TO IMMOBILIZE OR NOT TO IMMOBILIZE.... THAT IS THE QUESTION...

- Matthew N. Jackson, M.D., FACEP

USED TO BE SIMPLE.....

- Immobilization following injury used to be a simple decision—but no one was thinking....
- Up to 5 million people per year receive spinal immobilization in the United States.

THE FEAR

- Old Thinking—spinal immobilization previously based on fear of injury and mechanism, not objective assessment
  - Everyone who was involved in any kind of fall, MVC, assault, etc was immobilized indiscriminately, despite complaints, despite assessment
  - Was a cornerstone for patients “at risk” of spinal injury for decades.

THE PROBLEM

- More thought used to be put into the treatment of “potential injuries” than the cause of the incident
  - Syncope
  - Stroke/ICH
  - Tox
  - Sepsis
  - Seizure
  - Arrhythmia
  - Dehydration
  - Anemia/shock

OLD THINKING

- Previously, care of the injured patient was based on belief (dogma) that potential of injury could lead to rapid deterioration without immobilization—finding that this just “isn’t true”
- Concerns for injury ballooned to include large amounts of patients that would otherwise have little to no chance for significant injury.
  - High risk and very low risk patient were treated the same.
  - More than 50% of patients immobilized in the prehospital setting have no complaints of pain.
  - No thought was really ever given to possible complications of immobilization
**Sometimes it's obvious**

- Serious mechanisms
- Multisystem trauma
- Distracting injuries
  - Long bone fracture
  - Visceral injury needing surgical evaluation
  - Large lacerations/wounds
  - Deep cuts
  - Burn (very painful)
- Injuries producing acute functional impairment

- Neurological compromise
  - GCS < 14, confusion
  - Inappropriate response to external stimuli
  - Deficits on motor or sensory exam.
- Intoxication

**Fear of a rare animal**

- Old problems
- Fear of a rare animal
  - Cervical spine injuries fortunately not that common
    - Overall prevalence of c-spine injuries roughly 1-2%, fortunately many of those not unstable.
    - Less than 1% (0.4-0.7%) of fractures actually suffer a spinal cord injury or unstable c-spine fracture
  - Fear of liability and from doing harm
    - Of those that suffered chord injury or unstable cervical injuries, many suffered devastating consequences
      - Paralysis
      - Permanent neurological disability
      - Loss of income, lifestyle, happiness
      - Decreased life span
      - Chronic disability leads to other complications and illness
      - Increased dependence on healthcare in the patient’s lifetime
      - Increased healthcare expenditure

- Other problems
  - We are finding that indiscriminate immobilization leads to a lot of other problems...
    - Problems created can be worse than the tiny chance of potential injury
    - So what’s the big deal???

- Other problems
  - Increased pain
    - Immobilization actually causes neck and back pain
      - Iatrogenic
      - Increased discomfort during transport
      - Many patients who did not have neck or back pain prior to immobilization were found to have significant pain on arrival to the ER, so much so that it led to XR evaluation due to inability to clinically clear the patient.

- Other problems
  - Less of this...
PROBLEMS

- Prolonged ER stays
  - Workups, pain management
    - Increased use of narcotics, sedating medications, side effects
    - Nausea, vomiting, sedation, AMS
    - Increased urinary catheters (can’t let patient up who has back pain)
    - Iatrogenic UTI’s, increased discomfort
  - Patient satisfaction and expectations
    - Most patients have been on the board about 1 hour by the time they are cleared by a physician.

OTHER PROBLEMS

- Respiratory compromise
  - Positioning
    - Capd
    - CHF/pulmonary edema/orthopnea
  - Restrictive devices (straps, head blocks, c-collar)
- Increased intracranial pressure
  - Laying flat increases ICP in ICH, cerebral edema
- Risk for aspiration
  - Increased anxiety
    - Tied down to hard board
  - Claustrophobia
  - Painful/uncomfortable
  - Motion sickness

OTHER PROBLEMS

- Pain from immobilization increases XR and CT utilization
  - Ionizing radiation exposure leading environmental factor associated with breast cancer
  - In 1998 (Nexux trial), was estimated that 800,000 people per year in the US undergo cervical spine radiography
    - Cost of $180 million (in 1998)
    - Only 10,000 of 800,000 radiographs identified injuries
    - 790,000 negative XR’s. (98%)”

OTHER PROBLEMS

- Difficulty managing secretions
  - Turning a patient on a board to facilitate emesis and secretion control may cause shifts in weight that can further destabilize spinal injuries or other injuries
- Prolonged immobilization increases risks of pressure sores
  - Older patients with kyphosis
    - Thinner skin
  - Lower muscle mass

OTHER PROBLEMS

- Most studied subgroup of trauma is penetrating trauma
  - Doubled mortality for penetrating trauma patients receiving c-spine immobilization
    - Unclear the relation to causality
  - Of more than 30,000 patients in 1 study with penetrating trauma, only 1.43% had spinal fractures, and only 0.38% had unstable fractures.
  - NNH=66

WHAT IS THE SOLUTION?
HOW DO WE TACKLE THIS?

- IS IT SAFE TO CLEAR A SPINE CLINICALLY?????

- Yes it is....very well studied, with good clinical decision rules that have been validated.
  - NEXUS
  - Canadian C-spine rules

- But is it safe to apply these rules in the pre-hospital realm or at the triage desk?????

HOW DO WE TACKLE THIS?

- Classically, spinal clearance performed by physician upon arrival in the ER...

HOW DO WE TACKLE THIS?

- This is actually a well-studied issue
  - Pre-hospital realm and Nursing slow to be included.
  - Concerns for training and competency maintenance
  - Arguments against
    - Takes longer to have physician evaluate
    - Liability—who’s liable if something is missed—physician, nurse, paramedic, hospital?
    - Does the prehospital environment actually allow for good evaluation?
      - Uncontrolled scene
      - Lots going on

HOW DO WE TACKLE THIS?

- HOWEVER........
  - Huge impacts on patient care and flow can be made in the field (or even at triage) utilizing spinal clearance protocols
    - Increased throughput in the ER
    - Speeds up patient care
    - Increased efficiency
    - Decreased resource utilization
      - Decreased imaging, workups, meds, etc.
    - Increased patient satisfaction
    - Decreased complication rate from immobilization

CANADIAN C-SPINE RULES

- High sensitivity (90-100%), moderate specificity (up to 77%).
- In one study, decreased potential radiography of C-spine by 58.2%.
- More detailed than Nexus
- More specific than Nexus
NEXUS

- Sensitivity ranged from 83-100% and specificity ranged from 2-46%
- Simpler than Canadian rules

VALIDATION

- C-spine rules have been effectively applied to prehospital and triage nurses
- Multiple studies

VALIDATION

- Nexus rules applied by nurses
  - 59 of 112 patients met clinical criteria
    - Reduced time immobilized by 23.3 minutes (p<0.005).
    - No patient that met clinical criteria was found to have significant injury
  - CONCLUSION: simple criteria can be applied by emergency / triage nurses to allow safe removal of cervical collars

VALIDATION

  - Retrospective review from 1990-1996
    - Looked at effectiveness of selective spinal immobilization byprehospital providers in the Fresno/Kings/Madera EMS
    - Sensitivity was 99% in identifying patients needing c spine immobilization per protocol
    - Those not identified were at extremes of age
    - Suggested selective immobilization may be safely applied with caution used at extremes of age
FRESNO/KINGS/MADERA PROTOCOL

- Spinal immobilization
  - Implement spinal immobilization in the following circumstances
    - Spinal pain or tenderness, including neck pain with a history of trauma
    - Significant multiple system trauma
    - Severe head or facial trauma
    - Numbness or weakness in any extremity after trauma
    - Loss of consciousness caused by trauma
    - If altered mental status (including drugs, alcohol and trauma) and:
      - No history available
      - Found in setting of possible trauma (e.g., lying at the bottom of stairs or in the street)
      - Near drowning with a history or probability of diving
      - Distracting injury

VALIDATION


- Paramedics trained to clear c-spine
- 193 blunt trauma patients, 65 (34%) were cleared by EMS.
- Not excluded for “distracting injuries”
- No known missed injuries
- 6% (8 patients) who were not clinically cleared by EMS had c-spine injury.
- Conclusion: EMS personnel may reliably and effectively perform clinical clearance of the c-spine.


- Used NEXUS criteria
- 3 hours of education to prehospital providers involved
- 103 patients over 26 months included
  - 69 (67%) had no significant CSI identified at scene
  - 9% were taken to the ED with other injuries, all discharged the same day
  - In all, 60 (58%) were discharged on scene with no clinical adverse events
  - 33% did not have their c-spines cleared at scene
  - 29% were taken to the ER
  - No missed CSI.

EVALUATION OF THE SPINE

- Purpose of the PAEMS protocol
  - Identify and immobilize 100% of patients at risk for significant injuries
  - Identify and NOT immobilize patients who have NO risk for cervical spine injury...
  - Decrease use of backboards....

PAEMS PROTOCOL

- Indications: The spine assessment procedure evaluates the risk of spine injury in patients with definite or potential questionable mechanisms of injury. Using evidence-based medicine, this procedure is utilized to balance the risks and benefits of spine motion restrictions.

- Procedure:

  1. Explain the procedure to the patient. Ensure the patient understands the procedure before proceeding. Patient must be alert and reliable with no distracting injuries.
  2. Ask the patient to pointally report any pain or tenderness. Emphasize to the patient to not move or avoid the head during maneuvering.
  3. Hold the patient in a neutral position to test movement.
  4. Palpate the midline neck region and proceed orally along each individual vertebra along the cervical spine. If any evidence of tenderness to palpation, crepitus, or step-off signs are noted, immediately place a cervical splinting device.
  5. Head rotation and flexion: Ask the patient to rotate their head to one side, and if no pain, rotate their head to the other side. For any evidence of pain, immediately place a cervical splinting device.
  6. Once the cervical spine has been assessed, the patient may be leg rolled to assess the thoracic, lumbar, and sacral spine by palpating such individual vertebrae for tenderness, crepitus, or step-off signs. For any evidence of tenderness to palpation, crepitus, or step-off signs, immediately place a spine motion restrictions.
PAEMS PROTOCOL

KINEMATICS OF SPINAL INJURY
- Hyperextension
- Hyperflexion
- Compression
- Rotation
- Lateral Stress

COMMON MECHANISMS OF SPINAL INJURY
- Axial Loading (diving)
- Blunt Trauma
- Motor Vehicle Collision
- Bicycle Fall
- Children: Fall > 3 feet
- Adult: Fall from standing height

IMMOBILIZE??