

STATE OF CONNECTICUT EMS



**Spinal
Motion
Restriction
Training Presentation**

October 2014

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- Goals and Objectives
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- A&P Review (optional)
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 - Spinal Motion Restriction
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GOAL

To provide an educational package that introduces current interventions for the assessment and management of patients who present with potential spinal cord injuries in the pre-hospital setting.

OBJECTIVES



At the completion of the Spinal Motion Restriction educational program the student will achieve the following objectives in the stated domains:

COGNITIVE OBJECTIVES



- The student will identify at least two mechanisms of injury that are associated with potential spinal cord injury.
- The student will identify at least two subsets of patients at higher risk for spinal cord injury.
- The student will list at least three symptoms of spinal cord lesions.

COGNITIVE OBJECTIVES



- The student will list at least two detrimental effects of spinal immobilization on patients.
- The student will be able to justify the need for spinal motion restriction based on the patient's risk factors and the assessed signs and symptoms consistent with possible spinal cord injury.

AFFECTIVE OBJECTIVES



- The student will appreciate the patients' improved comfort and reduced risk of spinal cord impairment through the use of spinal motion restriction.
- The student will appreciate the negative effects of spinal immobilization on patient well-being and outcomes.

PSYCHOMOTOR OBJECTIVES



- The student will be able to demonstrate the ability to correctly assess a patient with potential cord injury.
- The student will be able to demonstrate the ability to perform proper spinal motion restriction utilizing current guidelines.

REASONS FOR SMR

GUIDELINE: *THE SCIENCE*

- No science supporting use of long spine board (LSB)
- New science supporting:
 - LSB painful, can cause injury
 - Can safely defer immobilization with set criteria
 - Can be harmful with certain injuries
 - Newer philosophy of Spinal Motion Restriction (SMR)

RESEARCH USED TO DEVELOP GUIDELINES

- Research is summarized in the Spinal Motion Restriction Bibliography located on the training and education page of the OEMS website:

www.ct.gov/dph/ems

TRADITIONAL SPINAL IMMOBILIZATION




- Based on fear of litigation
- Based on tradition
 - “We have always done it this way”
- NOT based on science

TRADITIONAL SPINAL IMMOBILIZATION

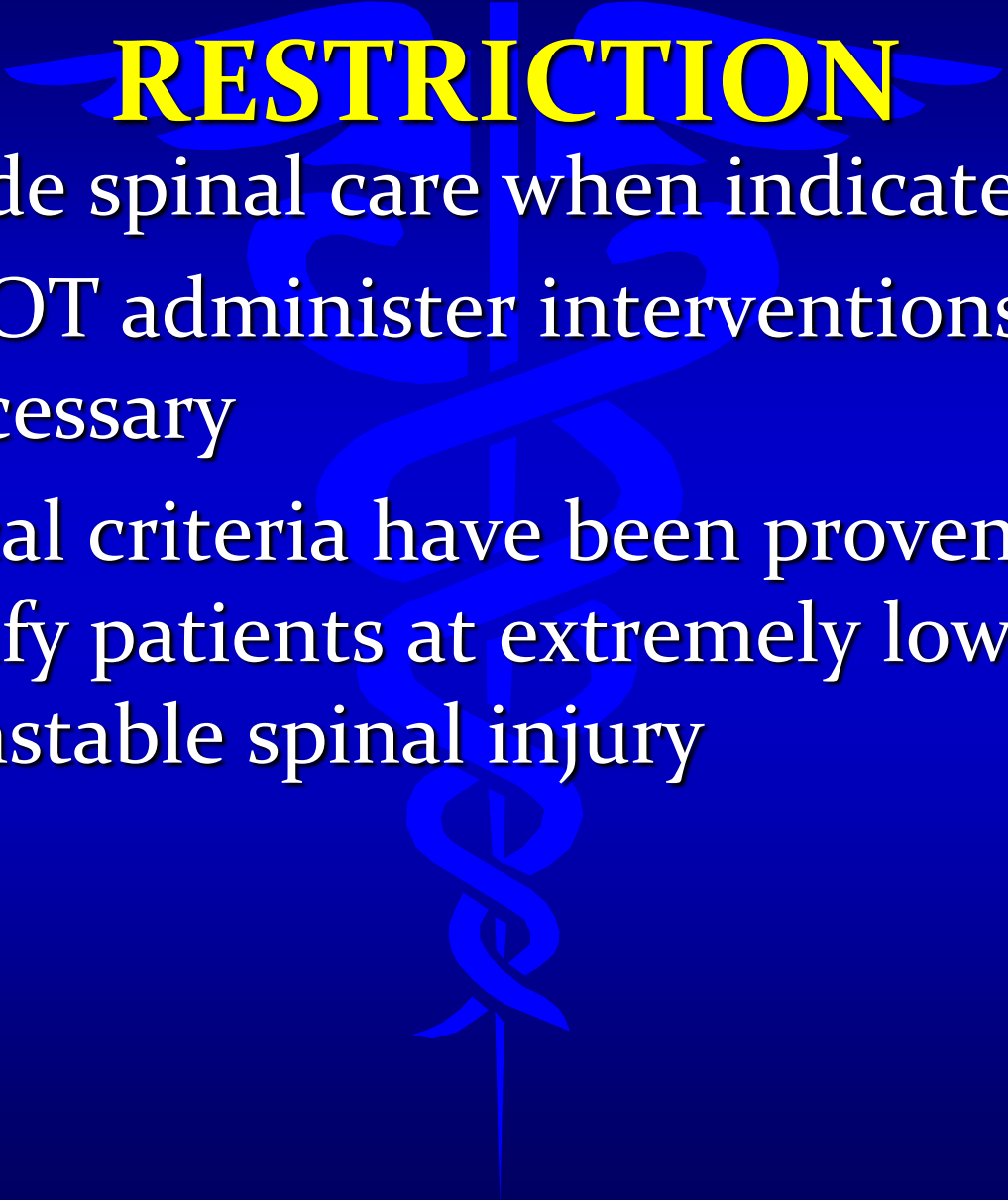
- If there was any injury or potential for injury it lead directly to immobilization, regardless of signs and symptoms
- Immobilize to a hard wooden or plastic board
- NO SCIENCE to support the use

SPINAL MOTION RESTRICTION



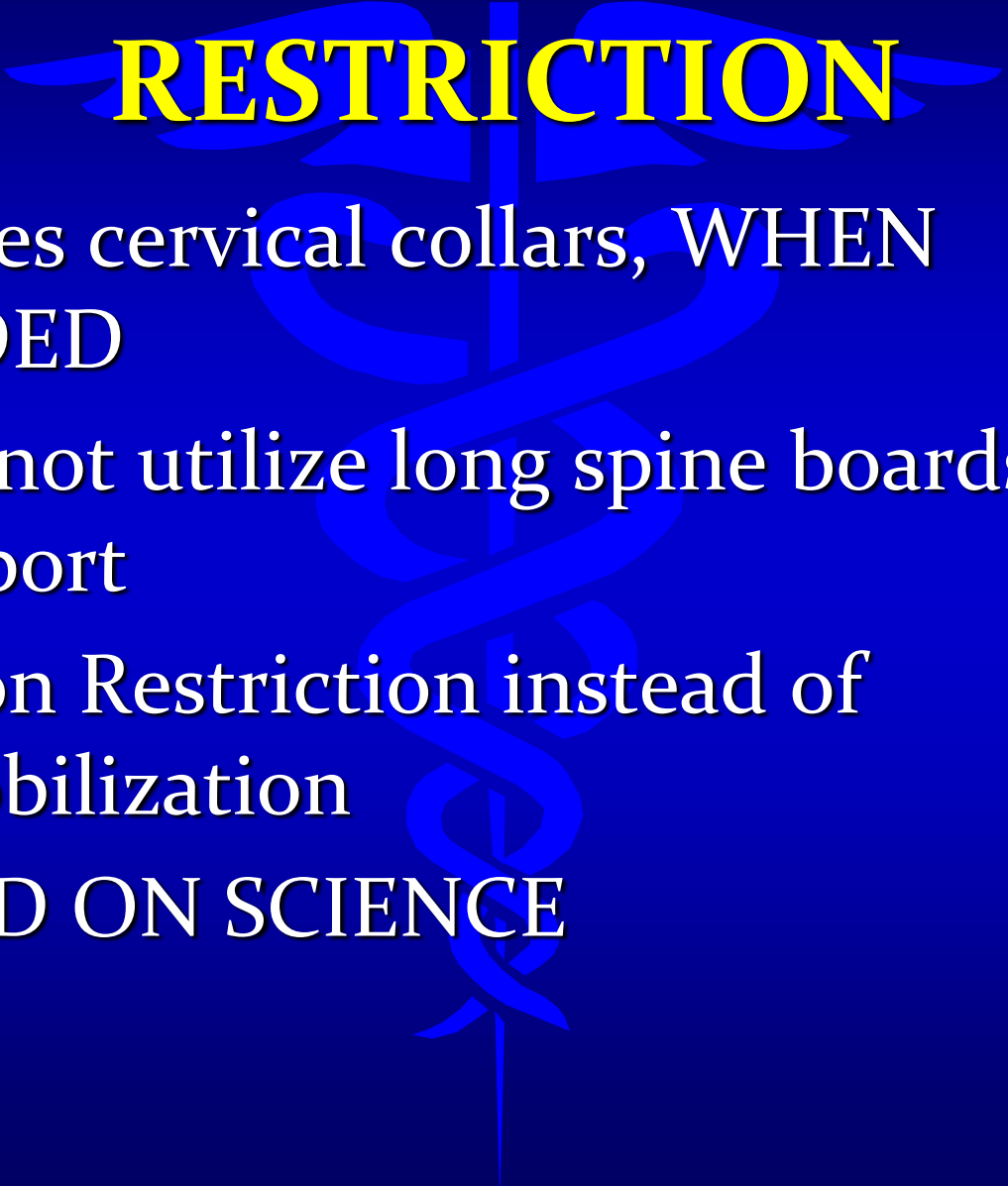
- A more enlightened approach to spinal injury
- Based on science and research
- The *NEW* standard of care
 - Best defense to litigation

SPINAL MOTION RESTRICTION



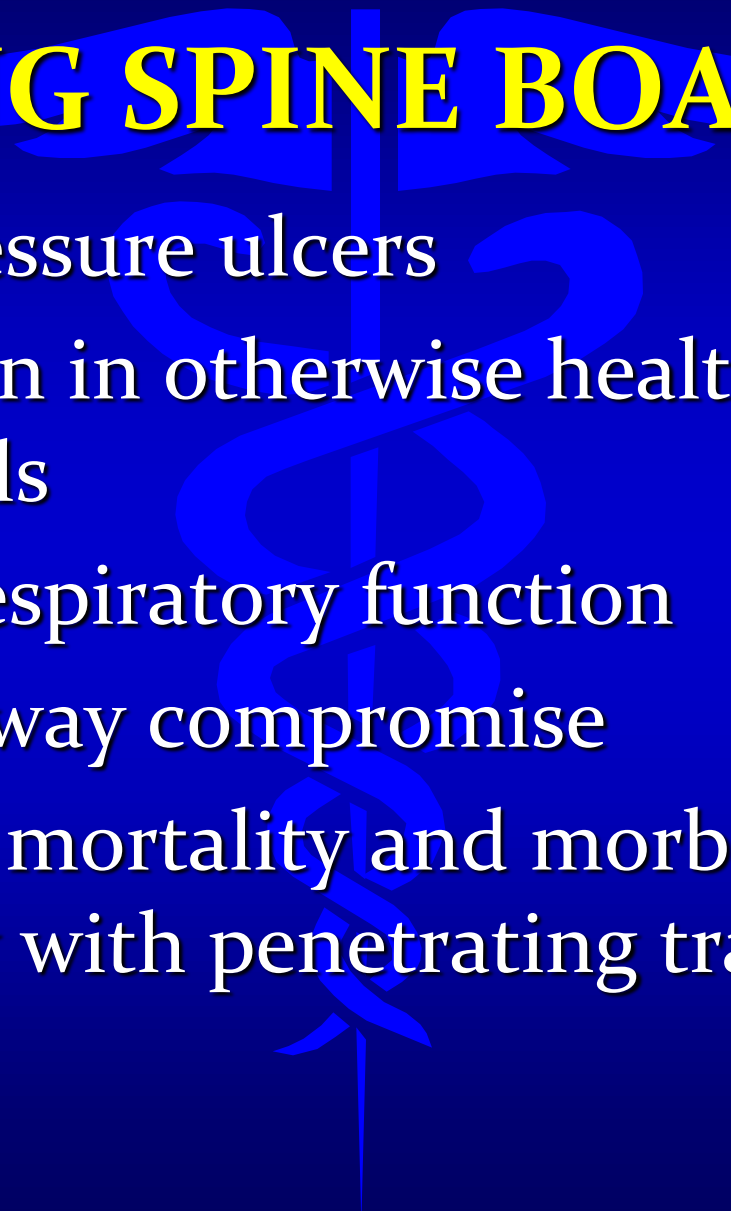
- Provide spinal care when indicated
- Do NOT administer interventions when unnecessary
- Clinical criteria have been proven to identify patients at extremely low risk for unstable spinal injury

SPINAL MOTION RESTRICTION

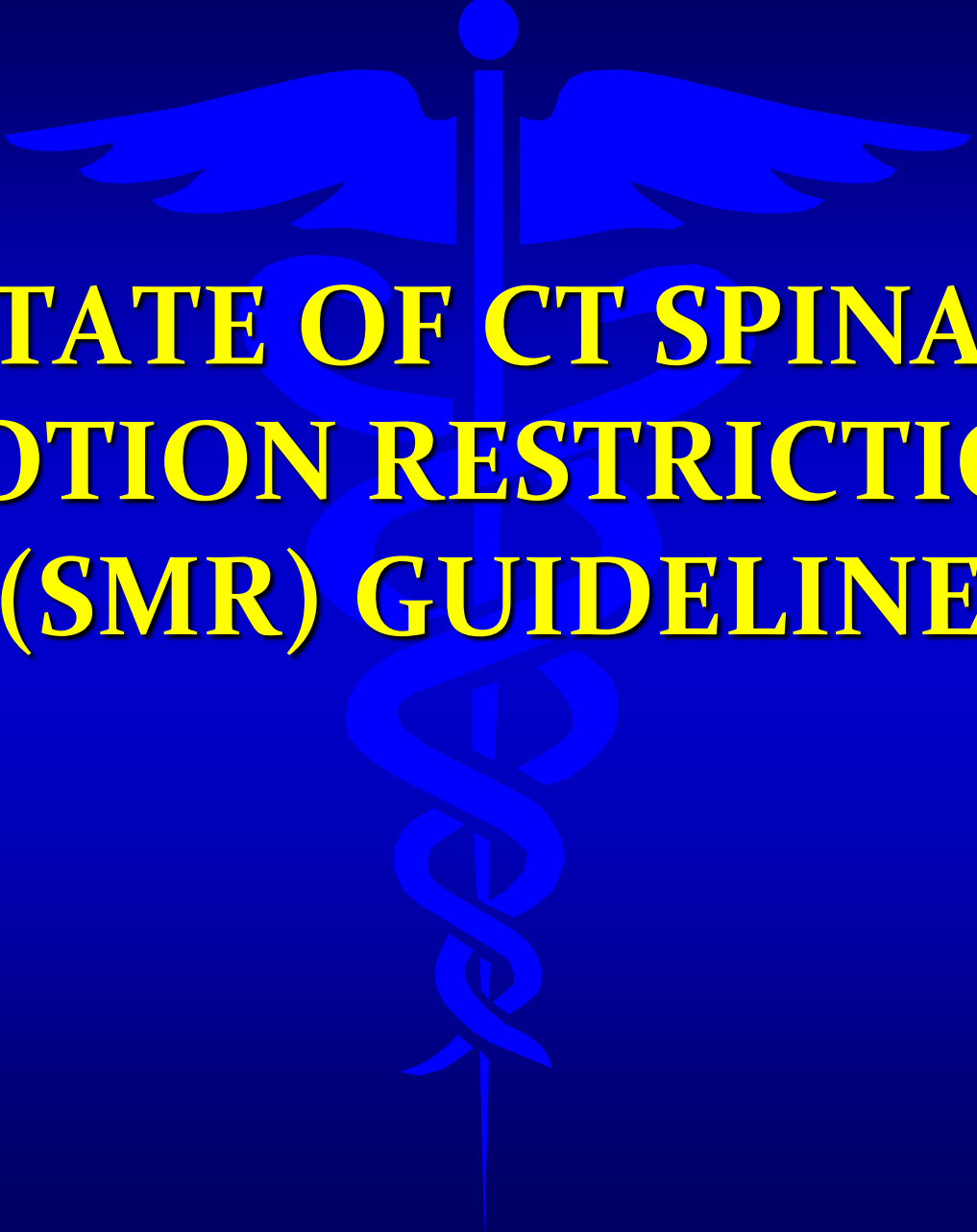


- Utilizes cervical collars, WHEN NEEDED
- Does not utilize long spine boards for transport
- Motion Restriction instead of immobilization
- BASED ON SCIENCE

THE SCIENCE LONG SPINE BOARDS



- Cause pressure ulcers
- Cause pain in otherwise healthy individuals
- Reduce respiratory function
- Cause airway compromise
- Increases mortality and morbidity, especially with penetrating trauma



**STATE OF CT SPINAL
MOTION RESTRICTION
(SMR) GUIDELINE**

STATE OF CT SPINAL MOTION RESTRICTION (SMR) GUIDELINE

- A redesigned approach to the management of spinal injuries
- Based on science
- Aimed at minimizing harm associated with traditional spine management.

PURPOSE



- The State of CT is supporting efforts to decrease unnecessary immobilizations in the field and reduce the risks and complications associated with this procedure. The intent of this guideline is to decrease injury and discomfort to patients caused by unnecessary spinal immobilization and use of long spine boards

RATIONALE



- There is evidence the use of backboards and immobilizing trauma victims may cause more harm than good by:
 - Causing pain
 - Changing the normal curve of the spine
 - Inducing patient agitation
 - Causing pressure ulcers
 - Compromising respiratory function
 - Delaying transport in penetrating trauma

KEY POINTS



- Backboards should be avoided for spinal “immobilization” or motion restriction with conscious patients
- **Placing ambulatory patients on backboards is unacceptable**

SPINE INJURY ASSESSMENT

INTRODUCTION TO SMR ASSESSMENT



- Omit SMR if all assessment criteria are safely assessed and normal

INTRODUCTION TO SMR ASSESSMENT



- Penetrating trauma such as a gunshot wound or stab wound should **NOT** be immobilized on a long board. Emphasis should be on airway and breathing management, treatment of shock, and rapid transport to a Level 1 or 2 trauma center.

INTRODUCTION TO SMR ASSESSMENT



- When possible, the highest level provider on scene should determine whether spinal motion restriction is to be used or discontinued (collar removed, etc.).
- When spinal motion restriction has been initiated and a higher level provider arrives, patients should be reassessed for spinal injury (as described in this section) to determine the most appropriate ongoing care.

WHO SHOULD BE ASSESSED FOR SMR?



- Evaluate patients for SMR who are suspected of having a traumatic spinal injury.
- Have high index of suspicion for pediatrics and patients with degenerative skeletal/ connective tissue disorders (i.e. osteoporosis, elderly, previous spinal fractures, etc)

WHO SHOULD BE ASSESSED FOR SMR?

- Maintain a high index of suspicion for mechanisms of injury that indicate a high risk of spinal injury:
 - Motor vehicle crash >60 mph
 - Rollover
 - Ejection
 - Falls >3 feet/5 stairs (patient standing with feet 3' above floor)
 - Axial load to head/neck (e.g., diving accident, heavy object falling onto head, contact sports).
 - Significant injury or mechanism of injury above the clavicle.
 - Injuries involving motorized recreational vehicles.
 - Bicycle struck/collision.

ASSESSING FOR SMR



- Patients who have sustained a mechanism of injury with potential for spinal injury require spinal motion restriction (as described further on) and protection of the injury site if :
 - The provider is unable to reliably assess the patient
OR
 - The patient exhibits any clinical signs or symptoms of an unstable spinal injury listed in the guideline

ASSESSING FOR SMR



- Apply SMR if patient can not competently participate in the exam due to one of the following:
 - Altered mental status (e.g., dementia, preexisting brain injury, developmental delay, psychosis, etc.)
 - Alcohol or drug intoxication
 - Distracted by significant injuries to self or others
 - Insurmountable communication barriers (e.g. hearing impairment, language, etc.).

ASSESSING FOR SMR



- Clinical findings requiring SMR
 - Midline spinal pain
 - Spinal deformity or tenderness with palpation
 - Abnormal (i.e. not baseline) neurological function or motor strength in any extremity
 - Numbness or tingling (paresthesia)
 - Sensation is not intact and symmetrical (or baseline for patient)
 - Cervical flexion, extension and rotation elicits midline spinal pain.

ASSESSING FOR SMR NORMAL MOTOR FUNCTION?

- Both Hands
 - Strength of grip and finger extension
- Or
 - Strength of wrist palmarflexion and dorsiflexion
- Strength of both plantarflexion (“push down”) and dorsiflexion (“pull up”)

ASSESSING FOR SMR NORMAL SENSORY FUNCTION?

- Check for intact (or baseline for patient) sensation in all extremities
- Ask about abnormal sensations (e.g. numbness/tingling)

ASSESSING FOR SMR NORMAL SPINE EXAM?

- Palpate vertebral column thoroughly
- No midline spine tenderness or deformity
- No midline spine pain when patient moves head up, down or side-to-side.
 - Last step in the overall spinal assessment
 - Instruct patient to move slowly and stop if they encounter pain

CLINICAL DECISION: SMR



- If patient is:
 - Able to be reliably assessed AND
 - Without any of the previous clinical findings
- Then patient should generally be transported without the use of a cervical collar or other means to restrict spinal motion.

CLINICAL DECISION: SMR



- If patient with spinal injury mechanism:
 - Is NOT able to be reliably assessed OR
 - Displays ANY of the previous clinical findings
- Then implement Spinal Motion Restriction (described further on).



**SHORT VERSION
OK TO OMIT SMR IF:**

Awake and alert

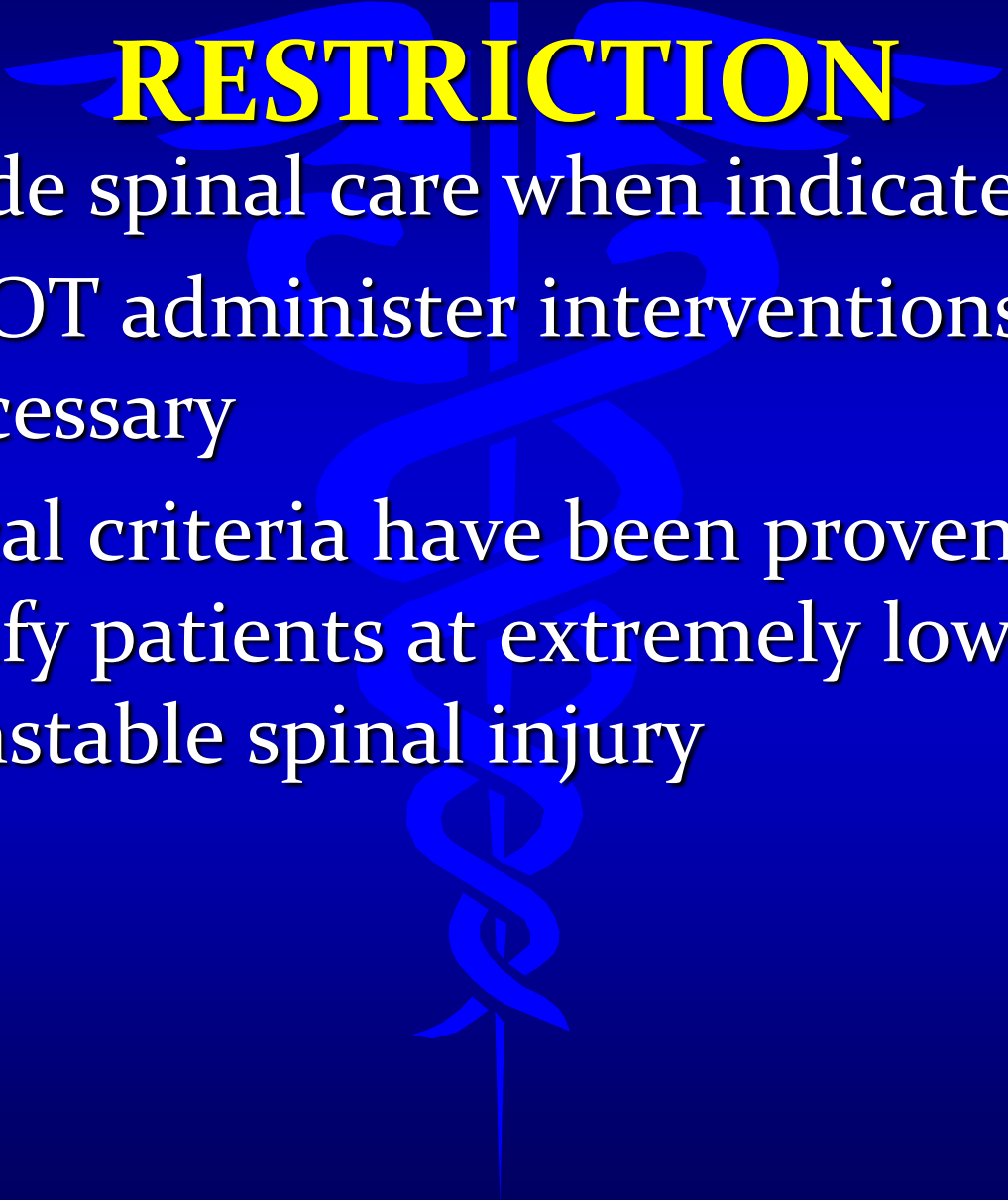
Spine doesn't hurt

Everything works normally



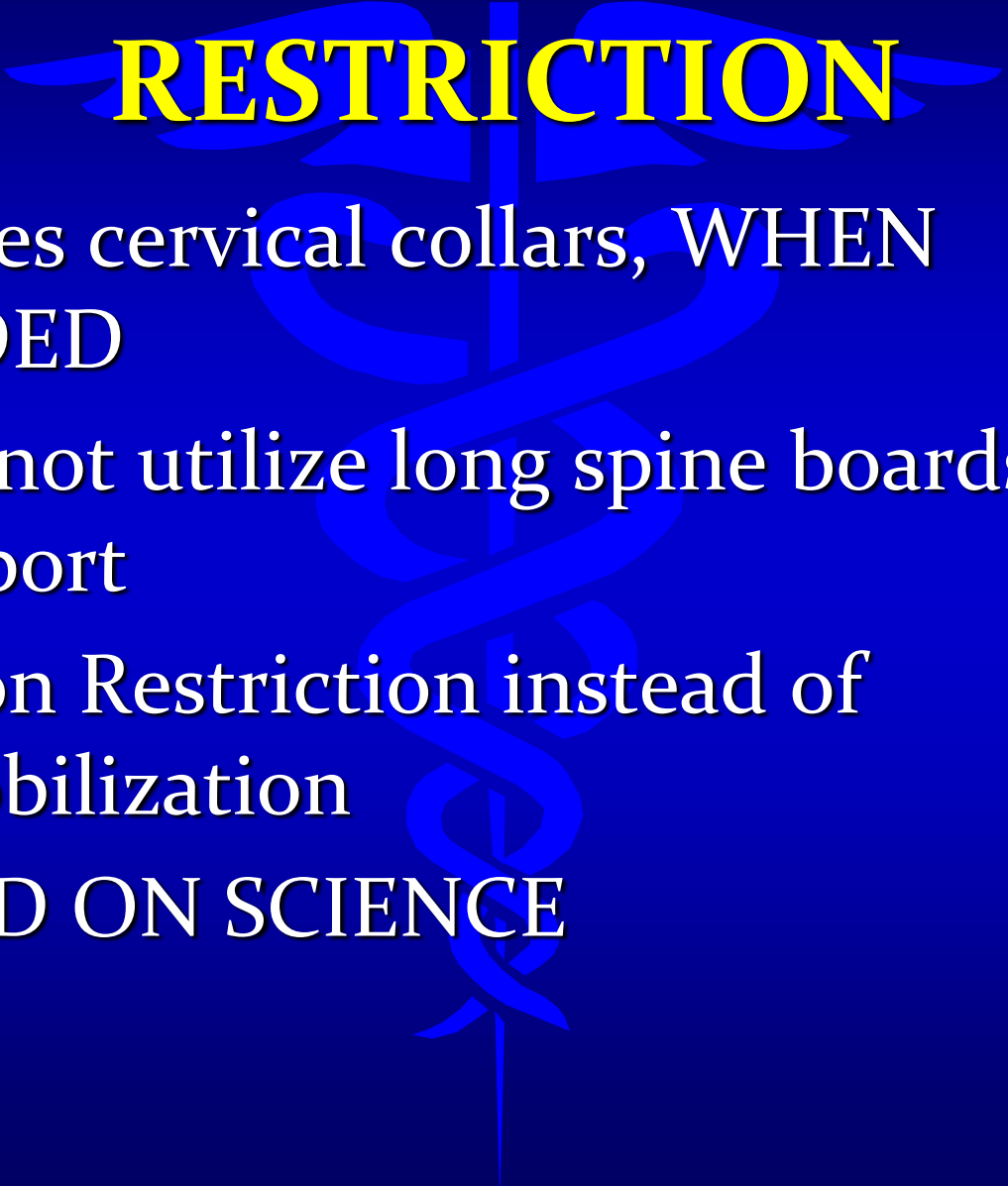
**SPINAL
MOTION
RESTRICTION**

SPINAL MOTION RESTRICTION



- The term spinal motion restriction (SMR) better describes the procedure used to care for patients with possible unstable spinal injuries.

SPINAL MOTION RESTRICTION



- SMR includes:
 - Reduction of gross movement by patient
 - Prevention of duplicating the damaging mechanism to spine
 - Regular reassessment of motor/sensory function

SMR: PURPOSE



- To decrease the risk of negative effects caused by traditional spinal immobilization while still providing appropriate care to patients with possible spinal injury by implementing alternative methods to achieve SMR.

SMR: INDICATIONS



- Any patient identified by State of CT's Spinal Injury Assessment to warrant spinal motion restriction. The spinal injury assessment should be performed prior to application of SMR.

SMR: INITIAL CARE



- Routine Patient Care.
- Maintain manual in-line stabilization during assessment.
- Minimize spinal movement during assessment and extrication.

SMR PROCEDURE EXTRICATION



- Self-extrication by patient is allowable if patient is capable.

SMR PROCEDURE

EXTRICATION

- A long backboard, scoop stretcher, vacuum mattress, or other appropriate full length extrication device may be used for extrication if needed.

SMR PROCEDURE

EXTRICATION AND MOVING

- Apply a cervical collar.
- For ambulatory patients, allow the patient to sit on the stretcher, and then lie flat.
- The "standing take-down" is eliminated.

SMR PROCEDURE LIFTING AND MOVING

- Pull sheets, other flexible devices, scoops and scoop-like devices should preferentially be utilized to move non-ambulatory patients when appropriate.
- Long, rigid spine boards should have only limited utilization.

SMR PROCEDURE

RIGID DEVICES DURING TRANSPORT

- Once the patient is moved to the stretcher, remove any hard backboard device.
- Patients should only be transported to the hospital on a rigid vacuum mattress or hard backboard if removal would delay transport of an unstable patient or it is necessary for other treatment priorities.

SMR PROCEDURE

RESTRICTION OF TORSO AND HEAD MOTION

- Lay the patient flat on the stretcher
- Secure firmly with all straps
- Leave the cervical collar in place.
- Instruct the patient to avoid moving their head or neck as much as possible.
- Elevate the back of the stretcher only if necessary to support respiratory function, patient compliance or other significant treatment priority.

SMR PROCEDURE

ALTERNATIVES TO CERVICAL COLLAR

- For conscious patients that poorly tolerate a rigid cervical collar (e.g., due to anxiety, shortness of breath), the cervical collar may be replaced with a towel roll and/or padding to minimize spinal motion.

SMR PROCEDURE

PATIENTS WITH NAUSEA OR VOMITING

- May place in a lateral recumbent position
- Maintain the head in a neutral position using manual stabilization, padding, pillows, and/or the patient's arm.
- Refer to applicable nausea and vomiting protocol.

SMR PROCEDURE

PATIENT COMFORT

- Patients should be allowed to be in position of comfort.
- Apply adequate padding to prevent tissue ischemia and increase comfort.
- Preferred patient positions (in descending order) for SMR are
 - Supine
 - Lateral
 - Fowler's Position (least elevation of head preferred)

SMR PROCEDURE

ONGOING ASSESSMENT

- Regularly reassess motor/sensory function (include finger abduction, wrist/finger extension, plantar/dorsal flexion and sharp/dull exam if possible).
- If patient experiences negative effects from the SMR methods/positioning used, alternative measures should be implemented.

SMR PROCEDURE

MOVEMENT OF PATIENT AT HOSPITAL

- Transfer from ambulance to hospital stretchers and vice-versa should be accomplished while continuing to limit motion of the spine.
- The use of slide boards, sheet lifts, etc. should be considered.

SMR: PEDIATRIC PATIENTS



- For pediatric patients 6 y/o and younger or <60 pounds requiring SMR, transport in a pediatric restraint system (as described in the ambulance minimum equipment list).
- Utilize pediatric restraint systems for older/larger children when appropriate and they fall within the device's recommended range.

PEDIATRIC PATIENTS

SMR in Car Seat

- **Apply padding and cervical collar as tolerated to minimize the motion of the child's spine. Rolled towels may be used for very young children or those who do not tolerate a collar.**
- **Avoid methods that provoke increased spinal movement.**

PEDIATRIC PATIENTS

Re-Use of Car Seats

- In a motor vehicle crash infants and children may remain in their own child safety seat, provided all of the following conditions are met:
 - The seat has a self-contained harness;
 - It is a convertible seat with both front and rear belt paths;
 - Visual inspection, including under movable seat padding, does not reveal cracks or deformation;
 - Vehicle in which safety seat was installed was capable of being driven from the scene of the crash;
 - Vehicle door nearest the child safety seat was undamaged;
 - The airbags (if any) did not deploy;
 - Provider ensures appropriate assessment of patient posterior.

PEDIATRIC PATIENTS

Critical Care Access Consideration

- If the patient requires significant care (e.g. airway management) that cannot be adequately performed in the car seat or pediatric restraint system, remove the patient and secure him/her directly to the stretcher.



**SPECIAL
CONSIDERATIONS**

SPECIAL CONSIDERATIONS

Interfacility Transport

- Long backboards do not have a role for patients being transported between facilities.
- If the sending physician requests a long backboard be used, discuss NOT using a long backboard in light of these guidelines.
- If long backboard still mandated by sending physician, utilize padding to minimize patient discomfort.

SPECIAL CONSIDERATIONS

Respiratory Compromise

- Consider the use of SpO₂ and EtCO₂ to monitor respiratory function.
- SMR may limit patient's respiratory function, especially in geriatric/pediatric restricted to long spine board.
- Use SMR with CAUTION for patients presenting with dyspnea and position appropriately.

SPECIAL CONSIDERATIONS

Combative Patients

- Avoid methods that provoke increased spinal movement and/or combativeness.
- Physically forcing SMR on a patient is counter-productive

SPECIAL CONSIDERATIONS

Penetrating Trauma

- Patients with penetrating trauma such as a gunshot or stab wounds should NOT be immobilized on a long spine board.
- Additional movement will not worsen an already catastrophic spinal injury with neurological deficit.
- Focus on ABCs and rapid transport to a level 1 or 2 trauma center.



**POINTS TO
REMEMBER**

POINTS TO REMEMBER



- As with traumatic brain injury, secondary injury to the spine often arises from increased pressure (e.g. swelling, edema, hemorrhage) or from hypoperfusion or hypoxia (e.g. vascular injury).
- Studies suggest protecting the injury site from pressure may be as important as reducing spinal movement.

POINTS TO REMEMBER



- While the optimal treatment for secondary injury has not been established, providers should protect the injury site and be cognizant of the risk of secondary injury.

POINTS TO REMEMBER



- In some circumstances, extrication of a patient using traditional spinal immobilization techniques may result in greater spinal movement or may dangerously delay extrication.
- All patients who have suffered possible spinal trauma should be handled gently and spinal motion should be minimized.

POINTS TO REMEMBER



- Caution should be exercised in older patients (e.g. 65 years or older) and in very young patients (e.g. less than 3 years of age), as spinal assessment may be less sensitive discerning spinal fractures in these populations.
- Only remove secure-fitting helmets from patients receiving SMR when necessary to provide clinically important patient care (e.g. airway maintenance, ventilation, etc.).

SUMMARY:

WHAT DO WE DO NOW?

- Other options for extrication and movement of patients:
 - Scoop
 - Vacuum Splint
 - LSB for extrication only

SUMMARY: LONG SPINE BOARDS



- Not routinely used to immobilize a patient
- May be used to facilitate the extrication/movement of patients from automobiles involved in significant collisions and confined spaces
- MCI incidents, used to extricate and move multiple patients

SUMMARY: LONG SPINE BOARDS



- Can use for CPR – cardiac arrest
- If patient on a LSB, they should be transitioned to a position of comfort on a cot/stretchers as soon as possible.
- No Standing Take Downs!!

SUMMARY: LONG SPINE BOARDS



- Patients who are awake, oriented and physically capable may be allowed to self-extricate from confined space/automobile. They should be placed in a position of comfort on the ambulance cot.



COMMON SITUATIONS

How to apply new SMR guideline?

CASE 1



- Low mechanism MVC
- No complaint of neck back injury
- Competent to participate in assessment
- No concerning clinical findings on exam

No SMR required

CASE 2



- Fall victim, ~15 feet, at home
 - Alert, oriented, no distress
- Complaint of mid line upper back pain

Needs SMR

- Can use scoop, LSB and c-collar to extricate from home – to stretcher
- If used, remove LSB for transport
- Position of comfort, pt. limits motion

CASE 3

- Gun shot wound to chest
- Paralysis below wound site
- No fall or other blunt Trauma

NO SMR

- Use direct lift or (if necessary) scoop or other lifting device to quickly place patient on stretcher
- Do not delay transport.

CASE 4

- High school football game, player has a helmet-to-helmet hit.
- Complaining of midline neck pain and “pins and needles” to arms and legs

Needs SMR

- Equipment snug: leave on, place on scoop, transport on stretcher, limit head movement
- Equipment loose: remove carefully, c-collar, scoop, transport on stretcher limited head movement

CASE 5



- Minor low speed MVC
- Patient ambulatory on scene, complaining of midline neck pain

Needs SMR

- Since ambulatory, apply c-collar
- Allow patient to sit and lie down on stretcher for transport
- Position of comfort
- Patient limits head movement

CASE 6



- Patient diving into pool, struck head
- Patient with motor and sensation deficits to arms and legs.

Needs SMR

- C-collar, device to extricate from pool
 - LSB, Scoop
- Remove from extrication device (if used) for transport
- Limit head movement

CASE 7



- Hockey Player, head into boards
- Patient with weakness in upper extremities, “burning” sensation to touch

Needs SMR

- C-collar, device to extricate from ice
- Remove from extrication device (if used) for transport
- Limit head movement



**ADVANCED
CASE STUDIES**

CASE STUDY ONE



- Dispatch
 - 68 y/o female c/o weakness to arms, unable to get out of car. Car parked in shopping mall parking lot.
- Arrival
 - Pt sitting in drivers seat of car, GCS 15, no distress
 - Pt states she drove car over concrete parking divider, “really jerking my head” when she drove over 6 inch divider.

CASE STUDY ONE (CONT)



- Initial assessment: ABC's normal, c-spine control initiated
- Stable or unstable?
- Evaluate MOI

CASE STUDY ONE (CONT)



- Secondary Assessment
 - VS normal
 - No pain on palpation of spine
 - No deformity palpable
 - Lower extremities= normal motor or sensory exam
 - Upper extremities= Good sensation to light touch and sharp touch; but, weak motor function

CASE STUDY ONE (CONT)



- Risk/Reliability: Hx of osteoporosis
- Treatment:
 - C-Collar
 - Extricate to stretcher, limiting motion
 - Instruct patient to limit motion
 - Assist as needed by patient

CASE STUDY ONE (CONT)



- Reassessment: VS normal, further decrease in motor function of upper extremities, no sensory changes, lower extremities without changes, patient c/o dull pain to neck

CASE STUDY ONE (CONT)



- Diagnosis: Incomplete SCI
 - Central Cord Syndrome
- Discussion
 - Hyperextension mechanism
 - Swelling of central cord
 - Most common type of cord injury
 - Loss of motor and sensory function below level of lesion with greater loss in arms than legs

CASE STUDY TWO



- **Description of case:** A 53 year old male was involved in a moderate-speed MVA. He was driver of car that rear-ended another car. Both cars have serious fender damage. The hood of your patient's car is pushed in and bent. the windshield is intact. He states he was wearing his seat belt. He complains of some shoulder soreness. He is sitting in his car when you arrive.

CASE STUDY TWO (CONT)



- **Initial Assessment:** ABCs are normal. Cervical spine stabilization is manually provided because of the appearance of the cars.
- **Decide Stability of patient:** Stable
- **Evaluate MOI:** Questionable.

CASE STUDY TWO (CONT)



- **Secondary Assessment - Neurological and Sensory Exam:** Vital signs are normal. Pt. denies pain on palpation of spine. You feel no deformity. Neurosensory exam is normal. Pt is able to perform range-of-motion without pain or limitation. Motor examination is normal.
- **Risk / Reliability Assessment:** Pt. has no risk factors

CASE STUDY TWO (CONT)



- **Treatment:** Transport for evaluation of shoulder discomfort.
- **Reassessment:** Unchanged.
- **Diagnosis:** No indications for spinal motion restriction

CASE STUDY TWO (CONT)

- **Discussion:** Clinical clearance or inclusion using the algorithm is a systematic approach as noted above. This patient has no indications for spinal immobilization. Be sure to document your exam and treat his shoulder. Transport to the ED is still indicated.

CASE STUDY THREE

- **Description of case:** You are called to the home of a 32 year old woman who is complaining of left wrist pain. She is embarrassed that she had to call 911, but she can't stand the pain in her wrist and can't drive herself to the ER. She states that she injured her wrist about 6 hours earlier after she fell out of a moving car. She reports her friends said that she was initially unconscious for several minutes. She admits to drinking a few beers prior to the accident.

CASE STUDY THREE (CONT)



- **Initial Assessment:** ABCs are normal. No manual stabilization initially maintained. Pt. denied any neck/back complaints.
- **Decide Stability of patient:** Stable.
- **Evaluate MOI:** Significant.

CASE STUDY THREE (CONT)

- **Secondary Assessment - Neurological and Sensory Exam:** Vital signs are stable. Palpation of cervical spine reveals mild tenderness. Manual cervical spine stabilization is provided. Neurological exam reveals intact sensation to light touch and pain. Proprioception is normal. Patient moves all extremities. You note multiple abrasions over forehead, scalp and left arm and leg.

CASE STUDY THREE (CONT)



- **Risk / Reliability Assessment:** Loss of consciousness, alcohol use, associated injuries
- **Treatment:**
 - Cervical collar
 - Onto stretcher (short ambulation, stair chair)
- **Reassessment:** Unchanged
- **Diagnosis:** Subluxation of C-4 on C-5 with fracture of pedicle and arch of C-4

CASE STUDY FOUR



- **Description of case:** 5 year old male fell out of tree approximately 10 feet. Landed on hard ground. Parents report patient was unconscious for a few minutes. Child is now alert, oriented and is very quiet and still.

CASE STUDY FOUR (CONT)



- **Initial Assessment:** Airway, breathing and circulation are normal.
- **Decide Stability of patient:** Stable
- **Evaluate MOI:** Significant

CASE STUDY FOUR (CONT)



- **Secondary Assessment - Neurological and Sensory Exam:** Vital signs are normal. Secondary exam reveals shoulder pain and burning in both legs. Patient refuses to participate in exam any further or describe any other sensations.
- **Risk / Reliability Assessment:** Patient is at high risk for spinal cord injury/fracture due to age.

CASE STUDY FOUR (CONT)



- **Treatment:** SMR
- **Reassessment:** Unchanged.
- **Diagnosis:** SCIWORA
- **Discussion:** This patient suffered a fractured clavicle and a spinal cord injury.

CASE STUDY FIVE



- **Description of case:** 20 year old male, pedestrian stuck by car. Lying in road way, unconscious. Obvious head lacerations. Car left scene. Per witnesses, car travelling at high rate of speed, patient struck windshield and rolled off side of car.

CASE STUDY FIVE (CONT)

- **Initial Assessment: GCS 3, airway unstable, blood in airway, weak/rapid radial pulses**
- **Decide Stability of patient: unstable**
- **Evaluate MOI: high risk, pedestrian struck by car**

CASE STUDY FIVE (CONT)



- **Treatment:**
 - **Manage airway, suction, oral airway**
 - **Control head bleeding**
 - **Cervical Collar**
 - **Scoop stretcher to lift patient onto stretcher**
 - **Pad sides of head to limit movement**

CASE STUDY FIVE (CONT)



- **Reassessment:** Decreased respiratory rate/depth, begin assisted ventilations. Treat for shock
- **Diagnosis:** traumatic head injury
- **Discussion:** Do not immobilize on long spine board. Scoop is a good method to move patient.

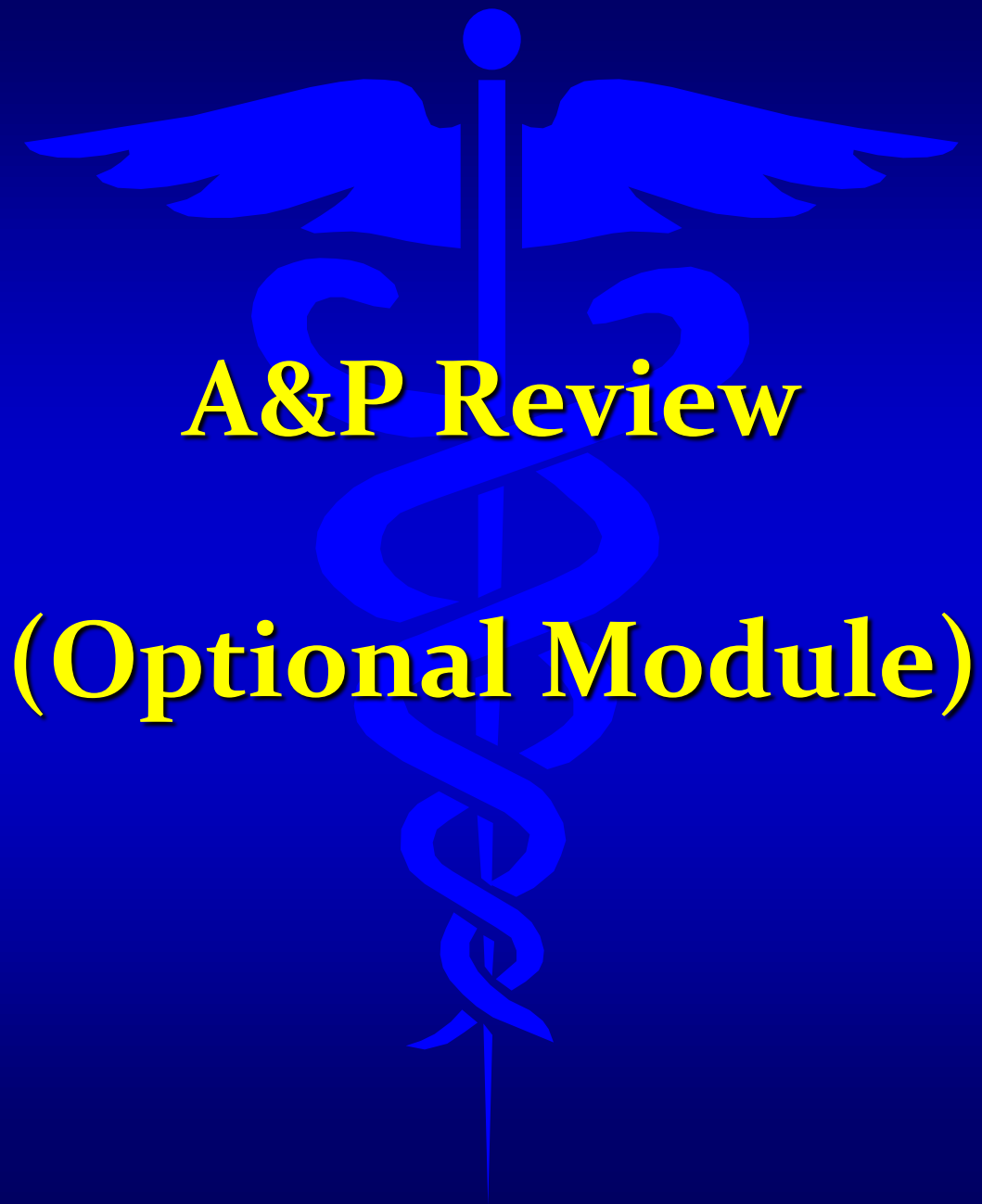
SUMMARY



- Evidence based
- The new standard
- Removes a dangerous tool, long spine board immobilization
- Following the standard of care is your best legal defense
- Immobilizing on a LSB is NO LONGER the standard of care

QUESTIONS





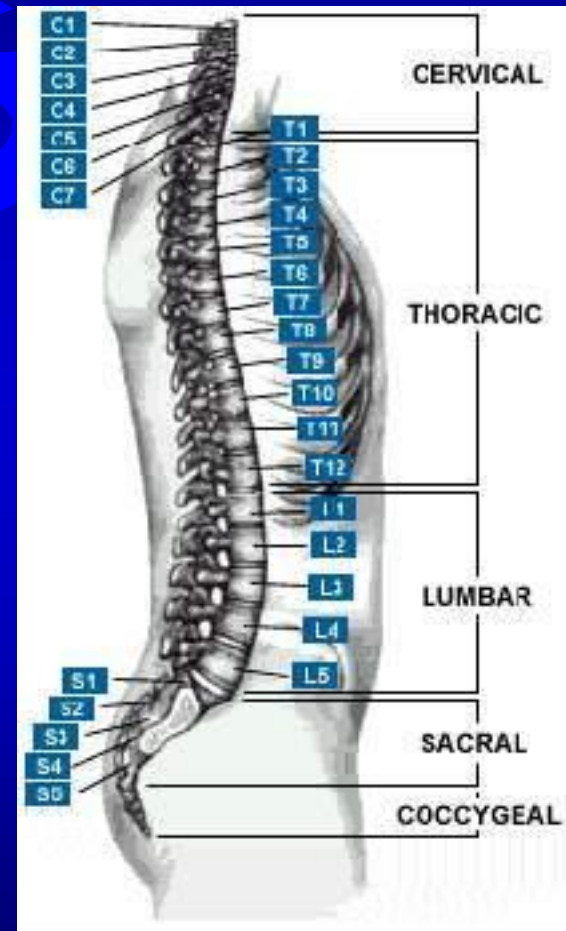
A&P Review

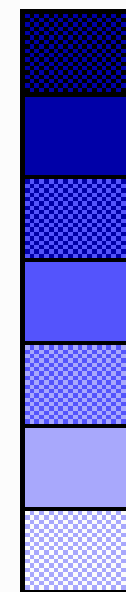
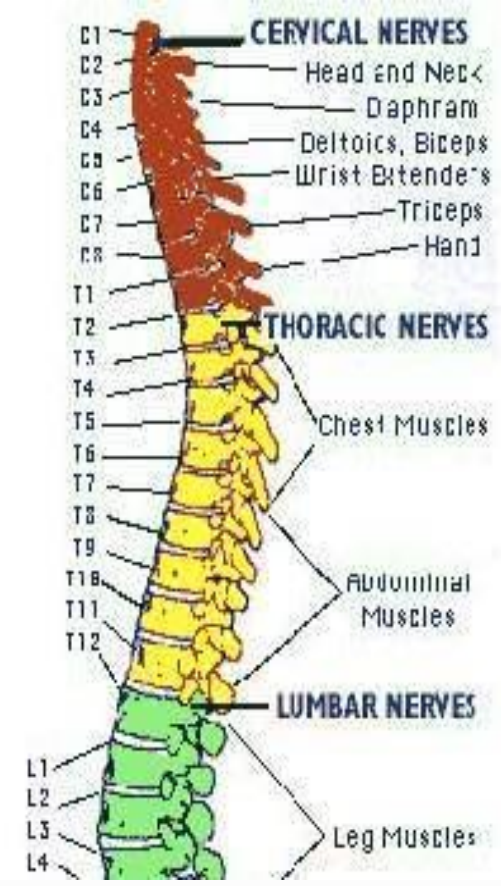
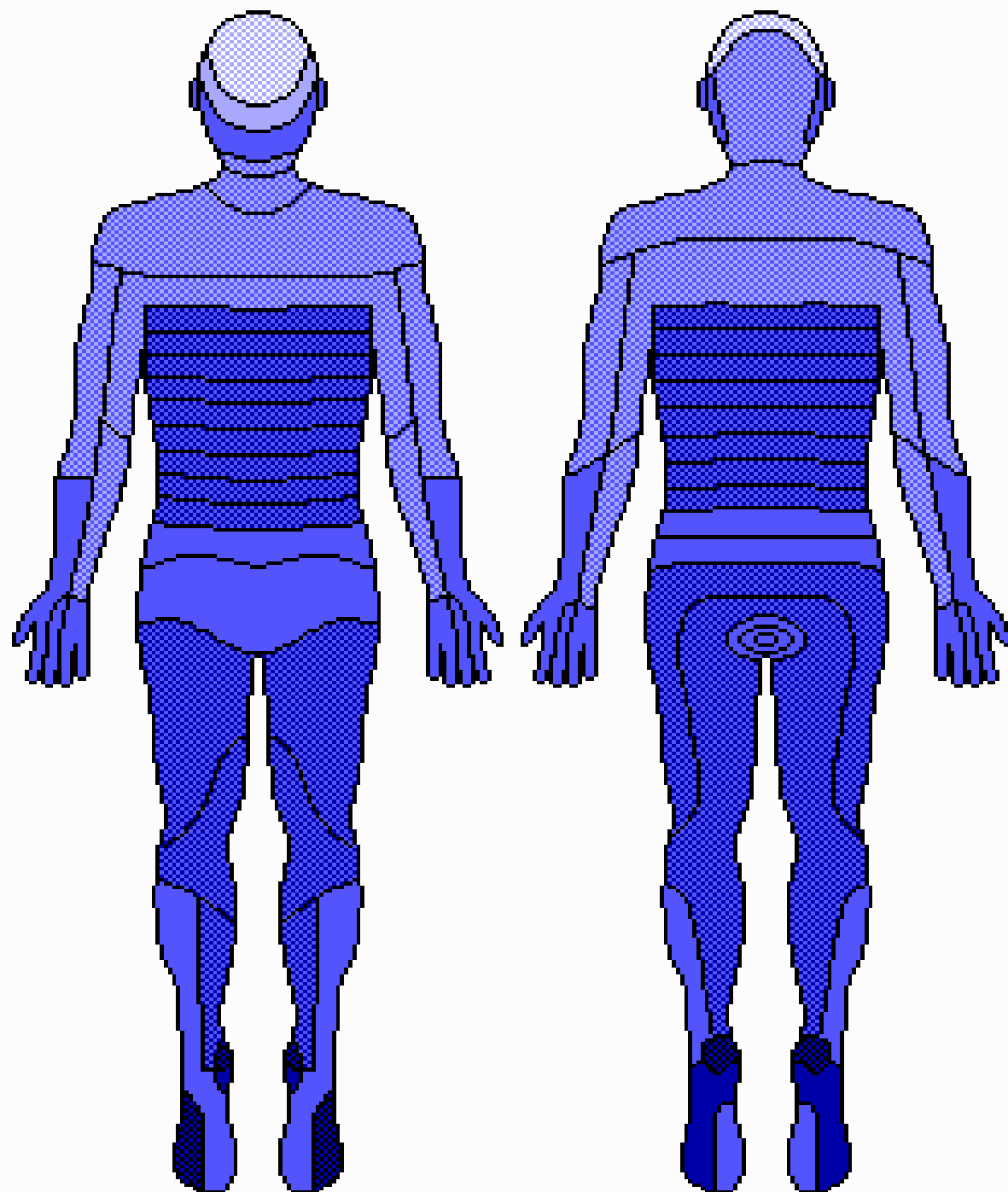
(Optional Module)

Anatomy & Physiology- General Structure & Function

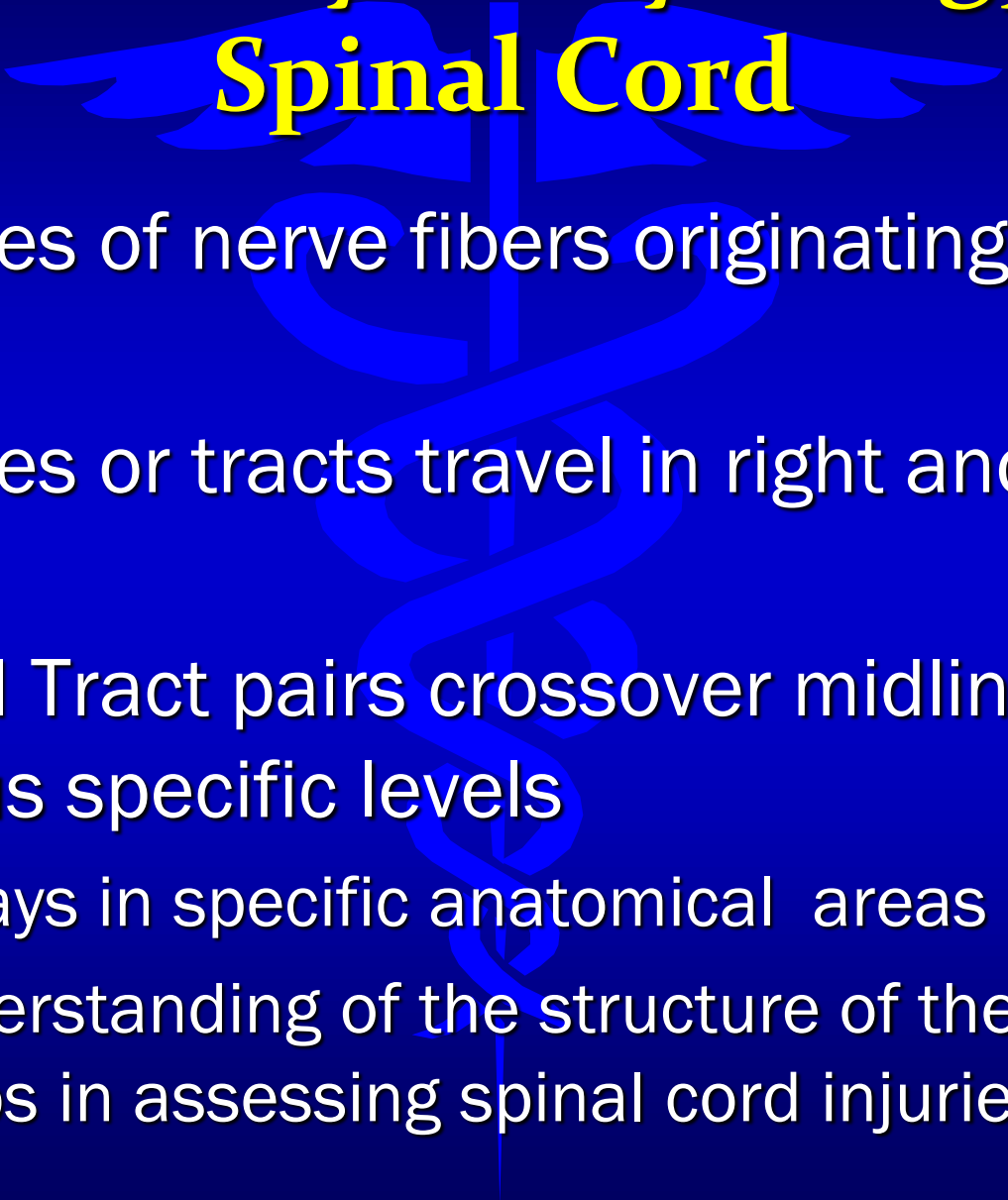
Spinal Column

- Made up of 26 vertebrae stacked on top of one another
- Divided into 5 areas; cervical, thoracic, lumbar, sacral, and coccyx





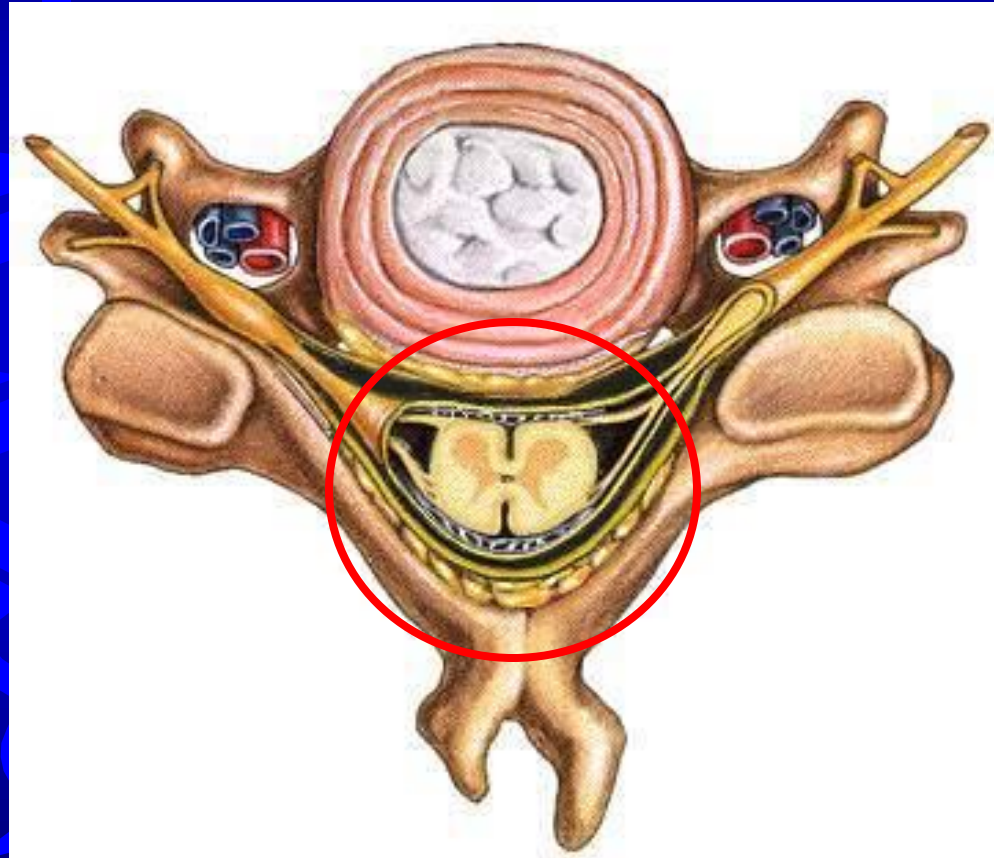
Anatomy & Physiology- Spinal Cord

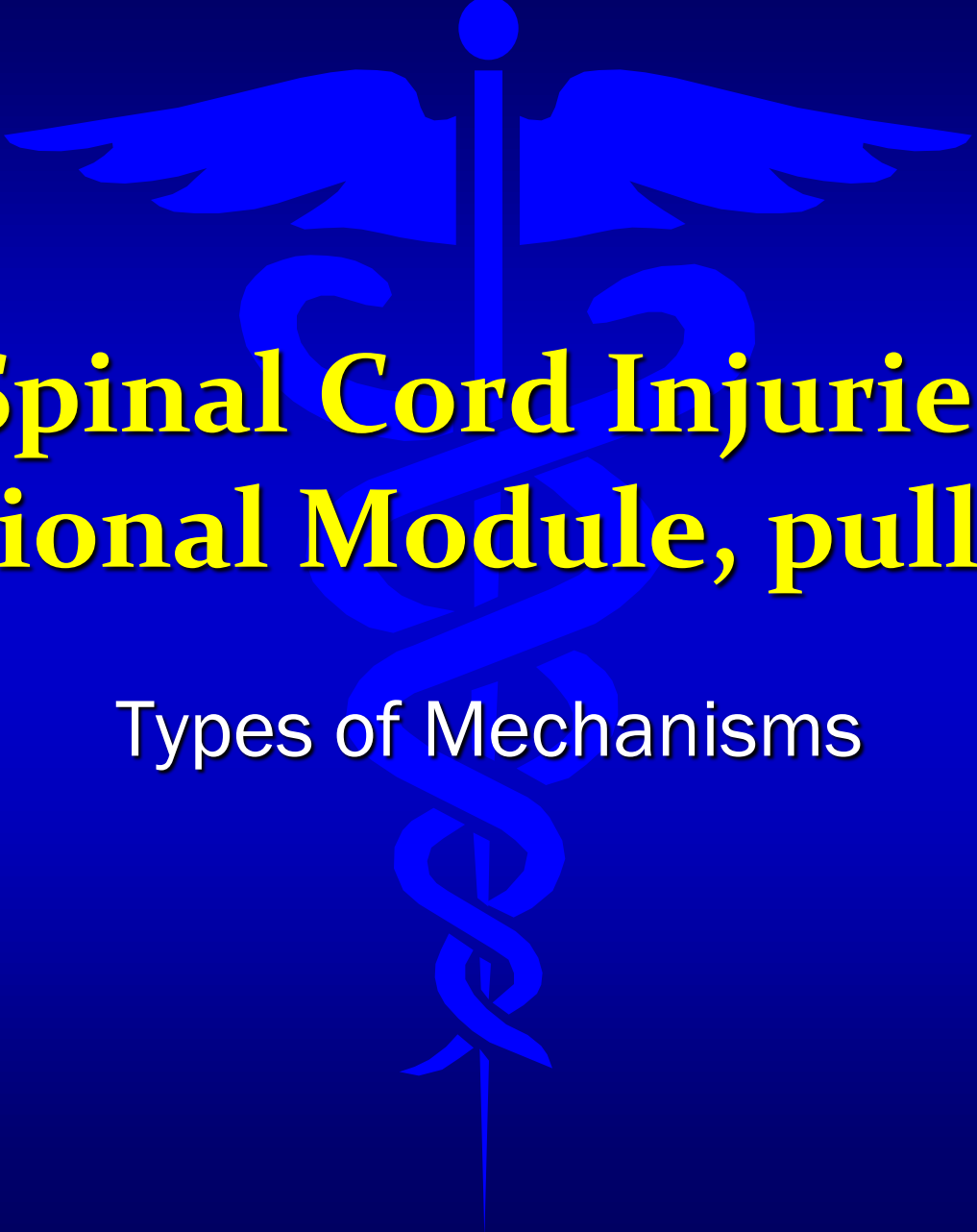


- Bundles of nerve fibers originating in the brain
- Bundles or tracts travel in right and left pairs
- Spinal Tract pairs crossover midline at various specific levels
 - always in specific anatomical areas
 - understanding of the structure of these tracts helps in assessing spinal cord injuries

Complexity of the Cord

- Descending motor
 - Corticospinal (pyramidal)
 - Voluntary Motor
- Ascending sensory
 - Spinothalamic: pain, temp, crude touch & crude pressure
 - Posterior (Dorsal): proprioception, vibration, fine touch & fine pressure





Spinal Cord Injuries

Optional Module, pull out

Types of Mechanisms

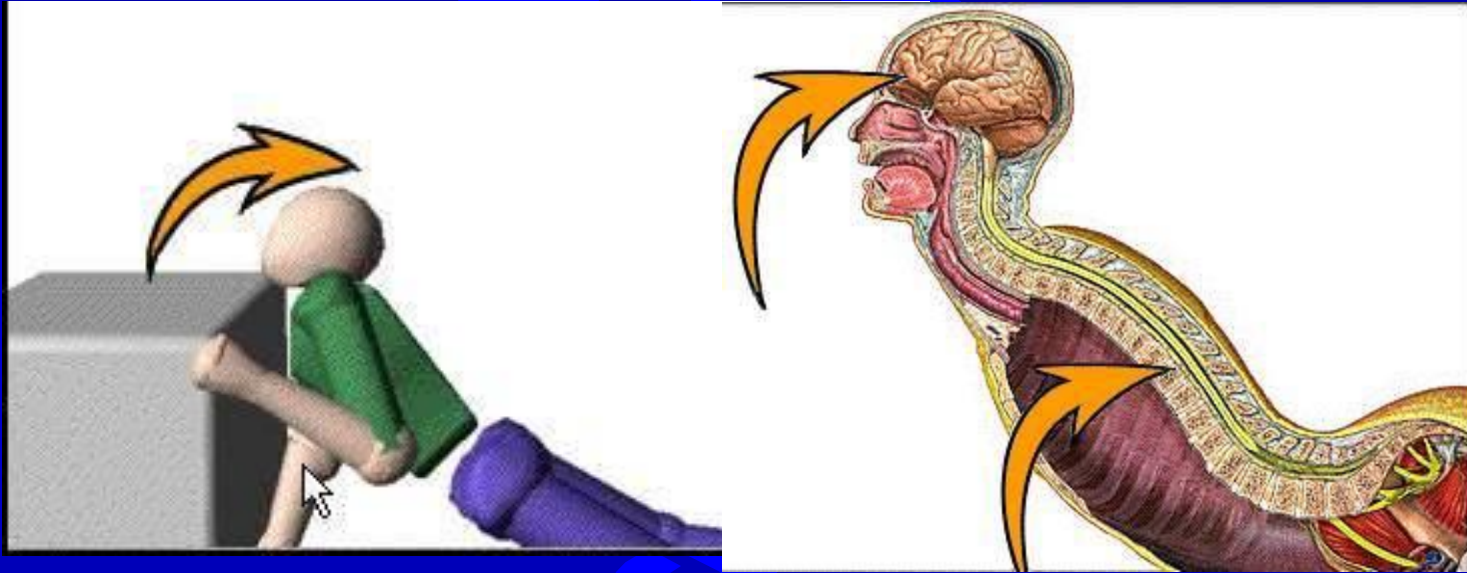
Alameda Video



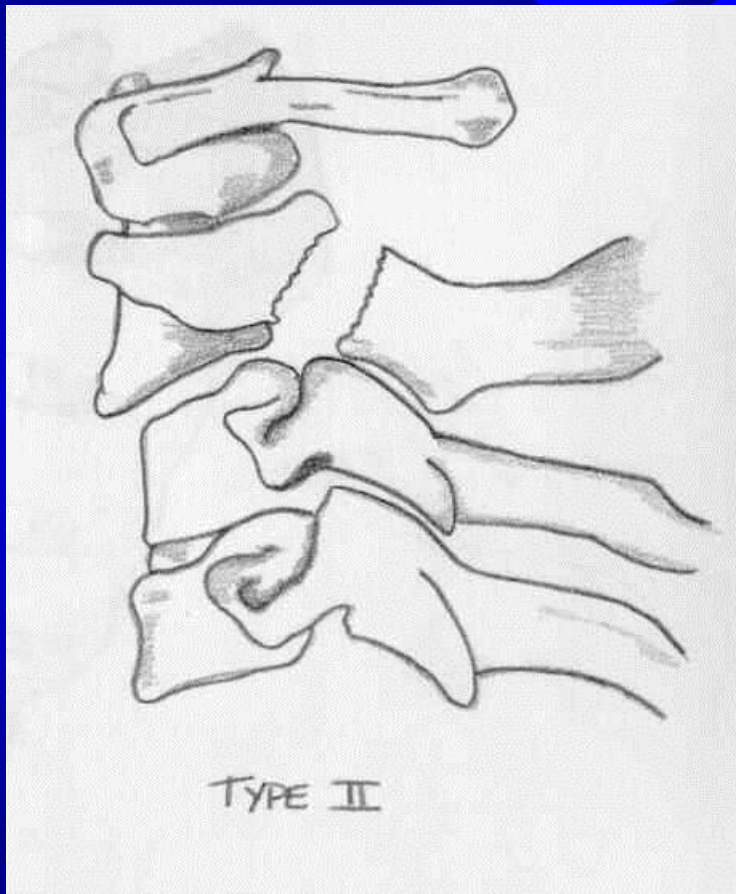
SPINAL INJURY ASSESSMENT (SMR) | PAGES 135-143

PROCEDURES

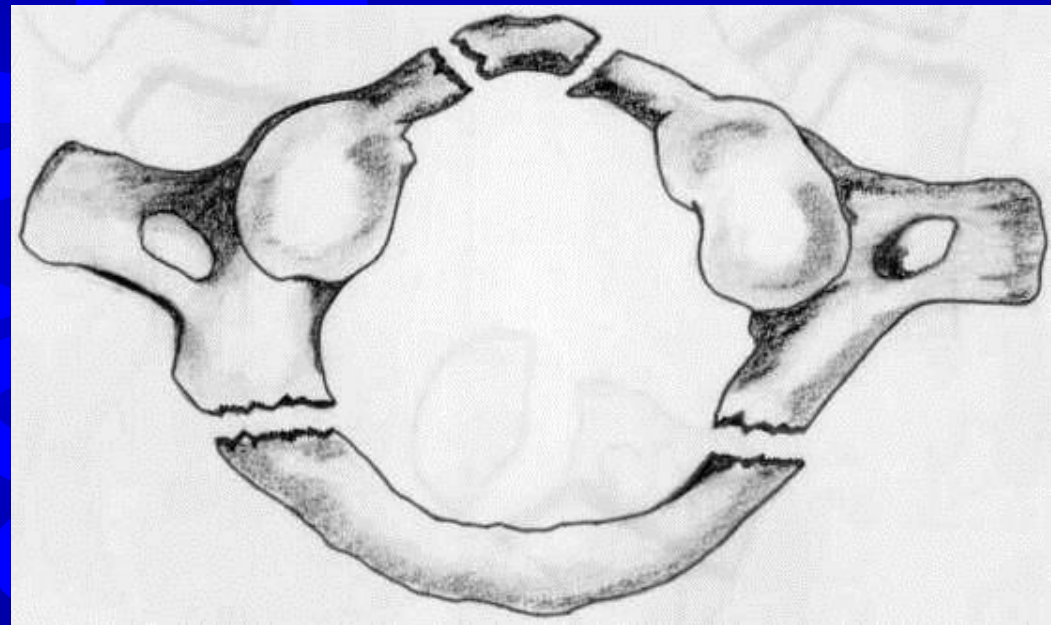
Hyperextension



Hyperextension Injuries

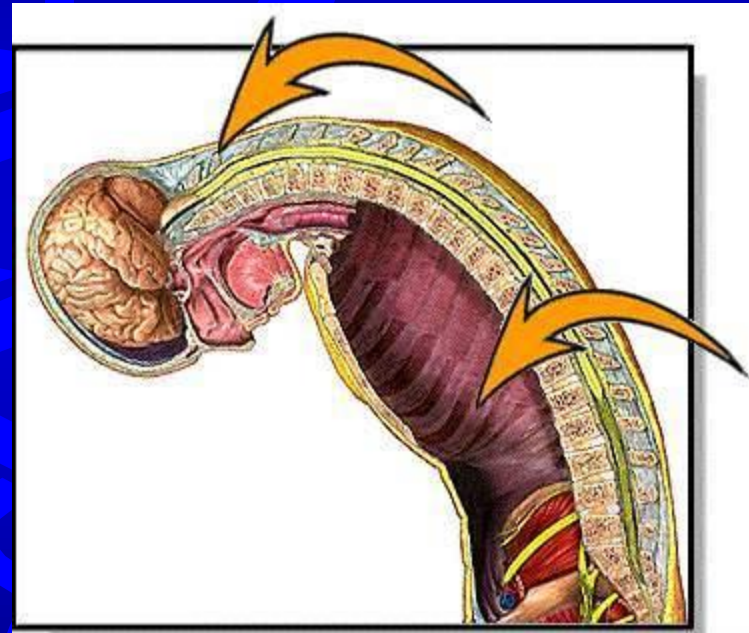
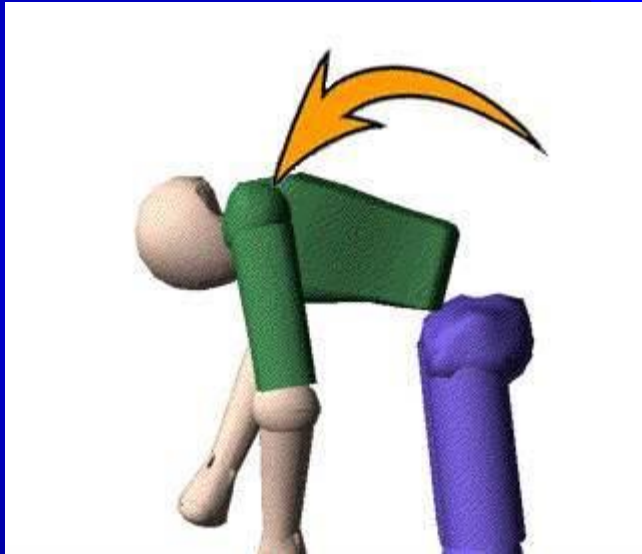


C-2 Odontoid
“Hangman’s Fracture”

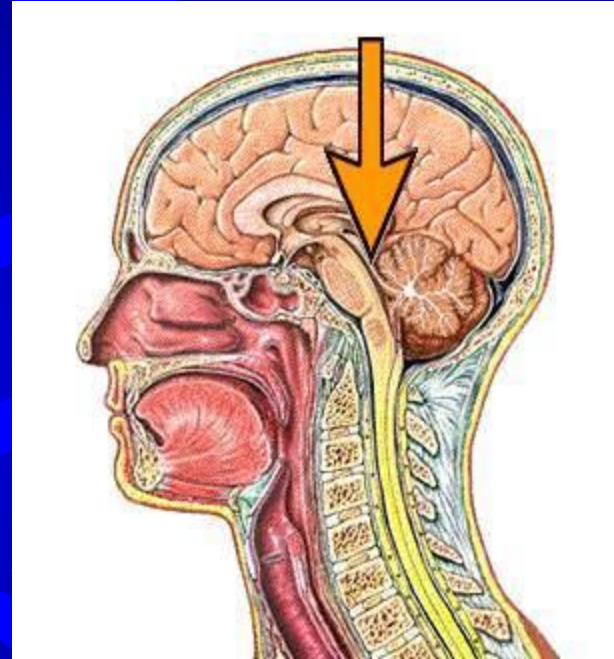
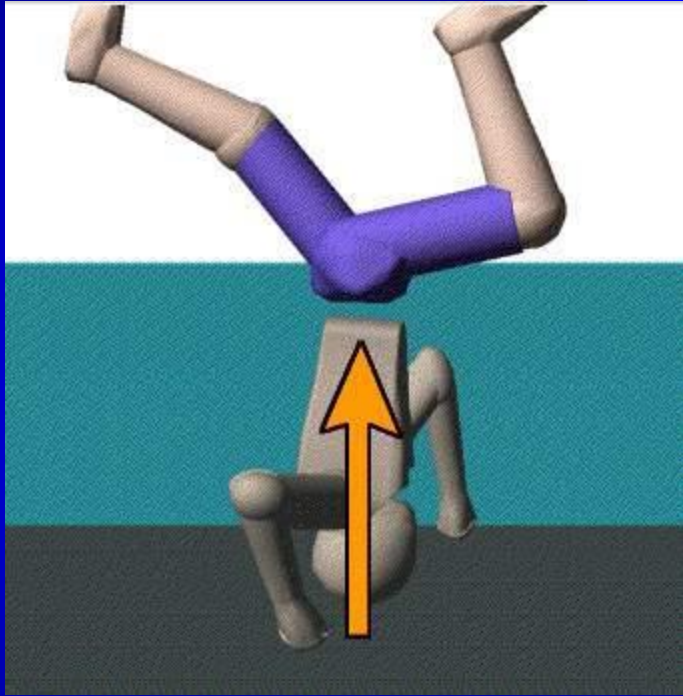


C-1 Atlas. “Jefferson Fracture”

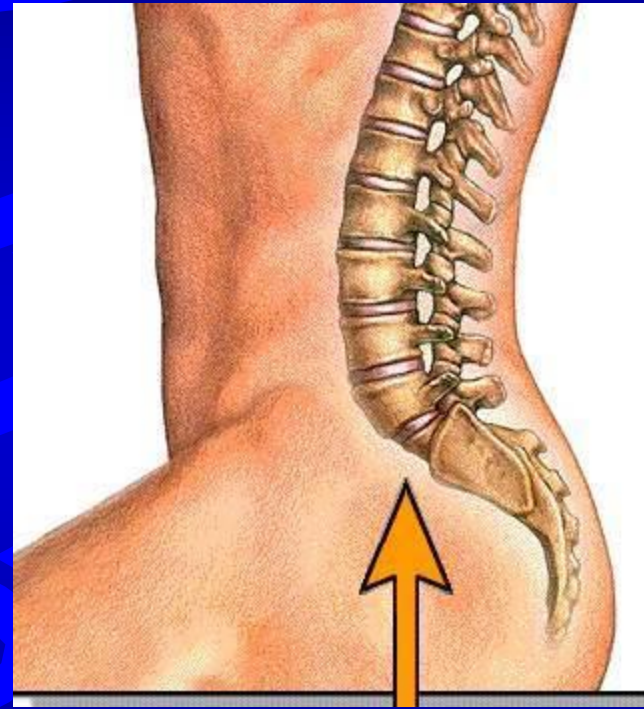
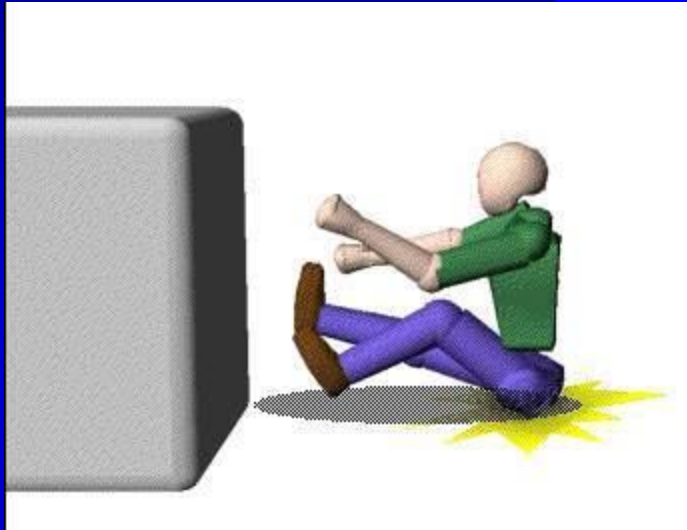
Hyperflexion - Direction of Force



Compression fracture - head



Compression Fx - Thoracolumbar





NEXUS

**Who needs spinal motion
restriction and xrays?
(Optional Module)**

NEXUS Study



- Evaluated the ability to predict none unstable spinal injuries based on clinical exam
- Proved a systematic/standardized exam can direct clinicians to safely NOT immobilize a patient

Why not immobilize and Xray everybody?

- Immobilization is uncomfortable: increased time immobilized = increased pain, risk of aspiration, vulnerable position, etc...

Why not immobilize and Xray everybody?

- >800,000 U.S. Patients receive cervical radiography each year
- Patient exposure to radiation
- >97% of xrays are negative
- Cost exceeds \$175,000,000 /year

Incidence of SCI



- About 50 patients per million population.
- 12,000/year are treated while another 4,800 die prehospital.
- Male-to-female ratio is approximately 2.5-3.0:1
- About 80% of males with SCI are aged 18-25 years.

National Emergency X-Radiography Utilization Study NEXUS

Hypothesis:

Blunt trauma victims have virtually no risk of cervical spine injury if they meet all of the following criteria:

- No neuro deficit,
- Normal Level of alertness
- No evidence of ETOH/Tox
- No posterior midline tenderness
- No other distracting painful injury

NEXUS



- 21 Centers enrolled 34,069 Blunt trauma victims who underwent cervical spine radiography.

What is a **significant distracting injury**?

- Ill-defined in the literature:
- “Distracting Painful Injuries associated with Cervical Spinal Injuries in Blunt Trauma”* suggests:
 - 1) Any long bone fracture
 - 2) Visceral injury necessitating surgical consult

* Ullrich, et al. AEM 2001;8:25-29.

What is a **significant distracting injury?** #2

- 3) Large laceration, degloving or crush
- 4) Large burns
- 5) *any injury producing acute functional impairment*

Distracting Painful Injuries

Conclusions

- Very subjective evaluation
- Most cervical spine clearance studies leave it to clinical judgement
- Several studies show good interobserver agreement among clinicians regarding DPI
- Use DPI liberally to improve sensitivity

NEXUS Definition: Intoxication



Patients should be considered intoxicated if they have

- 1) History of recent intoxication or ingestion
- 2) Evidence of intoxication on exam

NEXUS Definition:

Altered neurologic function

- 1) GCS 14 or less
- 2) disoriented to person, place, time, events
- 3) inability to remember 3 objects at 5 min.
- 4) Any focal deficit
- 5) delayed/inappropriate response to external stimuli

NEXUS - Results



- 818 patients with fracture identified
- All except 8 were identified by clinical decision rule
- Sensitivity 99% (95% CI 98-99.6%)

8 Patients Not Identified By NEXUS Rules

PATIENT'S SEX/AGE (YR)	CERVICAL-SPINE INJURY		COMMENT
	VERTEBRAE	TYPE OF INJURY	
M/38	C6	Spinous-process fracture	
M/53	C6-C7	Chipped osteophyte	
M/54	C2	Extension (teardrop) fracture; normal alignment without soft-tissue swelling	
M/20	C7	Anterosuperior end-plate avulsion, without soft-tissue swelling	Treatment with soft collar only; no sequelae
F/18	C5	Wedge compression fracture	Minimal loss of body height
F/81	C2	Isolated lateral-mass avulsion	Treatment with soft collar
M/84	C2	Isolated lateral-mass avulsion	Treatment with hard collar for 2 days, followed by soft collar
M/57	C6	Lamina fracture	

*A negative result indicated that the patient was considered to have such a low probability of cervical-spine injury that imaging was not necessary.

NEXUS- ER Doc Results



- Application of NEXUS criteria would reduce imaging by 12.6% in emergency departments.
- Average emergency physician could expect to see a missed fracture every 125 years of practice.

The Main Point:

You can't just decide to "clear" the spine without following a standard of care 100% of the time. No "neck-pain" in not an absolute clearance.

The Main Point:

Patients whose spinal cord injuries are missed are directly related to **poor assessment**, lack of recognition of SCI patterns and lack of knowledge about risk factors correlated to SCI.

Age Based Considerations

- Spinal Cord Injury Without radiologic Abnormality (SCIWORA)
 - 2/3 cases occur in < 8 years.
 - Cervical & Thoracic Levels most commonly injured.
- Due to anatomy of pediatric spine
 - Horizontal alignment
 - Limited support, easily moved

SCIWORA



- In group of children under 8 with spinal injuries.
 - 68 % had no radiographic findings.
 - Of these, 30% had delayed onset of symptoms.