MUSCULOSKELETAL DIAGNOSIS UTILIZING HISTORY AND PHYSICAL EXAMINATION: FOCUS ON SPINE

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Learning Objectives

1. Identify components of the focused history and physical examination that will guide musculoskeletal diagnosis

2. Utilize musculoskeletal examination provocative maneuvers to aide differential diagnosis

3. Review the evidence base (likelihood ratios etc.) that is known about musculoskeletal physical examination
Musculoskeletal Physical Exam

- Physical examination is key to musculoskeletal diagnosis
- Unlike many other organ systems, *the diagnostic standard for many musculoskeletal disorders is the exam finding* (e.g. diagnosis of epicondylitis, see below)
- “You may think you have not seen it, but it has seen you!”

**Cozen’s Test.**

- The clinician stabilizes the patient’s elbow with one hand, and the patient is asked to pronate the forearm and extend and radially deviate the wrist against the manual resistance of the clinician.
- A reproduction of pain in the area of the lateral epicondyle indicates a positive test.

*Lateral Epicondylitis confirmed on exam by reproducing pain at lateral epicondyle with resisted dorsiflexion at wrist **not diagnosed with imaging**

*¾ of medical diagnoses are still made on history and exam despite technological advances of modern medicine*
Musculoskeletal Physical Exam

1. Inspection – symmetry, swelling, redness, deformity
2. Palpation – warmth, tenderness, crepitus, swelling
3. Range of motion *most sensitive for joint disease

Bates Pocket Guide to Physical Examination and History Taking: “To measure ROM precisely a simple pocket goniometer is needed. Estimates may be made visually.”

4. Special Tests: Provocative maneuvers
## Normal Joint Range of Motion

<table>
<thead>
<tr>
<th>Joint</th>
<th>Flexion-extension</th>
<th>Abduction/Adduction</th>
<th>Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td>180°</td>
<td>180° abduction 45° add across body</td>
<td>90° internal &amp; external</td>
</tr>
<tr>
<td>Elbow</td>
<td>150°</td>
<td>--</td>
<td>180°</td>
</tr>
<tr>
<td>Wrist</td>
<td>70° dorsiflexion</td>
<td>50° ulnar 20-30° radial</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>80-90° palmer flex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fingers</td>
<td>90° MCP; 120° PIP</td>
<td>30-40° MCP</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>80° DIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip</td>
<td>10-20° /120°</td>
<td>40° abduction 25° adduction</td>
<td>40° internal 45° external</td>
</tr>
<tr>
<td>Knee</td>
<td>130°</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Ankle</td>
<td>45° plantar flexion</td>
<td>20° dorsiflexion</td>
<td>30° inversion 20° eversion</td>
</tr>
<tr>
<td>Cervical Spine</td>
<td>45° flexion 60° extension</td>
<td>Lateral bending 40°</td>
<td>60-80°</td>
</tr>
<tr>
<td>Lumbar Spine</td>
<td>90° flexion 30° extension</td>
<td>Lateral bending 35°</td>
<td>30°</td>
</tr>
</tbody>
</table>
Musculoskeletal Differential Diagnosis

• What is the “pain generator”?
• Is this joint pain originating from:
  ➢ **articular** structures (synovium, cartilage, bone)
  ➢ **peri-articular** structures (muscle, tendon, ligaments, bursae, nerves, skin structures)
Approach to Musculoskeletal Complaints

Musculoskeletal complaint

- Initial history and physical examination to determine
  1. Is it intra- or extra-articular?
  2. Is it acute or chronic?
  3. Is inflammation present?
  4. How many/which joints are involved?

Nonarticular condition
- Consider
  - Trauma/trauma
  - Fibromyalgia
  - Polymyalgia rheumatica
  - Bursitis
  - Tendinitis

Is it intra-articular?

- Consider
  - Acute arthritis
    - Infectious arthritis
    - Gout
    - Pseudogout
    - Reiter syndrome
    - Initial presentation of chronic arthritis

Is complaint >6 wks?

Acute

- Is inflammation present?
  1. Is there prolonged morning stiffness?
  2. Is there soft tissue swelling?
  3. Are there systemic symptoms?
  4. Is the ESR or CRP elevated?

Chronic

- How many joints involved?
Articular and peri-articular sources of musculoskeletal pain are best distinguished with:

- Finding of warmth during palpation of the affected area
- X-rays of the affected area
- MRI of the affected area
- Finding of reduced pain on passive ROM compared to active ROM of the affected area
- Laboratory tests for inflammation such as ESR and C-reactive protein

- A
- B
- C
- D: 100%
- E
Passive ROM Cervical Spine

Passive neck rotation

Loss of rotation is the universal sign of neck pathology. The patient is asked to relax. The examiner places one hand on the shoulder and one hand on the chin. The neck is passively rotated to the affected side and compared with rotation to the opposite side. Rotation less than 90 degrees is abnormal. 

Courtesy of Bruce C Anderson, MD.
Provocative Maneuvers to Diagnose Cervical Radiculopathy: SPURLING TEST, DISTRACTION TEST

Spurling’s Maneuver

- Neck extended
- Head rotated toward affected shoulder
- Axial load placed on the spine
- Reproduction of patient’s shoulder/arm pain indicate possible nerve root compression

90% specific, 45% sensitive.

Caution in patients with RA, cervical malformations, metastatic disease
Provocative Maneuvers to Diagnose Cervical Radiculopathy: SPURLING TEST

• SPURLING TEST:
  ➢ Test performed with head extended then repeated with chin tucked into supraclavicular fossa
  ➢ LR+4.5, LR-0.6

**If patient can rotate head >60 degrees to involved side unlikely to be cervical radiculopathy LR-0.2**
Likelihood Ratios

>10, <.1 = large changes in diagnosis
5-10, .2-.5 = moderate changes
2-5, >.5 = slight changes
1 = no difference in odds of disease
Cervical Radiculopathy versus Shoulder Source of Pain

• Patients COMMONLY experience posterior shoulder pain with cervical spine problems…the RULE not the exception

• C5, C6 most common levels of cervical disc disease=see dermatome pathway

• Many patients present c/o ‘shoulder pain’ not neck pain-physical exam of the neck and shoulder will often discriminate the pain generator

“LOOK ABOVE AND BELOW THE AREA OF MUSCULOSKELETAL PAIN COMPLAINT”
49-year-old man reports 6 months of "left foot drags, left knee gives out, balance not right". Tingling hands since skiing accident age 20. Exam left knee normal, spinal ROM decreased, Spurling/SLR/Lhermitte-neg, motor 5/5, DTRs left 2-3+. You should:

- Order x-rays cervical spine (A)
- Order MRI cervical spine without contrast (B)
- Refer for PT addressing cervical spine and core strength (C)
- Refer for balance PT (D)
- Refer for chiropractic manipulation (E)
# Red Flags in Patients with Neck Pain

## Red flags in patients with neck pain

<table>
<thead>
<tr>
<th>Symptom or finding</th>
<th>Clinical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recent major neck trauma</td>
<td>Raises concern for cervical spine fracture</td>
</tr>
<tr>
<td>Neurologic symptoms or signs that suggest spinal cord issue (e.g., weakness, gait difficulty, bowel or bladder dysfunction)</td>
<td>Raises concern for cervical cord compression</td>
</tr>
<tr>
<td>Shock-like paresthesia (Lhermitte's phenomenon) with neck flexion</td>
<td>Suggestive of cervical cord compression or multiple sclerosis</td>
</tr>
<tr>
<td>Fever or chills</td>
<td>Suggestive of infection</td>
</tr>
<tr>
<td>History of injection drug use</td>
<td>Raises concern for cervical spine or disc infection</td>
</tr>
<tr>
<td>Immunosuppression</td>
<td>Raises concern for infection</td>
</tr>
<tr>
<td>Chronic glucocorticoid use</td>
<td>Raises concern for infection or cervical spine compression fracture</td>
</tr>
<tr>
<td>Unexplained weight loss</td>
<td>Suggestive of malignancy</td>
</tr>
<tr>
<td>History of cancer</td>
<td>Raises concern for metastatic disease to cervical spine</td>
</tr>
<tr>
<td>Headache, shoulder or hip girdle pain, or visual symptoms in older patient</td>
<td>Suggestive of rheumatic disease (e.g., polymyalgia rheumatica, giant cell arteritis)</td>
</tr>
<tr>
<td>Anterior neck pain</td>
<td>Suggestive of a non-spinal cause (e.g., angina pectoris)</td>
</tr>
</tbody>
</table>

Chart from: Evaluation of the Adult patient with neck pain. UpToDate accessed 10/5/19
Cervical Myelopathy seen in Primary Care

• Cervical spinal cord compression often presents insidiously – there is no well-defined pattern of neurologic deficits
  ➢ Weakness arms, legs, or both
  ➢ Sensory loss
  ➢ Urinary/rectal sphincter dysfunction
  ➢ Pain neck, scapula, shoulder, or radiating into arms
  ➢ Gait disturbance
  ➢ Bilateral sensory/motor loss hands misdiagnosed as carpal tunnel syndrome – EMG/NCV will not support this

• Some patients present acutely following minor neck trauma – fall, whiplash etc.
• MRI/CT can diagnose
• EMG/NCV doesn’t add much but can quantify upper motor neuron loss and R/O other disorders like ALS
Provocative Maneuver to Diagnose Cervical Myelopathy: LHERMITTE’S SIGN

Lhermitte’s sign

- Passive or Active Neck Flexion

Pain/Electric sensation shooting down back or into legs
- Myelopathy
- Multiple Sclerosis
Symptoms and Signs Cervical Root Impingement

### Symptoms and signs of cervical root lesions

<table>
<thead>
<tr>
<th>Root</th>
<th>Pain</th>
<th>Numbness</th>
<th>Weakness</th>
<th>Reflex affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>C5</td>
<td>Neck, shoulder, scapula</td>
<td>Lateral arm (in distribution of axillary nerve)</td>
<td>Shoulder abduction, external rotation, elbow flexion, forearm supination</td>
<td>Biceps, brachioradialis</td>
</tr>
<tr>
<td>C6</td>
<td>Neck, shoulder, scapula, lateral arm, lateral forearm, lateral hand</td>
<td>Lateral forearm, thumb and index finger</td>
<td>Shoulder abduction, external rotation, elbow flexion, forearm supination and pronation</td>
<td>Biceps, brachioradialis</td>
</tr>
<tr>
<td>C7</td>
<td>Neck, shoulder, middle finger, hand</td>
<td>Index and middle finger, palm</td>
<td>Elbow and wrist extension (radial), forearm pronation, wrist flexion</td>
<td>Triceps</td>
</tr>
<tr>
<td>C8</td>
<td>Neck, shoulder, medial forearm, fourth and fifth digits, medial hand</td>
<td>Medial forearm, medial hand, fourth and fifth digits</td>
<td>Finger extension, wrist extension (ulnar), distal finger flexion, extension, abduction, and adduction, distal thumb flexion</td>
<td>None</td>
</tr>
<tr>
<td>T1</td>
<td>Neck, medial arm and forearm</td>
<td>Anterior arm and medial forearm</td>
<td>Thumb abduction, distal thumb flexion, finger abduction and adduction</td>
<td>None</td>
</tr>
</tbody>
</table>

### Cervical Dermatomes

Schematic representation of the cervical and T1 dermatomes. There is no C1 dermatome. Patients with nerve root syndromes may have pain, paresthesias, and diminished sensation in the dermatome of the nerve that is involved.
Thoracic Outlet Syndrome: Provocative Maneuvers

Adson Test

Roos Test
Thoracic Outlet Syndrome: Clinical Presentation May Mimic Cervical Spine Disorders

Thoracic Outlet Syndrome

- Thoracic Outlet Syndrome (TOS) results from neurovascular compression at the superior thoracic outlet.
- Compression of brachial plexus, subclavian artery, and/or subclavian vein.
- Points of compression at the costoclavicular junction, scalene triangle, and pectoralis minor tendon.

Pathophysiology

- Symptoms depend upon which structures are compromised:
  - Pain
  - Paraesthesia
  - Weakness
  - Discomfort in the upper limb
  - Vascular dysfunction

TOS Often presents with bilateral arm symptoms.
Why do patients with shoulder issues experience neurologic symptoms down the arm??

WINGED SCAPULA:
Why do patients with shoulder issues sometimes complain of neurologic symptoms down the arm??

NYU Long Island School of Medicine
35-yo male presents 2 days after injuring back; lifting weights when he felt sudden pull in low back. No sciatica, incontinence, fever, chills. Exam: Spasm lumbar, decreased ROM, SLR negative, motor/DTRs normal. Best next step in managing this patient is:

- MRI lumbar spine
- X-ray lumbar spine
- Bed rest for 3 days followed by PT program
- Referral to orthopedic spine specialist
- NSAIDs, heat, stretch, activity modification
<table>
<thead>
<tr>
<th>Mechanical low back pain</th>
<th>Nonmechanical spine disease</th>
<th>Visceral disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumbar strain</td>
<td>Neoplasia</td>
<td>Pelvic organs</td>
</tr>
<tr>
<td>Degenerative disease</td>
<td>Multiple myeloma</td>
<td>Prostatitis</td>
</tr>
<tr>
<td>Discs (spondylosis)</td>
<td>Metastatic carcinoma</td>
<td>Endometriosis</td>
</tr>
<tr>
<td>Facet joints (osteoarthritis)</td>
<td>Lymphoma and leukemia</td>
<td>Chronic pelvic inflammatory disease</td>
</tr>
<tr>
<td>Spondylolisthesis</td>
<td>Spinal cord tumors</td>
<td>Renal disease</td>
</tr>
<tr>
<td>Herniated disc</td>
<td>Retroperitoneal tumors</td>
<td>Nephrothiasis</td>
</tr>
<tr>
<td>Spinal stenosis</td>
<td></td>
<td>Pyelonephritis</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>Infection</td>
<td>Perinephric abscess</td>
</tr>
<tr>
<td>Fractures</td>
<td>Osteomyelitis</td>
<td>Acute aneurysm</td>
</tr>
<tr>
<td>Congenital disease</td>
<td>Septic diskitis</td>
<td>Gastrointestinal disease</td>
</tr>
<tr>
<td>Severe kyphosis</td>
<td>Paraspinal abscess</td>
<td>Pancreatitis</td>
</tr>
<tr>
<td>Severe scoliosis</td>
<td>Epidural abscess</td>
<td>Cholecystitis</td>
</tr>
<tr>
<td>Possible type I or type IV transitional vertebra*</td>
<td>Inflammatory arthritis (often HLA-B27 associated)</td>
<td>Penetrating ulcer</td>
</tr>
<tr>
<td>Possible spondylolisthesis</td>
<td>Ankylosing spondylitis</td>
<td>Fat herniation of lumbar space</td>
</tr>
<tr>
<td>Possible facet joint asymmetry</td>
<td>Psoriatic spondylitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relative arthritis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inflammatory bowel disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scheuermann disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(osteochondrosis)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paget disease</td>
<td></td>
</tr>
</tbody>
</table>

**HLA**: human leukocyte antigen.  
* A transitional vertebra is a congenital anomaly in which there is a naturally occurring articulation or bony fusion between the transverse processes of L5 and the sacrum, but there is still a small remnant disc space between L5 and the sacrum. Type II means that one or both transverse processes appear to form a diarthrodial joint with the sacrum, but there is no bony fusion. Type IV means that there is a type II abnormality on one side and a complete bony fusion on the opposite side.


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Joint guidelines from the American College of Physicians (ACP) and the American Pain Society (2007)

- Places patients into 3 broad categories:
  - Nonspecific low back pain
  - Back pain potentially associated with radiculopathy
  - Back pain potentially associated with another specific spinal cause
- Imaging not recommended routinely in non-specific low back pain
- Imaging recommended in cases where progressive or severe neurologic deficits are present or when serious cause is suspected
- MRI those with radicular symptoms only if a potential candidate for surgery or epidural steroid injections
Evaluating Patients with Low Back Pain

Low back pain

Presence of sciatica?
(occasionally without back pain)

No

Simple back pain
(66%)
- Age < 50
- No signs or symptoms of spinal disease
- No history of cancer

(likelihood of musculoskeletal cause = 0.99)

Conservative care for 4-6 wk.

Improved

Not improved

STOP

Plain film and ESR*

Complicated back pain
without radiculopathy
(37%)
- Age > 50
- Systemic signs, symptoms, or risk factors

Fever, weight loss, history of prior cancer, hematuria, adenopathy, IDU

(Probability of systemic disease is 7% to 76%, depending on the findings.
Most patients still have musculoskeletal pain (95%).)

Radioignosy
(3%)
- Signs and symptoms of radiculopathy,
without bladder or bilateral findings
- May also have systemic signs, symptoms, or risk factors noted in complicated back pain

Plain film & ESR*

If normal, conservative care for at least 4-6 wk unless neurologic deficit is progressive

If either abnormal, consider CT or MRI

Have high clinical suspicion in patient with known cancer and new back pain or patient with IDU, fever, and back pain

Close follow-up is warranted

If 12-wk failure, meets criteria for surgical low back pain

Urgent situation
(0.1%)
- Acute radiculopathy with urinary retention, saddle anesthesis, bilateral neurologic symptoms, or bilateral exam findings
- Progressive motor weakness
- May have systemic signs, symptoms, or risk factors

Urgent consultation and CT or MRI to evaluate for cord or cauda equina compression

*Some clinicians measure C-reactive protein in addition to ESR as an inflammatory marker.

Abbreviations: CT, computed tomography; ESR, erythrocyte sedimentation rate; IDU, injection drug use; MRI, magnetic resonance imaging.
79 yo male 6 weeks of LBP radiating into right leg. Pain is worse at night. PMH: HTN, prostate cancer. Exam: Mild lumbar pain w/spasm, SLR+20 degrees on right, 4/5 quadricep weakness, 1+DTR right patellar, sensory deficit lateral thigh. Next best step:

- Referral for physical therapy
- MRI scan lumbar spine
- Bed rest and lumbar bracing
- Epidural injection at L4
- ESR, C reactive protein and CBC
Red Flags in Patients with Low Back Pain

**History:**
- Cancer
- Unexplained weight loss
- Immunosuppression
- Prolonged use of steroids
- Intravenous drug use
- Urinary tract infection
- Pain that is increased or unrelieved by rest
- Fever
- Significant trauma related to age (e.g., fall from a height or motor vehicle accident in a young patient, minor fall or heavy lifting in a potentially osteoporotic or older patient or a person with possible osteoporosis)
- Bladder or bowel incontinence
- Urinary retention (with overflow incontinence)

**Physical examination:**
- Saddle anesthesia
- Loss of anal sphincter tone
- Major motor weakness in lower extremities
- Fever
- Vertebral tenderness
- Limited spinal range of motion
- Neurologic findings persisting beyond one month

Clinical Presentation of Cauda Equina Syndrome

**Myotomal distribution of root symptoms**

<table>
<thead>
<tr>
<th>Level</th>
<th>Myotome</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Trigeminal nerve</td>
</tr>
<tr>
<td>C3</td>
<td>C2</td>
</tr>
<tr>
<td>C4</td>
<td>C3</td>
</tr>
<tr>
<td>C5</td>
<td>C4</td>
</tr>
<tr>
<td>C6</td>
<td>C5</td>
</tr>
<tr>
<td>C7</td>
<td>C6</td>
</tr>
<tr>
<td>C8</td>
<td>C7</td>
</tr>
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<td>L1</td>
<td>L1</td>
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<td>L2</td>
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<td>S1</td>
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<td>S4</td>
<td>S4</td>
</tr>
</tbody>
</table>

**CAUDA EQUINA SYNDROME SYMPTOM CHART**

- **Bladder disturbances**
  - Urination different to normal.
  - Inability to start, stop & control urination.
  - Loss of normal sensation when urinating.
  - Loss of sensation of full bladder.

- **Saddle Numbness**
  - Loss of feeling between the legs.
  - Numbness in and around the genitals &/ anus.
  - Loss of feeling of toilet paper when wiping.

- **Sexual Dysfunction**
  - Loss of clitoral sensation.
  - Loss of sensation during intercourse.
  - Inability to achieve an erection or ejaculation.

- **Bowel function affected**
  - Constipation.
  - Loss of control of bowel movement.
  - Loss of feeling when passing a bowel motion.

- **Low Back Pain / Leg Weakness / Sciatica**
  - It is quite common to have a combination of back pain, leg pain, leg numbness or weakness. These symptoms however are common in people who have a history of back problems but do not have Cauda Equina Syndrome.
### Red Flags in Patients with Acute Low Back Pain: Correlation to Possible Etiology

<table>
<thead>
<tr>
<th>Red flags</th>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration &gt; 6 wk</td>
<td>Tumor, infection, rheumatologic disorder</td>
</tr>
<tr>
<td>Age &lt; 18 y</td>
<td>Congenital defect, tumor, infection, spondylolysis, spondylolisthesis</td>
</tr>
<tr>
<td>Age &gt; 50 y</td>
<td>Tumor, intra-abdominal processes (such as an abdominal aortic aneurysm), infection</td>
</tr>
<tr>
<td>Major trauma, or minor trauma in elderly</td>
<td>Fracture</td>
</tr>
<tr>
<td>Cancer</td>
<td>Tumor</td>
</tr>
<tr>
<td>Fever, chills, night sweats</td>
<td>Tumor, infection</td>
</tr>
<tr>
<td>Weight loss</td>
<td>Tumor, infection</td>
</tr>
<tr>
<td>Injection drug use</td>
<td>Infection</td>
</tr>
<tr>
<td>Immunocompromised status</td>
<td>Infection</td>
</tr>
<tr>
<td>Recent genitourinary or gastrointestinal procedure</td>
<td>Infection</td>
</tr>
<tr>
<td>Night pain</td>
<td>Tumor, infection</td>
</tr>
<tr>
<td>Unrelenting pain, even when supine</td>
<td>Tumor, infection, abdominal aortic aneurysm, nephrolithiasis</td>
</tr>
<tr>
<td>Pain worsened by coughing, sitting, or Valsalva maneuver</td>
<td>Herniated disc</td>
</tr>
<tr>
<td>Pain radiating below knee</td>
<td>Herniated disc or nerve root compression below the L3 nerve root</td>
</tr>
<tr>
<td>Incontinence</td>
<td>Cauda equina syndrome, spinal cord compression</td>
</tr>
<tr>
<td>Saddle anesthesia</td>
<td>Cauda equina syndrome, spinal cord compression</td>
</tr>
<tr>
<td>Severe or rapidly progressive neurologic deficit</td>
<td>Cauda equina syndrome, spinal cord compression</td>
</tr>
</tbody>
</table>
Low Back Pain with Sciatica in Primary Care

• **Differential Diagnosis of Sciatica:**
  - Herniated disc (95% are at L4-5, L5-S1 levels)
  - Tumors
  - Vertebral fracture
  - Epidural abscess
  - Spondylolisthesis
  - Lumbar spinal stenosis
  - Synovial cysts
  - Mononeuropathy
  - Piriformis syndrome
Provocative Maneuvers to Diagnose Lumbosacral Radiculopathy: STRAIGHT LEG RAISE TEST (SLR)

- **STRAIGHT LEG RAISE TEST**: positive if sciatica reproduced ~ 40° (30-70)
  - **THIS IS A PASSIVE EXAM**
  - Sciatica <30° or >70° not considered secondary to nerve root irritation
  - SLR ipsilateral+: sensitive but not specific
    - In primary care: sensitivity 64%, specificity 57%
    - LR+1.5, LR-0.4
  - SLR crossed+: specific but not sensitive
    - Sensitivity 28%, specificity 90%
    - LR+3.4, LR-0.8
  - Presence of paresis, muscle atrophy, impaired reflex – specific but not sensitive
    - Asymmetric patellar reflex L3 or L4 radiculopathy
      - LR+8.5, Specificity 93-96%
Provocative Maneuvers to Diagnose Lumbosacral Radiculopathy: FEMORAL STRETCH TEST FOR L2-4 RADICULOPATHY

- **FEMORAL NERVE STRETCH TEST:**
  - Confirms an upper lumbar radiculopathy L2-4
  - **THIS IS A PASSIVE TEST**
  - Positive response is pain in the patient’s back AND anterior thigh
  - Sensitivity 52%, Specificity 98%
  - LR+31.2, LR-0.5
Neurologic Findings in Lumbar Nerve Root Compromise

Testing for lumbar nerve root compromise

<table>
<thead>
<tr>
<th>Nerve root</th>
<th>L4</th>
<th>L5</th>
<th>S1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbness</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weakness</td>
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<td></td>
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<tr>
<td>Extension</td>
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<td></td>
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<tr>
<td>Quadriceps</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dorsiflexion</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Great toe</td>
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<td></td>
<td></td>
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<tr>
<td>Plantar</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Flexion</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Great toe</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Walking</td>
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<td></td>
<td></td>
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<tr>
<td>Heel walking</td>
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<td></td>
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<tr>
<td>Squat and rise</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Reflexes</td>
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<td></td>
<td></td>
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<tr>
<td>Knee jerk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diminished</td>
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<td></td>
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<tr>
<td>Ankle jerk</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Diminished</td>
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</tr>
</tbody>
</table>

Clinical Findings with Nerve Root Compromise - LS Spine

<table>
<thead>
<tr>
<th>Root</th>
<th>Pain</th>
<th>Sensory loss</th>
<th>Weakness</th>
<th>Stretch reflex loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Inguinal region</td>
<td>Inguinal region</td>
<td>Rarely hip flexion</td>
<td>None</td>
</tr>
<tr>
<td>L2-L3-L4</td>
<td>Back, radiating into buttoc, lateral thigh, lateral calf and dorsum foot, great toe</td>
<td>Anterior thigh, occasionally medial lower leg</td>
<td>Hip flexion, hip adduction, knee extension</td>
<td>Patellar tendon</td>
</tr>
<tr>
<td>L5</td>
<td>Back, radiating into buttoc, lateral thigh, lateral calf and dorsum foot, great toe</td>
<td>Lateral calf, dorsum foot, web space between first and second toe</td>
<td>Hip abduction, knee flexion, foot dorsiflexion, toe extension and flexion, foot inversion and eversion</td>
<td>Semitendinosus-semimembranosus (internal hamstrings) tendon</td>
</tr>
<tr>
<td>S1</td>
<td>Back, radiating into buttoc, lateral or posterior thigh, posterior calf, lateral or plantar foot</td>
<td>Posterior calf, lateral or plantar aspect of foot</td>
<td>Hip extension, knee flexion, plantar flexion of the foot</td>
<td>Achilles tendon</td>
</tr>
<tr>
<td>S2-S3-S4</td>
<td>Sacral or buttoc pain radiating into the posterior aspect of the leg or the perineum</td>
<td>Medial buttoc, perineal, and penileal regions</td>
<td>Weakness may be minimal, with urinary and fecal incontinence as well as sexual dysfunction</td>
<td>Bulbospongiosus, anal wink</td>
</tr>
</tbody>
</table>
### American College of Physicians best practice advice: Diagnostic imaging for low back pain

<table>
<thead>
<tr>
<th>Diagnostic imaging techniques</th>
<th>Radiography</th>
<th>Computed tomography (CT)</th>
<th>Magnetic resonance imaging (MRI)</th>
</tr>
</thead>
</table>

#### Indications for diagnostic imaging

| Radiography is recommended in patients with acute low back pain who have major risk factors for cancer (new onset of low back pain with history of cancer, multiple risk factors for cancer, or strong clinical suspicion for cancer). MRI is recommended in patients with acute low back pain who have risk factors for spinal infection (new onset of low back pain with fever and history of intravenous drug use or recent infections), risk factors for or signs of the cauda equina syndrome (new urinary retention, fecal incontinence, or saddle anesthesia), or severe or progressive neurologic deficits. Radiography is recommended after a trial of therapies in patients with minor risk factors for cancer (unexplained weight loss or age > 65 years), risk factors for ankylosing spondylitis (morning stiffness that improves with exercise, alternating buttock pain, awakening because of back pain during the second part of the night), risk factors for vertebral compression fracture (history of osteoporosis, glucocorticoid use, significant trauma, or elderly age [> 65 years for men or > 75 years for women]). MRI is recommended after a trial of therapy in patients with signs/symptoms of radiculopathy (back pain with leg pain in an L4, L5, or S1 nerve root distribution or positive result on straight leg raise test) who are candidates for surgery or epidural steroid injection. MRI is also recommended in patients with risk factors for or symptoms of symptomatic spinal stenosis (inducing leg pain, older age, or preexisting diagnosis) in patients who are candidates for surgery. MRI is generally preferred over CT scan for most cases of low back pain. CT scan may help visualize bone abnormalities and is used when patients have a metallic implant that is not suitable for MRI. Repeated imaging is only recommended in patients with new or changed low back symptoms. |

#### Evidence that expanding imaging to patients without these indications does not improve outcomes

Randomized trials of routine imaging versus usual care without routine imaging in patients without indications for diagnostic imaging suggest no clinically meaningful benefits on outcomes related to pain function, quality of life, or mental health.

Other supporting evidence includes the weak correlation between most imaging findings and symptoms, the favorable natural history of acute low back pain with or without imaging, the low prevalence of serious or specific underlying conditions, and underestimation of imaging on treatment outcomes.

#### Harms of unnecessary imaging

- Radiation exposure (for lumbar radiography and CT)
- Labeling
- Iatrogenic reactions and contrast nephropathy (for indicated contrast with CT)
- Potential association with subsequent unnecessary, invasive, and expensive procedures

#### Approaches to overcome barriers to evidence-based practice

| Patient expectations or preferences for routine imaging: Use talking points based on evidence-based guidelines to aid in patient education |
| Triage constraints: Use evidence-based online or print education materials to supplement face-to-face education |
| Clinician uncertainty: Recognize the low likelihood of serious conditions in the absence of clinical risk factors and the evidence that shows no benefit associated with routine imaging |
| Clinician incentives: Based on patient satisfactions; advocate for incentives that are based on providing appropriate care |

#### Taking points for clinicians when discussing low back pain imaging with patients

| Risk factor assessment can almost always identify patients who require imaging |
| The prevalence of serious underlying conditions is low in patients without risk factors |
| The natural history of acute low back pain is quite favorable, but patients require reevaluation if they are not better after about 1 month |
| Routine imaging does not improve clinical outcomes but increases costs and may lead to potentially unnecessary invasive treatments, such as surgery |
| Imaging abnormalities are extremely common, especially in older adults. But most are poorly correlated with symptoms |
| In most cases, treatment plans do not change after imaging studies |
| Plain imaging is associated with radiation exposure, which can increase the risk for cancer in the case of lumbar radiography and computed tomography |
72-year-old woman months of left buttock dull pain radiating down posterior leg. Onset insidious; worse with walking. Retired executive, lots of time on computer, travels. PMH: HTN. Exam: Pulses 2+, Left hip reduced ext. rotation, SLR-/~FABER-. Diagnosis?

- Hip osteoarthritis
- Lumbar radiculopathy (Sciatica)
- Peripheral arterial disease
- Piriformis syndrome
- Greater trochanter bursitis
Provocative Test for Piriformis Syndrome: FAIR TEST

PIRIFORMIS SYNDROME:
- Dull, achy buttock pain that may radiate into deep posterior thigh or lower leg
- Commonly confused with lumbar disc disease
- Triggers: Trauma, Prolonged sitting, Overuse (Running, Tennis)
- **FAIR Test:** Flexion, Adduction, Internal rotation of hip (operating characteristics are not reported)
- THE ‘SCIATICA’ THAT WILL NOT GET BETTER: YOUR EXPERIENCED PHYSICAL THERAPIST WILL HELP DIAGNOSE THIS

**FAIR Test**
- FAIR (flexion, adduction, and internal rotation) test.
- performed with the patient in a lateral recumbent position, with
  - the affected side up, the hip flexed to an angle of 60 degrees, and
  - the knee flexed to an angle of 60 degrees to 90 degrees. While stabilizing
  - the hip, the examiner internally rotates and adducts the hip
  - by applying downward pressure to the knee.
Thank You
References

Evidence-Based Physical Diagnosis. 4th edition 2016. Steven McGee MD


Deyo RA, Mirza SK. Herniated Lumbar Intervertebral Disk. NEJM 2016:374;18: 1763-72