KEEP THE BACKBOARD

Nothing Sensible Ever Goes Out of Fashion

Terence Valenzuela MD MPH FACP FACEP

A Series of Friendly Debates on Timely EMS Topics

Discussants

r. Fowler aka "Reverend Ray"

Dr. Valenzuela

Reverend Ray bringing the word

The "Case" Against the Spine board

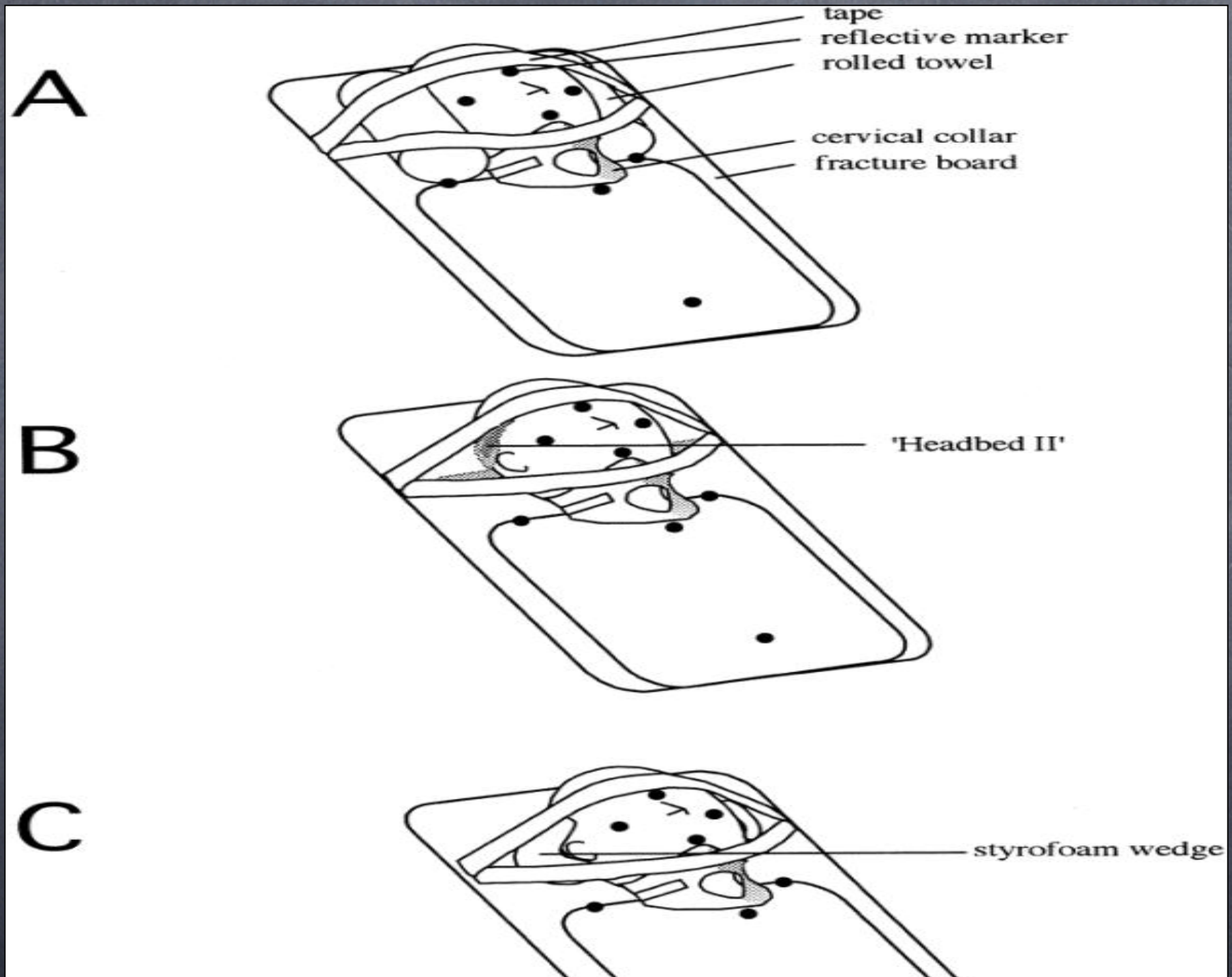
- Spine boards do not immobilize the spine
- Spine boards cause pain, impair breathing and increase risk of pressure ulcers
- Spinal injuries are rare
- There is no evidence of benefit from spinal immobilization

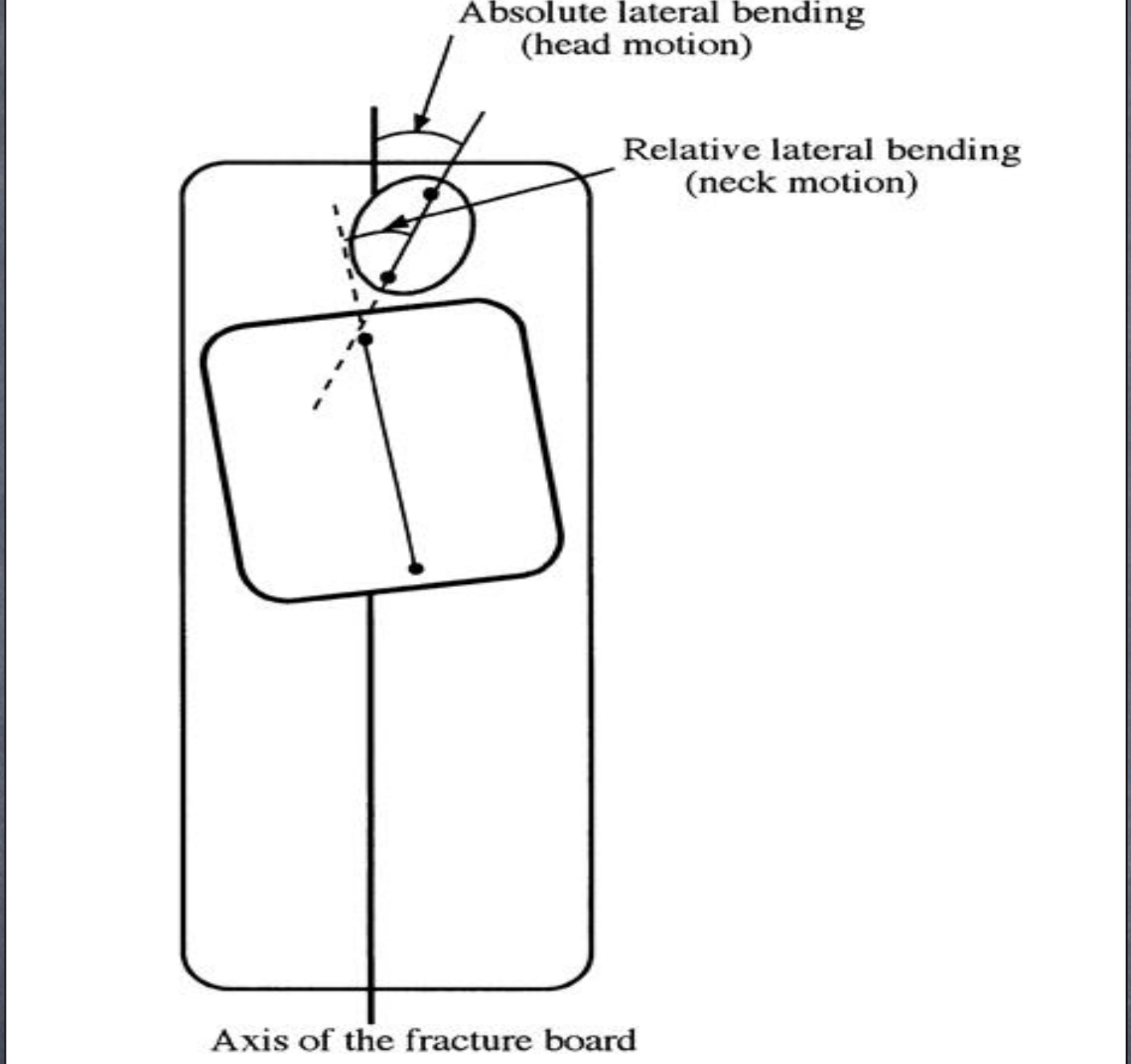
Fowler says:

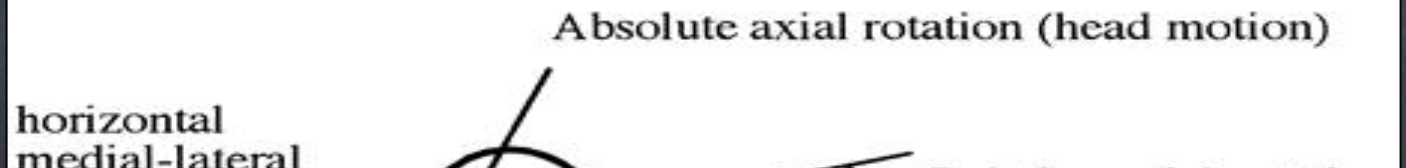
ne boards Do
t Immobilize
e Spine

M, Fernie GR. The efficacy of head immobilization techniques during simulated vehicle motion. *Spine (Phila Pa 1976).* 1999;24:1839-1844.[1]

- Six healthy volunteer immobilized patients.
- Computerized tilt board
- Reflective markers were placed on the forehead, chin, zygomatic arches,
- Quantification of head and body movement via achieved using four high-speed
- Shuttered cameras (60 frames/second, shutter speed 1/500 sec) video-based motion analysis system

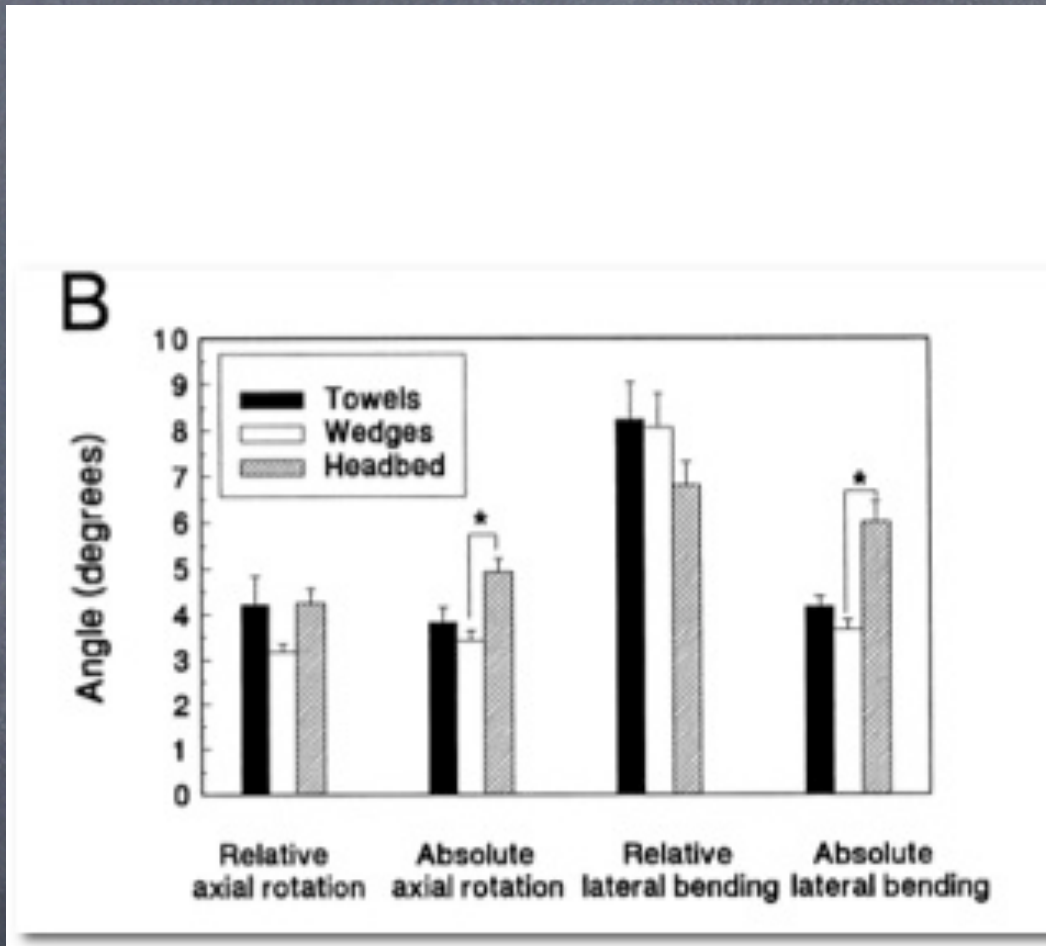

A
tape
reflective marker
rolled towel
cervical collar
fracture board
B
'Headbed II'
C
styrofoam wedge


Absolute lateral bending
(head motion)
Relative lateral bending
(neck motion)
Axis of the fracture board


Absolute axial rotation (head motion)
horizontal
medial-lateral

M, Fernie GR. The efficacy of head immobilization techniques during simulated vehicle motion. *Spine (Phila Pa 1976).* 1999;24:1839-1844.

- "None of the three immobilization techniques was successful in eliminating head motion or neck rotation. Movement of the trunk contributed substantially to the lateral bending that occurred across the neck."



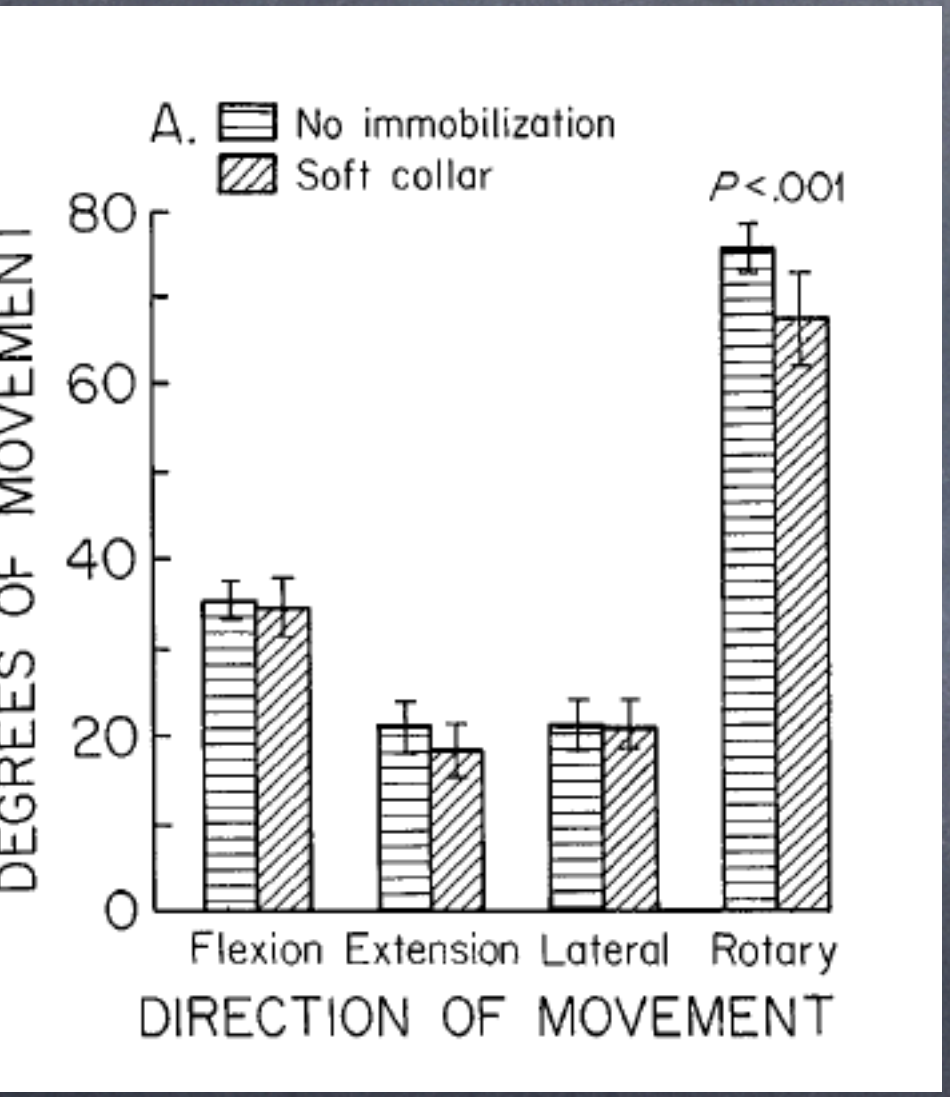
Fernie GR. The efficacy of head immobilization techniques during simulated vehicle motion. *Spine (Phila Pa 1976).* 1999;24:1839-1844.

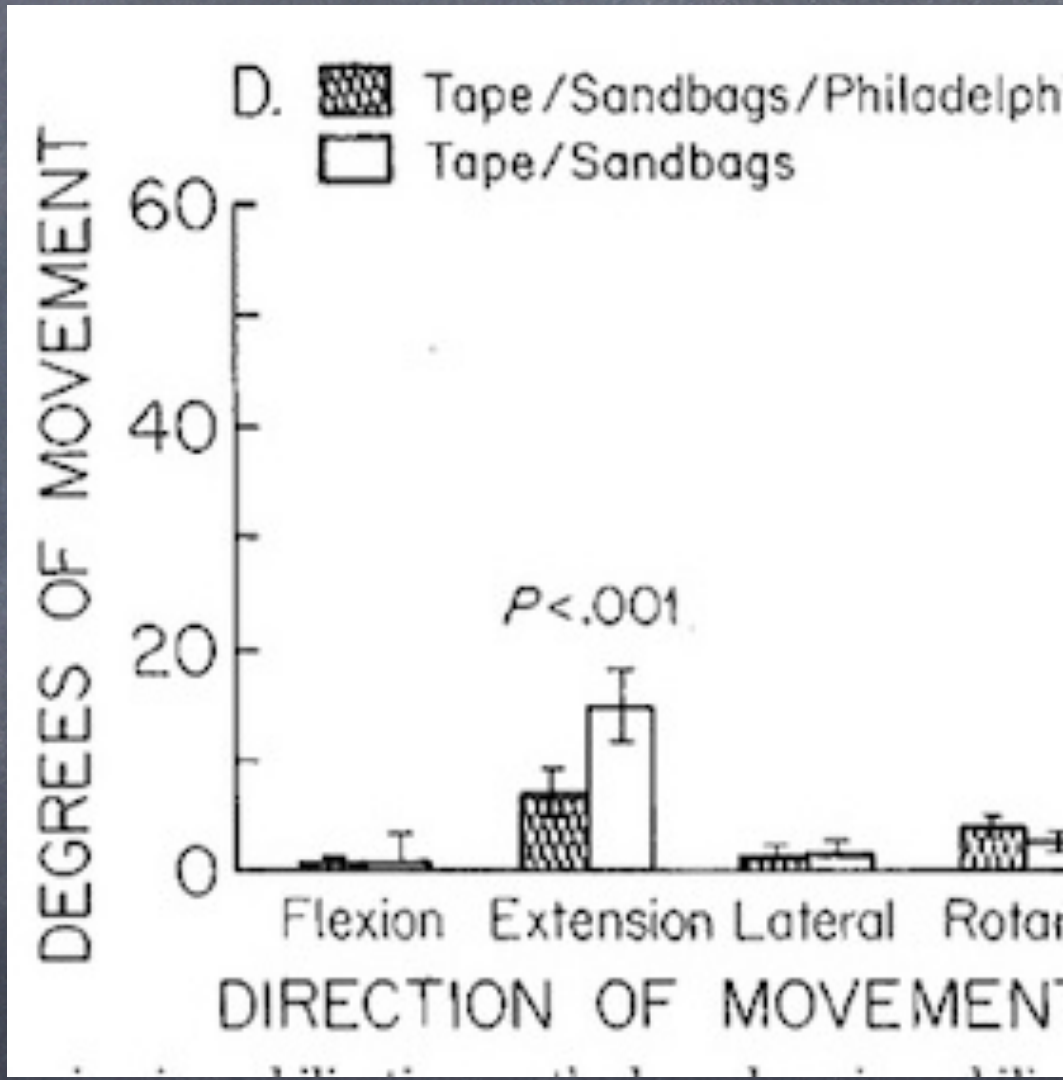
- Also
  - "The current study highlights the significance of trunk motion as a factor influencing the efficacy of immobilization strategies"
  - "The current results suggest ***that improvements in fixation of the head without comparable fixation of the trunk may be ineffective in reducing spinal motion at the neck.***"
  - ? Argument for the long spine board?

immobilization methods." J Trauma 23(6): 461-464.[2]

- Twenty five healthy volunteers
- Immobilization methods
  - Soft collar
  - Philadelphia collar
  - Tape and sandbags
  - Tape + sandbags + Philadelphia collar
- Instructed to flex, extend, bend lateral and rotate as much as possible

immobilization methods." J Trauma 23(6): 461-464.





collar? A prospective radiographic evaluation in healthy adult volunteers. *J Trauma.* 1998;45:374-378.[3]

	Aspen Collar		
	Unrestricted (degrees)	Restricted (degrees)	Percent
n-extension	98.8 ± 12.4	31.1 ± 9.2	31.5 ±
l bending	31.1 ± 4.2	15.9 ± 6.2	47.5 ±
ead rotation	64.6 ± 4.7	26.8 ± 7.3	40.7 ±

ervical immobilization is a myth. Even the

How Much is Enough Immobilization ?

Study	Method	Lateral Bending in Degrees
Podolsky 1983	Soft collar Philadelphia Collar Tape and sandbags	4
Graziano 1987[4]	Stif-Neck Immobilizing Collar Kendrick Extrication Device (KED) Extrication Plus-One	8-16
Perry 1999	Towels Hedbed II Head wedges	8

Fowler

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Spine boards
ause pain, impair
breathing and
ncrease risk of
pressure ulcers.

Chan, D., R. Goldberg, et al. (1994). "The effect of spinal immobilization on healthy volunteers." Ann Emerg Med **23**(1): 48-51.[6]

Twenty one healthy volunteers (mean age 24) immobilized on long spine board for 30 mins

Pain (occipital, lumbar, sacral) reported by all subjects

Fifty five percent rated pain as moderate to severe

Obvious drug seekers

Bauer D, Kowalski R. Effect of spinal immobilization devices on pulmonary function in the healthy, nonsmoking man. *Ann Emerg Med.* 1988;17:915-918.[7]

TABLE 2. *Long spinal board*

rameter	Prestrapping (L/min)	Poststrapping (L/min)	P
C	5.52 ± 0.79	4.98 ± 0.67	.000
V_1	4.29 ± 0.64	3.99 ± 0.57	.007
F 25%-75%	4.11 ± 1.12	3.68 ± 1.02	.025
V_1:FVC	0.791 ± 0.05	0.793 ± 0.05	.854

ues are mean ± SD.

Test	Post-Strapping
FVC	90%
FEV_1	93%

Linares, H. A., A. R. Mawson, et al. (1987). "Association between pressure sores and immobilization in the immediate post-injury period." Orthopedics **10**(4): 571-573.[8]

- Retrospective study of 27 patients with spinal cord injury during initial hospitalizatioon
- Thirteen developed pressure ulcers; 14 did not.
- Compared patient recall of immediate post injury period

	Injury to "rolled"
No pressure ulcers	< 2 hours
Developed pressure ulcers	> 3 hours

or early occurring pressure ulcers following spinal cor
injury." Am J Phys Med Rehabil **67**(3): 123-127.
last Surg **15**(1): 41-49.[9]

Table 1

associated with the development of pressure sores in spinal cord-injured males within 30 days of in
($P < 0.1$)[a]

Factor	Cases	Controls	*t*	Significance
consciousness (%)	45.5	18.8		0.09 (Fisher's tes
n of immobilization prior to admission (hr)	17.1 ± 11.3	10.6 ± 7.6	1.777	0.06
e of injury site from Charity tal (miles)	80 ± 116	24 ± 27	2.056	0.05
the spinal board (hr)	11 ± 6.3	6 ± 5.1	1.799	0.09
blood pressure at the time of sion (mm Hg)	100.2 ± 22.6	121 ± 23.7	−2.492	0.02

s are given as mean ± SD.

Fowler
ys:

nal Injuries
e Rare

Goldberg, W., C. Mueller, et al. (2001). "Distribution and patterns of blunt traumatic cervical spine injury." Ann Emerg Med **38**(1): 17-21.[10]

Blunt trauma + C-spine X-rays	34,069
Radiographic C-spine injury	818 (2.4%)
Injury "potentially unstable"	464 (57%)
Injury "clinically significant"	118 (14%)

How Freakin' Common Does it Have to Be?

Severity of Injury	Average Yearly Expenses (in February 2013dollars)		Estimated Lifetime C Age At Injury (discounte	
	First Year	Each Subsequent Year	25 years old	5
High Tetraplegia (C1-C4) AIS ABC	$1,044,197	$181,328	$4,633,137	$
Low Tetraplegia (C5-C8) AIS ABC	$754,524	$111,237	$3,385,259	$
Paraplegia AIS ABC	$508,904	$67,415	$2,265,584	$
lete Motor Functional at Any Level AIS D	$340,787	$41,393	$1,547,858	$

ta Source: Economic Impact of SCI published in the journal *Topics in Spinal Cord Injury Rehabilitation* Volume 16 Number 4 in 201

How Freakin' Common Does it Have to Be?

- Status at hospital discharge
  - Incomplete Tetraplegia 41%
  - Incomplete Paraplegia 19%
  - Complete Tetraplegia 12%

DeVivo MJ. Epidemiology of traumatic spinal cord injury: trends and future implications. *Spinal Cord*. 2012;50:365-372.[11]

- US Incidence of 4.0 per 10^5 population (12,400 spinal cord injuries/year)
- The proportion of complete injuries
  - 1970s 53.6%
  - Since 2000 48.7%
- Predictions for future
  - C1-C4 injuries ↑ 2% /decade
  - Ventilator dependency ↑ 1% / decade

Fowler
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of-hospital spinal immobilization: Its effect on neurologic injury. *Acad Emerg Med.* 1998;5:214-219[12]

- Comparison University of New Mexico Trauma Center and University of Malaya, Malaysia Trauma Center
- A retrospective, 5 year chart review of all All patients with acute blunt traumatic spinal or spinal cord injuries transported directly from the injury site to the hospital and admitted to the inpatient service or ED

hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med.* 1998;5:214-219

- The University Hospital, University of Malaya in Kuala Lumpur, Malaysia, which is ***not served by an out-of-hospital emergency medical services (EMS) system***
- The University of New Mexico Hospital in Albuquerque, NM, which ***is served by an extensive EMS system.***

Hauswald M, Ong G, Tandberg D, Omar Z. Out-of-hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med.* 1998;5:214-219

The OR for disability was higher for patients in the United States (all with spinal immobilization) after adjustment for the effect of all other independent variables (2.03; 95% CI 1.03-3.99; p = 0.04).

The estimated probability of finding data as extreme as this if immobilization has an overall beneficial effect is only 2%. Thus, there is a 98% probability that immobilization is harmful or of no value.

We repeated this analysis using only the subset of patients with isolated cervical level deficits. We again failed to show a protective effect of spinal immobilization (OR 1.52; 95%

spinal immobilization: its effect on neurologic injury. *Acad Emerg Med.* 1998;5:214-219

FLAWS

- Few predictor variables:
  - Hospital
  - Age → Grouped by Decade
  - Gender
  - Level of Deficit → Three Categories
  - Mechanism of Injury → Four categories
- Outcome: Neurologic Injury
  - "disabled or not disabled"

hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med.* 1998;5:214-219

FLAWS

- Does not include victims dead on scene or during transport
- Does not include severity of non-spinal injuries
- Severity of spinal injury varied within categories
  - "Even those injuries that were placed in discrete diagnostic categories were not matchable"

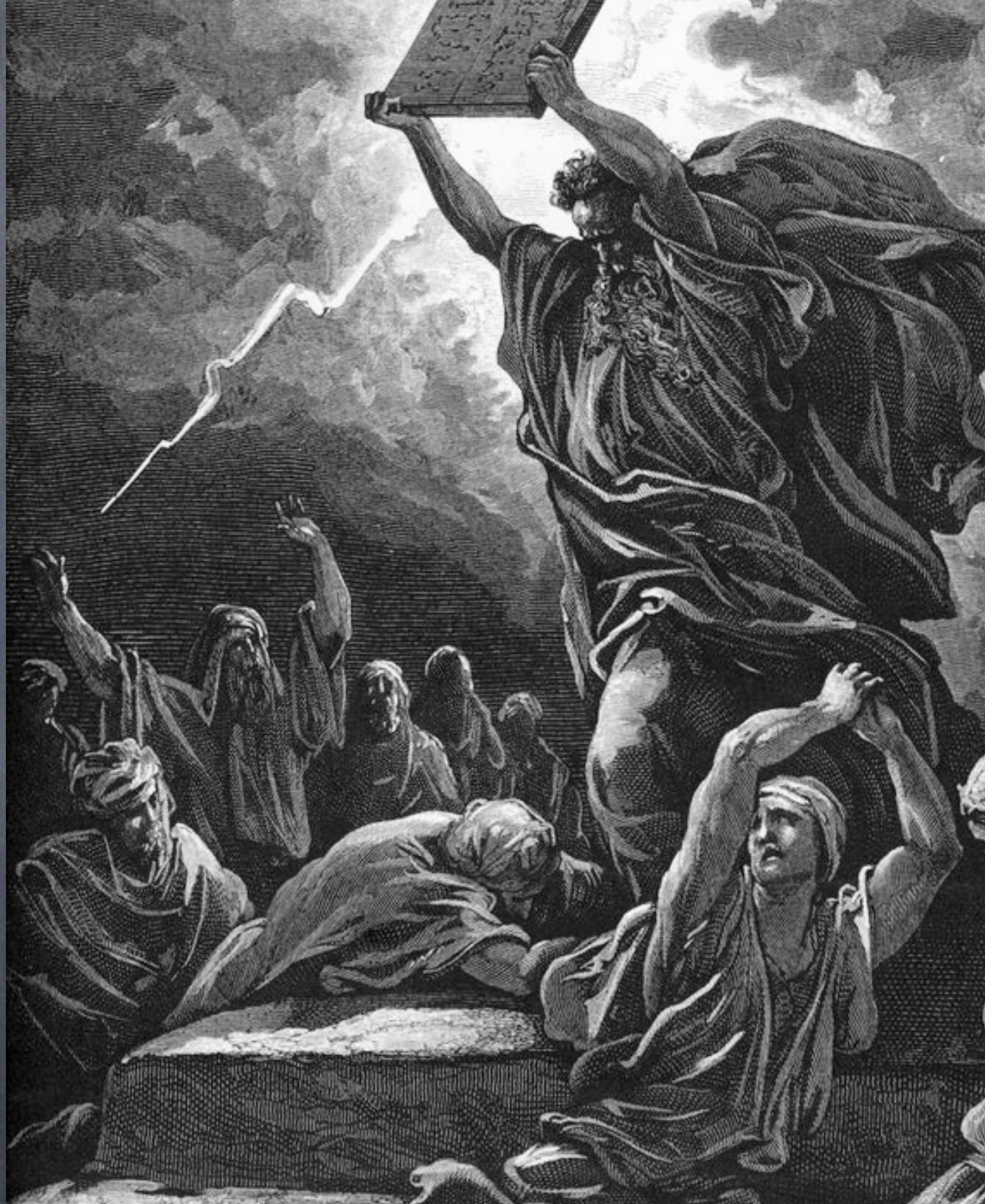
hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med.* 1998;5:214-219

Conclusion not supported by data

- "The actual percentage of injuries that are ***likely to be made worse*** by lack of immobilization during the immediate post-injury period ***is much smaller***. The risk of neurologic deterioration is greatly exaggerated"


FOX
5

The Holy Cochrane Library



trauma patients. Cochrane Database of Systematic Reviews 2001, Issue 2. Art. No.: CD002803. DOI: 10.1002/14651858.CD002803.[13]

- Means of immobilization can cause tissue pressure and discomfort, difficulty in swallowing and serious breathing problems

- The effects on mortality, neurological injury, spinal stability and adverse effects in trauma patients ***remains uncertain.***

trauma patients. Cochrane Database of Systematic Reviews 2001, Issue 2. Art. No.: CD002803. DOI: 10.1002/14651858.CD002803.

- The review authors could not find any randomized controlled trials of spinal immobilization strategies in trauma patients.
- ***Spinal cord damage*** from injury ***causes long-term disability*** and can dramatically affect ***quality of life***. The current practice of ***immobilising trauma patients*** before hospitalisation to prevent more damage ***may not always be necessary***, as the likelihood of further damage is small.

End of Story?

- EBM's Six Dangerous Words[14]
- "There is no evidence to suggest"
- Presumes "evidence" = formal hypothesis testing in an adequately powered study

Smith, G. C. and J. P. Pell (2003). "Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomized controlled trials." BMJ **327**(7429): 1459-1461.[15]

- **Objective:** To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.
- **Design:** Systematic review of randomized controlled Trials.
- **Data sources**: Medline,Web of Science, Embase, appropriate internet sites and citation lists.
- **Study selection**: Studies showing the effects of using a parachute during free fall.
- **Main outcome measure** Death or major trauma, defined as an injury severity score > 15.

prevent death and major trauma related to gravitational challenge: systematic review of randomized controlled trials." BMJ **327**(7429): 1459-1461.

Results: We were unable to identify any randomized controlled trials of parachute intervention.

Conclusions: As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomized controlled trials

Clinical Significance

Advocates of evidence based medicine have criticized the adoption of interventions evaluate by using only observational data.

We think that everyone might benefit if the m radical protagonists of evidence based medicine organized and participated in a double blind, randomized, placebo controlled, crossover trial the parachute.

From Where The Spinal Immobilization "Dogma"?

Kossuth, L. C. (1965). "The removal of injured personnel from wrecked vehicles." J Trauma **5**(6): 703-708.[16]

Farrington, J. D. (1967). "Death in a Ditch.." Bull Am Coll Surg **98**(6): 44-53; discussion 43.[17]

Farrington, J. D. (1968). "Extrication of victims--surgical principles." J Trauma **8**(4): 493-512.[18]

of the cervical spine; an end-result study." J Bone Joint Surg Am **39-A**(2): 341-376.

- Case series 77 patients treated for cervical fracture, dislocation or both at the Massachusetts General hospital from 1940-1950

of the cervical spine; an end-result study." J Bone Joint Surg Am **39-A**(2): 341-376.

Time of onset of neuro deficit	Patients	%
Immediate complete cord	15	20
Immediate partial cord	19	25
Nerve root pressure only	15	20
No deficit	28	36
LATE ONSET	8	10
Total	77	100

a sad commentary that one in every ten patients' symptoms of cord
ession or an increase in cord symptoms developed subsequent to the time
iginal injury-during emergency care, during the time the diagnosis was b

of the cervical spine; an end-result study." J Bone Joint Surg Am **39-A**(2): 341-376.

- "...it is the responsibility of the trained aide who is first called upon to care for the patient with a neck injury to institute emergency measures which will protect the cord"
- Traction applied to the long axis of the of the spine in the neutral position will protect the cord which has escaped injury at the time of or subsequent to fracture or dislocation of the cervical spine..."

of the cervical spine; an end-result study." J Bone Joint Surg Am 39-A(2): 341-376.

- "Traction is applied to the cervical spine, as first aid, by means of an adjustable brace"
- "The brace is so constructed that it exerts a constant pressure against the chin and occiput in the cephalad direction and against the chest and shoulder girdle in a caudate direction"

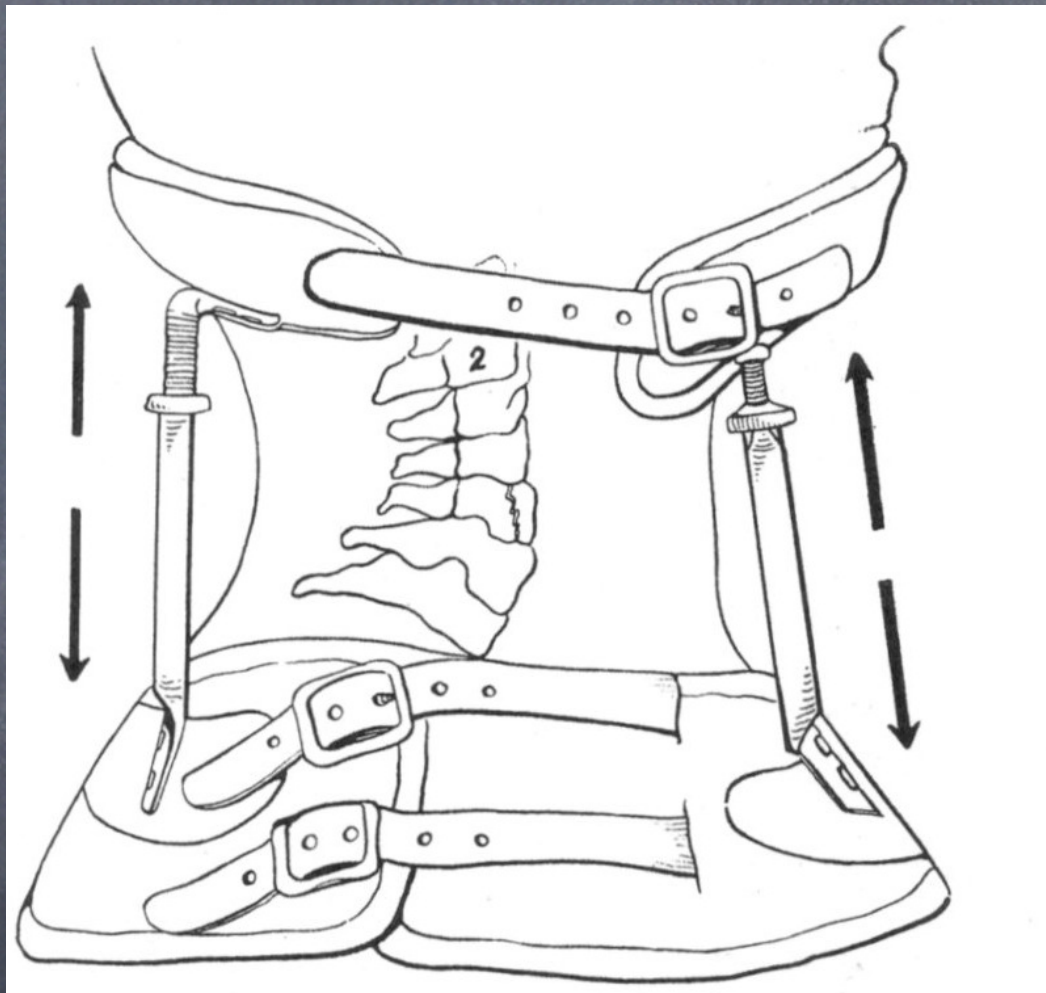


FIG. 9

Fig. 9: Cervical-traction brace used in first aid and at all times when the patient is being moved about before the neck is stabilized.

of the cervical spine; an end-result study." J Bone Joint Surg Am 39-A(2): 341-376.

- "During the past 13 years, such a brace has been used successfully as a routine measure...
- The brace must be worn at all times when the patient is moved from place to place..."
- "No cord injury occurred in any of these patients during these years while wearing one of the

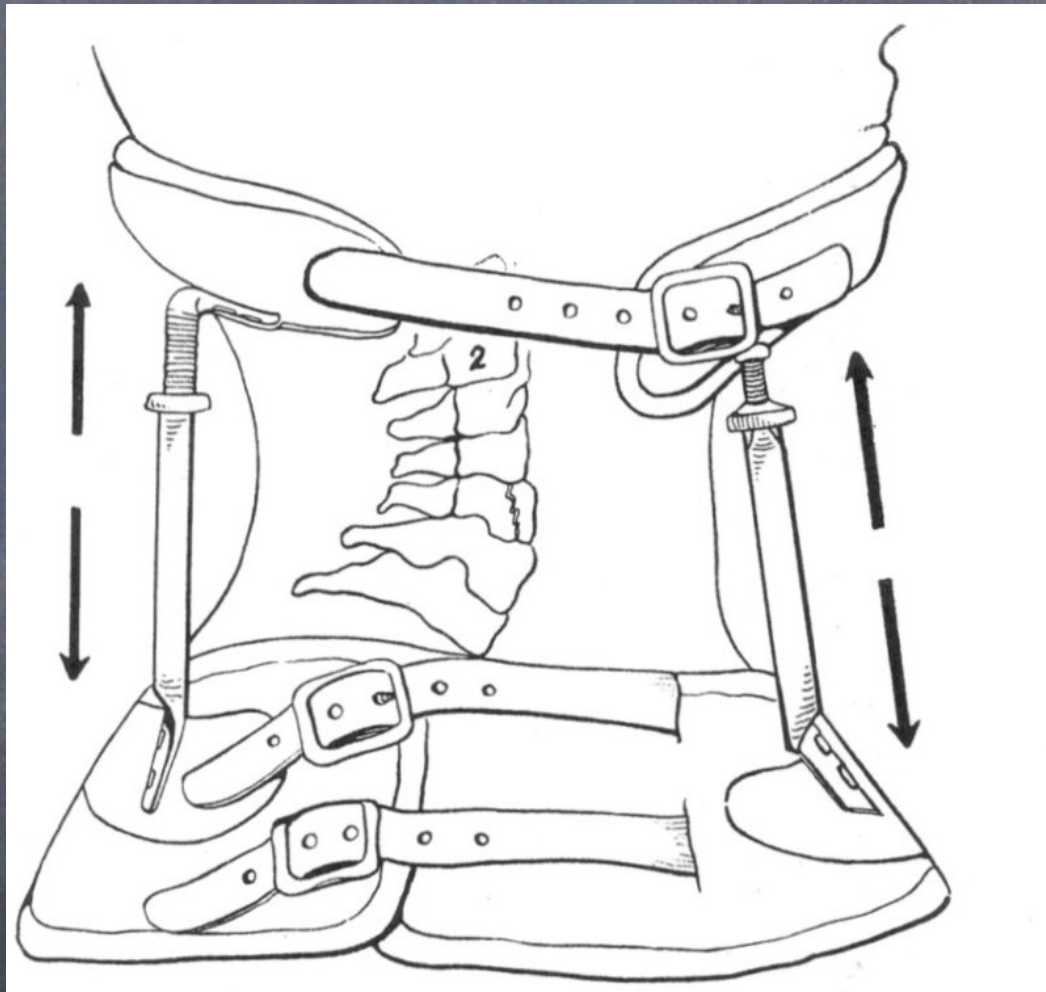


FIG. 9

Fig. 9: Cervical-traction brace used in first aid and at all times when the patient is being moved about before the neck is stabilized.

"Early management of the patient with trauma to the spinal cord." Med Serv J Can **22**(7): 512-523.[20]

- Case series of 958 patients who suffered spinal cord injury from 1941 to 1966 and treated in Toronto, Canada.
- 29 recorded cases where the record clearly indicates that the onset of paralysis was delayed for hours or days, so that progression occurred after an interval.

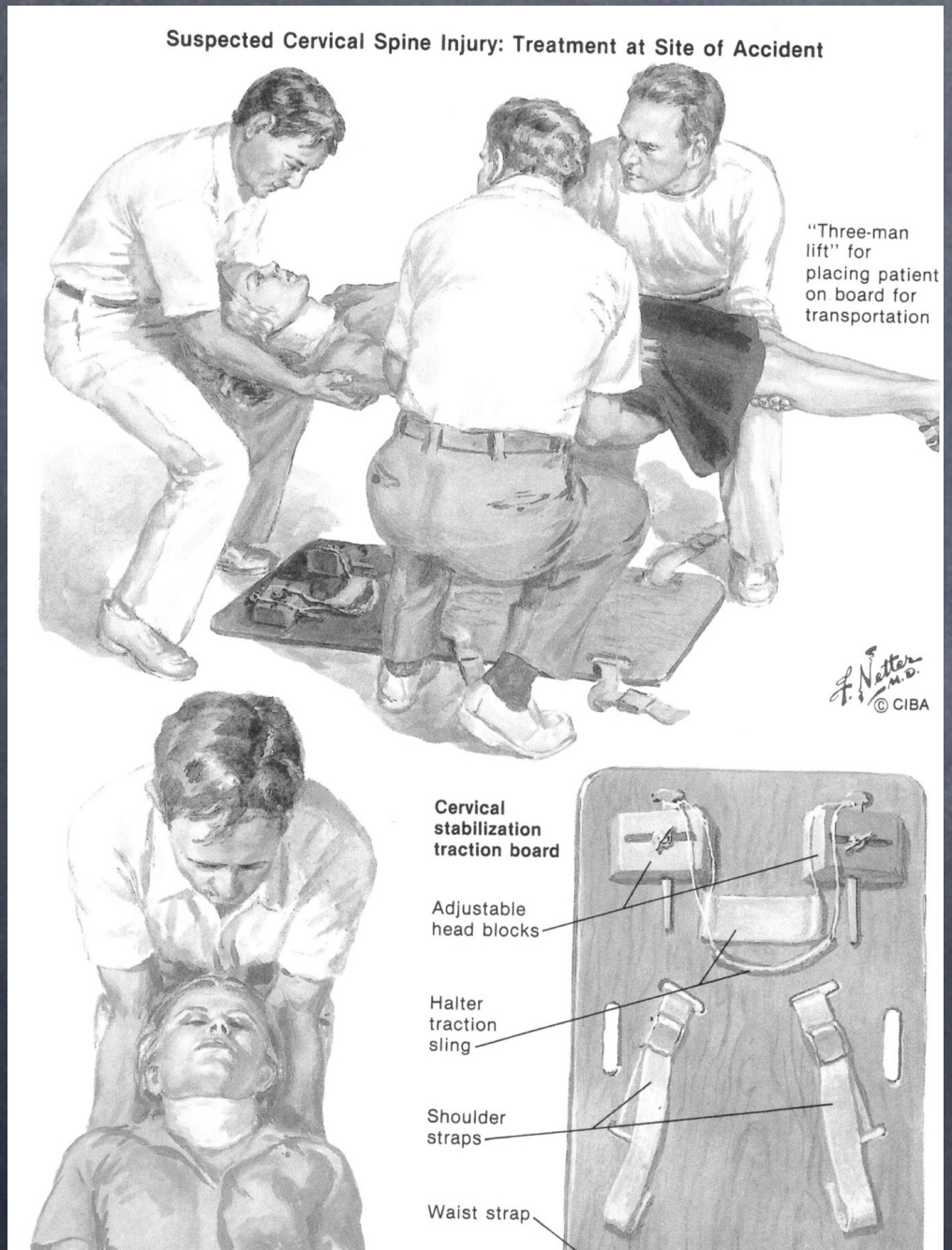
Early management of the patient with trauma to the spinal cord." Med Serv J Can 22(7): 512-523.

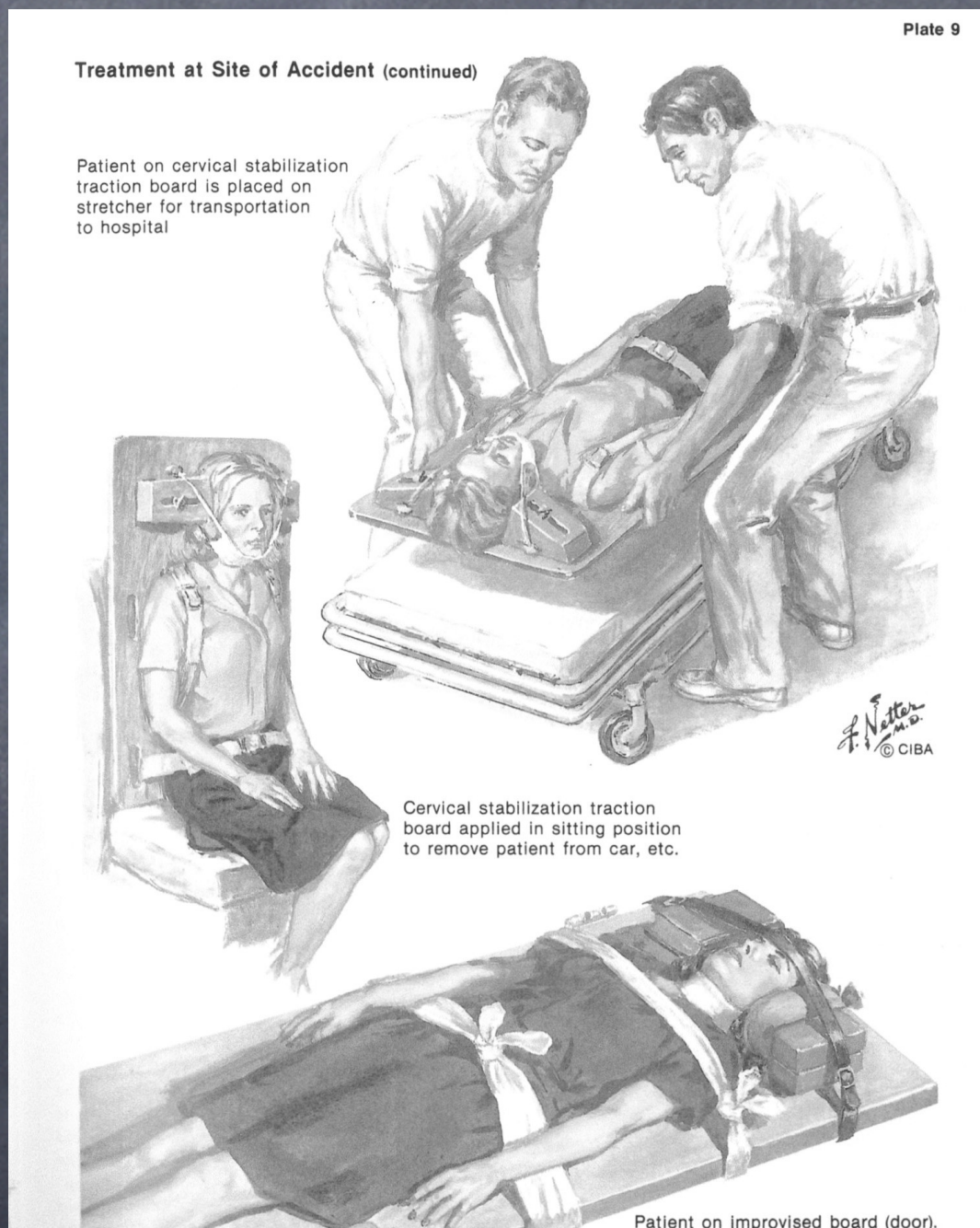
- Case II
  - 24-year-old male railroad worker whose train car derailed into a ditch.
  - "He crawled out of the car and walked a few yards,, After approximately half an hour, during which he rubbed his lower extremities with his hands, he was once more able to move his feet and legs and he got up and walked a few yards."
  - "When he reached hospital hours later his legs were paralyzed."
  - "Simple first aid measures would prevent the development of such a devastating condition. These are more important in their long-term significance than the greatest of surgical skill applied after the paralysis has occurred"

Cloward, R. B. (1980). "Acute cervical spine injuries." Clin Symp **32**(1): 1-32.[21]

- Treatment at the accident site
  - "If they (1st responders) are poorly trained or carelessly disregard the correct methods of handling the injured person, they may risk his entire future"
  - "A small movement may irreparably injure the vulnerable spinal cord"
- Moving the Patient
  - The uppermost consideration in moving the patient is to stabilize the neck…
  - Our gratifying results may be partly due to the fact that the author lives on a small island (Hawaii) and has personally trained the ambulance paramedics"

Cloward, R. B. (1980). "Acute cervical spine injuries." Clin Symp **32**(1): 1-32.





Partington JD 1968

"Extrication of Victims—Surgical Principles"

James Styner MD 1976[22]

- Crashed his airplane with wife and children aboard
- Wife killed. Two children comatose from head trauma
- Local ED was closed and locked. MDs who responded di not stabilize their C-spines
- Helped develop ATLS course

Use of the Long Backboard
NAEMSP and ACS
PREHOSPITAL EMERGENCY CARE 2013;17:392–393[23]

- Appropriate patients
  - Blunt trauma and altered Level of consciousness
  - Spinal pain or tenderness
  - Neurologic complaint
  - Anatomic deformity of spine
  - Drug or alcohol intoxication
  - High-energy mechanism of injury and any of:
    - Drug or alcohol intoxication
    - Inability to communicate
    - Distracting injury

Use of the Long Backboard
NAEMSP and ACS
PREHOSPITAL EMERGENCY CARE 2013;17:392-393

- Not necessary
  - GCS = 15
  - No spinal tenderness or anatomic abnormality
  - No distracting injury
  - No intoxication
  - Penetrating trauma neck, etc. without deficit
- Rigid collar no spine board
  - Ambulatory at scene
  - Long transport
  - "Patients for whom a backboard is not otherwise indicated"

Summary

- Long board necessary to immobilize spine "enough"
- Evidence of adverse consequences for other than pain is weak
- Absence of evidence for benefit is not evidence of absence of benefit
- There were good reasons for initial adoption of long spine board
- Still, large number of patients for whom long

Good bye, Ray

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*rehospital emergency care : official journal of the National Association o
MS Physicians and the National Association of State EMS Directors.*
013;17:392-393.