Spinal Trauma
History of Spinal Injury Management
Edwin Smith papyrus

- Spinal cord injury is a mortal condition and has been recognised as such since antiquity.
- In about 2500 BC, in the *Edwin Smith papyrus*, Egyptian physician accurately described the clinical features of traumatic tetraplegia (quadriplegia) and revealed an awareness of the awful prognosis with the chilling advice: “an ailment not to be treated”.

i.e. 3000–4000 – Egypt: Description of the first spine cord injuries

No treatment
Assyrian sculpture from 645-635 B.C. First Perfect Representation of Spinal Cord Injury
Hippocrates Advocate traction for Spine injury treatment
Ibn Sina (Avicenna) 980-1030
The Canon of Medicine:
Spinal Cord injury no treatment
Epidemiology of Traumatic Spine Injury
Incidence of spinal cord trauma in developed countries: 11.5-53.4 injured/1 million people
Causes and location of spinal cord injury*

1. Road traffic accidents (motorcycle) 45%
2. Domestic and industrial (workplace associated accidents) 34%
3. Injuries in sports 15%
4. Self harm, criminal assault 6%

Epidemiology of Traumatic Spinal Cord Injury in USA
The Factors of the High Incidence of Spine Trauma

Military Actions

Severe Road Traffic Accident
Prehospital Care in Spinal Injury Patient Prevention
Primary Prevention
SCC Mechanisms of injury

Twisted spinal cord

Rotational injury

SCI Mechanisms of injury

Compression fracture & compressed spinal cord

Hyperflexion

Compressed vertebrae

Spinal cord

Ruptured ligament

Projet Wipeout, Hoag Memorial Hospital Presbyterian Newport Beach, Ca. EUA

THE ONLY SAFE DIVE IS THE ONE YOU NEVER TAKE

Diving is the fourth leading cause of paralyzing spinal cord injury. We believe it's one of the most preventable. Shepherd Center has compiled 10 years of information on every diving injury we've treated to make people aware that diving is simply not worth the risk.

WHO GETS HURT DIVING?

10-19 years

20-29 years

30-39 years

40-49 years

50-59 years

60-69 years

70-79 years

HOW OLD ARE INJURED DIVERS?

89% male

11% female

WHERE ARE DIVERS DIVING?

Swimming pool: 36%

Ocean: 34%

River: 16%

Lake: 11%

Other: 3%

When do diving injuries happen?

February

March

April

May

June

July

August

September

October

November

December

2014 is the year to be free of diving injuries. Help spread the word and ALWAYS enter the water feet first.

Shepherd Center

DON'T DIVE

GO IN FEET FIRST

Remember that a single dive can change your life forever.
Avoid the accident
Diminished the injuries

ThinkFirst program
Passive protections
Every injured patient should be considered and treated as a spine injured.

If any suspect of spine injury the whole spine should be considered instable untill the opposite has proven.
Prehospital Care in Spinal Injury Patient Field Care
Field Care
   Rapid trauma assessment and immediate treatment of life-threatening injuries
   More detailed trauma assessment and stabilization of non life-threatening injuries

Casualty Evacuation Care
   Continual casualty assessment
Scene Assessment

Determine safety of scene
Determine mechanism of injury
Determine number of casualties
Request additional help if necessary
Communicate verbally with casualty
   Helps establish immediate status of airway, breathing, circulation, and mental status

Airway
Breathing
Circulation
Disability (Neurologic status)
Exposure

Primary Assessment: ABCDE
When life-threatening injuries are encountered during the primary assessment, stop and perform the necessary life-saving procedure before proceeding.

Failure to do so may result in an otherwise preventable death.

IMPORTANT!
Airway

Attention to manual stabilization of cervical spine if appropriate
Airway obstructions are often noisy (but not always)
Suspect airway problems
  Unconscious
  Head, face, neck, chest injuries
Open, clear, and maintain the airway
Breathing

Look, Listen, and Feel

If chest injury and severe difficulty breathing, perform needle chest decompression to relieve tension pneumothorax.
Circulation

Look for severe external bleeding

STOP THE BLEEDING!
  - Direct pressure
  - Pressure points
  - Tourniquet

Assess for internal bleeding
  - Check pulses
  - Observe for shock

Initiate IV fluids
Disability (Neurologic Status)

Level of consciousness using AVPU scale
    Alert: Converses spontaneously and appropriately
    Verbal: Responds to verbal stimuli
    Painful: Responds to painful stimuli
    Unresponsive: Unresponsive to any stimuli

Pupil size
    Pupils should be equal and constrict vigorously to light stimulus

Motor function
    Strength should be normal and equal in all extremities
Exposure

Remove clothing to expose area of injury
Do not delay resuscitation to expose injuries
Keep casualty covered after exposure to avoid hypothermia due to blood loss
Casevac

Prepare to Evacuate
Diagnosing and excluding spinal injury

A polytraumatised patient should be treated as having spine injuries until excluded:

- Conscious,
- No sensory or motor deficit,
- CT scan of cervical spine - negative

Maintenance of mean arterial pressure and oxygenation are important for both polytraumatised and isolated spine injured patients.
Initial Hospital Evaluation of Spinal Trauma Patient
Detailed History:
  Circumstances of accident
  Mechanism of injury
Clinical evaluation:
  Primary Trauma assessment
  Secondary Trauma assessment
  Neurological evaluations
  ASIA Classification
Radiological evaluations
Continue ATLS - life threatening lesions
Sign of SI/SCI: physical and neurological exam

local sign: pain, steps, pressure sensitivity, deformity

neurological sign: focal neurol.deficit

warning: altered mental status, intoxication distracting painful injury
Secondary Trauma Assessment: Head to Toe

Head
Neck
   Apply cervical collar if unconscious
Chest
Abdomen
Pelvis
Extremities
Back
   Log roll casualty to stabilize spine
Perform more detailed exam of body areas

Deformities
Contusions
Abrasions
Penetrating injuries
Burns
Tenderness
Lacerations
Swelling

Secondary Trauma Assessment
Steps in ASIA Classification

1. Determine sensory score
2. Determine motor score
3. Determine single neurological level (lowest segment where sensory and motor function is still normal on both sides)
4. Determine if injury is complete or incomplete (If there is no anal contraction or anal sensation the injury is complete, otherwise injury is incomplete)
5. Determine ASIA Impairment Scale (AIS)

ASIA Impairment Scale:
AIS A if injury is complete
AIS B motor injury is complete
AIS C at least half of the key muscles below single level are grade 3 or better
AIS D less than grade C
AIS E Normal
American Spinal Injury Association (ASIA) Classification System

**Sensory evaluation:**

0 - Absent Sensation  
1 - Sensation present, but abnormal  
2 - Intact sensation  

Sensory system is divided into 28 dermatomes: 7 cervical, 12 thoracal, 5 lumbar, 4 sacral  

Left and right side are graded individually  

Light touch (dorsal column) and pin prick (spinothalamic system) are graded individually  

224 points for a patient with no sensory deficit
Motor evaluation:
0- Total paralysis
1- Visible muscle contraction
2- Full range of movement with gravity eliminated
3- Full range of movement against gravity
4- Full range of movement against gravity with partial resistance
5- Full motor activity
Each limb is divided into 5 muscle groups, each receiving 1-5 point, totaling max. points per limb
100 point maximum for no motor deficit
Radiology of Spinal Trauma Patient
Analog x-ray

AP and Lateral
AP and Lateral

Analog x-ray
CT for evaluation of bony structures
3D CT for evaluation of bony structures
MRI for evaluation of soft tissues

Ligamentous injury
MRI for evaluation of soft tissues

Spinal Cord Injury
Classifications and Scoring of Spinal Injuries
AOSpine Upper Cervical Classification System

Upper Cervical Spine Fractures Overview

I. Occipital condyle and occipital cervical joint complex injuries

II. C1 ring and C1-2 joint complex injuries

III. C2 and C2-3 joint complex injuries

Type A: Bony injury only
- Without significant ligamentous, tension band, discal injury
- Stable injuries

Type B: Tension band/ligamentous injury
- With or without bony injury
- No complete separation of anatomic integrity
- Stable or unstable depending on injury specifics

Type C: Translation injury
- Any injury with significant translation in any directional plane and separation of anatomic integrity
- Unstable injuries

Neurology

<table>
<thead>
<tr>
<th>Type</th>
<th>Neurological</th>
</tr>
</thead>
<tbody>
<tr>
<td>N0</td>
<td>Neurologically intact</td>
</tr>
<tr>
<td>N1</td>
<td>Transient neurologic deficit</td>
</tr>
<tr>
<td>N2</td>
<td>Radiculopathy</td>
</tr>
<tr>
<td>N3</td>
<td>Incomplete spinal cord injury</td>
</tr>
<tr>
<td>N4</td>
<td>Complete spinal cord injury</td>
</tr>
<tr>
<td>NX</td>
<td>Unexaminable patient</td>
</tr>
<tr>
<td>+</td>
<td>Continued spinal cord compression</td>
</tr>
</tbody>
</table>

Modifiers

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Injuries at High Risk of Non-Union with Nonoperative Tx</td>
</tr>
<tr>
<td>M2</td>
<td>Injury with significant potential for instability</td>
</tr>
<tr>
<td>M3</td>
<td>Patient Specific Factors Affecting Tx</td>
</tr>
<tr>
<td>M4</td>
<td>Vascular Injury or Abnormality Affecting Tx</td>
</tr>
</tbody>
</table>

Classification nomenclature

Atlanto-occipital dissociation with a complete spinal cord injury.

Primary injury ➔ **OC Type C, N4** ➔ Neurologic status and modifiers
AOSpine Subaxial Classification System

Algorithm for Morphologic Classification

START

Displacement/Dislocation → YES → C Translation

NO

Tension band injury → YES →

Anterior → YES → B3 Hyperextension

Osseoligamentous disruption → YES → B2 Osseoligamentous disruption

Posterior → Mono-segmental osseous disruption → YES → B1 Pure transosseous disruption

NO

Vertebral body fracture → YES →

Both endplates involved → YES → A4 Complete burst

NO → A3 Incomplete burst

Posterior wall involvement → YES → A2 Split/Pincer

NO → A1 Wedge/Impaction

Vertebral process fracture → YES → A0 Insignificant injury

NO → No injury

Subaxial Cervical Spine 2
Thoraco/Lumbar Spine 1
Thoraco/Lumbar Spine 2
Sacral Spine 1
AOSpine Sacral Classification System

Sacral Fractures—Overview
Hierarchical system progressing from least to most unstable

- **Type A. Lower Sacroccygeal Injuries**
  No impact on posterior pelvic or spinopelvic instability

- **Type B. Posterior Pelvic Injuries**
  Primary impact is on posterior pelvic stability

- **Type C. Spino-Pelvic Injuries**
  Spino-pelvic instability

### Neurology

<table>
<thead>
<tr>
<th>Type</th>
<th>Neurological</th>
</tr>
</thead>
<tbody>
<tr>
<td>N0</td>
<td>No neurological deficits</td>
</tr>
<tr>
<td>N1</td>
<td>Transient neurological injury</td>
</tr>
<tr>
<td>N2</td>
<td>Nerve root injury</td>
</tr>
<tr>
<td>N3</td>
<td>Cauda Equina Syndrome/Incomplete SCI</td>
</tr>
<tr>
<td>N4</td>
<td>Complete SCI</td>
</tr>
<tr>
<td>NX</td>
<td>Cannot be examined</td>
</tr>
<tr>
<td>+</td>
<td>Continued spinal cord compression</td>
</tr>
</tbody>
</table>

### Modifiers

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>Soft tissue injury</td>
</tr>
<tr>
<td>M2</td>
<td>Metabolic bone disease</td>
</tr>
<tr>
<td>M3</td>
<td>Anterior pelvic ring injury</td>
</tr>
<tr>
<td>M4</td>
<td>Sacroiliac joint injury</td>
</tr>
</tbody>
</table>

**Classification nomenclature**

Transformaminal fracture (B3) high energy injury associated with anterior pelvic ring (M1) and soft tissue injury (M3)

Primary injury → B3; M1, M3 → Neurologic status and modifiers
Management of Spinal Cord Injury
decompression of the nerve elements
restaurate of the stability
restaurate of the spine anatomy
preserv the motion of the spine

Goal of the Treatment
Medical treatment of spinal injuries patients

Treatment of cardiovascular complications:
In traumatic tetraplegia the thoracolumbar (T1–L2) sympathetic outflow is interrupted, therefore vagal tone become unopposed and bradycardia and hypotension can become dominant:

Treat bradycardia under 50Hz and hypotension under 90Hgmm

Do not mistake hypotension for loss of fluids and overinfuse patients in neurogenic shock

Apply antiembolism stockings

If there are no medical or surgical contraindications give lowmolecular weight heparin within 72 hours
The mortality of polytraumatised patients increases with long surgical times, metabolic acidosis, hypothermia and coagulopathy.

“damage control” principle- decrease surgical time thereby decreasing the systemic inflammatory response syndrome (SIRS)

Damage control principles
Timing is important for incomplete spinal cord lesions, surgery can improve neurological deficits. In case of complete lesion decompression and fixation should be also considered. Optimal intensive care circumstances can be made possible. Secondary systemic inflammatory reaction can be decreased.

Damage control principles
• Neurological motor deficit (progressive paralysis)
• Spinal canal stenosis, secondary spinal cord damage
• Unstable spine fracture
• Open spine injury

Surgical indications for early spine surgery
Upper Cervical Spine Injury
Craniovertebral Junction Trauma Classification

1. Occipital condyle fractures
2. Atlanto-occipital dislocation
3. C1 fracture
4. Atlanto-axial instability (anterior, rotatory)
5. C2 fractures (dens, hangman’s fracture, complex fractures)
Determining factors for management planning

• Reducability
• Localisation of lesion (direction, extent)
• Etiology of lesion

Balance of proper decompression and instability
Difficulties in case of Injury of Craniocervical junction

- Hypermobility with heavy physiological load
- Diagnosis not easy – instability?
- No standardised treatment because of the special anatomy
Clinical Manifestation

• Asymptomatic
• Neural compression
  • Headache, neck pain
  • Dizziness, ataxia, gait disturbance
  • Diplopia, dysphagia
  • Tinnitus, nystagmus
• Elevated ICP
• Sudden death
Rare injury
Survival: rare
Autopsy results of MVA show 10% incidence
Serious neurological deficit
More common in children

Atlanto-occipital dislocation
Classification of C1 fracture by Gehweiler

- I./ Isolated fracture of the anterior arch
- II./ Isolated fracture of the posterior arch
- III./ Combined ant.+post. arch fracture „Jefferson”
- Isolated fracture of the lateral mass
- Isolated fracture of the transverse process
Type II.
Posterior arch fracture

- 2% of all cervical spine injury
- Bilateral weakest point: sulcus of the vertebral artery
- Hyperextension combined axial compression
- Usually with dens fracture
Type III.
Ant.+Post.arch Fracture/Jefferson

- 2% of all injury of the cervical spine
- Axial compression
- Lateral dislocation of the lateral masses
- May combine with the transverse ligament avulsion
Dens fractures

- 18% of cervical spine fractures
- 25-40% die at site of accident
- 20% have neurological signs
- 45% neck pain is the only symptom
- Unknown % : unrecognised
Dens fractures

Anderson-D’Alonso classification

I. typ
II. typ
III. typ
Modified Classification of Dens fractures

- Fracture surface orientation and location determine the treatment plan

- **Group A**: oblique-posterior and horizontal
- **Group B**: oblique-anterior
Group A

• **Group A:**
  oblique-posterior and horizontal

**Anterior screw fixation is recommended**
Group A fracture
Group A fracture
Group B

Group B: oblique-anterior

Application of Halo device is recommended
Or posterior C1-C2 fixation
Hangman’s Fractures

- Hangman’s fractures
  - Traumatic C2 spondylolisthesis
  - Hyperextension and axial loading
  - Bilateral fractures of the pedicul
  - Stabil
  - Neurological deficit rear
  - Immobilisation
Posterior atlanto-axial Transarticular Screw Fixation (Magerl- Sonntag)

- Reduction:
  - Halo device
  - Prone position
  - Under fluoroscopy control
- Posterior approach
- C1-C2 transarticular screws
- C1-C2 cable, bone graft
Posterior atlanto-axial Transarticular Screw Fixation (Magerl- Sonntag)
Posterior atlanto-axial Screw Fixation C1-2 according to Harms
Posterior atlanto-axial Screw Fixation C1-2 according to Harms
Subaxial Cervical Spine Injury
Understand injury pathophysiology and biomechanics
Fracture classification
Understand the advantages/disadvantages of various surgical approaches
Work within your level of familiarity and experience
What is SLIC?

- SLIC is a comprehensive classification system for subaxial cervical trauma
- Addresses the question of whether the patient will benefit from surgery
- Incorporates information about injury pattern, severity, treatment considerations, and prognosis into a unifying scoring system to guide management
- SLIC score is based on the assessment of 3 domains, which are considered independent predictors of clinical outcome:
  
<table>
<thead>
<tr>
<th>Morphology of Injury</th>
<th>Disco-ligamentous Integrity</th>
<th>Neurologic Status</th>
</tr>
</thead>
</table>

SLIC Score  
Vaccaro et al Spine 2007; 32 (21)  
2365-2374
## The Subaxial Injury Classification and Severity Score System (SLIC)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morphology</strong></td>
<td></td>
</tr>
<tr>
<td>No abnormality</td>
<td>0</td>
</tr>
<tr>
<td>Compression</td>
<td>1</td>
</tr>
<tr>
<td>Burst</td>
<td>2</td>
</tr>
<tr>
<td>Distraction (e.g., facet perch, hyperextension)</td>
<td>3</td>
</tr>
<tr>
<td>Rotation/Translation (e.g., facet dislocation, unstable teardrop or advance-staged flexion compression injury)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Discoligamentous complex</strong></td>
<td></td>
</tr>
<tr>
<td>Intact</td>
<td>0</td>
</tr>
<tr>
<td>Indeterminate (e.g., isolated interespinous widening, MRI signal changes only)</td>
<td>1</td>
</tr>
<tr>
<td>Disrupted (e.g., widening of the disk space, facet perch or dislocation, kypotic deformity)</td>
<td>2</td>
</tr>
<tr>
<td><strong>Neurological status</strong></td>
<td></td>
</tr>
<tr>
<td>Intact</td>
<td>0</td>
</tr>
<tr>
<td>Root injury</td>
<td>1</td>
</tr>
<tr>
<td>Complete cord injury</td>
<td>2</td>
</tr>
<tr>
<td>Incomplete cord injury</td>
<td>3</td>
</tr>
<tr>
<td>Continuous cord compression in setting of neuro deficit (Neuro Modifier)</td>
<td>1</td>
</tr>
</tbody>
</table>

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### SLIC Classification

4< non operative  
4= operative/nonoperative  
4> operative
- SLIC is a valid and reliable tool for the classification of subaxial cervical spine injury.

- SLIC is based on the assessment of three domains, which are independent predictors of clinical outcome:

<table>
<thead>
<tr>
<th>Morphology of Injury</th>
<th>Disco-ligamentous Integrity</th>
<th>Neurologic Status</th>
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</thead>
</table>

(Click on links to review)

- The score of each domain is added to give the total SLIC score, which helps determine whether surgery is indicated.

<table>
<thead>
<tr>
<th>SLIC Score</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&lt; non operative</td>
<td>4= operative/nonoperative</td>
</tr>
</tbody>
</table>
Why early or urgent decompressive surgery?

- to prevent deterioration of neurological deficit
- to improve the neurological outcome
- to reduce the length of hospital stay
- to facilitate mobilization
- to reduce the rate of immobilisation complications
Closed reduction

Fast
Patient general awake and able to monitor
After reduction can wait for surgery
Makes surgery technically easier
Can have deterioration from overdistraction, unrecognized other injury
Not always possible
Will eventually need surgery
Approaches: Options

Anterior
Midline
Anterolateral

Posterior
Midline
Transmuscular

Combined
Surgical treatment of subaxial cervical spine

Classic anterior approach, decompression, fusion with plate (Caspar)

Posterior approach, reduction, fusion (screw + plate or rods, frame + cable)

Combined anterior-posterior approach
Anterior cervical fusion according to Caspar: Gold Standard
Anterior C5 AO Type A 4. burst fractures treated with anterior approach corpectomy
Anterior Approach

Advantages
- Avoid prone positioning
- Disc herniations can be removed
- High fusion rate
- Maintenance of lordosis

Disadvantages
- Biomechanically inferior to posterior approach
- Hoarseness, dysphagia risk
- Risk of failure with endplate/facet fractures
Posterior Approach

Advantages
- Biomechanically robust
- Familiar to surgeons
- High success rate
- Allows direct open reduction

Disadvantages
- Wound infection rate
- Inability to prevent segmental kyphosis with disc collapse
C5-C6 TypeC fractures bilateral locked, facet no neurological deficit
C5-C6 Type C fractures
bilateral locked, facet no neurological deficit
C5-C6 Type C fractures bilateral locked, facet no neurological deficit.
C5-C6 Type C fractures bilateral locked, facet no neurological defect
FRONT-BACK-FRONT
C5-C6 Type C fractures bilateral locked, facet no neurological deficit
Thoracic and Lumbar Spine Injury
1. Morphologic classification

This is based on the Magerl classification modified by the AOSpine Classification Group. For this evaluation radiograms and CT scans with multiplanar reconstructions are essential. In some cases additional MR images might be necessary. Three basic types are identified on the basis of the mode of failure of the spinal column:

- **Type A:** Compression injuries. Failure of anterior structures under compression.
- **Type B:** Failure of the posterior or anterior tension band.
- **Type C:** Failure of all elements leading to dislocation or displacement.
### Type A

Describe *injury to the vertebral body without tension band (PLC) involvement*. There are five subtypes and no further sub-classification.

These subtypes are also used as *description of vertebral body fracture* in B and CTypes.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A0</strong></td>
<td><em>Minor, nonstructural fractures</em></td>
</tr>
<tr>
<td><strong>A1</strong></td>
<td><em>Wedge-compression</em></td>
</tr>
<tr>
<td><strong>A2</strong></td>
<td><em>Split</em></td>
</tr>
<tr>
<td><strong>A3</strong></td>
<td><em>Incomplete burst</em></td>
</tr>
<tr>
<td><strong>A4</strong></td>
<td><em>Complete burst</em></td>
</tr>
</tbody>
</table>
Thoracolumbal injuries
AO classification Type A – compression fracture

A1.: **stable** (‘log roll’) **no surgery**

A2.: **stable** (except for when nucleus pulposus is between the fractured fragments, ventral fixation is needed later) - **no surgery**

A3.: **unstable** - **percutaneous dorsal instrumentation**
Type B

Describe the failure of posterior or anterior constraints (in case of TL this is the tension band or PLC / Posterior Ligamentary Complex or the anterior longitudinal ligament).
Is to be combined with subtypes A when appropriate. There are three subtypes:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Transosseous tension band disruption / Chance fracture</td>
</tr>
<tr>
<td></td>
<td>Monosegmental pure osseous failure of the posterior tension band. The classical Chance fracture.</td>
</tr>
<tr>
<td>B2</td>
<td>Posterior tension band disruption</td>
</tr>
<tr>
<td></td>
<td>Bony and/or ligamentary failure of the posterior tension band together with a Type A fracture. Type A fracture should be classified separately.</td>
</tr>
<tr>
<td>B3</td>
<td>Hyperextension</td>
</tr>
<tr>
<td></td>
<td>Injury through the disk or vertebral body leading to a hyperextended position of the spinal column. Commonly seen in ankylosis disorders. Anterior structures, especially the ALL are ruptured but there is a posterior hinge preventing further displacement.</td>
</tr>
</tbody>
</table>
Thoracolumbal Injuries
AO classification Type B – compression fracture

B1.

Can closed reposition be done?
- damage control, percutan dorsal fixation

B2.

Closed reposition can not be done?
or decompression is needed?
- Standard open surgery with ventral fixation later

B3.
Type C

Describe displacement or dislocation. There are no subtypes as because of the dissociation between cranial and caudal segments various configurations are possible in different images. Is combined with subtypes of A if necessary.
Thoracolumbal injuries
AO C – rotation

• Closed repostition
• Decompression is needed
• Percutan instrumentation is not sufficient
• Later ventral surgery can be done
• Initial Damage Control (decompression and stabilisation) is recommended
Posterior Transpedicular fixation

• Pedicel connects the anterior (vertebral body) and the posterior (facet joints and lamina) half of the vertebra

• Biomechanical advantages

• Relevance in spinal instrumentation
Entry points for transpedicular screws
Direction of the Th-L pedicle screws
Primary definitive care vs. Damage controll

Coagulopathy? Acidsos? Hypothermia?
Concomittant injuries?
Surgeons experience?
Percutaneous MIS (minimal invasive surgery) spinal fixations
Intraoperative Neuromonitor

Intraoperative monitor
Postoperative surgical field MIS
• Dorsal operation first
• Prone position is not contraindicated for polytrauma patients
• Ventral surgery should only be done after patient is stable and healed

Summary

thoracolumbar spine injuries
treatment
Gunshot Injury to the Spine
Penetrating injury

Rare
Under 35 year old male patients
Debridement
Removal of the bone and the projectile from the spinal canal
Dura repair advisable
Summary
Every injured patient should be considered and treated as a spine injured

If any suspect of spine injury the whole spine should be considered instable untill the opposite has proven.

Take Home Messages
Thank You