

بِسْمِ خُدا

Evaluation of Low Back Pain

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Serious systemic etiologies

Among patients who present with back pain , less than 1 percent will have a serious systemic etiology

Spinal cord or cauda equina compression

Cord compression

Metastatic cancer

Spinal epidural abscess

Vertebral osteomyelitis

Spinal cord or cauda equina compression

- There are many causes of CES, the most common:
- **Herniation of the intervertebral** disc in 22.7percent
- **Ankylosing spondylitis** in 15.9 percent
- **Lumbar puncture** in 15.9 percent
- **Trauma** in 7.6 percent
- **Malignant tumor** in 7.2 percent
- **Benign tumor** in 5.7 percent, and
- **Infection** in 5.3 percent.
- Cord compression varies depending on the cancer.
- C.C the initial manifestation of malignancy in 20 percent..
- Metastatic disease from any primary cancer can cause cord compression

Sun JC, et al. Assessment of CES progression pattern to improve diagnosis Spine. 2014.

Serious systemic etiologies

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- **Pain** is usually the first symptom, but **motor** (usually weakness), **sensory** findings are present in the majority of patients at diagnosis.
- **Bowel and/or bladder dysfunction** are generally late findings.

Serious systemic etiologies

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Metastatic cancer

- The bone is one of the most common sites of metastasis. A history of cancer is the strongest risk factor for back pain.
- Metastatic disease from **breast, prostate, lung, thyroid, and kidney** cancers account for 80 %
- **Approximately 60 percent of patients with MM** have skeletal lytic lesions present at diagnosis.
- History of cancer, **sudden and severe pain** : Fx
- Patients may also have neurologic symptoms.

Serious systemic etiologies

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Spinal epidural abscess

- Spinal **epidural abscess** is a rare but serious cause of back pain
- Initial symptoms : **fever and malaise**, are often nonspecific
- **localized back pain** may be followed by **radicular pain** if untreated, **neurologic deficits**.
- Risk factors include:
 - 1- Recent spinal injection
 - 2- Epidural catheter placement
 - 3- Injection drug use
 - 4- Infections : contiguous or bacteremia
 - 5- Immunocompromised patients

Urgent antibiotic treatment and surgical therapy for those with neurologic symptoms is required

Serious systemic etiologies

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Vertebral osteomyelitis

Vertebral osteomyelitis

- Generally increases with age
- Many cases: hematogenous (bacteremia)
- Risk Factor include an immunocompromised state and injection drug use
- Typically presents with **gradual onset of symptoms over several days**
- Most patients will present with **back pain** but may **not have fever** or other systemic symptoms

Prompt antibiotic treatment improves outcomes

Less serious, specific etiologies

Among patients who present with back pain , less than
1 percent will have a serious systemic etiology

Vertebral compression fracture

Radiculopathy

Spinal stenosis

Ankylosing spondylitis

Osteoarthritis

Other etiologies

Vertebral compression fracture

- Approximately 4 percent of patients presenting with LBP will have a vertebral compression fracture
- Patients present with acute onset of localized back pain which may be incapacitating.
- Risk Factors for osteoporotic fracture include advanced age and chronic GC use.
- A history of an osteoporotic fracture is a RF for subsequent fractures, which can be mitigated by therapy.

Vertebral compression fracture

Clinical risk factors for fracture

Advancing age
Previous fracture
Glucocorticoid therapy
Parental history of hip fracture
Low body weight
Current cigarette smoking
Excessive alcohol consumption
Rheumatoid arthritis
Secondary osteoporosis hypogonadism or premature menopause, malabsorption, chronic liver disease,IBD

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Other etiologies

Radiculopathy

- Damage to a spinal nerve root : **degenerative changes** in the vertebrae, disc protrusion, and other causes.
- Over 90 percent are L5 and S1 radiculopathies.
- Patients present with **pain, sensory loss, weakness, and/or reflex changes**.
- Many patients with symptoms of acute lumbosacral radiculopathy improve gradually with supportive care..
- Sciatica refers to a **sharp or burning pain** radiating down from the buttock along the course of the sciatic nerve.

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Other etiologies

Spinal stenosis

- **Spondylosis** (degenerative arthritis affecting the spine)
- **Spondylolistheses**
- **Thickening of the ligamentum flavum** are the most common causes, typically affecting patients >60 years
- Ambulation-induced **pain localized to the calf and distal lower extremity** resolving with sitting or leaning forward
- Other symptoms include **back pain and sensory loss and weakness in the legs.**
- Rare patients develop a CES.
- A trial of conservative, nonsurgical treatment is the initial therapy for most patients

Less serious, specific etiologies

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Spinal stenosis

Ankylosing spondylitis

Osteoarthritis

Other etiologies

Ankylosing spondylitis

- Among patients who present with back pain, it is that approximately 0.5 percent will have AS.
- It is most common in men under the age of 40 years.
- Almost all patients report inflammatory back pain (morning stiffness, improvement with exercise, pain at night,...) .
- Patients may also have extraskkeletal disease manifestations (eg, uveitis).

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Osteoarthritis

Other etiologies

Osteoarthritis

- **LBP may be a symptom of OA of the facet joints spine. Patients may also complain of hip pain, either from OA of the hip or referred pain from the spine.**
- **OA most commonly presents in patients over the age of 40.**
- **Pain is typically exacerbated by activity and relieved by rest.**
- **Osteoarthritis can lead to spinal stenosis.**

Less serious, specific etiologies

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Other etiologies

Other etiologies

Scoliosis and hyperkyphosis

Back pain can be associated with scoliosis and hyper-kyphosis.

Psychologic distress

Psychologic distress (eg, depression or somatization) may contribute to the severity symptoms of LBP

Etiologies outside the spine

- LBP may be a symptom of problems outside the back.
- Examples : pancreatitis, nephrolithiasis, pyelonephritis, abdominal aortic aneurysm, or herpes zoster.
- Patients generally have other accompanying symptoms.

Other etiologies

Piriformis syndrome

- The piriformis syndrome is thought to be a condition in which the piriformis muscle, a narrow muscle located in the buttocks, compresses or irritates the sciatic nerve

Sacroiliac joint dysfunction

- Sacroiliac joint dysfunction a term to describe pain in the region of the SIJ believed to be due to **malalignment** or **abnormal joint movement**
- Tests of pelvic symmetry or SIJ movement have been shown to have low intertester reliability and maneuvers such as fluoroscopically guided injections of the SIJ have been unreliable in diagnosis and treatment
- The SIJ may be a referred site of pain: degenerative disc at L5S1, spinal stenosis, or OA of the hip.

Other etiologies

Bertolotti's syndrome

- Back pain in the setting of a **transitional vertebra** is known as "Bertolotti's syndrome."
- It is a congenital anomaly with **Articulation** or **Bony fusion between the transverse processes of L5 and the sacrum**.
- Estimates of prevalence of transitional vertebra range from **4 to 36 percent**
- It remains unclear whether these individuals have a higher risk of back pain than those without such an anomaly.
- Generally, patients with BS should initially be **treated similarly as patients with nonspecific back pain**.

Initial evaluation

- History:

- Physical Examination:

 - 1-Inspection of the back and postur

 - 2-Palpation / percussion of spin

 - 3-Neurologic exam

 - 4- SLR

 - 5- Nonorganic (waddels sign)

 - 6-Others: urinary incontinence,....

- Lab. Studies:

- Imaging:

 - Limited utility of imaging**

 - (Clinically insignificant or uncertain significant)

 - 1- Annular fissure (tear)

 - 2-Schmorls node

 - 3- Modic change

Initial evaluation

- Modalities:
 - 1- Advanced imaging
 - a- MRI
 - b- CT Scan
 - c- Radionuclide Scan,....
 - 2- Plain radiographs
- Indication for imaging:
 - 1- ACP
 - 2- APS
 - 3- NICE
 - 4- ABIM
- Red Flags:

1- Risk assessment for acute LBP:

A - Neurologic deficit

B - Infection:

- High clinical suspicion**
- Concern for infection but no high**

C - Cancer

- Current or recent cancer**
- Moderate to high for cancer**
- Low risk cancer**

D -Compression fracture

a-Trauma

2- Risk assessment subacute back pain:

A- Radiculopathy or lumbar stenosis

B- Cancer risk

C- Other patient:

- Concern for AS**
- Concern for OA**
- Patients without specific concern**

3- Risk assessment chronic back pain:

Initial evaluation

- **History:**

- **Physical Examination:**

 - 1-Inspection of the back and postur

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- **Lab. Studies:**

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Initial evaluation

Clinical evaluation includes: History and Physical Examination
to evaluate for signs or symptoms that indicate need for immediate imaging and
further evaluation

**For most patients with acute LBP (<4 weeks), laboratory tests and imaging are not necessary
in the initial evaluation**

History

- It is important to evaluate for evidence of specific etiologies of back pain
- The history include **location, duration, and severity of the pain,** details of any **prior back pain,** and
- How current symptoms compare with any previous back pain

History

- **Constitutional symptoms** : unintentional weight loss or night sweats
- **History of malignancy**, precipitating events, therapies attempted
- **Neurologic symptoms** : weakness, falls, gait instability, numbness or other sensory changes
 bowel/bladder symptoms
- **Stability or progression of symptoms**, history of recent bacterial **infections** (particularly bacteremia),
- Recent or current use of **injection drugs**
- History or current **use of corticosteroid**
- Recent **procedures in the back**
- Social or **psychologic** distress

History of cancer, age >50 years, unexplained weight loss, duration of pain >1 month, nighttime pain, and unresponsiveness to previous therapies

Physical examination

Purpose is to identify features that suggest: further evaluation

Inspection of back and posture

- Inspection of the patient on physical examination can reveal anatomic abnormalities such as scoliosis or hyper-kyphosis

Palpation/percussion of the spine

- Palpation and/or percussion of the back: vertebral or soft tissue tenderness
- Vertebral tenderness is a sensitive, but not specific finding for spinal infection, and in patients with vertebral metastases and osteoporotic compression fracture

Physical examination

Neurologic exam

- Neurologic exam including evaluation of the **reflexes**, **strength**, **sensation**, and **gait**.
- For **radiculopathy**, neurologic testing should focus on the **L5 and S1** nerve roots.

Straight leg raising

- The SLR and other maneuvers can be helpful in identifying whether symptoms are radicular in nature..

Physical examination

Nonorganic signs (Waddell's signs)

- 1- **Overreaction** during physical examination
- 2- **Superficial tenderness**
- 3- **SLR** that improves when the patient is distracted
- 4- **Inexplainable neurological deficits** (non-dermatomal distribution of sensory loss, sudden giving way or jerky movements with motor exam, inconsistency in spontaneous activity: dressing, getting off table)
- 5- **Pain elicited by axial loading** (pressing down on top of head, or rotating the body at hips or shoulders)

Physical examination

Others

- New or worsening **urinary incontinence**, measure bladder post void residual (by ultrasound) to differentiate overflow incontinence from urge and/or stress incontinence
- History strongly **suggests malignancy**, evaluate as appropriate (lymph node, breast, prostate evaluation...)
- Other physical examination (hip examination or examination for peripheral vascular disease)

Initial evaluation

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(Clinically insignificant or uncertain significant)
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Laboratory studies

Most patients with acute low back pain do not require any laboratory testing

- When suspected **infection** or **malignancy** : ESR and/or CRP in addition to plain radiographs to determine the need for advanced imaging
- CRP may have similar or greater value than the ESR; however, CRP has not been similarly evaluated in the evaluation of LBP
- Mostly in patients with systemic causes of LBP
- Normal CRP, ESR and radiographs of Lumbar spine is unlikely to have underlying infection , malignancy
- Brucellosis,TB

Electrodiagnostic studies

- **EDX provide physiologic information**
- **Can confirm nerve compression and define the distribution and severity of involvement**
- **Use in discordance between clinical presentation and Imaging**
- **Can differentiating peroneal N.palsy or plexopathy from radiculopathy**
- **EDX is unnecessary in a patient with obvious radiculopathy**

Initial evaluation

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Imaging

Limited utility of imaging

- Earlier use of imaging for LBP without associated symptoms **is not associated with improved outcomes** but increases the use of invasive procedures.
- In a meta- analysis that compared immediate imaging (MRI, CT or radiography) with usual care for patients with acute and subacute LBP, without signs or symptoms of infection or malignancy:
Found no significant differences in short term (up to 3 months) or long term (6 to 12 months) outcomes for patient pain or function
- An observational study in patients ≥ 65 years with back pain but without radiculopathy:
No differences in disability at one year for patients who received early imaging (within six weeks) compared with those who did not

Chou R,et al. Imaging strategies for low-back pain: systematic review and meta-analysis. Lancet 2009;
Jarvik JG, et al. Association of early imaging for back pain with clinical outcomes in older adults. JAMA 2015.

Imaging

Limited utility of imaging

Imaging often show abnormal findings in adults without LBP

- 1- **Disc herniation** on MRI are seen in **22 to 67 percent**
- 2- **Spinal stenosis** in **21 percent**
- 3- **Osteoarthritis** is often seen on imaging
- 4- **Facet joint OA** in 40 to 80 years old, **60 percent of men and women**

- Even when the radiographic findings are consistent with clinical presentation, magnitude of radiographic findings does not necessarily correlate with **clinical severity and outcome**, and **clinical improvement may not correlate** with resolution of the radiographic defect.

-In one follow-up of 283 patients with disk herniation who had surgery, **MRI at one year F/U showed disk herniation in 35 and 33 percent** of patients with favorable and unfavorable outcomes, respectively

Eno JJ, et al. The prevalence of sacroiliac joint degeneration in asymptomatic adults. J Bone Joint Surg Am 2015

[El Barzouhi A, et al. Magnetic resonance imaging in follow-up assessment of sciatica. N Engl J Med 2013.](#)

Imaging

Findings on MRI are insignificant:

Annular fissures (tears)

- Annular fissures, are separations annular fibers from disk or from attachments to the vertebral bone.
- No correlation between the presence of annular fissure and back pain.
- Asymptomatic patients had 38 percent evidence of annular fissures

Schmorl's nodes

- Schmorl's nodes, representing herniation of the nucleus pulposus into the adjacent end plate, 20 percent of MRI studies in patients without back pain.
- Although Schmorl's nodes are not an independent risk factor for back pain.

Imaging

Findings on MRI are insignificant

Modic changes

- Modic changes are of unclear clinical significance.
- Specific signal changes in the vertebral endplate and adjacent bone marrow on a spine MRI
- These changes occur in 6 to 10 percent of asymptomatic adults
- Modic change in about 20 to 40 percent of patients with LBP
- The prevalence of Modic changes increases with age.
- It is unclear whether the presence of these changes is helpful in guiding the selection of treatment options
- The type of Modic change in a single patient may progress or regress over time

Imaging Modalities

The main imaging modalities to evaluate LBP are MRI, CT, and plain radiographs
Imaging is not indicated in many patients with low back pain

Advanced imaging

- MRI best initial exam for most patients with LBP who require advanced imaging
- Can demonstrate normal and pathologic discs, ligaments, nerve roots, epidural fat, and shape and size of the spinal canal
- MRI is more sensitive and specific than plain radiographs for detection of spinal infection and malignancy
- MRI enhancement with gadolinium allows distinction of scar from disc in patients with prior back surgery
- CT scan In patients who require advanced imaging but cannot undergo MRI
- Radionuclide scans are an alternative to MRI for evaluation of possible osteomyelitis
- Myelography is rarely performed and used when a patient is not able to undergo CT or MRI

Imaging

Modalities

Plain radiographs

- When plain radiographs are indicated, AP and lateral views of the lumbar spine are usually adequate
- Oblique and spot views **increase the risks of radiation exposure**, and add little new diagnostic information
- Flexionextension views may be helpful in **surgical fusion procedures** or for whom **instability** is a concern
- Plain radiographs are a reasonable option for imaging in patients **when concerned for infection or malignancy**, but clinical suspicion is nothing
- Often combined with ESR or CRP for evaluation.

Imaging

Indications for imaging

The majority of patients with LBP of less than **Four weeks** duration do not require imaging

- Onequarter of patients 18 to 50 years with acute LBP who underwent imaging exams had no identifiable indication for imaging
- Inappropriate lumbar imaging can lead to **irrelevant findings** and additional **costly** studies, **unneeded treatments**, and **unwarranted surgery**

Joint guidelines from the American College of Physicians (ACP) and the American Pain Society(APS) recommend that "clinicians should not routinely obtain imaging or other diagnostic tests in patients with nonspecific low back pain" and reserve imaging for patients with severe or progressive neurologic deficits or when serious underlying conditions are suspected on the basis of history and physical examination

Imaging

Indications for imaging

- Guidelines from the National Institute for Health and Care Excellence (NICE) in the UK advise clinicians to “not routinely offer imaging in a non-specialist setting for LBP with or without sciatica”
- The ACP provides practical advice about when imaging studies **should be considered** in patients with acute LBP, with the exception of imaging for suspected vertebral compression fracture
- Avoiding imaging in acute LBP has been identified as a recommendation in the American Board of Internal Medicine's (ABIM) "Choosing Wisely" campaign.

Indications for imaging

Red flags

- Some guidelines suggest "red flags" symptoms, which may identify patients at risk for a more dangerous cause of back pain and represent an indication for earlier imaging exams.
- There are limited data to support the use of most of the red flags as an indication for early imaging
- Systematic reviews of studies that used one or more of these indications for imaging found that only a history of cancer has been shown to increase the probability of finding spinal malignancy.

History

Red flags

Pain worse at rest or at night

Prior history of cancer

History of chronic infection (especially lung, urinary tract, skin)

History of trauma

Incontinence

Age > 70 years

Intravenous drug use

Glucocorticoid use

History of a rapidly progressive neurologic deficit

Examination

Unexplained fever

Unexplained weight loss

Percussion tenderness over the spine

Abdominal, rectal, or pelvic mass

Internal/external rotation of the leg at the hip, heel percussion sign

Straight leg – or reverse straight leg- raising signs

Progressive focal neurologic deficit

Risk assessment for acute back pain

Neurologic deficits

Infection

Cancer

Risk assessment for acute back pain

Neurologic deficits

less than 1 percent will have a **serious systemic etiology** that requires evaluation with immediate advanced imaging

Symptoms of **spinal cord or CES compression** or **progressive and/or severe neurologic deficits**:
immediate MRI

- Patients with radiculopathy or spinal stenosis with **stable symptoms** do not need immediate imaging
- If there is no improvement in symptoms: image after **four to six weeks** of conservative therapy.

Risk assessment for acute back pain

Neurologic deficits

Infection

Cancer

Infection

- Patients in high clinical suspicion for **spinal infection** : immediate imaging
- Patients with **neurologic** symptoms :MRI
- In patients **without neurologic** symptoms, the choice of modality depends on clinical suspicion.

Risk assessment for acute back pain

Infection

High clinical suspicion

- Patients with a high clinical suspicion for vertebral **osteomyelitis** or **epidural abscess** : MRI
- Raise suspicion for : **recent spinal procedure** or **current IV drug use** with **high fever** and **localized back pain** and **tenderness**
- **MRI is the most sensitive imaging modality for detecting spinal infection**
- Patients who are unable to obtain an MRI, a **CT scan** is a useful alternative to evaluate for **epidural abscess**
- Radionuclide scans are an option to evaluate for **osteomyelitis**

Risk assessment for acute back pain

Infection

Concern for infection present but not high

- Evaluate patients with plain radiographs and ESR or CRP
- Patients with a **positive plain radiograph** undergo further evaluation for infection
- Patients with a high ESR or CRP but a **negative plain radiograph** : evaluated with MRI
- Plain radiographs are **less sensitive than MRI** for spinal infection
- The sensitivity **of plain radiograph** for spinal infection is 82% and specificity 57%.
- **Lower sensitivity and specificity of plain radiographs**, combine the evaluation with ESR or CRP
- Infection is **very unlikely** in patients with an ESR <20 and no more than one risk factor for a systemic illness

Risk assessment for acute back pain

Neurologic deficits

Infection

Cancer

Risk assessment for acute back pain

Cancer

- Patients with cancer or Risk F. for cancer and neurologic deficits should have immediate imaging
- In patients without neurologic deficits, the decision to image is based on risk factor

Current or recent cancer

- Imaging for these patients will vary depending on a variety of factors
- For such patients, consult with their **oncologist** to discuss the most appropriate imaging exam.

Moderate to high risk for cancer

- Start the evaluation with plain radiographs and ESR (or CRP)
- Patients with **positive radiograph** : appropriate further evaluation for malignancy
- Patients with a high ESR or CRP but negative plain radiograph : further evaluated with MRI

Risk assessment for acute back pain

Cancer

Moderate to high risk for cancer

- Risk Factors : **patient's age**, **smoking history**, **family history**, **physical exam. findings**, **recent weight loss**
- Vertebral **metastases** are often associated with **localized pain** and **focal tenderness** on examination
- It is likely that patients having more than one such feature are at higher risk than those with a single risk factor
- The sensitivity of plain radiographs for malignancy is 60% and specificity 95%.
- Cancer is very unlikely in a patients with an ESR <20 and no more than one risk factor

Low risk for cancer

- Do not obtain immediate imaging in patients with acute **LBP** who are at low risk for cancer (one risk factor).
- If the pain is persistent : image after four to six weeks.

Compression fracture

- Patients with vertebral compression fracture : **plain radiographs** for evaluation
- Increased risk for vertebral fractures include:
 - Prolonged glucocorticoid use
 - Advanced age
 - Significant trauma
 - Presence of contusion or abrasion
 - Recent mild trauma in a patient with osteoporosis
- Patients with osteoporotic Fx have **sudden onset of pain** and have **localized pain** and **tenderness**
- While the ACP guidelines **suggest that imaging should be deferred in patients with suspected vertebral compression fracture**, when clinical suspicion is high:
 - it is reasonable to obtain **plain radiographs** on initial evaluation

Risk assessment subacute back pain

- Patients who have not improved after **four to six weeks** of conservative therapy and who did **not receive imaging** on initial evaluation **are reevaluated**.
- Patients who have developed **neurologic deficits or symptoms of infection** : Advanced imaging
- Patients who present initially with LBP of more than **four to six weeks** : undergo risk assessment
- Repeat imaging is indicated in patients with new or worsening symptoms
- The modality will depend on the **suspected diagnosis** and the modality of the **initial imaging** exam.

Risk assessment subacute back pain

Radiculopathy or spinal stenosis

Cancer risk

ankylosing spondylitis

osteoarthritis

Risk assessment subacute back pain

Radiculopathy or spinal stenosis

Patients with **persistent symptoms** due to a **lumbosacral radiculopathy** or **spinal stenosis** who have **not responded to conservative treatment** and who are candidates for an invasive therapies : MRI for further evaluation

Risk assessment subacute back pain

Radiculopathy or spinal stenosis

Cancer risk

ankylosing spondylitis

osteoarthritis

Risk assessment subacute back pain

Cancer risk

- In patients with LBP who did not immediate imaging but have **RF for cancer** and do not improve with conservative therapy after **four to six weeks**: plain radiographs and ESR (or CRP)
- Patients with a **positive radiograph** : further evaluation for malignancy.
- Patients with a positive ESR (or CRP) but **negative plain radiograph** : further evaluated with MRI.

Risk assessment subacute back pain

Radiculopathy or spinal stenosis

Cancer risk

ankylosing spondylitis

osteoarthritis

Risk assessment subacute back pain

Other patients

Concern for ankylosing spondylitis

- Patients with **persistent** back pain despite **four to six weeks** of conservative therapy who also have signs or symptoms concerning for **AS** should have a **plain radiograph**

Concern for osteoarthritis

- Lumbosacral, pelvic (SIJ,hip) radiographs may be considered for **older patients** with **persistent** back pain
 - OA of hip: referred to back causing back pain
- Patients with low back symptoms , a **standing pelvis radiograph** will evaluate both hips for OA
- if symptoms lateralize, a twoview hip (standing frontal and frogleg views) is appropriate

Risk assessment subacute back pain

Patients without specific concerns

**In patients with no concerns for a particular etiology:
treat with conservative therapy for **another eight weeks****

Risk assessment chronic back pain

Patients who present **initially** with **LBP >12 weeks** duration undergo the risk assessment for acute and subacute back pain.

- In patients without specific concerns and not received any imaging and there is no improvement after 12 weeks: **image with a plain radiograph** and consider the **need for referrals for further evaluation and treatment**

Counseling patients who request imaging

- Patients often **expect that imaging will be ordered** during their initial visit for back pain.
- Patients should be **assured** that improvement is to be expected and should be advised that:
 - They are unlikely to have a serious underlying condition
 - Incidental imaging findings, unrelated to their pain, are common, and may lead to unnecessary further tests or interventions
 - Imaging is appropriate if they do not improve



Thank You

Imaging evaluation for acute low back pain

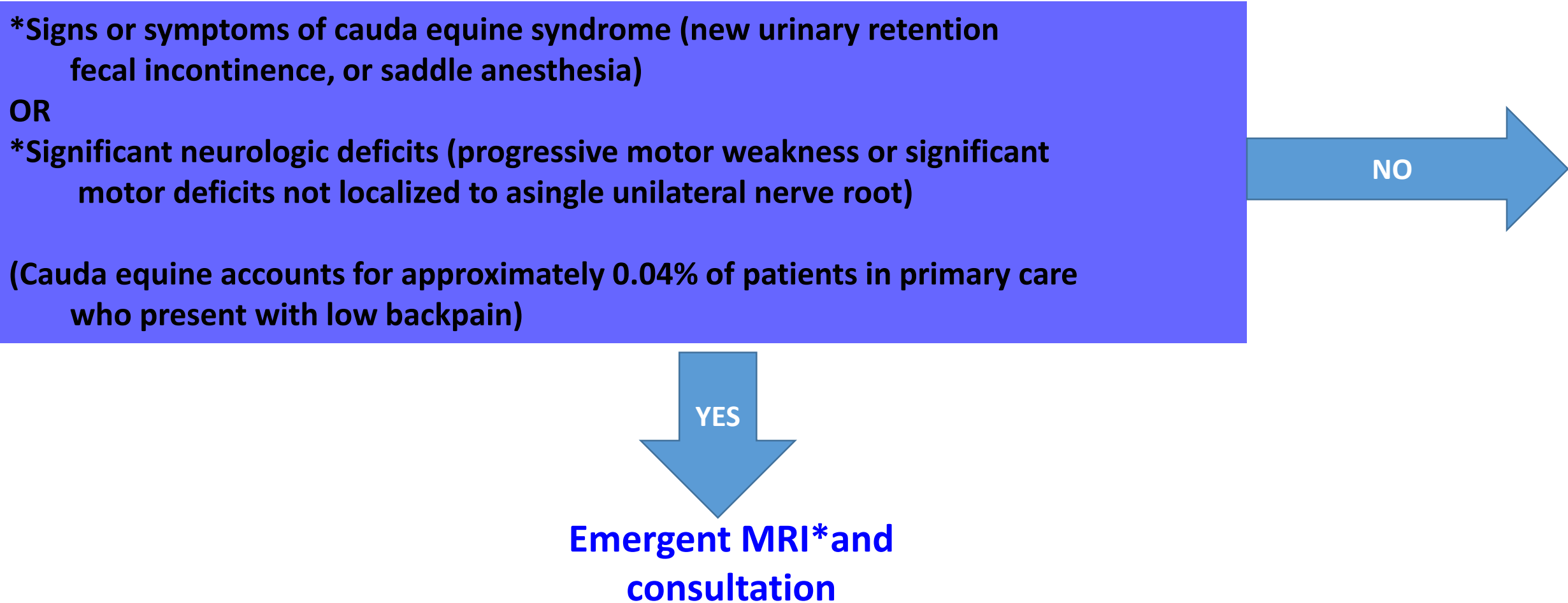
***Signs or symptoms of cauda equine syndrome (new urinary retention
fecal incontinence, or saddle anesthesia)**

OR

***Significant neurologic deficits (progressive motor weakness or significant
motor deficits not localized to a single unilateral nerve root)**

**(Cauda equine accounts for approximately 0.04% of patients in primary care
who present with low back pain)**

NO



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graph TD; A["*Signs or symptoms of cauda equine syndrome (new urinary retention, fecal incontinence, or saddle anesthesia)  
OR  
*Significant neurologic deficits (progressive motor weakness or significant motor deficits not localized to a single unilateral nerve root)  
  
(Cauda equine accounts for approximately 0.04% of patients in primary care who present with low back pain)"] -- NO --> B[ ]; A -- YES --> C[Emergent MRI* and consultation];
```

YES

**Emergent MRI* and
consultation**

Imaging evaluation for acute low back pain

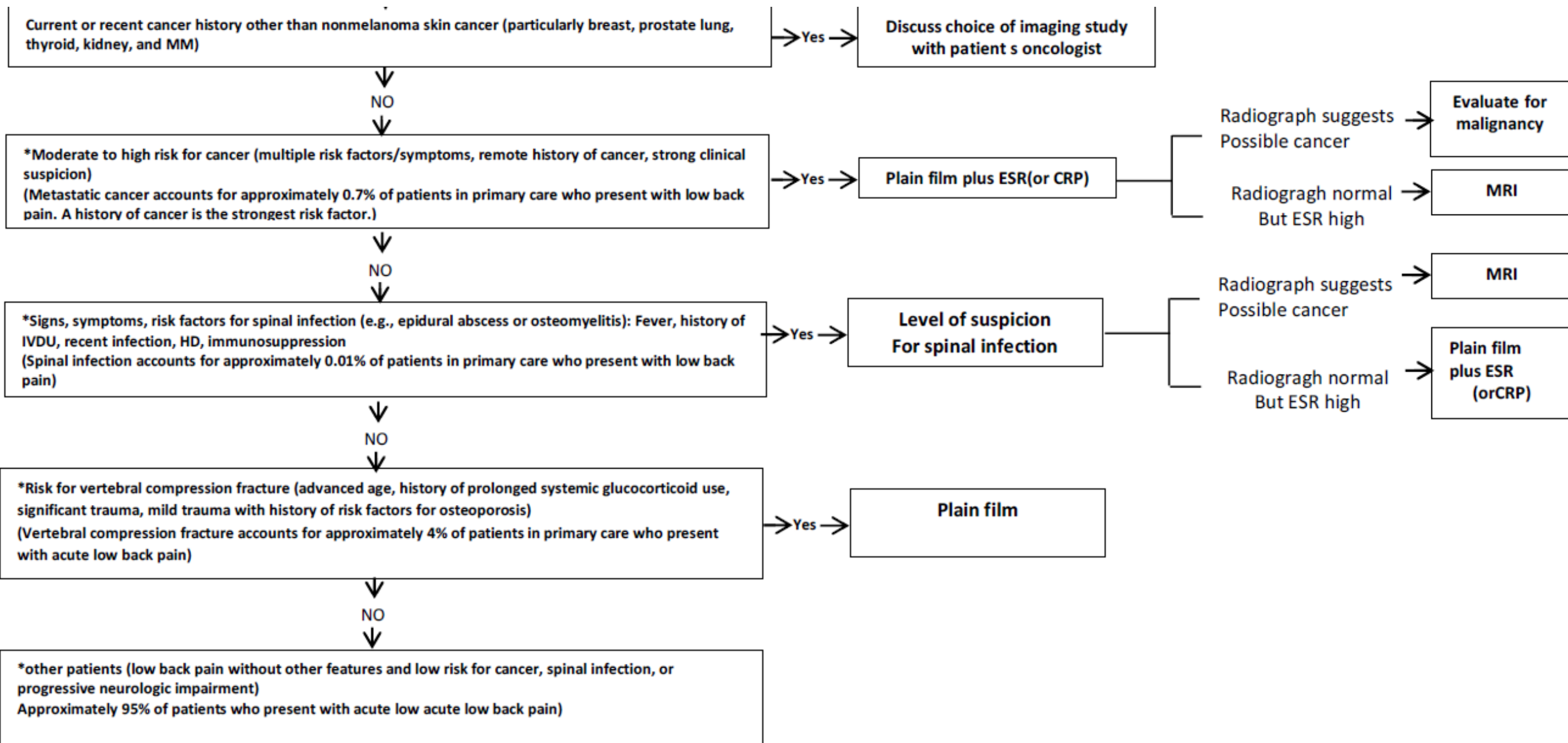
Current or recent cancer history other than nonmelanoma skin cancer (particularly breast, prostate lung, thyroid, kidney, and MM)

NO

YES

**Discuss choice of imaging study
with patient's oncologist**

Imaging evaluation for acute low back pain



Radiculopathy

Solitary nerve root lesions of the lumbosacral spine

Root	Pain	Sensory loss	Weakness	Stretch reflex loss
L1	Inguinal region	Inguinal region	Rarely hip flexion	None
L2-L3-L4	Back, radiating into anterior thigh, and at times medial lower leg	Anterior thigh, occasionally medial lower leg	Hip flexion, hip adduction, knee extension	Patellar tendon
L5	Back, radiating into buttock, lateral thigh, lateral calf and dorsum foot, great toe	Lateral calf, dorsum foot, web space between first and second toe	Hip abduction, knee flexion, foot dorsiflexion, toe extension and flexion, foot inversion and eversion	Semitendinosus/semi membranous (internal hamstrings) tendon
S1	Back, radiating into buttock, lateral or posterior thigh, posterior calf, lateral or plantar foot	Posterior calf, lateral or plantar aspect of foot	Hip extension, knee flexion, plantar flexion of the foot	Achilles tendon
S2-S3-S4	Sacral or buttock pain radiating into the posterior aspect of the leg or the perineum	Medial buttock, perineal, and perianal regions	Weakness may be minimal, with urinary and fecal incontinence as well as sexual dysfunction	Bulbocavernosus, anal wink

Radiculopathy

Testing for lumbar nerve root compromise

Nerve root

L4

L5

S1

Pain



Numbness



Motor weakness

Extension of quadriceps

Dorsiflexion of great toe and foot

Plantar flexion of great toe and foot

Screening examination

Squat and rise

Heel walking

Walking on toes

Reflexes

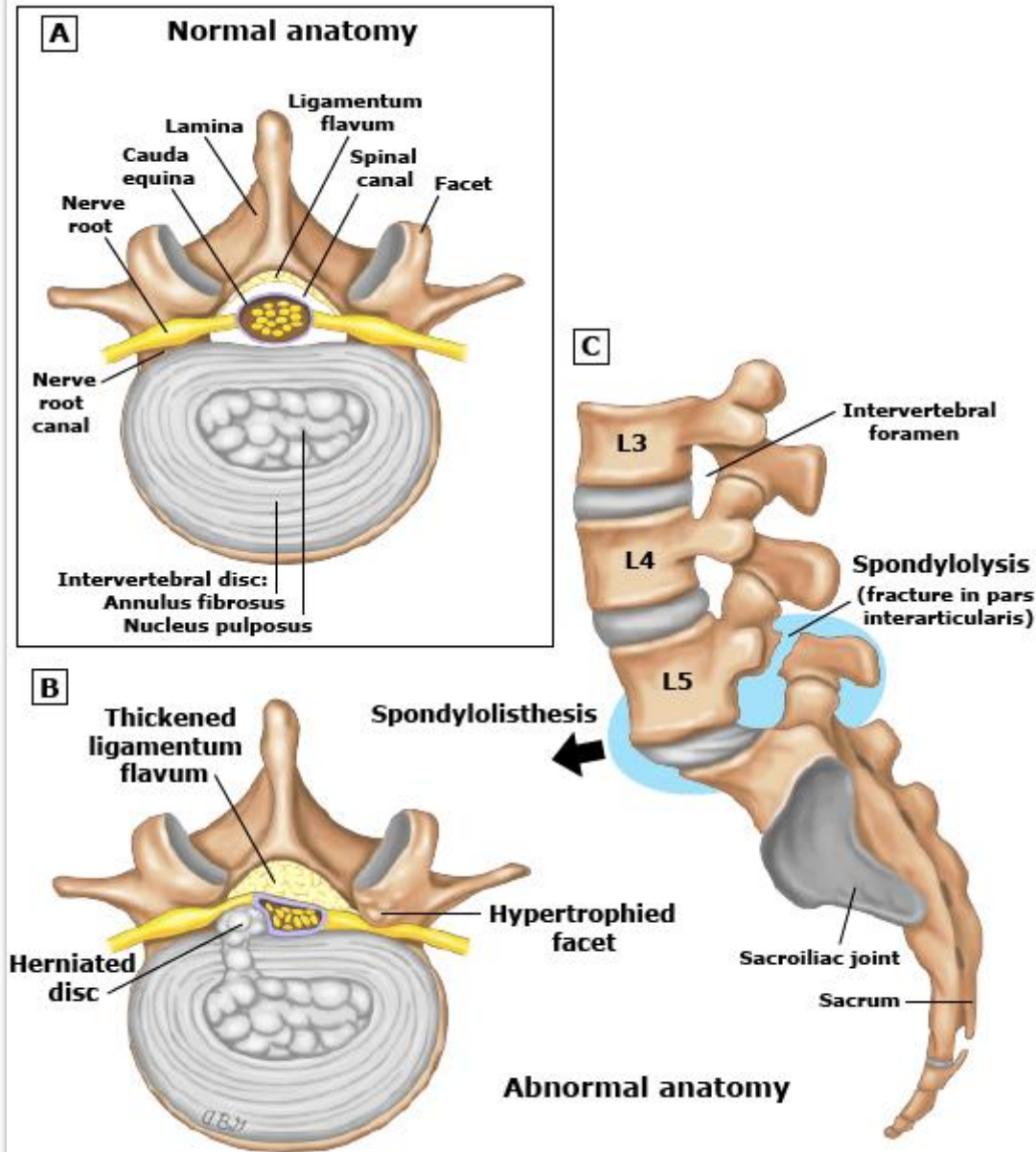
Knee jerk diminished

None reliable

Ankle jerk diminished

Spinal Stenosis

Common pathoanatomical conditions of the lumbar spine



(A) Normal lumbar vertebra with cauda equina, nerve roots, intervertebral disc and ligamentum flavum.

(B) Abnormalities including a thickened ligamentum flavum, a hypertrophied facet and a herniated disc. These pathologic structures cause the canal to narrow and can impinge on the cauda equina and nerve roots.

(C) Spondylolysis and spondylolisthesis. Spondylolysis is a fracture in the pars interarticularis of the vertebra. Spondylolisthesis occurs when this fracture widens and the vertebral body slides forward on the one below it.

Spinal Stenosis Comparison of symptoms in neurogenic and vascular claudication	Symptoms	Neurogenic	Vascular
	Quality	Pain/numbness /tingling	Cramping/ tightness
	Increased with walking	Yes	Yes
	Relieved walking flexed with a cart	Yes	No
	Relieved standing erect	No	Yes
	Relieved sitting/lying	Within minutes	Immediate
	Increased walking uphill/upstairs	No/less	Yes
	Increased walking downhill	Yes/more	Yes
	Increased biking/back flexed	No	Yes
	Increased biking/back extended	Yes	Yes

Osteoarthritis

Clinical manifestations of osteoarthritis

Age of onset
Usually after age 40
Commonly affected joints
Cervical and lumbar spine
First carpometacarpal joint
Proximal interphalangeal joint
Distal interphalangeal joint
Hip
Knee
Subtalar joint
First metatarsophalangeal joint
Uncommonly affected joints
Shoulder
Wrist
Elbow
Metacarpophalangeal joint
Symptoms
Pain without significant swelling or other inflammatory characteristics
Stiffness, if present, worse after effort; may be described as evening stiffness

Osteoarthritis

Clinical manifestations of osteoarthritis

Findings on physical examination
Crepitus
Bony enlargement
Decreased range of motion
Malalignment
Tenderness to palpation
Synovial fluid analysis
Clear fluid
WBC <2000/mm ³
Normal viscosity
Radiographic features
Joint space narrowing
Subchondral sclerosis
Marginal osteophytes
Subchondral cysts
Patterns of presentation
Monoarticular in young adult
Pauciarticular, large-joint in middle age
Polyarticular generalized
Rapidly progressive
Secondary to trauma, congenital abnormality, or systemic disease
Prognosis

Physical Examination

Inspection of back and posture

Terminology used in back pain

Spondylosis: Arthritis of the spine. Seen radiographically as disc space narrowing and arthritic changes of the facet joint.
Anterolisthesis, spondylolisthesis, retrolisthesis:
•Anterolisthesis is the anterior displacement of a vertebral body relative to the one below.
•Spondylolisthesis is anterolisthesis secondary to spondylolysis but is also used to denote anterolisthesis from any cause.
•Retrolisthesis is the posterior displacement of a vertebral body relative to the one below.
A radiologist determines the degree of slippage upon reviewing spinal radiographs. Slippage is graded I through IV:
•Grade I - 1 to 25% slip
•Grade II - 26 to 50% slip
•Grade III - 51 to 75% slip
•Grade IV - 76 to 100% slip
Generally, Grade I and Grade II slips do not require surgical treatment and are treated medically. However, Grade III and Grade IV slips, and some milder grade slips, may benefit from surgery if persistent and disabling symptoms are present.
Spondylolysis: A fracture in the pars interarticularis where the vertebral body and the posterior elements protecting the nerves are joined. In a small percent of the adult population, there is a developmental crack in one of the vertebrae, usually at L5.
Spinal stenosis: Local, segmental, or generalized narrowing of the vertebral canal by bone or soft tissue elements, usually bony hypertrophic changes in the facet joints and by thickening of the ligamentum flavum.
Radiculopathy: Impairment of a nerve root, usually causing radiating pain, numbness, tingling, or muscle weakness that corresponds to a specific nerve root.
Sciatica: Pain, numbness, tingling in the distribution of the sciatic nerve, radiating down the posterior or lateral aspect of the leg, usually to the foot or ankle.
Cauda equina syndrome: Loss of bowel and bladder control and numbness in the groin and saddle area of the perineum, associated with weakness of the lower extremities. This condition can be caused by abnormal pressure on the bottom-most portion of the spinal canal and spinal nerve roots, related to either bony stenosis or a large herniated disc.
Lordosis, kyphosis, scoliosis:
•Kyphotic curves refer to the outward curve of the thoracic spine (at the level of the ribs).
•Lordotic curves refer to the inward curve of the lumbar spine (just above the buttocks).
•Scoliotic curving is a sideways curvature of the spine and is always abnormal.
A small degree of both kyphotic and lordotic curvature is normal. Too much kyphotic curving causes round shoulders or hunched shoulders (Scheuermann's disease).
Too much lordotic curving is called swayback (lordosis). Lordosis tends to make the buttocks appear more prominent.

Physical Examination

Nonorganic signs (Waddell's signs)

Overreaction during physical examination
Superficial or widespread tenderness
Inconsistent supine and seated (distracted) straight leg raise test
Unexplainable neurologic deficits
Pain on simulated axial load (top of head pressure)

Indication for Imaging

ACP best practice advice: Diagnostic imaging for low back pain

Diagnostic imaging techniques	Radiography
	Computed tomography (CT)
	Magnetic resonance imaging (MRI)
Indications for diagnostic imaging	- Radiography is recommended in patients with acute LBP who have major RF Cancer (new onset of LBP with history of cancer, multiple risk factors for cancer, or strong clinical suspicion for cancer). - MRI is recommended in patients with acute LBP who have risk factors for spinal Infection (new onset of LBP with fever and history of intravenous drug use or recent infection), risk factors for or signs of the CES(new urinary retention, fecal incontinence, or saddle anesthesia), Neurologic deficitssevere or progressive .

Counseling patients who request imaging

- In addition, a **careful physical exam** with ongoing commentary ("I am checking strength for any sign of nerve injury") may be reassuring
- Patients who perceive that they have received an adequate explanation for the cause of their problem are less likely to want additional diagnostic
- In one randomized trial, low-risk patients who received an educational intervention rather than a plain radiograph were equally satisfied

Imaging evaluation for acute low back pain

- **This algorithm is intended to identify the small minority of patients with acute (<4 to 6 weeks) low back pain who present to the office and need immediate imaging**
- **Most patients (95%) will not require immediate imaging.**
- **Exclusion: History of significant trauma**