Spinal Disorders

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Objectives

• The ability to demonstrate knowledge of the characteristics of the major conditions:
  – Degenerative neck or back pain
  – Spinal cord or root entrapment (for example, herniated lumbar disc)
  – Osteoporotic vertebral fracture
  – Spinal deformity (scoliosis, spondylolisthesis)
  – Destructive (infectious and tumor related) back pain (for example, tuberculosis, metastasis, certain cancers)
Degenerative Spinal Disorders

• Degeneration:
  • “deterioration of a tissue or an organ in which its function is diminished or its structure is impaired”

• Other terms:
  – “Spondylosis”
    • “Degenerative disc disease”
    • “Facet osteoarthrosis”
Etiology

• Multi-factorial
  – Genetic predisposition
  – Age-related
  – Some environmental factors:
    • Smoking
    • Obesity
    • Previous injury, fracture or subluxation
    • Deformity
    • Operating heavy machinery, such as a tractor
Anatomy

• Anterior elements:
  – Vertebral body
  – *Inter-vertebral disc*
    • Degeneration occurs at the disc

• Posterior elements
  – Pedicles, laminae, spinous process, transverse process, *facet joints (2 in each level)*
    • Osteoarthrosis occurs at the facet joints
Anatomy, cont.

• Neurologic elements:
  – Spinal cord
  – Nerve roots
  – Cauda equina
Pathology: The inter-vertebral disc

• The first component of the 3 joint complex
  – “motion segment”
• It is primarily loaded in FLEXION
  – Composed of “annulus fibrosus” and “nucleus pulposus”
• Degeneration of the nucleus:
  – loss of cellular material, loss of hydration
  → Pain!
The inter-vertebral disc, cont.

• Disc degeneration will also cause
  – Bulging of the disc
    →”Spinal” stenosis
  – Loss of disc height
    →”Foraminal” stenosis
  – Herniation of the nucleus
    →”Radiculopathy”
    (e.g. sciatica in the lumbar spine)
Pathology: The facet joints

• Scientific name: “zygapophysial joints”
  – Synovial joints
  – 2 in each motion segment
    • Are primarily loaded in EXTENSION
  – Pattern of degeneration similar to other synovial joints
    • Loss of hyaline cartilage, formation of osteophytes, laxity in the joint capsule
The facet joints, cont.

- Facet degeneration will cause:
  - Hypertrophy, osteophyte formation
    - Contributing to spinal stenosis or foraminal stenosis
  - Laxity in the joint capsule
    - Leading to instability (degenerative spondylolisthesis)
Presentation

- Falls into 2 categories:
  - Mechanical pain: due to joint degeneration or instability
    - “Axial pain” in the neck or back
    - Activity related—not present at rest
  - Neurologic symptoms: due to neurologic impingement
    - Spinal cord
      - Presents as myelopathy, spinal cord injury
    - Cauda equina & Nerve roots
      - Presents as radiculopathy (e.g. sciatica) or neurogenic claudication
Presentation, cont.

• Mechanical pain
  – Associated with movement
    • Sitting, bending forward (flexion):
      – originating from the disc
        » “discogenic pain”
    • Standing, bending backward (extension):
      – originating from the facet joints
        » “Facet syndrome”
• Neurologic symptoms
  – Spinal cord
    • Myelopathy:
      – Loss of motor power and balance
      – Loss of dexterity
        » Objects slipping from hands
      – UMN deficit (rigidity, hyper-reflexia, positive Babinski..)
  • Spinal cord injury
    – Spinal stenosis associated with a higher risk of spinal cord injury
Presentation, cont.

• Cauda equina & Nerve roots
  – Radiculopathy
    • LMN deficit
    • Commonest is sciatica, but cervical root impingement causes similar complaints in the upper limb
  – Neurogenic claudication
    • Pain in both legs caused by walking
    • Must be differentiated from vascular claudication
### Table – Differentiating neurogenic and vascular claudication

<table>
<thead>
<tr>
<th>Factors</th>
<th>Neurogenic</th>
<th>Vascular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation after walking</td>
<td>Increased weakness</td>
<td>Unchanged</td>
</tr>
<tr>
<td>Palliative factors</td>
<td>Bending over, sitting</td>
<td>Stopping</td>
</tr>
<tr>
<td>Provocative factors</td>
<td>Walking downhill</td>
<td>Walking uphill</td>
</tr>
<tr>
<td></td>
<td>Increased lordosis</td>
<td>Increased metabolic demand</td>
</tr>
<tr>
<td>Pulses</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>“Shopping cart” sign</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>van Gelderen bicycle test</td>
<td>No leg pain</td>
<td>Leg pain</td>
</tr>
</tbody>
</table>
The Cervical spine: introduction

- Degenerative changes typically occur in C3-C7
- Presents with axial pain, myelopathy, radiculopathy
- Physical examination:
  - Stiffness (loss of ROM)
  - Neurologic exam
    - Weakness
    - Loss of sensation
    - Hyper-reflexia, hypertonia
    - Special tests: Spurling’s sign
The Cervical spine: Management

• Conservative treatment
  – First line of treatment for axial neck pain and mild neurologic symptoms (e.g. mild radiculopathy without any motor deficit)
    • Physiotherapy:
      – Focus on ROM and muscle strengthening
    • Non-steroidal anti-inflammatory medications (NSAID)
      – E.g. Diclofenac, ibuprofen, naproxen
    • Neuropathic medication: for radiculopathy pain
      – E.g. Gabapentin or pregabalin
The Cervical spine: Management

• Surgical management
  – Indicated for:
    • Spinal stenosis causing myelopathy
    • Disc herniation causing severe radiculopathy and weakness
    • Failure of conservative treatment of axial neck pain or mild radiculopathy
  – Procedures:
    • Anterior discectomy and fusion
    • Posterior laminectomy
Anterior Discectomy and fusion
Break for 5 minutes
The Lumbar spine

• Degenerative changes typically occur in L3-S1
• Presents with axial pain, Sciatica, neurogenic claudication
• Physical examination:
  – Stiffness (loss of ROM)
  – Neurologic exam
    • Weakness
    • Loss of sensation
    • Hypo-reflexia, hypo-tonia
    • Special tests: SLRT
The Lumbar spine: management

• Axial low back pain
  – Conservative treatment if first-line and mainstay of treatment
    • Physiotherapy: core muscle strengthening, posture training
    • NSAID
  – Surgical treatment indicated for:
    • Instability or deformity
      e.g. high-grade spondylolisthesis
    • Failure of conservative treatment
Lumbar Spondylosis
Lumbar Spondylosis
The Lumbar spine: management

• Spinal stenosis
  – Conservative treatment is first line of treatment
    • Activity modification, analgesics, epidural cortico-steroid injections
  – Surgical treatment
    • Indicated for
      – Acute Motor weakness e.g. drop foot
      – failure of –minimum- 6 months of conservative treatment
    • Spinal decompression (laminectomy) is the commonest procedure
Spinal Stenosis

- Compressed spinal nerves
- Enlarged facet joints

- Normal area for spinal nerves
- Facet joints
The Lumbar spine: management

- Disc herniation
  - Conservative treatment is first line of treatment for mild sciatica without motor deficit
    - Short (2-3 day) period of rest, NSAID, physiotherapy, epidural cortico-steroid injection
    - 95% of sciatica resolves within the first 3 months without surgery
  - Surgical treatment:
    - Indicated for cauda-equina syndrome, motor deficit, failure of 2 months of conservative treatment
    - Procedure: Discectomy (only the herniated part)
Disc Herniation

Disc material

Nerves

Disc herniation
Discectomy

LUMBAR DISC HERNIATION
Discogenic Pain  Herniated Nucleus Pulposus

Nucleus pulposus
Phospholipase A2
Prostaglandins
Nitric oxide
Metalloproteinases
Unidentified
Inflammatory process

Neovascularization of disc

Inflammatory cell infiltrate
(chemical signal for revascularization)

Fissure in anulus fibrosus
Sinuvertebral nerve
Nociceptors in anulus fibrosus
Dorsal root ganglion

Chemicals may reach nociceptors via fissure to lower threshold for firing. Pain is caused by mechanical forces superimposed on chemically activated nociceptors.

Nerve root–dura interface may be involved by inflammatory process. Chemical factors and compression both contribute to lumbar pain.

Disc Rupture and Nuclear Herniation

Rim lesion
Tears in internal annular lamellae
Herniated nucleus pulposus

Peripheral tear of anulus fibrosus and cartilage end plate (rim lesion) initiates sequence of events that weaken and tear internal annular lamellae, allowing extrusion and herniation of nucleus pulposus.

Discectomy
Herniated nucleus pulposus
Nerve root compressed by herniated disc

Portion of lamina and facet removed
Disc material removed to decompress nerve root
Spinal Fusion
Osteoporotic Vertebral Fractures

- Pathologic fractures
- Anterior column (±middle column) only compromised (Wedge/Burst Fracture)
- Often missed
- Repetitive fractures result in kyphotic deformity (hunchback)
- Treat the underlying cause!!
Spinal Deformities

• Scoliosis
  – deformity of the spine in the Coronal plane

• Kyphosis:
  – deformity of the spine in the Sagittal plane

• Spondylolisthesis
  – Translation of one vertebra over another
Types of scoliosis

• Congenital
  – Associated with anomalies of the bony vertebral column, e.g. hemivertebra

• Acquired (=secondary)
  – Secondary to other pathology, e.g. tumor, infection

• Idiopathic
  – Most common is adolescent type
Adolescent idiopathic scoliosis

- Three dimensional deformity of the spine
  - Vertebral Rotation is the hallmark
- Painless deformity
  - Usually noticed by parents/others
- Examination:
  - neurologically normal, positive Adams test
- Management:
  - depends on age & degree of deformity
Scoliosis
Scoliosis
Spondylolisthesis

• Conservative treatment first
• Surgery if Grade 3 or more or failed conservative management.

• Types:
  – “Degenerative” Spondylolisthesis
  – “Isthmic” spondylolisthesis
    • Caused by inter-articularis defect (spondylolysis)
Grades of spondylolisthesis

- Normal 0–25%
- Grade I 26–50%
- Grade II 51–75%
- Grade III 76–100%
- Grade IV >100%
Spondylolisthesis
Destructive Spinal Lesions

- Present with **pain at rest** or **pain at night**
- Associated with **constitutional symptoms**
- Most common causes
  - Infection
  - Tumors
- Vertebral body and pedicle are the commonest sites of pathology
Spinal Tumors

- Primary Spinal tumors:
  - Rare
  - Benign (e.g. osteoid osteoma) or malignant (e.g. chordoma)
  - Management depends on pathology

- Spinal metastasis
  - Very common
  - Biopsy required if primary unknown
Spinal infections

• Most common is TB and Brucellosis
• History of contact with TB patient, raw milk ingestion
• Potentially treatable diseases once diagnosis is established and antimicrobials administered
Spinal Tuberculosis (with psoas abscess)
Thanks,
Questions?