

# Field Evaluation of Cervical Spinal Injuries NCEMSF Conference 2010

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# Cervical Spinal Immobilization

- Standard of care for patients suffering traumatic force to the head, face, neck or torso.
  - “If there is any soft tissue damage to the head, face, or neck due to a sudden deceleration injury ... then assume that there is a cervical spine injury. Any blunt trauma above the clavicles also may damage the cervical spine.” (Brady Emergency Care 5<sup>th</sup> Ed., 1990)





# Cervical Spinal Immobilization

- Often based on Mechanism of Injury
- Indications for immobilization based on mechanism alone: (Basic Trauma Life Support 3<sup>rd</sup> Ed., 1995):
  - Blunt trauma above the clavicles
  - Motor vehicle or bicycle accident
  - Fall
  - Any violent injury with forces that could act on the spinal column or cord



# Cervical Spinal Immobilization

- “The only way to rule out a cervical spinal injury is with an x-ray.”



# Cervical Spinal Immobilization

- Liberal use warranted because it could prevent devastating spinal cord injury resulting in paralysis or death.
- Prevent costly lawsuits \$\$\$\$\$\$\$\$\$\$!



# Cervical Spinal Immobilization

- Liberal use emphasizes **sensitivity** over **specificity**
- Sensitivity = Ability of a test to detect what you are looking for if it is present.
- Specificity = Ability of a test to detect only what you are looking for - minimal number of false positives



# Cervical Spinal Immobilization

- Immobilizing patients on the basis of mechanism of injury (MOI) alone is highly sensitive for detecting c-spine injury but poorly specific
- For example, if we immobilize all pt's with an MOI for c-spine injury we will be 100% sensitive but may only be 1% specific



# Cervical Spine Immobilization

- Cervical spine injury occurs in 2%-4% of all cases of blunt force trauma (Davis et al., 1993)
- So 96%-98% of all patients we immobilize will not have a cervical spine injury



# Cervical Spinal Immobilization

- What would be wrong with applying an 100% sensitive test even if it has poor specificity to catch these potentially devastating injuries?
- A great number of patients with no spinal injury are immobilized as a result
- Spinal immobilization is not a begin procedure



# Immobilization and morbidity

- March et al., 2002:
  - 18/20 healthy volunteer subjects with no neck or back pain report having midline spinal tenderness after 60 minutes of CNS immobilization.
    - Midline tenderness in the ED requires X-Ray evaluation of the spine
    - Charge for routine c-spine films \$100 in this institution



# Immobilization and morbidity

- Can worsen respiratory status of COPD and CHF patients
- Increased risk of aspiration (Bauer et al., 1988)
- Pressure necrosis (Chan et al., 1994)
- Poor fitting C-Collars can cause increases in ICP (Ho et al., 2002)



# Immobilization and cost

- Unavoidable consideration in today's health care environment
- Radiological c-spine evaluations cost about \$180 million per year in the US
  - Elimination of unnecessary c-spine studies could save \$60 million a year (Hoffman et al., 1998)



# Does spinal immobilization even work?

No studies validating prehospital spinal immobilization

- Patients with blunt trauma spinal injuries taken to the hospital without spinal immobilization in Malaysia had less neurologic disability than similar patients that were immobilized in the field in New Mexico (Orledge and Pepe, 1998)



# Mechanism of Injury

Domeier et al. (1999):

- Mechanism of Injury has no impact on the ability to predict spinal injury using other standard clinical criteria



# Cervical spine injury evaluation

Is there another way?

- NEXUS Study published in the *New England Journal of Medicine* July 13, 2000 by Hoffman et al.



# NEXUS Study

- Examined the utility of using a set of clinical criteria to identify patients at low risk of c-spine injury:
  1. No midline cervical tenderness
  2. No focal neurologic deficit
  3. Normal alertness
  4. No Intoxication
  5. No painful distracting injury



# NEXUS Study

- Evaluated 34,069 patients at 21 ED's across the U.S. who had cervical spine x-rays to rule out injury
- 818 patients (2.4%) found to have a c-spine injury
- Criteria identified 810 of these patients (99%)



# NEXUS Study

- NEXUS criteria was:
  - 99.0% sensitive for c-spine injury
  - 99.8% specific for c-spine injury



# NEXUS Study

Of the 8 patients with injuries missed by the NEXUS criteria:

- 6 of the patients had injuries that were clinically insignificant
- 1 patient had the criteria applied improperly
- 1 patient had stable, asymptomatic injury



# NEXUS Study

## Conclusion:

“A simple decision instrument based on clinical criteria can help physicians to identify reliably the patients who need radiography of the cervical spine after blunt trauma. Application of this instrument could reduce the use of imaging in such patients.”



# NEXUS Study

Can this tool be applied in the prehospital setting for evaluation of potential cervical spine injuries?



# Paramedic evaluation

- Research by Sahni et al. (1997) found excellent agreement on assessment of C-Spine exam between paramedics and physicians in simulated patients and felt that paramedics could clinically clear C-Spines in the field.



# Paramedic evaluation

Frailey and Henry:

- Paramedic system that used an evaluation tool to evaluate if spinal immobilization was indicated over a 30 day period
- 87 patients evaluated, 33 determined not to require spinal immobilization – **No spinal injuries in the group determined not to require immobilization.**



# Paramedic evaluation

Stroh and Braude (2001):

- Fresno/Kings/Madera (CA) EMS using a selective spinal clearance protocol June 1, 1990 to June 30, 1996
- Correctly identified 499 out of 504 patients not requiring spinal immobilization
  - 99% Specificity



# Paramedic evaluation

Patients not immobilized and later found to have a C-Spine injury:

- 2 protocol violations (0.4%)
- 3 missed by proper application of the protocol (0.6%)
  - Patients were at extremes of age: 9 m/o, 73 y/o and 76 y/o
- 2 of the missed injuries were considered to be unstable



# Consensus Presentation

Hankins et al. (2001)

## *Prehospital Emergency Care*

- “Evidence is sufficient to support implementation, but not entirely, of clinical clearance criteria in the out of hospital setting.”
- Extensive training and CQI required
- Local agencies and Medical Directors need to determine if applicable to their system and what criteria should be used.



# Refined Clinical Criteria

## Hankins et al. (2001)

1. No extremes of age:  $< 12$  or  $> 65$
2. No altered mental status
3. No neurologic deficits
4. No distracting injury
5. No midline or paraspinal status



# Pittsburgh EMS 2001

- Medical Direction and Training Division develop a Spinal Immobilization Guideline using data in the literature and existing protocols
  - NEXUS
  - Fresno/Kings/Madera (CA) EMS
  - Criteria of Hawkins et al. (2001)
  - Medical Rescue Team South Authority (PA)



# Pittsburgh EMS Spinal Immobilization Guideline

Guiding principal: *If in doubt immobilize the patient!!*

1. Evaluate the mechanism of injury:
  - a. Patients who are unstable, have mechanisms of injury that fit Trauma Center Triage Criteria, fall under the Major or Multi-system Trauma protocol or who are a Trauma Team Activation must be immobilized



# Pittsburgh EMS Spinal Immobilization Guideline

1. Mechanism of injury (continued):
  - b. Patients who have no mechanism of injury for head or spinal trauma and no neurologic deficits or complaints (such as a patient who trips and falls and injures an extremity but does not strike his head) do not be immobilized
  - c. Patients with a mechanism of injury that indicates some potential of spinal trauma (blunt force trauma to the head, minor MVC's, falls, etc.) should be evaluated using this guideline



# Pittsburgh EMS Spinal Immobilization Guideline

2. Manually stabilize the cervical spine

3. Determine the patient's age:

- a. If the patient is  $< 12$  y/o or  $> 65$  y/o he or she is not eligible to be evaluated under this guideline and must be immobilized.
- b. Young children may not be able to understand and cooperate with the exam adequately. Patients over 65 are at an increased risk for occult spinal injury



# Pittsburgh EMS Spinal Immobilization Guideline

4. Evaluate the patients LOC and ability to provide an accurate exam:
  - a. The patient must be CAOx4 – oriented to person, place, time and purpose/events. If the patients is not CAOx4 their ability to provide an accurate exam and answers to questioning is considered unreliable.
  - b. If the patient has baseline confusion or dementia they can not be clinically cleared.



# Pittsburgh EMS Spinal Immobilization Guideline

4. Evaluate the patient's LOC and ability to provide an accurate exam. (continued):
  - c. The patient must be able to communicate clearly with the crew and cooperate with the exam
  - d. If the patients has a decreased LOC or is unable to communicate with the exam, then the patient must be immobilized. Otherwise, continue with the exam.



# Pittsburgh EMS Spinal Immobilization Guideline

5. If the patient has signs of impairment from alcohol or illicit drugs, he or she must be immobilized.

*If there is any doubt if the patient is impaired err on the side of caution and immobilize the patient!*

- How do we determine who is impaired?
- Intoxication is a clinical diagnosis
- Used police criteria



# Pittsburgh EMS Spinal Immobilization Guideline

- a. For the purposes of this guideline a person should be considered impaired if her or she has:
  1. Difficulty with cognitive functions: difficulty answering questions, following commands or with reasoning
  2. Slurred speech
  3. Unsteady gait
  4. Difficulty ambulating or a reported history of difficulty ambulating or patients who can not get up on their own
  5. Reported history of heavy ETOH consumption or significant drug usage.



# Pittsburgh EMS Spinal Immobilization Guideline

## 6. Head injury with LOC

- If the patient has a primary head injury with a loss of consciousness, no matter how brief, he or she must be immobilized. Head injury with LOC indicates the possibility of a closed head injury, which may make the patient's ability to understand and comply with the exam unreliable.
- If the patient had an LOC from a medical cause, i.e. the patient had a syncope and fell and struck his or her head but is now CAOx4 the patient may continue to be evaluated with this guideline – proceed to the next step



# Pittsburgh EMS Spinal Immobilization Guideline

7. If the patient complains of Cervical, Thoracic or Lumbar Spine pain or any neurologic deficit he or she must be immobilized
- Neurologic complaints requiring immobilization include:
    - Extremity numbness, tingling, burning or parasthesia
    - Extremity weakness or paralysis



# Pittsburgh EMS Spinal Immobilization Guideline

8. A full neurologic exam must be performed, evaluating motor function and sensation in each extremity.
  - Palpate and inspect the spinous process of each vertebra in the C-Spine, T-Spine and L-Spine for pain, deformity or significant trauma over the spine.
  - Evaluate the neurologic exam for extremity weakness, paralysis, numbness, tingling, burning or parasthesia – either unilateral or bilateral



# Pittsburgh EMS Spinal Immobilization Guideline

- If the patient has neurologic deficits, pain or deformity in any part of the spine then he or she must be immobilized
- Injury in one segment of the spine increases the chances of trauma in another area of the spine
- Full spinal immobilization should always be performed



# Pittsburgh EMS Spinal Immobilization Guideline

## 9. Evaluate for the presence of any distracting injury

– Distracting injuries are injuries that are so painful or graphic in nature to the patient that they may interfere with the patient's ability to provide an accurate exam

- Extremity fractures
- Significant soft tissue injuries
- Significant burns
- Any injury causing the patient significant pain or distress



# Pittsburgh EMS Spinal Immobilization Guideline

## 10. Range the Cervical Spine:

- a. Flex by touching the chin to the chest
- b. Extend the head as far posteriorly as possible
- c. Touch chin to right shoulder
- d. Touch chin to left shoulder

If the patient has any pain or discomfort on ROM **STOP** and immobilize the patient.

Immobilize if the patient can not range the neck as normal.



# Pittsburgh EMS Spinal Immobilization Guideline

- If the C-Spine ROM is normal without pain then the evaluation is complete and spinal immobilization is not indicated.
- If there are any doubts about immobilization, err on the side of caution and **IMMOBILIZE** the patient or maintain manual C-Spine stabilization and consult the MD



**PITTSBURGH EMS  
CERVICAL SPINE IMMOBILIZATION EVALUATION**

PT NAME:	MEDIC UNIT
AGE:	CCR#
SEX:	DATE
CHIEF COMPLAINT:	TIME

**MANUALLY STABILIZE THE C-SPINE DURING EVALUATION**

	NO	YES*
<b>1. Major Trauma – Trauma Alert?</b> <ul style="list-style-type: none"> <li>▪ Examples: Airway concerns, hypotension, multiple long bone fractures, fall &gt;15 ft, rollover accident, ejection from a vehicle, GSW to torso, head or neck, etc.</li> </ul>		
<b>2. Age &lt;12years or &gt;65 years?</b>		
<b>3. Decreased LOC – Altered Mental Status?</b> <ul style="list-style-type: none"> <li>▪ Confusion, Dementia or Alzheimer's</li> <li>▪ Language, speech or communication problem</li> <li>▪ Combativeness, hysteria, will not comply with exam.</li> </ul>		
<b>4. ETOH Consumption or under the influence of drugs?</b>		
<b>5. Head injury resulting in Loss Of Consciousness?</b>		
<b>6. Positive Patient Complaints and Symptoms?</b> <ul style="list-style-type: none"> <li>▪ Cervical, Thoracic or Lumbar pain.</li> <li>▪ Extremity numbness, tingling, burning or parasthesia.</li> <li>▪ Patient complains of extremity weakness or paralysis.</li> </ul>		
<b>7. Positive Physical Exam Findings?</b> <ul style="list-style-type: none"> <li>▪ Any spinal pain on palpation.</li> <li>▪ Deformity to the spine on palpation or significant external trauma over the spine.</li> <li>▪ Extremity weakness, paralysis, numbness, tingling, burning or parasthesia.</li> </ul>		
<b>8. Is there a Distracting Injury?</b> <ul style="list-style-type: none"> <li>▪ Any injury causing severe pain or otherwise distracting the patient from the exam.</li> </ul>		
<b>9. Pain on Range of Motion of the Neck or patient unable to normally range the neck.</b>		

**\*IF THE ANSWER TO ANY OF THESE QUESTIONS IS YES THE PT MUST BE IMMOBILIZED.**

**IF THE ANSWER TO ALL OF THESE QUESTIONS IS NO SPINAL IMMOBILIZATION IS NOT INDICATED**

**LEAVE THE PINK COPY OF THIS FORM WITH THE PATIENT AT THE HOSPITAL – TURN THE OTHERS INTO TRAINING DIVISION.**

CREW: \_\_\_\_\_

# Documentation

- Complete evaluation checklist
  - One copy with patient @ ED
  - Turn other copies in to Training Division (CQI)
- Document in the tripsheet:
  - Physical exam
  - Serial neuro exam
  - Use of the guideline
  - Patient refusal to be immobilized or cooperate with exam



## Maine EMS Spine Protocol Quality Assurance Form

### VI. Indications for Immobilization (*check all that apply*):

Patient Unreliable (Intoxicated, Altered LOC, Acute Stress)

Distracting Injury

Abnormal Sensory/Motor Exam

Spine Pain/Tenderness (indicate at least one  
mark in columns A and B)

<u>A</u>	<u>B</u>
Cervical	Posterior
Thoracic	Lateral
Lumbar	Anterior

# SMR Decision – ITLS 6<sup>th</sup> Ed (2008)

## Reliable patient

- **Calm**
- **Cooperative**
- **Sober**
- **Alert**
- **No distracting injuries**

## Unreliable patient

- **Acute stress reaction**
- **Head/brain injury**
- **Altered mental status**
- **Intoxication with drugs and/or alcohol**
- **Distracting injuries**

# SMR Not Indicated – ITLS 6<sup>th</sup> ED (2008)

No high-risk mechanism of injury

No alteration of mental status

No distracting injuries

Not intoxicated

No pain or tenderness along spine

No neurological deficits

**SPINAL IMMOBILIZATION  
STATEWIDE BLS PROTOCOL****Procedure:****A. All patients:**

1. Provide manual stabilization of the cervical spine<sup>2</sup> until,
  - a. Full spinal immobilization has been completed (usually requires a rigid c-spine collar, cervical immobilization device and long spine/back board.

***OR***

- b. Immobilization is not indicated as determined by this protocol.
2. Immobilize the entire spine<sup>3,4</sup> in any trauma patient who sustains an injury with a mechanism having the potential for causing spinal injury and who has at least one of these clinical criteria:<sup>5</sup>
  - a. Altered mental status (including any patient that is not completely alert and oriented)
  - b. Evidence of intoxication with alcohol or drugs
  - c. A distracting painful injury (including any suspected extremity fracture)
  - d. Neurologic deficit (including extremity numbness or weakness- even if resolved)
  - e. Spinal pain or tenderness (in the neck or back)

**WARNING: These criteria cannot be assessed on any patient with a language or communication barrier (including young pediatric patients) that prevents understanding and appropriately responding to the assessment questions. If there is any doubt about whether the patient meets any of the clinical criteria listed above, immobilize the spine.**

3. Follow other appropriate treatment or transport protocols. <sup>6</sup>

# Implementation

- In-service training on the guideline conducted May – July 2001.
- Evaluation checklists and “luggage tags” reminders of the evaluation procedure issued to units in November 2001
- Guideline implemented for field use on November 23, 2001



# CQI Results

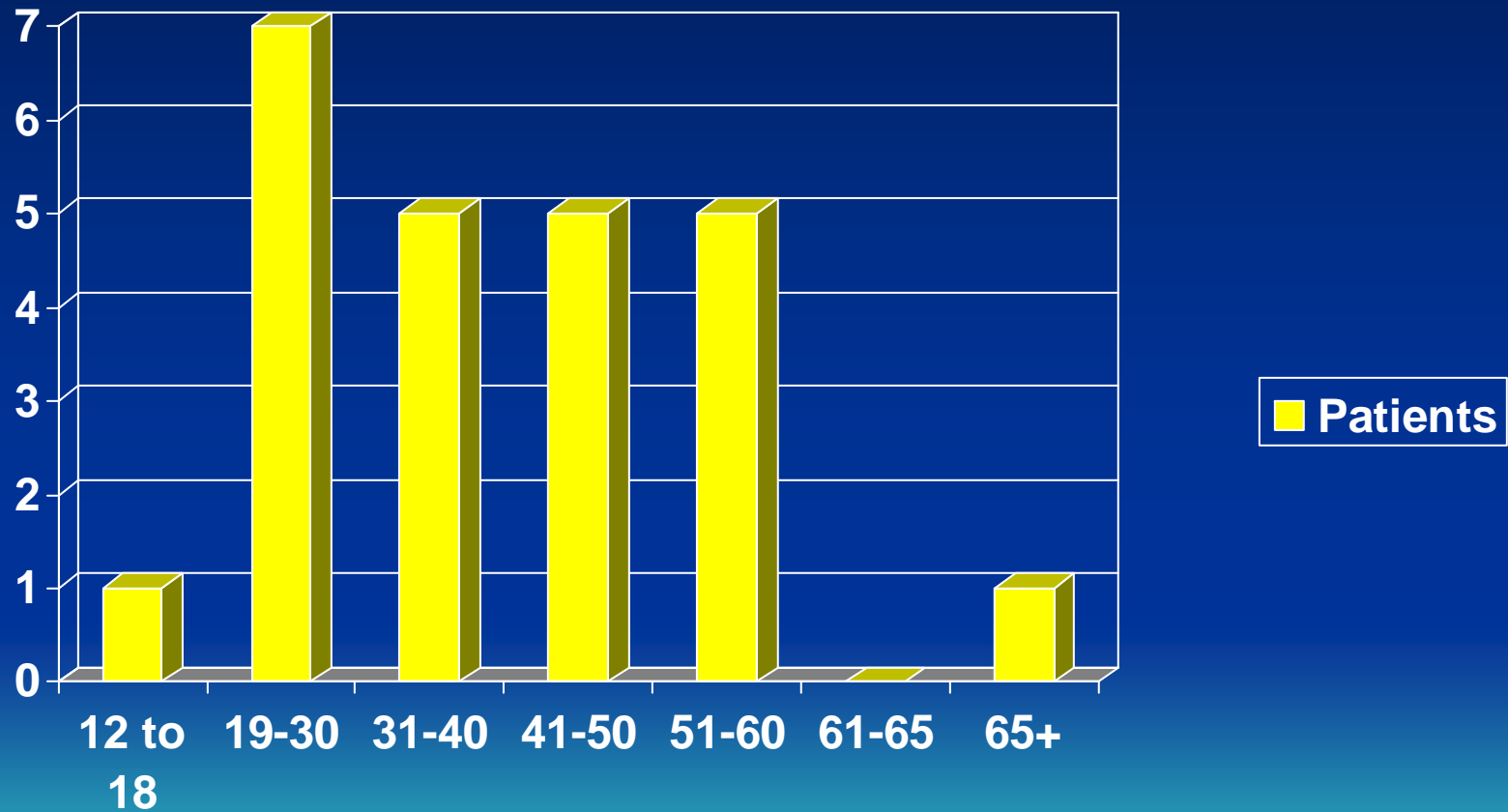
November 23, 2001 – August 25, 2002

- 56 Documented uses of the guideline
- 49 Patients (87.5%) determined not to require immobilization
  - Follow-up received on 24 of these patients (49%)
- 7 Patients (12.5%) immobilized by the evaluation criteria
  - Follow-up received on 3 of these patients (43%)

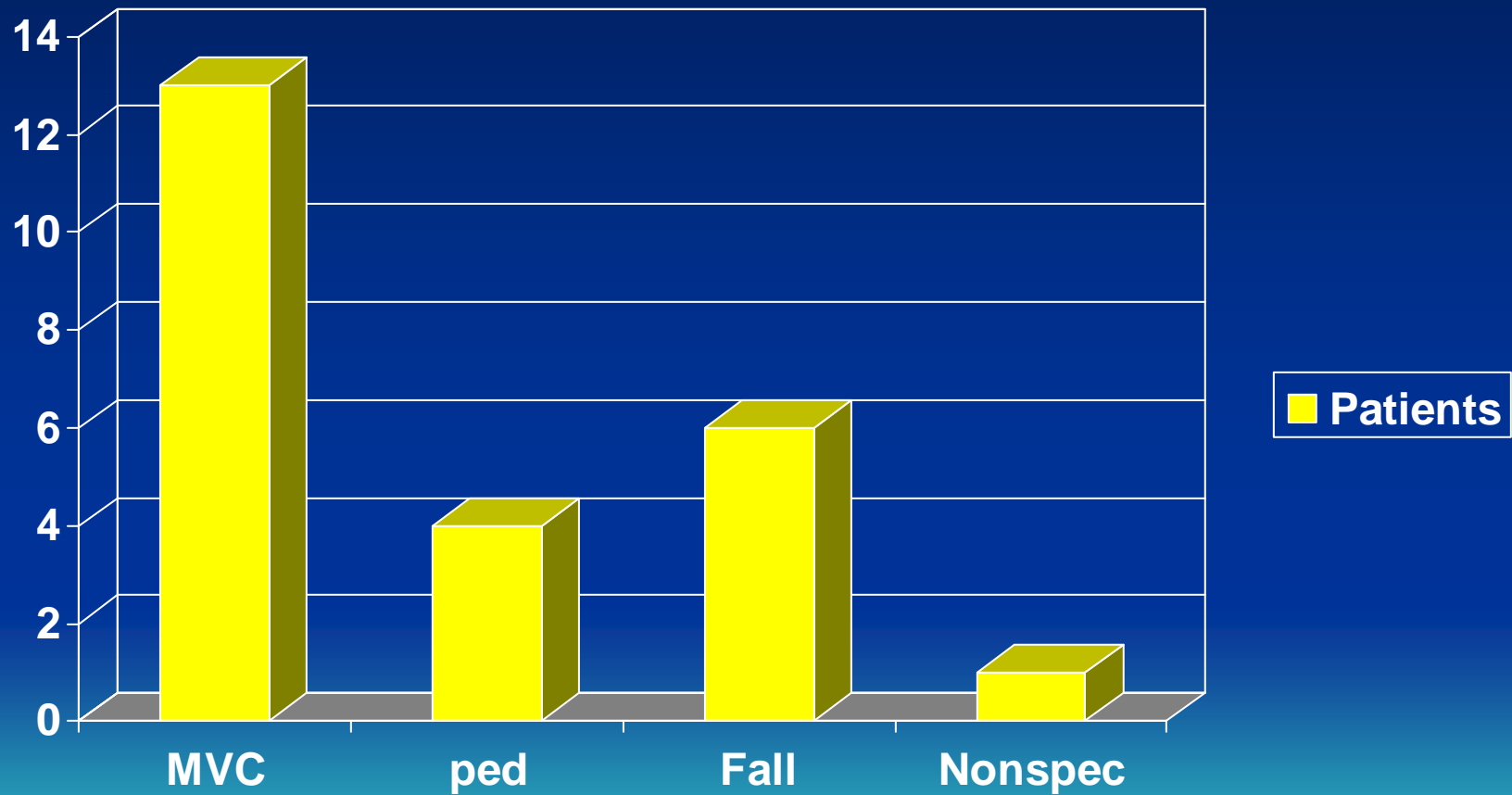


# CQI Results

## Immobilization not indicated - age



# Immobilization not indicated - Incident type



# Immobilization not indicated

## Injuries on follow-up

Soft Tissue Injury = 18

No Dx. given = 4

Extremity ortho. injury = 2

LS strain = 2

Closed Head Injury = 2

Cervical strain = 1

SAH = 1

Facial FX = 1

No injury = 1

Spinal Fx or structural inj = 0

# Immobilization not indicated

## Injuries on follow-up

- Of the patients that follow-up could not be obtained on there were no reports or complaints of missed spinal injury.



# Protocol Violations

One, possibly two found on CQI (1.8% - 3.6%):

- Age (83 y/o who fell)
  - No C-Spine injury: Nasal bone FX and head contusion
- Mechanism (Fall > 15')
  - Patient initially gave a low height for the fall but then changed his story enroute to the hospital.
  - No C-Spine injury: Tooth FX, R wrist and L Hand FX and L leg laceration



# Protocol Violations

- Concerns of some crews using the protocol but not following and filling out the form properly??
- Not confirmed



# Immobilization indicated by guideline

## Age:

- 31-40: 1
- 41-50: 1
- 51-60: 1

## MOI:

- MVC: 2
- Fall: 1



# Immobilization indicated by guideline

## Injuries:

- Closed Head Injury = 3
- Skull FX = 1
- Cervical Strain = 2
- Extremity FX = 2
- Soft Tissue Injury = 1
- Spinal FX or Dislocation = 0

# CQI Results

November 23, 2001 – August 25, 2002

- For patients followed up on the evaluation guideline was **100% Sensitive** (24/24) for determining which patient spinal immobilization was not indicated for
- **88.9% Specific** (24/27) for determining who did not require immobilization



# Conclusion

- The Pittsburgh EMS Spinal Immobilization Guideline can safely determine which trauma patients do not have indications for spinal immobilization in the field.



# Implementing a Protocol in your system

- Develop with medical direction
- Initial and review training
- CQI



# Questions??

