Thoracic and lumbar spinal injury

Dr. Abrisham
Goal: alignment
  Stability
  Preserve neuologic function
  early mobilization

Incidence: most site is thoraco lumbar
  50% $T_{11}$ to $L_1$
  30% $L_2$ to $L_5$
  Motor vehicle
  25% $\rightarrow$ full greater 6 feet
  Neurologic deficit $\rightarrow$ 20%
  Associated injury $\rightarrow$ 50%
Anatomic consideration:

Thoracic: 1) greatest intrinsic stability
2) relative narrow canal
3) greater axial rotation

Lumbar: greater flex and ext.

Thoracolumbar junction: transition zone
Mechanism of injury

- axial compression
- lateral compression
- flexion
- extension
- distraction
- shear
- rotation

The most common force is flex – rotation and flex – distraction
Initial evaluation and management.

Systematic fashion review
Supine position + rigid board or collar
Splint of extremity
View back for:
  ➢ laceration
  ➢ ecchymosis
  ➢ local tenderness
  ➢ swelling
  ➢ step off

Attention to spinal cord injury
Attention to hypo perfusion and hypotension
Associated injury
Pharmacologic agent
Systemic hypothermia after SCI
Initial neurologic evaluation

motor and sensory and reflex examination

motor function grade 0-5

rectal sphincter tone and volitional control

sensory function dermatome and sacral sparing.
Spinothalamic tract function

- pain
- Light touch
- temperature
Post column function

Vibration

Position sense
Reflex:

- super fascial abdominal $T_1 - T_{10}, T_{11} - L_1$
- cremastric $T_{12} - L_1$
- patellar tendone $L_3 - L_4$
- achill reflex $S_1$
- anal wink $S_2 - S_4$
- bubo cavernous $S_2 - S_4$
- clonus
- babinski test
Spinal shock

• Resolve after 24-48
• Return of reflex below injury
• Bulbo caverinosus Ref. is first return

Ref → spinal shock
Ref + → negative spinal shock
Neurologic injury classification

complete or incomplete

central cord: upper motor involuement

sparing of lower extrimity

the most common in complete injury
Ant cord syn:

- the most is in complete
- in the thoracic spine
- poor prognosis
Post cord syn:

- vibratory and position
- preserve bowel and bladder function
Brown – sequard syn:

- Ipsilat motor and control at pain temperature and light touch
- Preserve bowel and bladder function
- The best prognosis for recovery
Conus medullaris $T_{12} - L_{1}$ level
Radiologic evaluation

- first detect spine injury
- second detect stability
- Ap and lat x-ray
- swimmer's view for upper thoracic
In lat x-ray

- height
- width
- alignment
In Ap x-ray

- Alignment
- Inter pedicular distance
- Alignment of spinous process
- Rib and transverse process
CT scan:
- some center screening CT scan
- sequential 5 mm
MRI

- Cord evaluation
- Soft tissue evaluation
- Hemorrhage
- Hematoma
- Compression
- Neural transection
- Predicting recovery
Concept of spinal stability and its rule in fracture classification systems
Mechanical spinal stability:

ability to resist physiologic load without progressive deformity or damage to the neural element

Spinal neurologic stability:

presence or absence of a neurologic deficit
Fracture classification systems
Nicoll 1949

- Ant wedge Fx
- Lat wedge Fx
- $F_x - D_x$
- Isolated neural arch $F_x$
Holds worth
2 column concept

Flex.
Flex – rotation
Extension
Compression
Mechanical instability ➔ failure of 2 column from 3 column
MCA fee
Base of CT scan

- Wedge compression
- Stable burst
- Unstable burst
- Chance
- Flex - distraction
- Translational
Ferguson – Allen
3 column + force

- Compressive flex.
- Distractive flex.
- Lat flex.
- Translational
- Torsional flex.
- Vertical compression
- Distractive – extension
- Isolated transverse process Fx
Ao classification

- vertebral body compression
- ant & post element + distraction
- ant & post + rotation
Thoracolumbar injury classification & severity score (TLICS)

- Base morphology
- Integrity of posterior ligament
- Neurologic status
morphology

1  \(\Rightarrow\) compression Fx
   + burst component

2  \(\Rightarrow\) translation or rotation

3  \(\Rightarrow\) distraction injury

3  \(\Rightarrow\) combination injury
1 $\Rightarrow$ Intact PLC

1 $\Rightarrow$ Intermediate PLC
Signal change in $T_2$ without structural mal alignment

2 $\Rightarrow$ disrupted PLC
Neurologic status

0 ⇒ intact neurologic

2 ⇒ simple nerve root injury

2 ⇒ complete neurologic deficit (motor & sensory)

3 ⇒ incomplete neurologic deficit

3 ⇒ cauda equina deficit
Total score 3 $\leq$ \(\rightarrow\) non surgical

Total score 5 $\geq$ \(\rightarrow\) surgical treatment

Total score 4 \(\rightarrow\) gray zone
Description & diagnosis of specific fracture type

Sprain: injury of ligament and musculotendinous

X-ray is enough
Indication

CT or MRI

- High – energy mechanism
- Unreliable history
- Significant physical examination
- Obvious swelling
- Neurologic injury
- Ankylosing sponditis
- Congential anomaly
Disc herniation

- traumatic disc herniation
- usually associated with Fx
- MRI
Minor Fx

- Transverse process Fx
- Spinous process Fx

\[ \text{indirect trauma} \]
Stable Fx
CT scan

- pars Fx
- lamina Fx
- articular process Fx
Compression Fx

- axial compression through body sup or inf end plate or buckling of ant cortex or both end plate

- the main distinguishing feature of compression is predominant failure of ant column in compression, whereas the flex – distraction injury is characterizedly predominant failure of post column in tension
Burst Fx:

- Axial compression through body
- Lat compression cause an variant
- Asymmetrical in coronal plane
- Middle column involvement
Flex – distraction injury (chance Fx)

- Distractive force > crushing force
- Tension failure of the post ligamentous complex and associated ant and middle column
- Axis of rotation is in front of ant column
- Normal ant column height
2 type injury

- Osseous (chance Fx)
- Disco ligamentous (chance variant)
Facet Dx in CT scan
naked facet
or empty facet sign
Fx – Dx

Hall mark: unilat or bilat facet disruption translation in Ap or lat x-ray
Extension & extension–distraction injury

- Commonly seen in AS, DISH
- Gap in ant or middle column
- Naked facet sign
Penetrating injury:

- Almost always is stable
- MRI is controversial
- Risk of migration
General treatment:

- Operative or non operative clue to treatment
- Mechanical instability
- Neurologic deficit
- Significant spinal deformity
- Multiple injury
Bracing principle

- Mechanical stable Fx and neurologic intact

- Upper lumbar or thoracolumbar Fx

  1. jevet – type hyperextension for sagittal plane injury
  2. custom – molded total contact for coronal or rotational component
Lower lumbar Fx (below L₃) → TLSO
with in corporation to one thigh

Fx above T₆ → cervico thorasic orthosis
Regardless of the level and type of injury once the brace is fit, up right radiography should be obtain to make sure the Fx is stable in the brace.
- Brace worn in out of bed
- Bending and twisting is forbidden
- Lifting over 10 pound is forbidden
- Typical brace duration is 3 month
- F/U in 2w, 6w x-ray in upright
  - x-ray in brace → 6-8 interval
- Flex and extension x-ray after weaning
Surgical principles
Achieving and maintaining anatomic reduction and stability

- Post pedicle screw are more rigid than anterior
- Quite versatile
- Ant spine is main axial load bearing

neural element decompression

- Ant app
  - restoration of ant column
- Ant app must supplemently post instrument
Decompression

- Neurologically intact patient with significant canal compromise of 50% or more do not benefit from decompression

- Decompression reserve for neurologic deficit
- Resorption of retropulsed
- Neurologic deficit + retro pulsed bone decompression in 48h. direct or indirect.
(3) Minimization of construct length

Long segment: 2 level above
    and 3 level below

Short segment: one level above
    one level below
(4)

Appropriate surgical timing

- Early decompression \(\rightarrow\) depend or many factor

- Progressive deficit \(\rightarrow\) quickly
(5) Avoidance of complication

- Dural tear
- Iatrogenic neural injury
- Pseudo arthrosis
- Failure of fixation
- Iatrogenic flat back
- Infection
- Medical complication
Specific treatment
Sprain or minor Fx

* Brace
* Not to be rigid
  - in L₅ transverse process Fx define post lig injury or sacral Fx

* in minor Fx may have more significant intra abdominal injury
Traumatic disc herniation

very rare

similar to nontraumatic

bracing not necessary
Compression Fx

- Usually intrinsically stable
- Postural reduction and plaster cast immobilization
  significant + kyphosis (30°)
- Surgery
  vertebral body height (50%)
- Post pedicle screw + fusion
- Surg in 7-10 d of injury
Burst Fx

stable burst $\rightarrow$ Brace

Unstable burst $\rightarrow$ Surg
Factor guiding treatment of burst Fx

- Neurologic deficit
- Extent of spinal canal compromise
- Degree of deformity
- Integrity of post lig
Neurologic intact + kyphosis $< 30^\circ$

+ vertebral height $< 50\%$

+ minimal post lig injury

$\rightarrow$ Brace

Burst Fx + neurologic deficit (unstable) $\rightarrow$ Surg

Burst Fx + post lig injury $\rightarrow$ Surg

highly comminuted $\rightarrow$ Ant app

height loss $> 50\%$
Definition of post lig injury is borderline

Mobilization in brace with serial upright x-ray
Long term outcome depend on neurologically injury

Outcome of surg and brace is similar

Some loss of height after both type treatment

Kyphosis $> 30^\circ$ is the least desirable and the most predictor of back pain
Flex – distraction injury (chance Fx)

- Incidence 10% - 15%
- Due to lap – belt
- High intra abdominal injury
- Focal kyphosis
- Brace → stable bong injury
- minimally anagulated bony

  minimal angulated : reduction of kyphosis in supine position

- Unstable bony or lig → surg
- Failure of brace in kyphotic deformity of greater than 20°
Fx – Dx

highly unstable

75% neurologic injury

Only surg

Awake positioning in neurologic intact
Extension – distraction injury

Unstable

Awake positioning

Surg
Penetrating injury

- gun shot wound
- rarely mechanical unstable
- one column injury $\Rightarrow$ No brace
- 2 column injury $\Rightarrow$ brace
Indication surg

- If bullet cause compression and neurologic deficit
- In stable neurologic deficit surg be perform at 7-10 d
- CSF fistule in %6
- Usually instrumentation no need