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## Introduction

The intervertebral disc is crucial to the function of the spine. Sitting between the vertebrae they serve as a shock absorber, helping enhance fluidity and strength of spinal motion, and dispersion of axial and torsional forces. The intervertebral disc is made up of a collagenous exterior annulus fibrosus and a gelatinous interior nucleus pulposus. The nucleus pulposus is 85% aqueous, and as well includes II collagen that serves to resist axial compression. The annulus fibrosus consists of concentric lamellae that are attached to the cartilaginous endplate of each vertebra, providing it with a high tensile force. The nutritional pathway of the disc is precarious; the disc itself is relatively avascular, relying on oxygen and nutrient diffusion from the blood supply to the endplates. This

means that oxygen tension and glucose concentration are lowest at the center of the disc. A decrease in nutrients and oxygen supply to the disc due to loss of end plate permeability makes it difficult for the disc to maintain its matrix and cell turnover, which leads to degeneration. Proteoglycans and aggrecan molecules are degraded, resulting in loss of glycosaminoglycans and in decreased osmotic pressure. This affects the load-bearing function of the disc, resulting in loss of disc height and bulging of nuclear contents. The loss of hydration and desiccation can lead to increased stress concentrations on the endplate and annulus, which have been associated with discogenic pain. In addition, loss of disc height can lead to abnormal loading of the apophyseal joints, potentially causing osteoarthritic changes [1].

## Disc Disease

There are four stages of interverbal disc herniation: annular degeneration, nuclear herniation, extrusion and sequestration. Annular degeneration occurs with age and is marked by loss of disc elasticity. Disc nuclear herniation occurs when there is displacement of the disc material through radial annular tears resulting in disc bulging surrounded by the circumferential outer annulus. Extrusion and sequestration occur when the nuclear material extends outside the disc annulus and can thus include portions of nucleus

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pulposus, cartilaginous endplate, fragmented apophyseal bone, annular tissue or all of the previously mentioned. Disc herniations are generally associated with disc degenerative changes; however, a healthy intervertebral disc under too much of a torque or load can also herniate. Due to the convex shape of the vertebrae, annular fibers are subjected to higher strain when a weight load is applied to the spinal column in some degree of flexion, making the annulus more vulnerable to radial or longitudinal tears. Obese people or those having jobs with prolonged sitting, repetitive heavy lifting, and twisting or vibration exposure will be more prone to disc degeneration and herniation. All these factors, along with cigarette smoking and intense physical activity, can accelerate disc degeneration beyond what occurs with normal aging and maturation.

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## Symptoms

Most physicians see patients with intervertebral disc herniation because they are experiencing either leg or low back pain, with or without a variable degree of motor or sensory loss. Pain, in this case, is caused by not only the mechanical effect of the herniated material on the nerve root, but also from chemical and autoimmune reactions causing the root inflammation. The nucleus is laden with inflammatory mediators, including phospholipase A2, histamine, lactate, bradykinin, substance P, calcitonin-gene related peptide, and vasoactive intestinal peptide among others. From a radiological perspective, it has generally been shown that the severity of lower extremity pain is associated with more severe disc disease, but this is not always the case as large free fragments can be asymptomatic. In cases where only a small amount of herniated material causes pain, chemical factors from inflammatory mediator liberation are likely to be responsible for the pain. Unfortunately, not even magnetic resonance imaging (MRI) is able to give us enough information to determine whether a patient's operant pathol-

ogy is mechanical/compressive or chemical/inflammatory.

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## Treatment

Intervertebral lumbar disc herniation has a high likelihood of spontaneous recovery without surgical interventions, and an acute pain episode usually abates in 1–2 weeks in most people. The areas of treatment can be divided into conservative management and invasive treatments. When starting conservative management, most people begin with a combination of pharmacological and non-pharmacological strategies. Pharmacological interventions include acetaminophen, NSAIDs, muscle relaxants, tramadol, corticosteroids, and even short courses of opioids for moderate to severe pain, in accordance with the World Health Organization's stepladder approach to managing chronic pain. Pharmacological strategies are mainly aimed at symptom control until pain abates. Non-pharmacological strategies include physical therapy, acupuncture, chiropractic manipulation, or therapies such as yoga, tai chi, or meditation. The majority of people improve with conservative treatments exclusively or in conjunction with a multimodal analgesic regimen as mentioned previously. It has been demonstrated that between 9% and 35% of patients with acute low back pain continued to have symptoms that were clinically significant at 6 months, with no further improvement even when reassessed at 2 years. The same study demonstrated a recurrence rate of 47% between 6 months and 2 years after the initial episode of acute low back pain [2]. While this helps to shed some light on the timeline between acute and chronic pain, as well as pain recurrence caused by intervertebral disc herniation, many studies continue to endorse considering surgery after 6 weeks in case of continued severe pain or lower extremity motor function loss.

If conservative treatment does not provide symptom relief, more invasive treatments are generally considered. Epidural glucocorticoid injections have long been touted as the first step in invasive interventional management of symptomatic intervertebral herniated discs. Whether

by a lumbar interlaminar, caudal, or transforaminal approach, epidural injections have been shown to reduce pain scores and disability mainly in the short term (usually at 2 weeks) as well as delay the need for surgical intervention for as long as 13–28 months [3]. Patients may experience relief for a period of time but may require additional repeat injections following pain recurrence.

Whereas the efficacy of steroids in epidural injections is controversial, a meta-analysis of 10 randomized controlled trials of epidural injections for the treatment of radicular low back pain confirmed that epidural injections of local anesthetic with or without steroids resulted in significant improvement in pain and functionality, as well as decreased opioid consumption [4]. However, epidural injections have not been shown to decrease the need for eventual subsequent surgery in patients with chronic pain secondary to herniated intervertebral disc. Surgical interventions such as discectomy, disc arthroplasty and spinal fusion are considered only once less invasive measures have failed. Spinal surgery, however, is not without potential serious morbidity risks. Post-laminectomy syndrome, also known as failed back surgery syndrome (FBSS), is a pain that continues despite surgical intervention, and is a well-described complication with notable treatment failure rates. While individual reports vary on incidence, the report with the longest follow-up (average 14.3 years) showed that 74.6% of patients had mild residual pain and 12.7% of patients had frequent mild or occasional severe pain, despite treatment intervention. This study also mentioned that 10% of patients had to undergo a revision of their surgery, [5] which further highlights the challenges physicians face when managing patients with chronic back pain.

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### Differential Diagnosis

- Lumbosacral Facet Syndrome.
- Lumbosacral Radiculopathy.
- Lumbosacral Spondylolisthesis.
- Lumbosacral Spondylolysis.

### High Yield Points

- Patients with disc disease usually experiencing either leg or low back pain, with or without a variable degree of motor or sensory loss.
- Pain is usually caused by not only the mechanical effect of the herniated material on the nerve root, but also from chemical and autoimmune reactions causing the root inflammation.
- Conservative management includes a combination of pharmacological (acetaminophen, NSAIDs, muscle relaxants, corticosteroids, etc) and non-pharmacological strategies (physical therapy, acupuncture, chiropractic manipulation, etc.).
- When conservative treatment does not provide symptom relief, more invasive treatments are generally considered. Epidural steroid injections are the first step in invasive interventional management. Whether by a lumbar interlaminar, caudal, or transforaminal approach, epidural injections have been shown to reduce pain scores and disability mainly in the short term as well as delay the need for surgical intervention.

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### Questions

1. A 50-year-old male presents to his PCP with a complaint of lower back pain that has developed over the past week. He cannot recall a specific injury or incident that could have led to this pain. He denies any weakness, or change/loss of sensation in his legs, episodes of incontinence or changes in his bowel movements. Normal vital signs on exam. Physical examination is negative for any focal spine tenderness, 5/5 strength and intact sensation to light touch throughout the bilateral lower extremities. Which of the following is the most appropriate next step in the management of this patient?

- A. NSAIDs/acetaminophen and 2 weeks of bed rest
  - B. NSAIDs/acetaminophen and continuation of activities as feasible, and limiting bending/twisting
  - C. Initiation of oral narcotic and muscle relaxants
  - D. Lumbar spine radiographs, including MRI  
Answer: B
2. A 40-year-old male recently diagnosed with a L3-L4 disc herniation after a car accident will most likely present with symptoms affecting which nerve root?
- A. L2
  - B. L3
  - C. L4
  - D. L5  
Answer: C
3. When should imaging be obtained in patients with non-specific low back pain in the absence of clinical red flag symptoms?
- A. Immediately (within the week)
  - B. 2-3 weeks
  - C. 4-6 weeks
  - D. Imaging not advised in the absence of red flag symptoms  
Answer: C

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