To Backboard or Not To Backboard, That is the Question? – Selective Spinal Immobilization

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Lecture Summary:
With evidence based medicine becoming a new standard in EMS, how do we change our protocols on things such as spinal immobilization that have been the standard of care without being proven as the best patient practice.

Objectives:

1) Review anatomy and injuries of spine injuries.
2) Discuss current standard of care and protocols regarding spine injuries.
3) Review research on spine injuries and evaluation/treatment standards.
4) How to implement focused selective spinal immobilization protocols in your system.
Objective 1 – Review anatomy and injuries of spine injuries.

See presentation slide notes.

Objective 2 - Discuss current standard of care and protocols regarding spine injuries

Spine immobilization for trauma based on mechanism of injury is one of the most frequently performed prehospital procedures. For some patients, effective spinal immobilization is prudent, yet for many the excessive use of this precaution may not be beneficial or necessary, and may do harm. It is estimated that over 50% of patients currently immobilized could be saved this procedure without untoward effects. The ‘old’ unproven standard of care for all patients with concern/mechanism for spinal column/cord injury is based on historical rather than scientific precedent.

Several EMS systems have successfully implemented selective spinal immobilization protocols that have proven to be safe and effective. In other countries in the world where little or no EMS systems exist, data has shown that outcomes are no worse without spinal immobilization. It is thought that the massive trauma exerted to cause an injury occurs at the time of the accident, not from limited motion during treatment that is orders of magnitude less, and thus unlikely to cause further injury. There are significant benefits of these protocols in Urban, Rural, and Wilderness EMS settings.

Objective 3 – Review Research on spine injuries and evaluation/treatment standards.

Reference/Research Summaries:


Evaluation of Maine’s (primarily rural state) Prehospital selective spine assessment protocol instituted July 1, 2002. In the 12 month study period, only one patient with an unstable spine fracture, and 19 stable fractures, were found to have not been immobilized by the protocol in approximately 32,000 trauma encounters. This single unstable spine injured patient was a 86 y.o. female who moved furniture one week prior to calling EMS and had a T6/7 subluxation that required operative fusion without any spinal cord injury. The protocol effectively decreased the number of patients immobilized by more than half. Its Sensitivity was 94.1% (CI95 of 82.9-100), Negative Predictive value of 99.9% (CI95 of 99.8-100), Specificity 59.3% (95CI of 58.8-59.8), and Positive Predictive Value of 0.1% (95CI of 0.1-0.1) for unstable acute spine fractures (unstable=required surgery). This study applied the rule to whole spine(C, T, and L).The protocol was instituted in patients with a mechanism of injury:

a) Axial loading (diving)
b) Blunt trauma
c) MVC – all motorized vehicles including automobile, motorcycle, snowmobile, etc.
d) Adult fall from standing height
Then if they were reliable (calm, cooperative, sober, and alert) without intoxication, altered LOC, or Acute Stress reaction. Also no distracting injury (any injury that produces clinically apparent pain that might distract the pain from the pain of a spine injury).
If the patient was then found to have no abnormal sensory/motor exam and no spine pain/tenderness they didn’t need to be immobilized. Very similar to NEXUS criteria. Elderly patients > 65 y.o. seemed to be the largest number of stable spine fractures without neurologic compromise, but also higher risk of complications (pain, pressure sores, respiratory compromise, etc.) from spinal immobilization. Simple and safe application of a selective spinal immobilization protocol that supports pre-hospital EMS use.

Same study population as above reference (Burton, Trauma 2006) but looked more the historic perspective of the Maine spine protocols and reasons why patients were immobilized (disqualified from non-immobilization). Immobilization decision was made for 1,301 (59%) of 2,220 patients in which spine assessment from was completed: 416 (32%) were unreliable, 358 (28%) were considered to have distracting injuries, 80(6%) had abnormal neurological exam, and 709 (54%) had spine pain or tenderness. Linked hospital data showed that of the 2,220 patients, only 7 acute spine fractures, which were all appropriately immobilized. This study concluded that the pre-hospital spine assessment protocol resulted in a non-immobilization decision in approximately 40% of their trauma patients without any adverse outcomes or misses.

Prospective ALS pre-hospital EMS system in two southeast Michigan counties (mixed suburban/rural) that implemented a spine injury assessment protocol in October 1997 and examined 4 years of outcome data. The protocol used the similar 5 NEXUS categories for spinal assessment.
  a) altered mental status
  b) evidence of intoxication
  c) suspected extremity fracture
  d) neurologic deficit
  e) spine pain or tenderness
There were 18,594 trauma patients with evaluation by protocol in 13,483 patients. Complete data for 13,357 available for analysis. Spine injuries confirmed in 415 (3%) and 50 patients had cord injuries (12% - 50 of 415). Sensitivity of the protocol was 92% (CI95 of 89.4-94.6) resulting in the nonimmobilization of 8% of the patients with spine injuries (33 of 415), but none had spinal cord injury. Specificity was 40% (CI95 of 38.9-40.5). 39% of patients were appropriately cleared from spinal immobilization. Some deviation from the protocol occurred, but none had a spinal cord injury. The protocol resulted in immobilization or most patients without causing harm because of spine immobilization.

Initial recommendations in the 1970’s from the Academy of Orthopedic Surgeons recommended spinal immobilization for patients with symptoms or physical findings after trauma. As ED evaluation of these patients revealed difficulty in accurately assessing these patients, as shift was made in the prehospital setting to immobilize based on mechanism of injury. This practice, although not scientifically based, remains the standard for nearly all US EMS systems. Since the 1990’s there has been an evidence based shift to establish clinical criteria to identify patients who spinal immobilization is not necessary. This began in the emergency department setting and is now becoming more common in prehospital EMS settings. The rational is that spinal immobilization is not an innocuous procedure. There are issues with patient comfort, airway and respiratory compromise, and pressure complications. The recommendations from the NAEMSP state:
Spine immobilization is indicated in prehospital trauma patients who sustain an injury with a mechanism having the potential for causing spinal injury and who have at least one of these criteria:

1. altered mental status
2. evidence of intoxication
3. a distracting painful injury (e.g., long-bone extremity fracture)
4. neurologic deficit
5. spinal pain or tenderness

Patients without mechanism of injury with the potential for causing spinal injury or those patients without one of the above clinical findings may safely have spinal immobilization omitted.


Interesting study that evaluated 5 years of retrospective chart reviews from 2 university hospitals, one in Malaysia without an organized EMS system, and thus no spinal immobilization, and then and modern EMS system in Albuquerque, NM. All patients with acute blunt traumatic spinal or spinal cord injuries transported directly from the injury site to the hospital were evaluated. None of the 120 patients seen at the University of Malaya (16,600 trauma patients) had spinal immobilization and all 334 patients seen at the University of New Mexico did (12,700 trauma patients). Neurologic injuries were labeled as disabling or not. There was less neurologic disability in the unimmobilized Malaysian patients (OR 2.03, CI 95 of 1.03-3.99). This corresponds to a <2% chance that immobilization had any beneficial effect. This study evaluated the entire spine and then again to just c-spine injuries. It was concluded from the data that out-of-hospital immobilization has little or no effect on neurologic outcome in patients with blunt spinal injuries. This was a rare study to be able to find a location that did not do spinal immobilization as it is considered to be the standard of care in many locations. Although this study was a retrospective chart review, it disproves many theories that are the basis of many justifications for spinal immobilization for all patients with blunt trauma.


(NEXUS – National Emergency X-radiography Utilization Study)

Landmark article to move to a standard of clinical spine clearance in selected emergency department patients with blunt trauma and minimal symptoms– prospective observational study. Estimated in US 800,00 cervical spine imaging per year. This study evaluated 34,069 blunt trauma patients in 21 centers-predicted avoidance of radiographic imaging in 4,309 pts (12.6%) – all patients did have films. C-Spine injuries found in 818 pts (18.9%), clinically significant injuries 578 (13.4%). Identified all but 8 of the 818 pts with c-spine injury (sens 99.0% - 95%CI 98.0-99.6%). Negative Predictive Value of 99.8% (95% CI 99.6-100%). Specificity was 12.9% and Positive Predictive Value of 2.7%. Only 2 pts classified as unlikely to have injury had a clinically significant injury – 1 of which did require surgical treatment. Need to have ALL 5 criteria to have low probability of injury (no radiographic study required):

1. No midline cervical tenderness
2. No focal neurologic deficit
3. Normal alertness
4. No intoxication
5. No painful/disturbing injury

Practitioners should be free to make exceptions for individual patients on clinical grounds.


No randomized control trials (RCT) have been performed on trauma patients in regard to spinal immobilization to determine its efficacy, and what techniques are superior. This study reviewed 17 RCT’s on healthy subjects that showed collars, full spine boards, vacuum splints, and abdominal/torso strapping provided the most significant reduction in spinal movement. The studies also clearly demonstrated the
adverse effects of spinal immobilization with increased respiratory effort, skin ischemia, pain, and discomfort.


The review study objective was to quantify the effect of different methods of spinal immobilization (including immobilization versus no immobilization) on mortality, neurological disability, spinal stability and adverse effects in trauma patients. Extensive database searches were performed (MEDLINE, EMBASE, etc) as well as contacting manufacturers in spinal immobilization devices. No randomized controlled trials (RCT) of spinal immobilization strategies in trauma patients were found. Trials in healthy volunteers were excluded. They concluded that the effect of spinal immobilization on mortality, neurological injury, spine stability and adverse effecting trauma patients remains uncertain and needs RCT studies. Airway concerns, breathing problems, pain, increased ICP, and tissue pressure in trauma patients are valid concerns that may lead to worsened morbidity and mortality in spinal immobilized patients without evidence based justification of the procedure. “The current protocol for pre-hospital spinal immobilization has a strong historical rather than scientific precedent.” It is estimated that over 50% of trauma patients without neck/back pain are unnecessarily transported in full spinal immobilization.


This article was an attempt to evaluate the cases for litigated missed cervical spine injuries in 10 states over 5 years. Type I error (inadequate or improper tests ordered) and Type III error (adequate tests were ordered and read accurately but were not sensitive enough to demonstrate injury) were the cases that sometimes could be successfully defended. Type II error (errors occurred when adequate tests were ordered, but were either misread, or not read at all) in all studied cases led to successful litigation against the defendants. Twenty cases were identified and averaged awards for $2.9 million. Eight cases resulted in verdicts in favor of the defendants, but none of these successfully defended cases were a Type II error. If CT scanning and flexion/extension plain films are ordered in patients with a high suspicion of cervical spinal injury, a marked decrease in missed injuries would be reported, and subsequently a decrease in successful litigation.


Prospective observational study in 21 centers identifying demographics of patients requiring spine radiographs from blunt trauma. Cervical spine injury is relatively rare, occurring in only 2-3% of patients with blunt trauma who undergo imaging studies, this study found 2.4% of patients presenting with blunt trauma. Substudy under NEXUS. Relative risk for injuries is greatest with elderly (>64) at 2.09, adult 0.87, and peds (<18) 0.39. Male sex RR of 1.72.


Canadian version of NEXUS with some subtle differences, but similar outcomes and recommendations. Estimated 1 million blunt trauma patients with possible C-Spine injuries are treated in the US each year. Incidence of acute fracture or spinal injury is less than 1%. This study evaluated a convenience sample of 8,924 adults (12,782 pts examined, 577 not x-rayed and couldn’t have 14 day phone f/u – considered less severely injured, 3,281 not enrolled by primary physician for variable reasons – but similar characteristics) in 10 large Canadian community and university hospitals. Patients were alert (GCS>15) and had stable v.s. Exclusions were <16 yo, minor injuries or no significant mechanism, GCS <15, abnormal v.s., injured >48 hours prior, penetrating trauma, paralysis, known vertebral disease, return visits for same complaint, pregnant. Not all patients had radiographs, phone follow up used to confirm no injuries – 2779 (31.1%), C-spine radiography in 6,145 pts (68.9%), CT studies done in 436 pts (4.9%). Of all study patients on 151
(1.7%) found to have clinically important c-spine injury, 28 found to have insignificant injury 28 (0.3%).
Using criteria to find the 151 clinically important cases the rule had a sensitivity (95% CI) of 100% (98-
100%), specificity of 42.5% (40-44%). Potential decrease of radiography using these rules with a relative
reduction of 15.5% (1,383 pts) from 68.9% (6,145 pts) of the total 8,924 pts in the study. The rule would
have also had identified 27 or 28 patients with clinically unimportant C-spine injuries. Same study
population with NEXUS criteria – missed 10 of 148 injuries that were important – giving a sensitivity of
only 93%. Needs further prospective study to validate.
Canadian C-spine rule – if all are met than no radiography is needed
Patients must first be:
1. Alert (GCS 15)
2. Stable v.s. in trauma patient where C-Spine injury is a concern
Then:
1. <65 yo
2. No dangerous mechanism (fall >= 5m/5 stairs, axial load-diving, MVC >100km/h (62mph),
rollover, ejection, motorized recreational vehicles, bicycle collision)
3. No paresthesias in extremities
Any low risk factor that will allow safe ROM:
1. Simple rear-end MVC (excluded are: pushed into oncoming traffic, hit by bus/large truck,
rollover, hit by high-speed vehicle)
2. Sitting position in ED
3. Ambulatory at any time
4. Delayed onset of neck pain (not immediate)
5. Absence of midline c-spine tenderness
Then:
1. Ability to actively rotate head 45 degrees to left and right

Stiell IG, et al. The Canadian C-spine rule versus the NEXUS low-risk criteria in patients with
This study set out to compare the US study NEXUS Low Risk Criteria (NLC) decision rule to guide the
use of cervical spine radiography in trauma patients with the Canadian C-spine Rule (CCR). A prospective
cohort study was performed in 9 Canadian emergency departments who utilized the 2 rules in stable, alert
trauma patients. 394 physicians evaluated 8,283 patients, with an overall incidence of 169 (2%) had actual
clinically important spine injuries. Each patient with the two rules before x-rays were obtained. The CCR
was more sensitive than the NLC (99.4% vs. 90.7%, p <0.001) and more specific 45.1% vs. 36.8%,
p<0.001) at detecting spine injuries. This was only done in a limited age range of 16-65 yo. The CCR is
more complete and thus has better sensitivity and specificity, but more cumbersome for the treating
clinician. There may have been some bias acknowledge by the authors, as this was a Canadian study and
there may have been more research familiarity, thus leading to a better utilization rate for the CCR. The
authors concluded that the CCR was superior to the NLC.

Stroh G, et al. Can an Out-of-Hospital cervical spine clearance protocol identify all patients with
This study evaluated the selective spine immobilization protocol in EMS services in Fresno County, CA
over a 6 year period by retrospective chart reviews at 5 local trauma hospitals. The patients with a
diagnosis of cervical spinal injury were identified. 861 patients with significant injuries were transported
and brought 504 patients by EMS with 495 arrived in spinal immobilization. Of the remaining 9 patients,
2 refused, 2 could not be immobilized, 3 injuries were missed by the protocol criteria, and 2 were missed
because of protocol violations. The result was that the protocol was 99% (C195 97.7-99.7) sensitive and
safe, but should be used with caution at extremes of age (4 patients missed were older than 67 and one was
9 months old).
Objective 4 - How to implement focused spinal assessment protocols in your system.

Review Research (above articles are a start - but you need to do your own as well)
Medical Director and Medical Control support
Review Established Protocols - See appendices for sample protocols.
Develop Protocol that works for your system
Education of EMS providers
Good QA/QI system in place to assure compliance with protocol
Review outcomes and decisions on an ongoing basis
The Canadian C-Spine Rule
For alert (GCS = 15) and stable trauma patients where cervical spine injury is a concern

1. Any High-Risk Factor Which Mandates Radiography?
   Age ≥ 65 years
   Dangerous mechanism*
   or
   Paresthesias in extremities

   No

2. Any Low-Risk Factor Which Allows Safe Assessment of Range of Motion?
   Simple rearend MVC **
   Sitting position in ED
   or
   Ambulatory at any time
   or
   Delayed onset of neck pain ***
   or
   Absence of midline c-spine tenderness

   No

3. Able to Actively Rotate Neck?
   45° left and right

   No

   Able

   No Radiography

* Dangerous Mechanism:
  - fall from elevation > 3 feet / 5 stairs
  - axial load to head, e.g., diving
  - MVC high speed (>160km/hr), rollover, ejection
  - motorized recreational vehicles
  - bicycle collision

** Simple Rearend MVC Excludes:
  - pushed into oncoming traffic
  - hit by bus / large truck
  - rollover
  - hit by high speed vehicle

*** Delayed:
  - i.e., not immediate onset of neck pain

Yes

Radiography

Unable

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Appendix B – Nexus Low-Risk Criteria, Stiell, NEJM, Dec 25, 2003 (full reference above)

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<th>Table 1. The NEXUS Low-Risk Criteria.</th>
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<td>Cervical-spine radiography is indicated for patients with trauma unless they meet all of the following criteria:</td>
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<td>† No posterior midline cervical-spine tenderness,‡</td>
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<td>‡ No evidence of intoxication,§</td>
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<td>§ A normal level of alertness,¶</td>
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<td>¶ No focal neurologic deficit,‖ and</td>
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<td>‖ No painful distracting injuries,‖</td>
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* Criteria are from Hoffman and colleagues.26
† Midline posterior bony cervical-spine tenderness is present if the patient reports pain on palpation of the posterior midline neck from the nuchal ridge to the prominence of the first thoracic vertebra, or if the patient evinces pain with direct palpation of any cervical spinous process.
‡ Patients should be considered intoxicated if they have either of the following: a recent history provided by the patient or an observer of intoxication or intoxicating ingestion, or evidence of intoxication on physical examination such as an odor of alcohol, slurred speech, ataxia, dysmetria, or other cerebellar findings, or any behavior consistent with intoxication. Patients may also be considered to be intoxicated if tests of bodily secretions are positive for alcohol or drugs that affect the level of alertness.
§ An altered level of alertness can include any of the following: a Glasgow Coma Scale score of 14 or less; disorientation to person, place, time, or events; an inability to remember three objects at five minutes; a delayed or inappropriate response to external stimuli; or other findings.
¶ A focal neurologic deficit is any focal neurologic finding on motor or sensory examination.
‖ No precise definition of a painful distracting injury is possible. This category includes any condition thought by the clinician to be producing pain sufficient to distract the patient from a second (neck) injury. Such injuries may include, but are not limited to, any long-bone fracture; a visceral injury requiring surgical consultation; a large laceration, degloving injury, or crush injury; large burns; or any other injury causing acute functional impairment. Physicians may also classify any injury as distracting if it is thought to have the potential to impair the patient’s ability to appreciate other injuries.
Spine Immobilization

Scope of practice: EMT, Parkmedic

Indications: Spinal immobilization is indicated for any patient with a history of trauma or found in the setting of potential trauma (including near-drowning) who meets any of the following criteria:

1. **Unstable Patient**: See Adult and Pediatric Major Trauma Protocols
2. **Pain**: Complaining of neck or back pain (without language barrier)
3. **Tenderness**: Midline posterior neck or back tenderness
4. **Altered mental status**: either GCS less than 15 or evidence of intoxication (drugs or alcohol)
5. **Disturbing injury**: Any injuries which appear to be distracting patient from identifying neck or back pain (ex: major fractures)
6. **Neuro deficit**: Any numbness, tingling or weakness not obviously explained by a co-existing extremity fracture
7. **Restricted or painful range of motion**: if a patient meets none of the above 5 criteria then they should be asked to move their head slowly from side to side and forward and backwards. If they are unable/unwilling to do so or describe pain or numbness/tingling in their arms or legs they should be immobilized.

Equipment: Backboard, rigid cervical collar, tape, straps, head supports

Procedure:

Complete spinal immobilization should ideally include backboard, rigid cervical collar, head support, taping of head to board and strapping of torso/extremities which permits patient to be turned on their side in case of vomiting, without movement of the spine. In the event that such equipment is not immediately available, immobilization can be maintained manually, using a blanket roll or other improvised bilateral head supports that prevent rotation and flexion. Specific attempts at improvising a collar need not be made.

Notes:

1. Children injured in motor vehicle collisions shall be immobilized and transported in their car seats whenever possible. Small children immobilized on a board will often require padding behind their torso to maintain neutral position because of their relatively large head.
2. **C-spine**: splint head to pelvis, no lateral movement of pelvis/legs, limited bending at hips OK for comfort.
   - **T-spine**: splint head to pelvis, immobilize legs at hip (may pad pelvis for comfort)
   - **L-spine/pelvis**: splint t-spine, pelvis, hips. Neck and head may be free for patient comfort.
3. When any doubt exists, err on the side of immobilization. This is especially true in the elderly.

Cross Reference:

Major Trauma – Adult and Pediatric
All other protocols when a potential spinal injury may exist:
   - Altered Mental Status
   - Near Drowning
   - Hypothermia/Hyperthermia

www.maine.gov/dps/ems/docs/Spinal%20QI%20Form.pdf

Figure 1. 2002 Maine EMS Spine Assessment Protocol.

*MVC applies to crashes of all motorized vehicles: e.g. automobile, motorcycle, snowmobile, etc.

** Clearance of the spine requires the patient to be calm, cooperative, sober, and alert.

*** Distracting injury includes any injury that produces clinically apparent pain that might distract the patient from the pain of a spine injury – pain would include medical as well as traumatic etiologies of pain.

This protocol may be used by MEMS licensees, at the AA level or above, who have successfully completed the MEMS Spine Injury Management Course.
PROTOCOL 4: SPINE INJURIES

Spinal assessment criteria allow rescuers to determine the need and justification for spine stabilization in the presence of an uncertain or positive mechanism of injury. This evaluation focuses on patient reliability, spinal column stability and neurologic function. Adequate time must be allowed for the evaluation. A clear assessment means that there is no significant spine injury and no need for spine stabilization.

1. Assess the mechanism. If a positive or uncertain mechanism exists, protect the spine by whatever method is feasible and available. This could include (but is not limited to) manual stabilization in the in-line position.

2. Do a thorough evaluation including a history and physical examination. To rule out a significant spine injury the patient must meet all of the following criteria:
   a. Patient must be reliable. The patient must be cooperative, sober, and alert, and must be free of other distracting injuries significant enough to mask the pain and tenderness of the spine injury.
   b. Patient must be free of spine pain and tenderness.
   c. Patient must have normal motor/sensory function in all four extremities:
      • Finger abduction/adduction or wrist extension (check both hands)
      • Foot plantar flexion/extension or great toe dorsiflexion (check both feet)
      • No complaint of numbness and sensation intact to sharp and dull stimuli in all four extremities
      • If reduced function in one particular extremity can be attributed with certainty to a specific extremity injury (e.g., unstable wrist injury), that deficit alone will not preclude ruling out a spine injury.

3. If a significant spine injury cannot be ruled out, the patient should be stabilized in a safe and comfortable position on a board, litter or other appropriate carrying device. Arrange for transport to hospital.

NB: There are situations in wilderness and technical rescue where the risk of spine stabilization exceeds the presumed benefit. In these circumstances spinal stabilization may be deferred or modified until risk can be mitigated. In unstable scenes or with unstable patients the remote possibility of exacerbating a spine injury may not justify the additional risk associated with stabilization.

The above specified protocol has been authorized for use by Wilderness Medical Associates WALS®, WRM, WEMT, WFR, and WAFA trained employees of the employer named on page one provided that they meet the requirements of the authorization criteria listed on page one.

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Physician Advisor

Field Protocols for Staff Manual
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rev. 02.09.07
Appendix F – Jackson Hole Fire/EMS Selective Spinal Immobilization Protocol
http://www.tetonwyo.org/fire/nav/202210.asp

Jackson Hole Fire/EMS Operations Manual

Approved by: Will Smith, MD, Medical Director
Approved by: Rusty Palmer, Chief
Approved by: Emergency Services Council

Title: Treatment Protocol: Spinal Immobilization Criteria
Division: 17
Article: 420.11
Revised: May-08
Pages: 2

SPINAL IMMOBILIZATION CRITERIA
(Procedure Guidelines)

SCOPE OF PRACTICE: EMT-A, EMT-I, Paramedic

PURPOSE
This protocol applies to patients that have sustained a mechanism of trauma that could cause a spine injury, and then determine if spinal immobilization is required.

SPINAL IMMOBILIZATION CRITERIA

- Assess for mechanism of spine injury. If a significant or uncertain mechanism exists, protect the spine initially by hand stabilization in the in-line position, until a detailed exam can be performed.
- Do a thorough evaluation including a history and physical examination. In patients with sufficient trauma to potentially cause a spine injury, the patient must meet all of the following criteria in order to be transported without spinal immobilization:
  1. Patient must be reliable with normal level of alertness without language barrier. The patient must be cooperative, sober, and alert to person, place, time, and events.
  2. Patient must be free of other distracting injuries significant enough to mask the pain and tenderness of a potential spine injury. "Significance" will vary based on the pain tolerance of the patient and ability to focus on your detailed exam.
  3. Patient must be free of midline spine tenderness.
  4. Patient must have normal motor/sensory function in all four extremities
     - Pt must be able to spread fingers and push/pull toes with equal strength
     - Normal sensation to sharp/pinprick and light touch in all four extremities currently, and no history of such findings since event (even if neurological symptoms have since resolved, they should still receive spinal immobilization).
     - If reduced function in a particular extremity can be attributed with certainty to a condition unrelated to a potential spine injury (elbow fracture that injures the radial nerve and causes wrist drop), that deficit alone will not require spinal immobilization.

- If the patient meets all four above criteria, then the patient must be able to move their head slowly from side to side and forward and backwards without significant pain. Minor muscular pain can be acceptable as long as no other complaints of numbness, tingling, or significant pain is incurred.
- If they are unable or unwilling to move head, then they should be immobilized.
- Patients who need spinal immobilization are determined by the above criteria, not mechanism of injury alone. If a patient can successfully meet all the above criteria, then they do not require...
spinal immobilization. This should be carefully documented.

- If the patient fails to meet any one of the above criteria, then a spine injury should be suspected and the patient must be placed in spinal immobilization. This should be done by using a combination of cervical collar, head blocks, strapping, and backboard (or other appropriate devices). Complete spinal immobilization should allow the patient to be turned on their side without movement of the spine.
- Patients in extremis with a mechanism of trauma should be immobilized and rapidly transported, without delay in performing this selective spinal immobilization.
- Careful neurological monitoring should be documented before and after spinal immobilization.
- Continue care and transport to hospital.

Procedure Guidelines: Spinal Immobilization Criteria