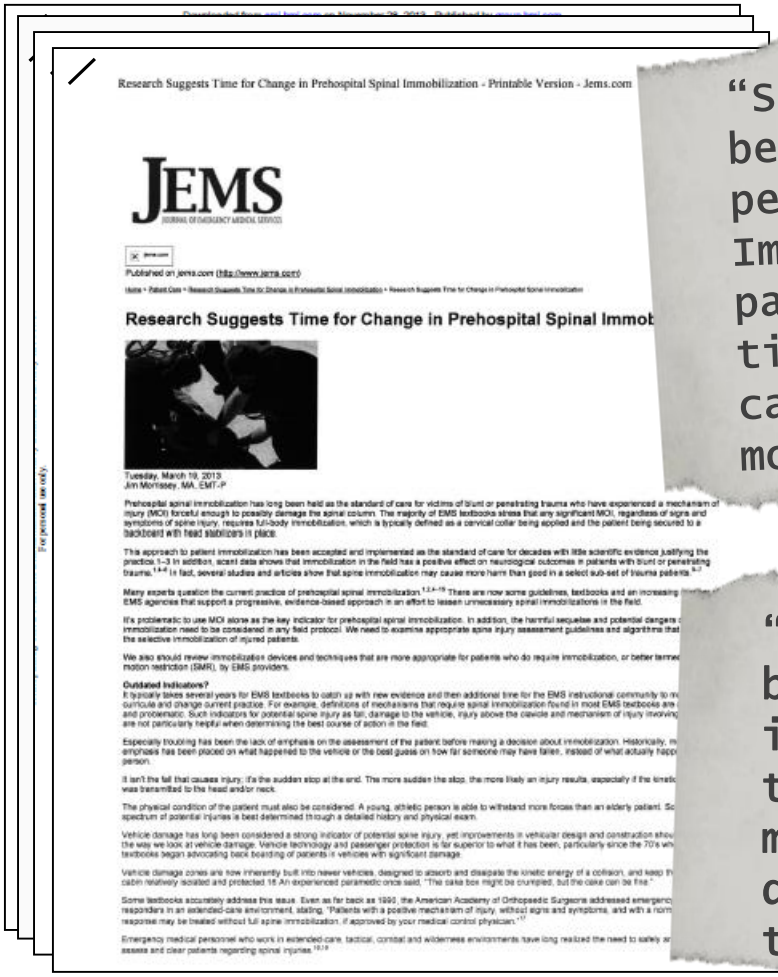
Coming to a Consensus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Research Suggests Time for Change in Prehospital Spinal Immob

Tuesday, March 19, 2013
Jim Morrissey, MA, EMT-P

"Studies have also shown limited or no benefit of prehospital immobilization of penetrating trauma patients. Immobilization of this subset of trauma patients can result in prolonged on-scene time and delayed transport to definitive care, which may increase morbidity and mortality" (Morrissey, 2013).

"Spinal immobilization isn't always a benign intervention. It can result in increased scene time, delay of delivery to definitive care, problematic airway management, increased patient pain or dyspnea, and unnecessary radiographic testing" (Morrissey, 2013).

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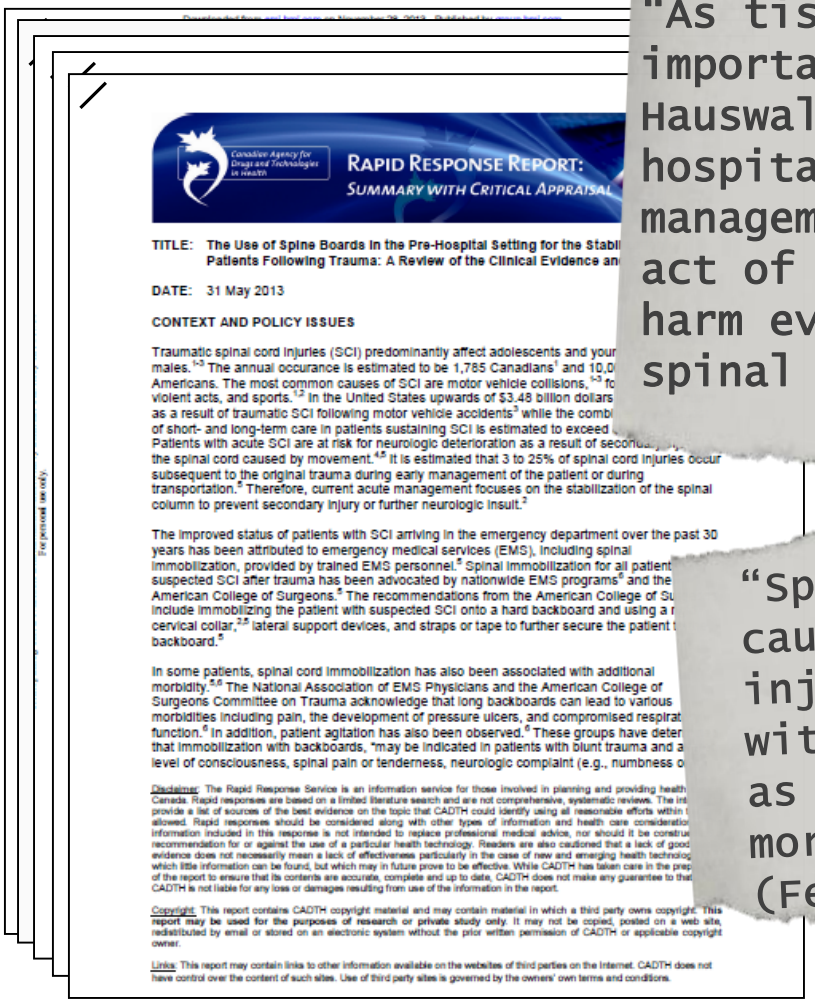
Coming to a Consensus



Canadian Agency for Drugs and Technologies in Health

RAPID RESPONSE REPORT:
SUMMARY WITH CRITICAL APPRAISAL

TITLE: The Use of Spine Boards in the Pre-Hospital Setting for the Stabi
Patients Following Trauma: A Review of the Clinical Evidence an

DATE: 31 May 2013

CONTEXT AND POLICY ISSUES

Traumatic spinal cord injuries (SCI) predominantly affect adolescents and your
males.[1-3] The annual occurance is estimated to be 1,785 Canadians[1] and 10,0
Americans. The most common causes of SCI are motor vehicle collisions,[1-3] fo
violent acts, and sports.[1,2] In the United States upwards of $3.48 billion dollars
as a result of traumatic SCI following motor vehicle accidents[3] while the combi
of short- and long-term care in patients sustaining SCI is estimated to exceed
Patients with acute SCI are at risk for neurologic deterioration as a result of secon
the spinal cord caused by movement.[4,5] It is estimated that 3 to 25% of spinal cord injuries occur
subsequent to the original trauma during early management of the patient or during
transportation.[5] Therefore, current acute management focuses on the stabilization of the spinal
column to prevent secondary injury or further neurologic insult.[2]

The improved status of patients with SCI arriving in the emergency department over the past 30
years has been attributed to emergency medical services (EMS), including spinal
immobilization, provided by trained EMS personnel.[5] Spinal immobilization for all patient
suspected SCI after trauma has been advocated by nationwide EMS programs[6] and the
American College of Surgeons.[5] The recommendations from the American College of Su
include immobilizing the patient with suspected SCI onto a hard backboard and using a r
cervical collar,[2,5] lateral support devices, and straps or tape to further secure the patient
backboard.[5]

In some patients, spinal cord immobilization has also been associated with additional
morbidity.[5,6] The National Association of EMS Physicians and the American College of
Surgeons Committee on Trauma acknowledge that long backboards can lead to various
morbidities including pain, the development of pressure ulcers, and compromised respirat
function.[6] In addition, patient agitation has also been observed.[6] These groups have deter
that immobilization with backboards, "may be indicated in patients with blunt trauma and a
level of consciousness, spinal pain or tenderness, neurologic complaint (e.g., numbness o

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provide a list of sources of the best evidence on the topic that CADTH could identify using all reasonable efforts within t
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which little information can be found, but which may in future prove to be effective. While CADTH has taken care in the prep
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"As tissue hypoxia remains the most important factor in trauma management, Hauswald (2012) point out that delaying hospital care (i.e. surgery, airway management, blood transfusions) through the act of spinal stabilization can subsequently harm even those patients with unstable spinal injury" (Fehlings et al., 2013).

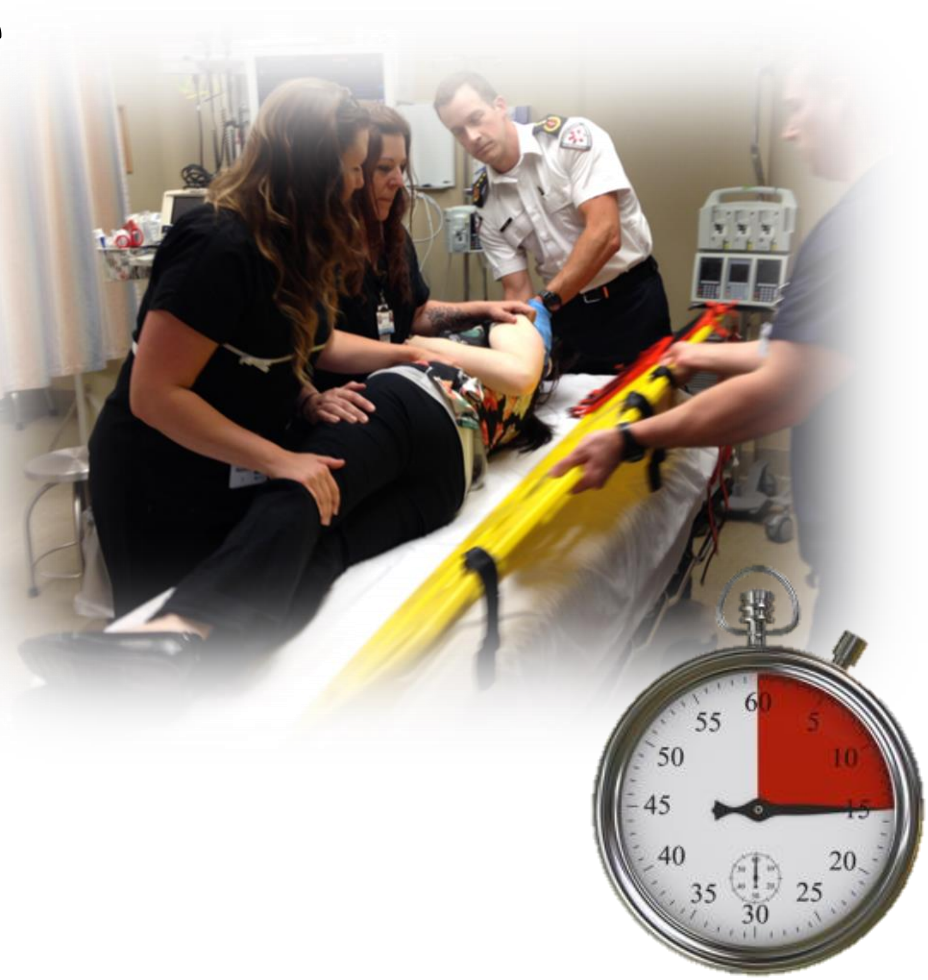
"Spinal immobilization has also been cautioned in the patient with penetrating injuries to the body, neck, or head without neurologic complaint or deficit as an association with increased mortality has been observed with its use" (Fehlings et al., 2013).

Changes Within the Industry

- Industry standards are changing to reflect recent evidence:
  - C-spine ‘clearance’ has been validated as safe practice by paramedics
  - Long board splinting is not benign; in fact carries significant risk
  - Standing take-downs may be risky and unnecessary
  - Boarding patients with penetrating injuries (not associated with neurological deficit) has been shown to cause harm
  - Self-extrication (where possible) is likely tied to fewer iatrogenic injuries

Changes Within the Industry

- Receiving trauma centers are responsible for the early removal of the long spine board
  - Even in the presence of suspected spinal cord injury
- Target time should be 15 minutes unless immediate clinical interventions are necessary



Changes Within the Industry

- Paramedics should advise receiving staff of total board time and be engaged in the early removal of the patient

Changes Within the Industry

- Scoop stretchers can be useful in the field and at the hospital

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Applying the Scoop Stretcher

Adjusting for Length

- Move the lock-pin lever on each side of the frame to the unlocked position
- Pull the foot section to the desired length
- Return the lock-pin levers to the locked position
- Push or pull the foot section until it locks in place

Separating

- Separate the stretcher
- Place the separated halves on either side of the patient
- Align right and left halves of the head and foot couplings; push together until Twin Safety Locks ® engage

Pediatric Immobilization

- The Pedi-Pac® provides spinal immobilization and restraint for children from 28 – 54” tall and weighing 9 to 41 kg

Pediatric Immobilization

- Built-in fastening loops connect to existing cot straps for maximum patient safety during transport.
- Individual leg restraints allow one leg to be immobilized while EMT attends to other leg.
- Adjustable head support with ear openings for monitoring fluid drainage
- Replaceable, colour-coded straps for easy identification
- Unit comes complete with head and chin straps and carrying case
- Sewn-in lifting handles at both ends for easy handling in confined areas.

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Pediatric Immobilization

Medications

- Steroids
  - Reduce the body's response to injury
  - Reduce swelling and pressure on cord
  - Administered within 1st 8 hours of injury
- Methylprednisolone (Solu-Medrol)
  - Reduce capillary dilation and permeability
- Dexamethasone (Decadron, Hexadrol)
  - Reduce capillary dilation and permeability
  - Five times more potent than Solu-Medrol

Medications

- Neurogenic shock
  - Fluid challenge
  - Dopamine
  - Atropine
- Combative patients
  - Consider sedatives to reduce anxiety and calm patient
    - Prevents spinal injury aggravation
  - Alters LOC
  - Medications
    - Meperidine (Demerol)
    - Diazepam (Valium)
    - Consider paralytics

Summary

- Pathophysiology
- Assessment
- Management