SACARAL SPINE FRACTURE
Esfahan 2015
anatomy

• foundation for lumbar as well as pelvic ring alignment
anatomy

- Transmission of load on the trunk is distributed by the first sacral segment through the iliac wings to the acetabulum on either side
anatomy

- Strong posterior lumbosacral and lumboiliac ligaments stabilize the osseous components of this transition zone, which is characterized by nonconstrained articulations.
• The sacrum is a kyphotic structure with a sagittal angulation ranging from 0° to 90°.
• This contributes to the sacral inclination angle of the superior end plate of S1, which then determines the compensatory lordosis of the lumbar spine.
anatomy

- protection for the lumbosacral (L4-S1) and sacral (S2-S4) plexuses and iliac vessels.
anatomy

• The sacral spinal canal is capacious and provides more than adequate space for the cauda equina
• the ability of this area to withstand blunt trauma and tolerate bulky implant systems.
anatomy

• The anterior rami of the S2 through S5 roots contribute to sexual function as well as bowel and bladder control by providing parasympathetic innervation to the bladder and rectum.

• The sympathetic ganglia of the inferior hypogastric plexus extend from the anterolateral L5 and S1 vertebral bodies caudally to the anterior surface of the sacrum along the medial margin of the anterior foramina of S2, S3, and S4.
Evaluation

• Approximately 30% of sacral fractures are identified late
• Delayed diagnosis-> negative impact on long-term outcome
Physical examination

- peripelvic pain
- high-energy blunt trauma, especially in the presence of an altered sensorium
- Lacerations, bruising, tenderness, swelling, and crepitus are clear signs of a potential underlying injury.
Physical examination

- a posterior sacral osseous prominence
- Morel-Lavelle lesion
Physical examination

- rectal examination is a standard component of the evaluation
- Sacral fracture should also undergo functional assessment of the lower sacral roots
Physical examination

• Maximum voluntary rectal sphincter contraction
• presence of light touch
• pinprick sensation
• specific reflexes including perianal wink and the bulbocavernosus and cremasteric reflexes
Physical examination

• Pelvic ring stability can be tested manually
Physical examination

gently applied internal and external rotation of the iliac wings

push-and-pull tests with supplemental radiographic documentation
Imaging

- Advanced Trauma Life Support protocol
- Pelvic AP
- Inlet
- Outlet
- Ferguson view
- lateral sacrum view
Imaging

• Specific finding:
  • 1) fractured L5 transverse process found in 61%
  • 2) a paradoxical pelvic inlet view found on supine anteroposterior radiographic projections found in 92%

• 3) stepladder sign indicative of anterior sacral foraminal disruption
• 4) radiographic landmarks may be obscured in a patient with osteopenia or lumbosacral dysmorphism
Imaging

• Ct – scan: Computed tomography is the preferred modality for diagnosing suspected or known posterior injury of the pelvic ring.
Imaging

- MRI:
  1) may be helpful for patients presenting with unexplained sacral neurological deficits after trauma
  2) reveal sacral stress fractures
Imaging

- Bone scan and SPECT: identifying posttraumatic arthritis as well as insufficiency fractures.
Classification
Denis classification

- Zone 1 - 50% N. deficit 6% (typically L4-L5 root)
- Zone 2 - 34% N. deficit 28% (usually L5-S1-S2 root) (malunion -> poor out come)
- Zone 3 - 16% N. deficit 57%
- (Bowel and bladder control or sexual function was impaired in 76%)
Denis classification

- Two additional factors to consider:
  - 1) injury is bilateral
  - 2) the axial level of the fracture
complex sacral Denis zone-III fractures.
Subclassification of Denis zone-III fractures as suggested by Roy-Camille et al. and modified by Strange-Vognsen and Lebech
Classification of injuries at the lumbosacral junction, as suggested by Isler.
Neurological impairment classification

Gibbons et al

4 stage
• 1) no injury
• 2) paresthesia only
• 3) motor loss but bowel and bladder control intact
• 4) Impaired bowel and bladder control
classification

systemic conceptual approach is more important than any classification
In patient evaluation

5 basic principle should be followed
1) Presence of active bleeding
2) Presence of an open fracture
3) Pattern and stability of skeletal injury
4) Neurologically injury
5) Systemic injury load
Treatment

- *Early Management*
- pelvic reduction
- minimize additional blood loss
Non op. treatment

• Indications are vague
• Contraindications are relative:
  • soft-tissue compromise
  • incomplete neurological deficit with objective evidence of neural compression
  • extensive disruption of the posterior lumbosacral ligaments
  • Patients with multiple injuries
Non op. treatment

- Activity modification aimed at preventing further fracture displacement
- Prolonged bed rest in skeletal traction
- Bed rest in a brace or cast
- Protected weightbearing, or early mobilization
Non op. treatment

- potential dangers:
  - Thromboembolism
  - Pulmonary complications
  - Skin breakdown
Surgical Decision-Making

should incorporate clear and realistically attainable goals:
1) fracture stabilization
2) Lumbosacral realignment
3) optimization of the chances for neurological recovery
4) adequate débridement of open injuries and compromised soft tissues
5) Minimization of additional morbidity.
# Surgical options

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timing of any surgical intervention

on the basis:
1) treatment goals
2) patient’s general medical status
3) invasiveness of the surgical procedure
Neurologic impairment

- range from incomplete monoradiculopathies to a complete cauda equina syndrome
- Neurological improvement of approximately 80% regardless of treatment
- Decompression may be less useful in root transection and root avulsion
- Decompression of compromised neural elements is preferably performed early, within the first twenty-four to seventy-two hours following injury
- Repair any dural tears
acceptable approach for decompression

- minimal reduction and stabilization for indirect decompression
- assessed with Ct-scan and physical exam
- focal limited decompression may be performed within the first two weeks after injury

severely displaced fracture should be considered for a comprehensive posterior decompression and stabilization
Surgical Stabilization Techniques

• Evolve
• goal of surgical intervention -> restore the stability of the lumbosacral articulation and pelvic ring
**Surgical Stabilization Techniques**

- Anterior approaches to the sacrum -> morbidity and limited exposure
- Role of external fixation -> limited to the emergent management or as supplemental treatment devices
Surgical Stabilization Techniques

- anterior stabilization should be considered before embarking on any posterior lumbosacral procedure
- Posterior fixation offers a high degree of mechanical construct stiffness, a low implant profile,
Surgical Stabilization Techniques

- Sacroiliac screw:
  1) Either supine or prone
  2) conventional c-arm
  3) Safety has been established

- Contraindication:
  1) Anomalous transitional lumbosacral anatomy
  2) Closed fracture reduction cannot be accomplished

- Potential drawbacks:
  1) Limited biomechanical strength
  2) Reliance on closed reduction
  3) Lack of c-arm
Surgical Stabilization Techniques

• indications for sacroiliac screws:
  1) Denis zone-I, II which can be adequately reduced
Surgical Stabilization Techniques

• Zone-II fractures with segmental comminution are susceptible to overcompression.
• Use bilateral midline-crossing sacroiliac screws when the technique is used to treat a zone-III “H” or “U” fracture configuration.
Surgical Stabilization Techniques

- posterior iliac tension-band plate as a supplemental internal fixation method with sacroiliac screw fixation can facilitate open fracture reduction and enhance biomechanical stiffness.
- it requires a posterior two incision approach, increased rate of wound-healing complications
Surgical Stabilization Techniques

- the most stable method: lower lumbar pedicle screw fixation and iliac screw fixation
- allows complete neurological decompression
- immediate stability
Thanks for attention