A Patient with Low Back Pain

Kimberly Collins, Harvard Medical School Year III
Gillian Lieberman, MD
Case Presentation

MJ is a 48 year-old male with a five month history of increased low back pain that radiates down his left leg, left leg weakness, new onset constipation, and slow urination.
Low Back Pain

- About 70% of adults have low back pain at some time

- Low back pain is second only to upper respiratory illness as a symptom-related reason for visits to the physician

Deyo, 1992
Differential for Back Pain

Mechanical Low Back Pain 97%
- Lumbar strain, sprain 70%
- Degenerative processes of disks and facets 10%
- Herniated disk 4%
- Spinal stenosis 3%
- Spondylolisthesis 2%

Non-Mechanical Spinal Conditions ~1%
- Neoplasia 0.7%
- Infection 0.01%
- Inflammatory arthritis 0.3%

Visceral Disease 2%
- Disease of pelvic organs
- Renal disease
- Aortic aneurysm
- Gastrointestinal disease

Deyo, 2001
Deciding whether to image

- Back pain in a patient <50 with no neurological deficits should be followed conservatively with follow-up in 6 weeks.
- Patients with back pain associated with neurological signs should have imaging.
- Back pain lasting more than 3 months is considered chronic and should be imaged.

Jarvik, 2002
Deciding whether to image

MJ’s symptoms: low back pain that radiates down his left leg, left leg weakness, new onset constipation, and slow urination.

Indications for imaging MJ:
• Left leg sciatica and weakness
• Changes in bowel and bladder function
## Imaging modalities for patients with low back pain

<table>
<thead>
<tr>
<th>IMAGING MODALITY</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain film</td>
<td>Allows visualization of bony structures, low cost</td>
<td>Soft tissue is not well visualized, radiation exposure</td>
</tr>
<tr>
<td>CT</td>
<td>Detailed visualization of bony structures, some visualization of soft tissue structures</td>
<td>Not great for evaluating soft tissue, radiation exposure, expensive</td>
</tr>
<tr>
<td>MRI</td>
<td>Best modality for soft tissue visualization, no radiation exposure. Test of choice for back pain with neurological signs!</td>
<td>Difficult to evaluate cortical bone and calcifications, very expensive</td>
</tr>
<tr>
<td>Bone scan</td>
<td>Can screen the entire skeleton, good for detecting diffuse bone processes, metastases</td>
<td>Low specificity</td>
</tr>
</tbody>
</table>
# Imaging modalities for patients with low back pain

<table>
<thead>
<tr>
<th>IMAGING MODALITY</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT Myelography</td>
<td>Used when MRI is contraindicated, allows visualization of spinal cord and nerve roots, can evaluate for lesions within the spinal canal</td>
<td>Invasive, involves the injection of contrast into the thecal sac</td>
</tr>
<tr>
<td>Discography</td>
<td>Evaluate for disc disease, such as tears</td>
<td>Invasive, rarely used</td>
</tr>
<tr>
<td>Bone densitometry/DEXA</td>
<td>Measures bone marrow density, good for determining fracture risk</td>
<td></td>
</tr>
<tr>
<td>Spinal angiography</td>
<td>Evaluate for AVM, vascular tumors of spinal cord</td>
<td>Invasive, rarely used</td>
</tr>
</tbody>
</table>
Anatomy of the lower spine

Subarachnoid space
Medullary cone
CSF in lumbar cistern
Spinous process of L4
Dural sac
Extradural (epidural) space in sacral canal—the continuation of the vertebral canal in the sacrum

Moore, 2002
A gadolinium-enhancing mass with central calcification is seen within the spinal canal. The mass is better visualized on MRI.
A gadolinium-enhancing mass with central calcification is seen within the spinal canal. The mass is better visualized on MRI.
Patient MJ: T2 Sagittal MRI of Lumbar Spine

The mass is located within the spinal column below the level of the cona medullaris and is seen compressing the cauda equina. The location of the mass can explain MJ’s symptoms, which are consistent with cauda equina syndrome.

Courtesy of Fabio Komlos, BIDMC
Cauda Equina Syndrome

Symptoms include:
- urinary retention
- saddle anesthesia - sensory loss occurring over the buttocks, posterior-superior thighs, and perianal regions
- unilateral or bilateral sciatica
- leg weakness
- diminished anal sphincter tone

Usually caused by a tumor or massive midline disk herniation.

Deyo, 1992
Intraspinal Masses

Extradural

Intradural Extramedullary

Intramedullary

Courtesy of Fabio Komlos, BIDMC
### Differential for Intraspinal Masses

<table>
<thead>
<tr>
<th>Extradural</th>
<th>Intradural Extramedullary</th>
<th>Intramedullary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk disease</td>
<td>Meningioma</td>
<td>Ependymoma</td>
</tr>
<tr>
<td>Metastases, myeloma and lymphoma deposits</td>
<td>Neurofibroma</td>
<td>Astrocytoma</td>
</tr>
<tr>
<td>Hematoma</td>
<td>Metastases = “drop mets”</td>
<td>Infarct</td>
</tr>
<tr>
<td>Abscess</td>
<td></td>
<td>Hematoma</td>
</tr>
</tbody>
</table>

Patient MJ: T2 Sagittal MRI

A second intraspinal mass can be seen on this sagittal MRI.
Bilateral acoustic schwannomas are a hallmark of NF2.
MJ’s Diagnosis

- The multiple intraspinal masses and bilateral acoustic schwannomas seen on MRI was suggestive of neurofibromatosis 2.
- The diagnosis was confirmed by pathology after removal of the intraspinal masses.
Neurofibromatosis

- There are two types: Neurofibromatosis Types 1 and 2
- Neurocutaneous syndromes
- Development of neoplasms primarily in organs derived from embryonic mesoderm (skin, central and peripheral nervous systems, eyes)
- Inherited as autosomal dominant conditions with variable penetrance
Neurofibromatosis

**NF1**
- Chromosome 17
- Gene product: GTPase activating protein
- One of the most common autosomal dominant disorders
- Cutaneous features: peripheral neurofibromas, café au lait spots, freckling of axilla
- Nervous system tumors: plexiform neurofibromas, gliomas, ependymomas, meningiomas, astrocytomas, pheochromocytomas

**NF2**
- Chromosome 22
- Gene product: cytoskeletal protein
- Less common autosomal dominant disorder
- Cutaneous features: café au lait spots and peripheral neurofibromas occur rarely
- Nervous system tumors: schwannomas, meningiomas, ependymomas

Ruggieri, 1999
Companion Patient 1: Plain radiograph

Cutaneous neurofibroma seen as a soft tissue swelling on plain radiograph.

Courtesy of Jim Wu, MD
Plexiform neurofibroma seen in a patient with NF1.
Radiographs taken before and after the onset of leg pain in a patient with NF1. Fibular fracture is seen in the second radiograph.
Companion Patient 3: MRI

The fibular fracture occurred due to mass effect from a neurofibrosarcoma.

T1W Gad+  
T2W

Courtesy of Jim Wu, MD
Summary

- The most common causes of back pain are mechanical.
- Not all back pain requires imaging.
- MRI is the best modality for imaging back pain with neurological signs.
- The differential for intraspinal masses can be divided into extradural, intradural extramedullary, and medullary.
- Neurofibromatosis is a neurocutaneous syndrome characterized by tumors of the skin and nervous system.
References


http://intl.elsevierhealth.com/e-books/viewbook.cfm?ID=576
Acknowledgements

- Fabio Komlos, MD
- Jim Wu, MD
- Gillian Lieberman, MD
- Pamela Lepkowskki
- Larry Barbaras, webmaster