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## Introduction

- Evaluation of low back pain can prove difficult at times and a nonspecific diagnosis may lead to poor treatment outcomes. Aside from detailed history and physical examination, neurologic and vascular examination are important components that may help to rule out more serious causes of low back pain such as myelopathy or abdominal aortic aneurysm. Low back pain with leg pain may be secondary to a herniated intervertebral disc compressing on a nerve root. Careful examination will allow for an accurate diagnosis and a focused treatment plan including a specific approach with interventional procedures.

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## Physical Examination

- **Inspection** should occur during history taking as the patient may exhibit avoidance of certain postures such as bending, twisting, or standing during the examination. The iliac crests

typically correlates with the level of the 4th lumbar vertebrae and the iliac crests should be equal in height as asymmetry may signify pelvic obliquity. The patient may demonstrate a spine shift in which they shift their lumbar spine away from an irritated nerve root due to a disc herniation. This may potentially draw the nerve root away from the herniated disc. Scoliosis should be noted along with the apex of the curvature as well as any associated muscle asymmetry. When examining the patient in the sagittal plane, the patient should demonstrate a certain degree of lumbar lordosis. Exaggerated lordosis may signify spondylolisthesis, hip flexion contracture, or weak hip extensor muscles.

- **Palpation** usually begins with the patient standing and the examiner palpating the top of the iliac crest which corresponds with the L4–L5 disc space. The spinous processes should be palpated for any step off deformity which may indicate spondylolisthesis. The paraspinal muscles may demonstrate spasm or trigger points upon palpation which may indicate presence of underlying pathology. Other structures that should be palpated for any tenderness include the greater trochanters, sacroiliac joints, and ischial tuberosities, on which the proximal hamstring tendons insert.
- **Range of motion** should be assessed actively in all planes including flexion, extension, side bending, and rotation. Particular attention

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should be pain to symmetry with lateral flexion and rotation. Mean degrees of normal lumbar range of motion are as follows: flexion (59°), extension (19°), lateral flexion (30–31°), and rotation (32–33°) [1]. Schobers test is another way to assess range of motion of the lumbar spine. A positive test is indicative of a restriction of the lumbar spine, most commonly caused by ankylosing spondylitis. This test is performed by marking the level of the L5 vertebral body with a mark 10 cm above this as well as another mark 5 cm below the original mark. The patient then flexes forward and the distance between the two marks is measured. Normal range of motion should increase the distance between the two marks, but when there is a restriction in lumbar flexion, the distance increases less than 4–5 cm indicating a positive test, signifying restriction.

- **Neurologic examination** should include manual muscle testing, sensory testing along the appropriate dermatomes from L2–S1, and reflex examination in the bilateral lower extremities. Radicular pain may be present along a lumbar nerve root pattern while a radiculopathy is technically considered when there is an objective finding such as weakness, sensory, or reflex loss. Common muscles to test include hip flexors (L1–L3 nerve roots), quadriceps (L2–L4), tibialis anterior (L4–L5), extensor hallucis longus (L5–S1), and gastrocnemius-soleus muscles (S1–S2). Functional testing is often helpful and can include repeated heel raises (testing S1–S2 nerve roots), single legged sit to stand (L3–L4), and single leg stance (Trendelenburg test) to assess hip abduction weakness (L5 nerve root). It should be noted that dermatomes may vary from patient to patient, with the least variation in distal extremity testing. Common reflexes tested in the lower extremities include the patellar reflex (L2–L4) and Achilles reflex (S1). The L5 reflex can be elicited by tapping the medial hamstring tendon.
- **Special tests** of the lumbar spine include provocative tests that may reproduce the patient's

radicular leg pain. The examiner should take note if the provoked pain radiates along a dermatomal pattern, which may be correlated with imaging if available and can guide a potential intervention. These tests should not be performed in isolation and used in combination with the remainder of the physical examination.

- The straight leg raise (SLR), or Lasegue sign, is performed by laying the patient supine and passively lifting the affected leg with knee extended. The test is considered positive if radicular pain is reproduced in the leg between 30 and 70°. Any pain beyond 70° is thought to be secondary to hamstring or gluteal muscle tightness. Sensitivity of this test can be increased by adding foot dorsiflexion and is most helpful for radicular pain that arises from the lower lumbosacral roots.
- The slump test has been shown to have even greater sensitivity than the SLR test. This test is performed with the patient seated with arms behind their back, legs together and knees against the examining table. The patient slumps forward as much as possible and the patient is asked to flex their head while the examiner applies further light pressure to flex the neck. While maintaining full spine and neck flexion, the affected knee is extended and the patient is asked whether their pain is concordant to their symptoms. Again, increased sensitivity can be added by adding foot dorsiflexion. The patient is then asked to extend their neck and relief of their symptoms with neck extension indicates a positive test. As with the SLR test, this test is more useful when the lower lumbosacral nerve roots are involved.

The femoral stretch test is more useful for upper lumbar nerve root irritation from the L2, L3, or L4 levels. This test is performed by having the patient lay prone with the examiner putting the knee into flexion and assessing whether pain is reproduced in the anterior part of the thigh. Increased sensitivity can be added by also applying hip extension while flexing the knee. This

test is not pathognomonic for an upper lumbar disc herniation and other etiologies can give a false positive test such as a femoral neuropathy, quadriceps or hip flexor tightness, or hip pathology.

- o Evaluation of the facet joints can be done to evaluate for axial back pain to due zygapophyseal or facet arthropathy. Typically, pain is worse with hyperextension and the pain can be reproduced in the patient with the passive extension rotation test. In this test, the patient is in the seated position with their arms across their chest. The patient is then brought into extension with full rotation to either side. This increases loading on the facet joints and if pain is elicited during this maneuver, it is considered positive, indicating facet arthropathy or facet mediated pain. However, due to poor sensitivity and specificity of physi-

cal examination maneuvers for diagnosing facet mediated pain, diagnostic medial branch blocks may be the preferred confirmatory method.

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## Reference

1. Ng JK, Kippers V, Richardson CA, Parnianpour M. Range of motion and lordosis of the lumbar spine: reliability of measurement and normative values. *Spine*. 2001;26(1):53–60.

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## Suggested Reading

- Magee DJ. *Orthopedic physical assessment*. Elsevier Health Science; 2013. p. 515–610.
- Malanga GA, Adler S, editors. *Musculoskeletal physical examination: an evidence-based approach*. Elsevier Health Sciences; 2006. p. 189–226.