Degenerative Disease of the Spine

www.fisiokinesiterapia.biz
Introduction: Talk Overview

• I. Anatomy

• II. Overview of Disease Processes:
  – A. Spondylosis
  – B. Intervertebral Disc Disease

• III. Diagnosis

• IV. Therapy
Introduction:
Myelopathy vs. Radiculopathy

• **Myelopathy**
  – Disease/compression of the spinal cord itself

• **Radiculopathy**
  – Disease/compression of a *specific* nerve root
    (i.e., a right-sided L5 radiculopathy)
I. Anatomy of the Spine

Lumbar vertebrae, assembled: left lateral view

Anterior vertebral segments: posterior view (pedicles sectioned)

Posterior vertebral segments: anterior view
I. Anatomy of the Spine

- Disc/vertebral body
- Ventral root
- Dorsal root
- Sup artic process
- Inf artic process
- Lamina
- Spinous process
- Spinous process
I. Anatomy of the Spine

Ligamentum Flavum

Post. Long. Ligament
I. Anatomy of the Intervertebral Disc

- **Annulus fibrosis**: peripheral disc
- **Nucleus pulposus**: central disc
I. Anatomy of the Spinal Cord

- **Spinal cord terminates at L1 vertebra in conus medullaris**
  - Individual nerve roots continue as cauda equina
II. Overview of Disease Processes:

A. Intervertebral Disc Disease

• A. Definitions:
  – Desiccation: loss of disc water
  – Disc bulge: circumferential enlargement
  – Protrusion: HNP eccentric to one side
  – Extruded disc: HNP through annulus into epidural space
  – Sequestered disc: HNP is a free fragment
IIA. Intervertebral Disc Herniation: Definitions
IIA. Intervertebral Disc Herniation

• B. Epidemiology:
  • Young population (25-45 y.o.)
    – C-spine: most occur at C5-6, C6-7
    – T-spine: uncommon (<1% of all disc herniations)
    – L-spine: most occur at L4-5, L5-S1

• C. Pathophysiology:
  • With repeated minor trauma or aging . . .
    Desiccation $\rightarrow$ disc flattens $\rightarrow$ axial loading stretches annular fibers:
    – Disc bulges (concentric)
    – Tears in annulus fibrosus
    – Herniation of nucleus pulposus (eccentric)
IIA. Intervertebral Disc Herniation: Nerve Root Compression
IIA. Intervertebral Disc Herniation: Nerve Root Compression
IIA. Intervertebral Disc Herniation: Which Root is Compressed?

- **Cervical Spine**
  - Nerve roots exit *above* pedicle of like-named vertebra
    - C1 root exits below occiput
  - A C4-5 HNP usually involves the *C5 nerve root*!

- **Lumbar Spine** different!
IIA. Intervertebral Disc Herniation: Which Root is Compressed?

- **Lumbar** (and thoracic) Spine
  - Nerve roots exit *below* pedicle of named vertebral body
    - The C8 nerve root exits below C7
    - T1 nerve root is *below* T1 vertebra
    - It follows that the L4 nerve root exits at L4-5

  - Does the L4-5 HNP therefore affect the L4 nerve root??
    » No, unless extreme lateral HNP
    » Reconsider the anatomy of the cauda equina
IIA. Intervertebral Disc Herniation:

Extreme lateral disc herniations are rare (<10%)
II. Overview of Disease Processes:

B. Spondylosis

• **A. Definition:**
  - Non-specific degenerative dz of spine
    - (1) End plate osteophytes → pain & neural compression if posteriolateral
    - (2) Facet joint arthritis → pain & neural compression (lateral recess vs. central stenosis)
    - (3) Ligamentous hypertrophy
  - Not = to spondylo*lysis* (or spondylo*listhesis*)

• **B. Epidemiology:**
  - Older population
IIB. Spondylosis: A Spectrum of Pathologic Changes in Facet Joints and Discs

- **C. Pathophysicsology:**

<table>
<thead>
<tr>
<th>Phases of spinal degeneration</th>
<th>Facet joints</th>
<th>Pathological result</th>
<th>Intervertebral disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysfunction</td>
<td>Synovitis</td>
<td>Dysfunction</td>
<td>Circumferential tears</td>
</tr>
<tr>
<td></td>
<td>Hypermobility</td>
<td></td>
<td>Radial tears</td>
</tr>
<tr>
<td></td>
<td>Continuing degeneration</td>
<td>↓</td>
<td>Internal disruption</td>
</tr>
<tr>
<td>Instability</td>
<td>Capsular laxity</td>
<td>↑</td>
<td>Disc resorption</td>
</tr>
<tr>
<td></td>
<td>Subluxation</td>
<td>↑</td>
<td>Osteophytes</td>
</tr>
<tr>
<td>Stabilization</td>
<td>Enlargement of articular processes</td>
<td>↓</td>
<td>One-level stenosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Multilevel spondylosis and stenosis</td>
</tr>
</tbody>
</table>

II B. Spondylosis:
Facet Joint Hypertrophy

- Hypertrophic, widened facet joint
- Normal facet joint
### III. Diagnosis: Broad Differential

Is presentation c/w a . . .

<table>
<thead>
<tr>
<th><strong>Radiculopathy?</strong></th>
<th><strong>Myelopathy?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lateral HNP</td>
<td>• Central Stenosis</td>
</tr>
<tr>
<td>• Neural Foraminal (Lateral Recess) Stenosis</td>
<td>• Congenital or Acquired</td>
</tr>
<tr>
<td>• Facet joint spondylosis/hypertrophy</td>
<td>• Bilateral facet joint hypertrophy</td>
</tr>
<tr>
<td>• (More distal lesion)</td>
<td>• Hypertrophy of supporting ligaments</td>
</tr>
<tr>
<td></td>
<td>• Spondylolisthesis</td>
</tr>
<tr>
<td></td>
<td>• Central HNP (cervical)</td>
</tr>
<tr>
<td></td>
<td>• (Tumor, Infection, etc.)</td>
</tr>
</tbody>
</table>
III. Diagnosis: Cervical Radiculopathy

- Is there a dermatomal pattern?
III. Diagnosis:
Lumbar Radiculopathy

- Is there a dermatomal pattern?
III. Diagnosis:  
Cervical Radiculopathy

• Is there a myotomal pattern?
  – **C5:** Deltoid
  – **C6:** Biceps, biceps DTR
  – **C7:** Triceps, triceps DTR
  – **C8-T1:** Interossei, abd. dig. minimi

• Compression, tilting head towards sx side (Spurling’s sign) may exacerbate
• Extension may exacerbate
• Distraction, flexion may relieve
III. Diagnosis: Lumbar Radiculopathy

- **Is there a myotomal pattern?**
  - L2,3: Iliopsoas
  - L4: Quadriceps, patellar DTR
  - L5: Ext. hallucis longus
  - S1: Gastroc.-soleus, ankle DTR

- **Straight leg raise may exacerbate**
  - Passive hip flexion reproduces sx$s$ *distal to knee*, worsened with ankle dorsiflexion *(Lasegue maneuver)*
III. Diagnosis:

Keep in mind more distal etiologies . . .

– **Plexus**
  • Thoracic outlet syndrome

– **Nerve**
  • Peripheral neuropathy
  • Compression syndrome

– **Neuromuscular Junction**

– **Muscle**
III. Diagnosis:
If c/w a radiculopathy . . .

- **Intervertebral Disc Herniation**
  - Suspect in *younger* pts
  - Acute onset
  - Pain increased on sitting

  and/or . . .

- **Spondylosis** ➔ **Lateral Recess Stenosis**
  - Suspect in *older* patients
  - Insidious onset
  - Pain better on sitting
III. Diagnosis: Myelopathy

• **Central Stenosis**
  - **Cervical:**
    • Spasticity, hyperreflexia
  - **Lumbar** *(remember, cord ends approx. @ L1 vertebra):*
    • Parasthesias, pain +/- weakness
    • Worse w/ walking
      - Can imitate vascular claudication
### III. Diagnosis:
**Lumbar Myelopathy**

<table>
<thead>
<tr>
<th><strong>Neurogenic claudication</strong></th>
<th><strong>Vascular claudication</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- On rest, sx persist <em>unless</em> pt. flexes spine</td>
<td>- On rest, crampy pain stops immediately</td>
</tr>
<tr>
<td>- Sxs more proximal (thigh and calves)</td>
<td>- Sxs more distal (primarily calves)</td>
</tr>
<tr>
<td>- Better at “bicycle test”</td>
<td>- Worse at “bicycle test”</td>
</tr>
<tr>
<td>- NI foot color/pulses/temp</td>
<td>- Foot color/pulses/temp</td>
</tr>
</tbody>
</table>

*It is possible for both to be present*
III. Diagnosis: Radiographic

• **I. Plain Film**
  – Identifies degenerative changes

• **II. MRI (or CT)**
  – Defines nerve root and/or spinal cord compression

• **III. Myelography**
  – Water-soluble intra-thecal contrast

• **IV. Discography**
III. Diagnosis: Radiographic

- Intervertebral Disc Degeneration and Herniation (MRI)
III. Diagnosis: Radiographic

- Intervertebral Disc Herniation (CT)
III. Diagnosis: Radiographic

- Facet Joint Spondylosis w/ Spinal Stenosis (CT)
III. Diagnosis: Radiographic

- Facet Joint Spondylosis w/ Spinal Stenosis (CT)
III. Diagnosis: Radiographic

- III. Myelography
IV. Therapy: Disc Disease

- **Sxs usually resolve**
  - 75-85% of patients w/ acute lumbar HNP improve with conservative tx
  

- **Epidural steroid injections offer short-term pain relief**
  - 60-85% short-term success
  
  - No difference from placebo at 6 mos.
  
IV. Therapy: Disc Disease

• **Surgical Discectomy**
  – **Indications:**
    • Failure of conservative tx > 6 weeks
    • Progressive neurological deficit
    • Focal lower extremity weakness (i.e., foot drop)
    • *Not* for back pain

• *Cauda equina syndrome* = a surgical emergency
IV. Therapy: Disc Disease

• **Surgical Discectomy**
  – Results:
    • **Only as good as the pt. selection**
      – 99.5% relief when disc sequestered
      – 38% relief when minimally bulging disc
    • **Controversial long-term efficacy**
      – Beneficial at 1 year vs. conservative tx
      – Not at 4 and 10 years f/u (Weber, 1983).
IV. Therapy: Disc Disease

- Surgical results only as good as the pt. selection . . .

*Fig. 60-24* Percent relief of sciatica with type of disc herniation. (From Spangfort E: *Acta Orthop Scand Suppl* 142:1, 1972.)
IV. Therapy: Spondylosis/Stenosis

- Sxs usually do not resolve with time and conservative tx

- **Facet Joint Steroid Injections**
  - Aid in dx and helpful in short-term pain relief

- **Surgical Decompression +/- Fusion**
  - No good RCTs on efficacy of fusion

Conclusion:

• **I. Overview of degenerative spine disease**
  – Spondylosis
  – Intravertebral disc disease

• **II. Approach to patient**
  – Radiculopathy
  – Myelopathy

• **III. Surgery primarily aimed at sx relief**
  – Controversial long-term efficacy