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## Spinal Stenosis And Neurogenic Claudication

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## Introduction

Approximately 90% of the population will present with low back pain at some point in their lifetime. Spinal stenosis is a condition that is caused by narrowing of the spinal (central) canal, the lateral recess, or neural foramen. This is a condition that can cause significant discomfort, interfere with activities of daily living, and may result in progressive disability.

## Etiology

Spinal stenosis most commonly is caused by degenerative osteoarthritis of the spine or spondylosis and occurs most frequently at the L4 to L5 level, followed by L5 through S1 and L3 to L4. Additional risk factors include obesity or a family history of this condition. Other factors such as disc protrusion or bulging (for example, caused by progressive disc degeneration with aging or trauma), loss of disc height, facet joint arthropathy, osteophyte formation, or ligamentum flavum hypertrophy can all lead to encroachment on and narrowing of the central canal and neural foramina.

Spondylolisthesis, the translation of one vertebral body anteriorly or posteriorly relative to an adjacent vertebral body, may also exacerbate spinal canal narrowing.

Additional acquired causes of spinal stenosis include space-occupying lesions such as synovial or neural cysts, neoplasms, or lipomas; traumatic or postoperative changes such as fibrosis; and skeletal diseases such as ankylosing spondylitis, rheumatoid arthritis, or Paget disease.

Congenital or developmental causes of spinal stenosis include dwarfism namely achondroplasia, Morquio's syndrome, and spinal dysraphism such as spina bifida, spondylolisthesis, and myelomeningocele.

## Epidemiology

Spinal stenosis occurs most frequently in individuals over the age of 60. In adults over the age of 65 years undergoing spinal surgery, lumbar spinal stenosis remains the leading pre-operative diagnosis. Many conditions have been associated with the development of spinal stenosis, but symptomatic spinal stenosis tends to occur most frequently in the setting of degenerative changes.

The majority of spinal stenosis tends to occur in lower lumbar levels as dorsal root ganglion diameter tends to be increased in this region causing greater encroachment of the neural foramina. The lower lumbar segments also tend to have a greater incidence of spondylosis and degenerative disc disease, leading to an even greater predisposition to spinal stenosis and nerve root impingement.

Though the majority of individuals over the age of 60 have some degree of spinal stenosis, most of these patients are also asymptomatic. The exact incidence of spinal stenosis is, therefore, difficult to determine.

## Pathophysiology

Neurologic symptoms such as claudication associated with spinal stenosis occur most commonly as a result of ischemia or mechanical compression of nerve roots. Increased intrathecal (subarachnoid space) compression as a result of narrowing of the spinal canal also can lead indirectly to mechanical compression of nerve roots and cause venous congestion, diminished arterial blood flow, and resultantly decreased impulse conduction at the nerve roots. However, narrowing at multiple spinal levels may be necessary to elicit such complications.

Symptoms of spinal stenosis are caused by and become most prominent when there is a reduction of the interlaminar space. This occurs naturally with prolonged standing when the spine is in an erect position. Extension of the spine causes overlapping of laminar edges of adjacent vertebral bodies, with resultant relaxation and inward buckling of the ligamentum flavum along with the movement of the superior facets in a rostral-anterior direction. Walking may additionally exacerbate symptoms as the increase in oxygen demands of the spinal nerve roots may exceed the available blood flow, especially in the case of elevated pressures in the intrathecal (subarachnoid) space.

## History and Physical

The most common symptom associated with spinal stenosis is neurogenic (or pseudo) claudication. Pain is exacerbated by walking, standing, or upright exercises. Pain relief occurs with sitting or forward flexion at the waist such as involved with squatting, leaning forward, or lying down. Many patients are asymptomatic when inactive. Extending the back while standing and development of symptoms which are quickly resolved by then leaning forward 20 to 40 degrees at the waist.

Additional symptoms of spinal stenosis, generally as a result of spinal nerve root involvement within the lumbar spinal canal, may include general discomfort, weakness in the legs, numbness, or paresthesias. Most patients typically experience bilateral symptoms, though in some cases the symptoms may be asymmetric in their complaint. Either case usually involves the entire leg rather than just one portion.

Although most patients often have a normal neurological exam, and some may have neurological signs or symptoms reflecting multiple lumbosacral radiculopathies in addition to the more typical symptoms of spinal stenosis. There may be evidence of focal weakness, absent deep tendon reflexes, or sensory loss.

## Evaluation

Neuroimaging is indicated if a patient presents with new-onset symptoms or there are signs or symptoms of radiculopathy or spinal stenosis. Magnetic resonance imaging (MRI) is the diagnostic modality of choice for spinal stenosis as it allows for visualization of both soft tissues and neural structures. Thus, MRI confirms the presence of anatomic narrowing of the spinal canal, or the presence of nerve root impingement. Though MRI is preferred, computed tomography (CT) may be employed to visualize bony structures when clinically indicated, and CT myelography is often utilized in the setting of MRI contraindications in certain patients. CT myelography is an adequate test to confirm the presence of narrowing of the spinal canal or nerve root impingement.

Electromyography and nerve conduction studies (EMG/NCS) are not necessary for making a diagnosis of spinal stenosis because many patients with spinal stenosis have normal EMG/NCS; however, they may be employed to evaluate patients in which spinal stenosis alone may not account for the neurologic symptoms.

## Treatment / Management

Unless a patient presents with markedly progressive neurological deficits or cauda equina syndrome, treatment is initiated with conservative and nonsurgical methods. These methods include physical therapy such as stretching, strengthening, and aerobic fitness to improve and stabilize muscles and posture; anti-inflammatory and analgesic medications; and epidural steroid injections. In addition to these methods, patients with lumbar spinal stenosis should be advised to avoid aggravating factors such as downhill ambulation and excessive lumbar extension.

In most cases, surgical treatment of spinal stenosis is elective, aimed at improving symptoms and function rather than preventing neurologic complications, and considered only once nonsurgical modalities have been attempted, or if a patient's symptoms are causing disability. If a patient presents with rapidly progressive neurological deficits or if there is the presence of bladder dysfunction, urgent surgery is required. This sometimes is seen in the setting of cauda equina syndrome, conus medullaris syndrome, trauma, or an intraspinal canal tumor. The surgical approach is multilevel decompressive laminectomy with or without lumbar fusion. Lumbar fusion is reserved for patients with spondylolisthesis.

## Pearls and Other Issues

A rare complication of lumbar spinal stenosis is cauda equina syndrome, presenting with incapacitating pain and significant neurologic disability. Clinically these patients present with bilateral leg weakness and may additionally complain of the bowel, bladder, or erectile dysfunction. There is involvement of S2 to S4 spinal nerve roots. If cauda equina syndrome is suspected, it is considered a neurological emergency warranting an immediate surgical consultation.

Differentiating between neurogenic and vascular claudication involves the following assessments:

*Neurogenic (pain, numbness, paresthesias)*

- Increased with walking, ambulating downhill/downstairs, and extension of the back
- Relieved with walking flexed with a cart, and sitting/lying

*Vascular (tightness, cramping)*

- Increased with walking, ambulating both up or down the hill (up or downstairs), and symptoms which are present in both extension and flexion of the back
- Relieved with sitting/lying
- Not relieved with walking flexed forward such as with a cart

## Questions

To access free multiple choice questions on this topic, [click here](#).

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