Spinal Immobilization
When is it really needed?

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Objectives

- Review implementation of spinal immobilization
- Discuss negative effects of immobilization
- Review role of immobilization in penetrating trauma
- Understand current recommendation for immobilization

EMSWORLD

Why We Need to Rethink C-Spine Immobilization

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Research Suggests Time for Change in Prehospital Spinal Immobilization

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

PRELIMINARY REPORTS

Out-of-hospital Spinal Immobilization: Its Effect on Neurologic Injury

Mark Hauswald, MD, Gracie Ong, MBBS, Dan Tandberg, MD, Zaliha Omar, MBBS

Objective: To examine the effect of emergency immobilization on neurologic outcome of patients who have blunt traumatic spinal injuries.

Methods: A 5-year retrospective chart review was carried out at 2 university hospitals. All patients with acute blunt traumatic spinal or spinal cord injuries transported directly from the injury site to the hospital were entered. None of the 120 patients seen at the University of Malaya had spinal immobilization during transport, whereas all 334 patients seen at the University of New Mexico did. The 2 hospitals were comparable in physician training and clinical resources. Neurologic injuries were assigned to 2 categories, disabling or not disabling, by 2 physicians acting independently and blinded to the hospital of origin. Data were analyzed using multivariate logistic regression, with hospital location, patient age, gender, anatomic level of injury, and

Results: There was less neurologic disability in the unimmobilized Malaysian patients (OR 2.03; 95% CI 1.03–3.99; p = 0.04). This corresponds to a <2% chance that immobilization has any beneficial effect. Results were similar when the analysis was limited to patients with cervical injuries (OR 1.52; 95% CI 0.64–3.62; p = 0.34).

blunt spinal injuries.

Key words: injury; trauma; morbidity; spine; immobilization; back board; emergency medical services; spinal cord.

Acad. Emerg. Med. 1998; 5:214–219.

Spinal immobilisation for trauma patients (Review)

Kwan I, Bunn F, Roberts IG

THE COCHRANE COLLABORATION®

Authors' conclusions

We did not find any randomised controlled trials that met the inclusion criteria. The effect of spinal immobilisation on mortality, neurological injury, spinal stability and adverse effects in trauma patients remains uncertain. Because airway obstruction is a major cause of preventable death in trauma patients, and spinal immobilisation, particularly of the cervical spine, can contribute to airway compromise, the possibility that immobilisation may increase mortality and morbidity cannot be excluded. Large prospective studies are needed to validate the decision criteria for spinal immobilisation in trauma patients with high risk of spinal injury. Randomised controlled trials in trauma patients are required to establish the relative effectiveness of alternative strategies for spinal immobilisation.

The Effect of Spinal Immobilization on Healthy Volunteers

From the Department of Emergency Medicine; Los Angeles County/ University of Southern California Medical Center, Los Angeles.

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Richard Goldberg, MD, FACEP
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Stacy Harmon, MD
Linda Chan, PhD

Study objective: To determine the effects of standard spinal immobilization on a group of healthy volunteers with respect to induced pain and discomfort.

Design: Prospective study.

Setting: University teaching hospital.

Type of participants: Twenty-one healthy volunteers with no history of back disease.

Interventions: Subjects were placed in standard backboard immobilization for a 30-minute period. Number and severity of immediate and delayed symptoms were determined.

Measurements and main results: One hundred percent of subjects developed pain within the immediate observation per iod. Occipital headache and sacral, lumbar, and mandibular pain were the most frequent symptoms. Fifty-five percent of subjects graded their symptoms as moderate to severe. Twenty-nine percent of subjects developed additional symptoms over the next 48 hours.

Conclusion: Standard spinal immobilization may be a cause of pain in an otherwise healthy subject.

ORIGINAL CONTRIBUTION
immobilization, spinal, devices;
pulmonary function, effect of spinal immobilization

Effect of Spinal Immobilization Devices on Pulmonary Function in the Healthy, Nonsmoking Man

TABLE 2. *Long spinal board*

Parameter	Prestrapping (L/min)	Poststrapping (L/min)	*P*
FVC	5.52 ± 0.79	4.98 ± 0.67	.0001
FEV_1	4.29 ± 0.64	3.99 ± 0.57	.0079
FEF 25%-75%	4.11 ± 1.12	3.68 ± 1.02	.0252
FEV_1:FVC	0.791 ± 0.05	0.793 ± 0.05	.8541

Values are mean ± SD.

Extrication

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0736-4679/$ - see front matter

ELSEVIER

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Selected Topics: Prehospital Care

CERVICAL SPINE MOTION DURING EXTRICATION

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Methods

oratory setting. Methods: Video motion capture was used to quantify the range of motion of the head relative to the torso in 10 participants as they were extricated from a mock motor vehicle during four different extrication techniques: 1) Unassisted Unprotected, 2) Unassisted Protected with a cervical collar (CC), 3) Assisted and Protected with a CC, and 4) Assisted and Protected with a CC and Kendrick Extrication Device. Results: The results indicated a significant de-

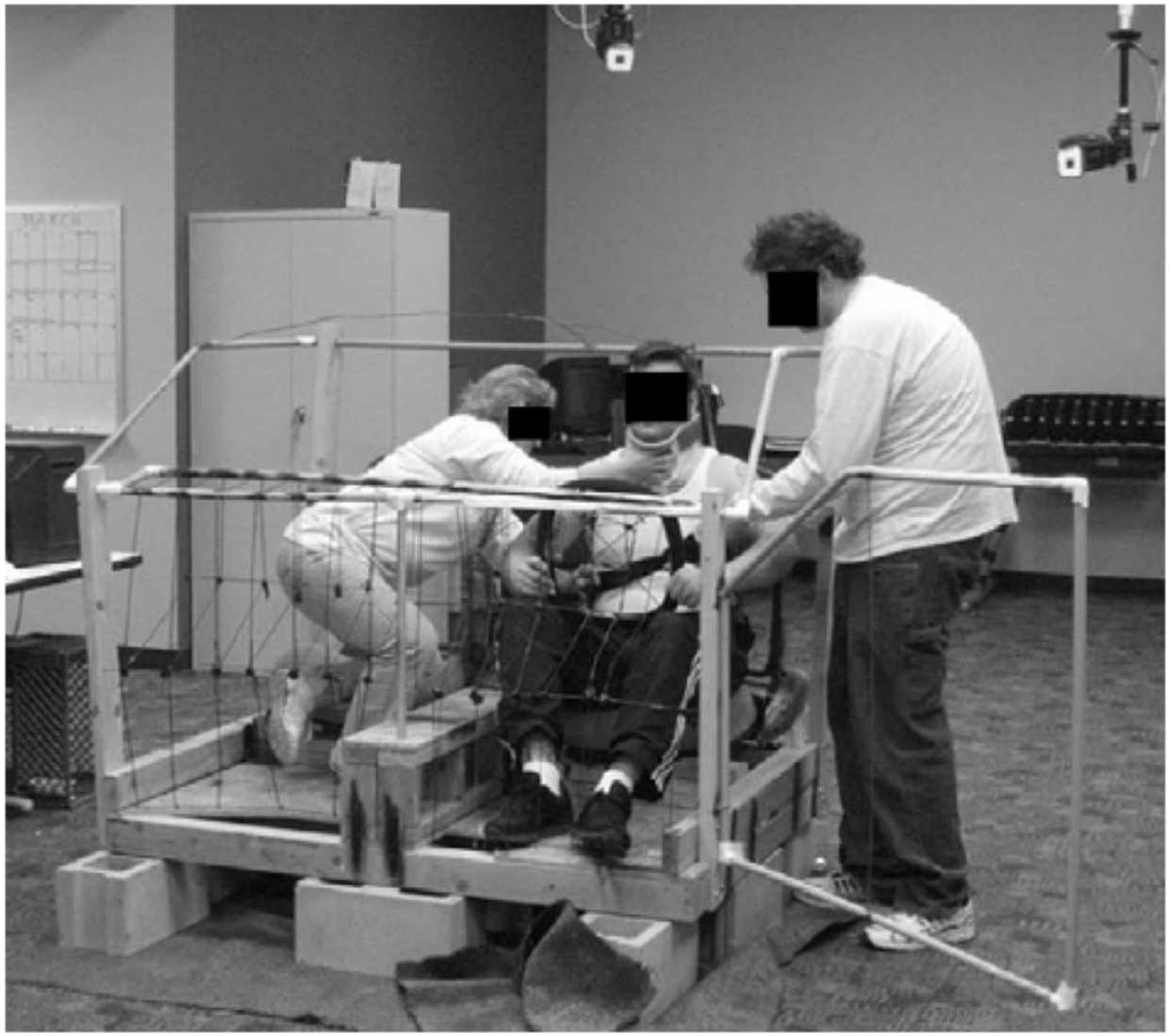

Figure 1. Application of the cervical collar by Emergency Medical Services personnel in the mock automobile. Visual monitoring cameras recording head and trunk movement of victim.

Results

Table 1. Planar Range of Motion (i.e., Flexion-Extension in the Sagittal Plane, Lateral Flexion in the Frontal Plane, and Rotation in the Transverse Plane) Means and SDs (+) of Essential Extrication Events for the Four Extrication Techniques

	Unassisted			CC Unassisted			CC Assisted			CC KED Assisted		
	Unprotected			Protected			Protected			Protected		
Extrication Event	Flex-Ext (deg)	Lateral Flex (deg)	Rotation (deg)	Flex-Ext (deg)	Lateral Flex (deg)	Rotation (deg)	Flex-Ext (deg)	Lateral Flex (deg)	Rotation (deg)	Flex-Ext (deg)	Lateral Flex (deg)	Rotation (deg)
CC application	-	-	-	11.2 ± 7.0	11.2 ± 4.0	11.6 ± 5.5	11.2 ± 4.7	10.9 ± 6.4	7.5 ± 3.2	8.9 ± 4.0	6.0 ± 2.5	6.4 ± 2.1
KED application	-	-	-	-	-	-	-	-	-	24.0 ± 16.2	15.9 ± 18.2	12.6 ± 2.3
Pivot in seat	24.3 ± 6.8*	23.9 ± 8.7*	26.6 ± 12.8*	11.5 ± 3.9	4.8 ± 1.5	7.6 ± 6.0	16.2 ± 9.3†	10.3 ± 4.2*†	9.4 ± 5.0†	14.2 ± 9.3	10.6 ± 8.9*†	11.8 ± 10.8†
Recline on board	40.2 ± 15.3*	21.6 ± 10.3*	32.2 ± 15.1*	23.7 ± 10.6	12.3 ± 7.0	17.0 ± 11.4	28.7 ± 12.5	24.4 ± 11.7‡	22.9 ± 9.7	36.5 ± 22.7	31.3 ± 17.4*	27.7 ± 14.6*
Stand	31.7 ± 12.6*	19.5 ± 7.9*	25.9 ± 10.9*	9.9 ± 7.2	4.0 ± 2.8	9.5 ± 9.0	-	-	-	-	-	-
Walk to board	33.6 ± 17.5*	19.2 ± 5.7*	34.4 ± 19.7*	10.6 ± 7.7	5.1 ± 2.4	6.3 ± 3.6	-	-	-	-	-	-

CC = cervical collar; KED = Kendrick Extrication Device.
* Significantly different from CC Unassisted Protected ($p < 0.10$).
† Significantly different from Unassisted Unprotected ($p < 0.10$).
‡ Significantly different from CC KED Assisted Protected ($p < 0.10$).

Penetrating Trauma

ORIGINAL ARTICLE

Spine Immobilization in Penetrating Trauma: More Harm Than Good?

Elliott R. Haut, MD, Brian T. Kalish, BA, EMT-B, David T. Efron, MD, Adil H. Haider, MD, MPH, Kent A. Stevens, MD, MPH, Alicia N. Kieninger, MD, Edward E. Cornwell, III, MD, and David C. Chang, MBA, MPH, PhD

Are you trying to kill them?

TABLE 3. Multiple Logistic Regression Showing Odds Ratio of Death for Penetrating Trauma Patients With Pre-Hospital Spine Immobilization

	OR of Death	95% CI	*p*
Prehospital procedures			
Spine immobilization	2.06	1.35–3.13	0.001
Intubation	1.31	0.97–1.77	0.079
IV fluids	1.95	1.55–2.47	<0.001
MAST	0.64	0.52–0.80	<0.001
Chest decompression	0.63	0.52–0.77	<0.001
Splint	3.83	0.30–48.96	0.301

Bottom Line

Potential Benefit of Spine Immobilization in Penetrating Trauma

Of 30,956 penetrating trauma patients with complete in-hospital procedure data, 443 (1.43%) had an open spine injury. There were 116 (0.38%) patients who underwent surgery (n = 105, 0.34%) or halo placement (n = 11, 0.04%). Of these 116 patients, 86 (74%) had complete spinal cord injury and would not have benefitted from spine immobilization. Only 30 (0.01%) of the 30,956 patients had incomplete spinal cord injury and underwent operative spine stabilization. The number needed to treat with spine immobilization to potentially benefit one penetrating trauma patient was 1,032. The NNH with spine immobilization to potentially contribute to one death was 66.

Why Do you Immobilize?

- “It’s the protocol”
- “Can’t be too careful”
- “Didn’t want to get yelled at”
- “Mechanism”
- Punitive?

Can EMS Personnel Clear the Spine?

- Multiple studies
- Overwhelmingly in favor
- Must follow criteria

Can an Out-of-Hospital Cervical Spine Clearance Protocol Identify All Patients With Injuries? An Argument for Selective Immobilization

From the Department of Emergency Medicine, University Medical Center, Fresno, CA.

Geoffrey Stroh, MD
Darren Braude, MD, EMT-P

See editorial, p. 632.

Conclusion: The Fresno/Kings/Madera EMS selective spine immobilization protocol is 99% (95% CI, 97.7% to 99.7%) sensitive in identifying patients with cervical injuries for immobilization. Those patients not identified were at extremes of age. These results suggest that selective immobilization may be safely applied in the out-of-hospital setting but should be used with caution at extremes of age.

Prospective Performance Assessment of an Out-of-Hospital Protocol for Selective Spine Immobilization Using Clinical Spine Clearance Criteria

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Shirley M. Frederiksen, RN, MS
Kathy Welch, MS, MPH

From the University of Michigan/Saint Joseph Mercy Hospital Emergency Medicine Residency (Domeier, Frederiksen), and the University of Michigan (Welch) Ann Arbor, MI.

Results: The study collected data on 13,483 patients; 126 of the patients were subsequently excluded from the study because of incomplete data, leaving a study sample of 13,357 patients with complete data. Spine injuries were confirmed in the hospital records for 3% (n=415) of patients, including 50 patients with cord injuries and 128 patients with cervical injuries. Sensitivity of the EMS protocol was 92% (95% confidence interval [CI] 89.4 to 94.6%) resulting in nonimmobilization of 8% of the patients with spine injuries (33 of 415). None of the nonimmobilized patients sustained cord injuries. The specificity was 40% (95% CI 38.9 to 40.5%).

Suspected Spinal Injuries
(Not Meeting Major Trauma Criteria)

This protocol is for awake and stable adult and pediatric patients NOT meeting the Major Trauma Criteria (Protocol T – 6).

Spine injury should be suspected if blunt mechanism of injury is present and should be treated if one or more of the following criteria is present:

IMMOBILIZATION CRITERIA

1. **Altered Mental Status for any reason, including possible intoxication from alcohol or drugs (GCS <15 or AVPU other than A).**
2. **Complaint of neck and/or spine pain or tenderness.**
3. **Weakness, tingling, or numbness of the trunk or extremities at any time since the injury.**
4. **Deformity of the spine not present prior to this incident.**
5. **Distracting injury or circumstances (i.e. anything producing an unreliable physical exam or history).**

High risk mechanisms of injury associated with unstable spinal injuries include, but are not limited to:

- **Axial load (i.e. diving injury, spearing tackle)**
- **High speed motorized vehicle crashes or rollover**
- **Falls greater than standing height**

IF THERE IS ANY DOUBT, SUSPECT THAT A SPINE INJURY IS PRESENT!

Position Statement

EMS Spinal Precautions and the Use of the Long Backboard

National Association of EMS Physicians and American College
of Surgeons Committee on Trauma

General Statement

The National Association of EMS Physicians and the American College of Surgeons Committee on Trauma believe that:

- Long backboards are commonly used to attempt to provide rigid spinal immobilization among emergency medical services (EMS) trauma patients. However, the benefit of long backboards is largely unproven.
- The long backboard can induce pain, patient agitation, and respiratory compromise. Further, the backboard can decrease tissue perfusion at pressure points, leading to the development of pressure ulcers.
- Utilization of backboards for spinal immobilization during transport should be judicious, so that the potential benefits outweigh the risks.

Consider Immobilization for:

- Blunt trauma and altered level of consciousness
- Spinal pain or tenderness
- Neurologic complaint (e.g., numbness or motor weakness)
- Anatomic deformity of the spine
- High-energy mechanism of injury and any of the following:
  - Drug or alcohol intoxication
  - Inability to communicate
  - Distracting injury

Do Not Immobilize

- Patients for whom immobilization on a backboard is not necessary include those with all of the following:
  - Normal level of consciousness (Glasgow Coma Score [GCS] 15)
  - No spine tenderness or anatomic abnormality
  - No neurologic findings or complaints
  - No distracting injury
  - No intoxication
- Patients with penetrating trauma to the head, neck, or torso and no evidence of spinal injury should not be immobilized on a backboard.

Do you need the board?

- Spinal precautions can be maintained by application of a rigid cervical collar and securing the patient firmly to the EMS stretcher, and may be most appropriate for:
  - Patients who are found to be ambulatory at the scene
  - Patients who must be transported for a protracted time, particularly prior to interfacility transfer
  - Patients for whom a backboard is not otherwise indicated

Future Protocol Changes

- SEMAC adopting NAEMSP statement
- Regional protocol changes
- Educational component needed