

What is spinal canal stenosis?

The condition known as spinal canal stenosis is a narrowing (stenosis) of the spinal canal that in most cases develops due to the degenerative (wear-induced) deformation of elements of the mobile segment of the spinal column. Over 90% of spinal canal stenoses result from degenerative processes.

In rare cases, vertebral fractures and inflammatory processes can also cause spinal canal stenoses resulting from structural changes in the mobile segment.

Spinal canal stenoses are also found with rare congenital diseases involving spinal column anomalies (mucopolysaccharidoses such as Morquio's syndrome or vertebral deformities as in Klippel-Feil syndrome).

Where do spinal canal stenoses occur?

Spinal canal stenosis can occur in all parts of the spinal column, but are most frequently observed in the mobile segments that bear the highest mechanical loads, i.e. the lower cervical spine and lumbar spine (cervical spinal canal stenosis, lumbar spinal canal stenosis).

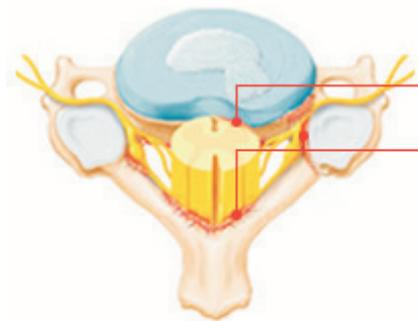
What are the causes of spinal canal stenosis?

Degenerative spinal canal stenosis develops as a consequence of wear-related morphological and static changes to the mobile segment.

Wear on the intervertebral disc and the resulting loss in height in the intervertebral space means that the forces acting upon the mobile segment can no longer be physiologically distributed.

Changes in pressure loads induce spondylotic outgrowths (spondylophytes) on the bony structures of the vertebral body altering its form (spondylosis). The stabilizing ligamentous apparatus of the affected segment grows looser, resulting in the destabilization of the vertebral joints and the outgrowth of osteophytes, the thickening of the joint capsule and the deformation of the facet joint surfaces (spondylarthrosis). The overstretched ligamentous apparatus of the spinal column, in particular the posterior longitudinal ligament and yellow ligament, thicken, further narrowing the spinal space.

- Spondylophytic outgrowths narrow the spinal cord and spinal nerve canals

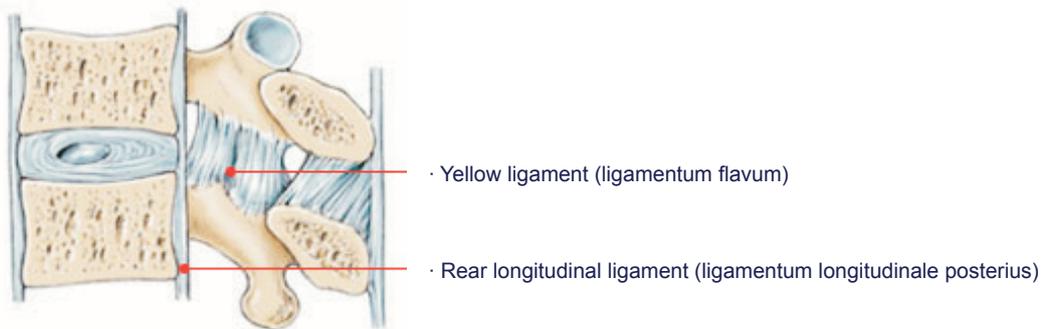


· Displacement of nucleus pulposus with pressure on the spinal cord

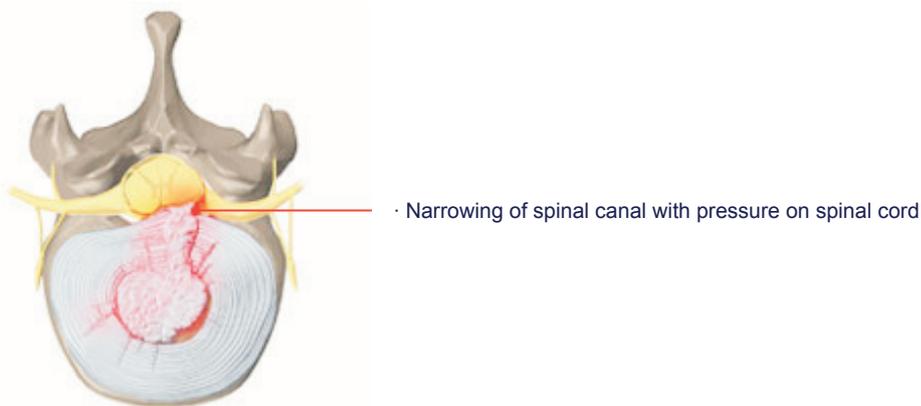
· Spondylophyte outgrowth

An intervertebral disc protrusion or herniated disc may further reduce the space for the spinal cord and spinal nerves due to a displacement of parts of the disc towards the spinal canal. Spondylolisthesis, or the forward displacement of a vertebra on its lower neighbor, can further narrow the spinal canal.

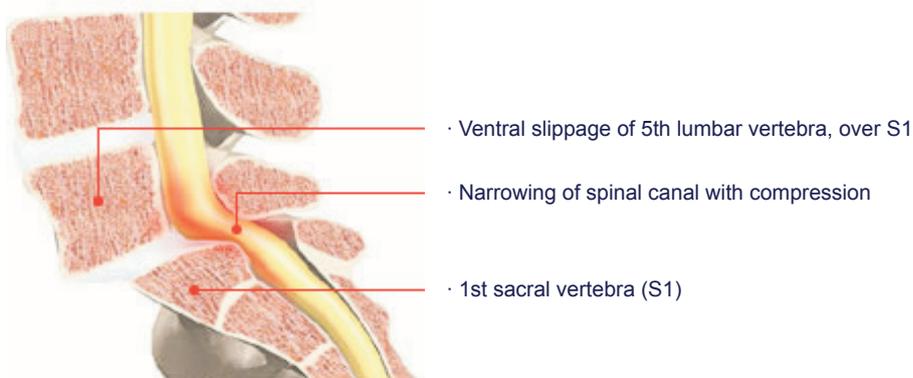
- Rear longitudinal ligament and yellow ligament are primarily susceptible to thickening



- Herniated intervertebral disc with compression of spinal cord by nucleus pulposus

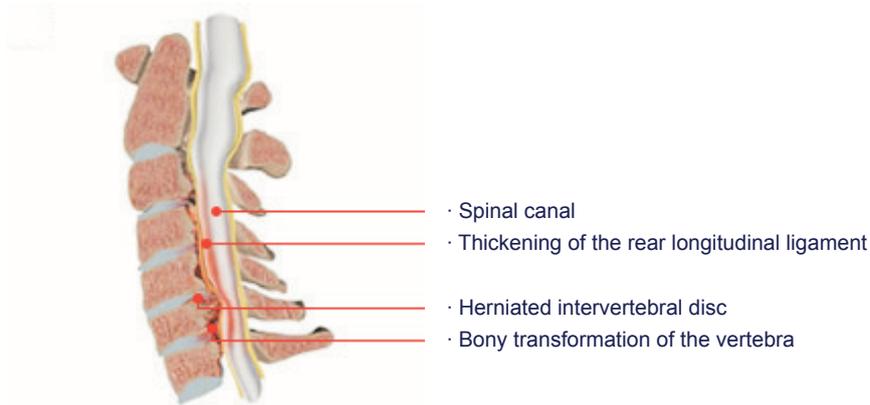


- Spinal canal stenosis in spondylolisthesis



The spinal cord and spinal nerve spaces are narrowed by outgrowths of spondylophytes on the vertebral body and arch, displacement of parts of discs, and the thickening of the joint capsules and ligaments: these all result in pressure on the spinal elements, which in turn causes pain and neurological symptoms.

- Cross-sectional image of the lower cervical spine with a narrowing of the spinal canal due to a herniated disc, reduced height of the intervertebral disc spaces, bony transformation of the vertebra and thickening of the rear longitudinal ligament.



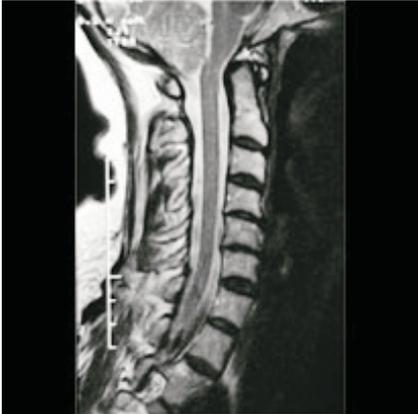
How is spinal canal stenosis diagnosed?

Following a thorough review of the patient's medical history together with clinical and neurological examinations, a tentative diagnosis can be confirmed by imaging methods that produce native images with functional and layered images, such as computer or nuclear magnetic resonance tomography.

- Native x-ray image of the cervical spine in 2 planes

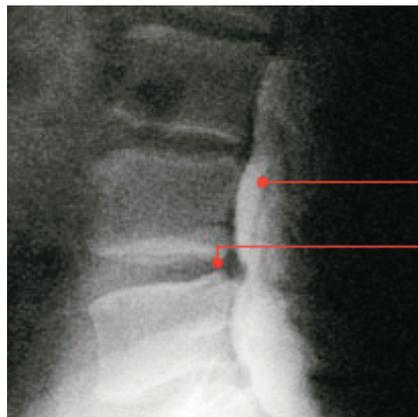
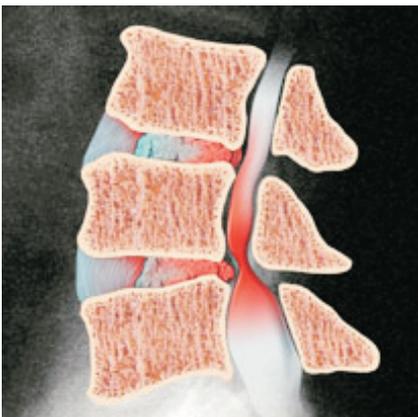


- Cervical spine, side view



Myelography, the introduction of a contrast agent into the dural sac, can provide additional information. This examination, which involves the injection of a water-soluble, completely absorbable contrast agent into the dural sac, can have side effects such as headaches, vertigo, nausea and allergic reactions to the contrast agent.

- Myelography of spinal canal stenosis and herniated intervertebral disc



- Spinal canal filled with contrast agent
- Herniated intervertebral disc

EMG and ENG neurophysiological examinations and evoked potentials are used to determine whether nerve tissue has been damaged by existing compression.

For spinal canal stenosis of the cervical or lumbar spine, Doppler ultrasonography is used to check on the condition of the blood vessels.

What are the symptoms?

Pains in the affected segment, hardened muscles in the back, tender trigger points and restricted mobility occur in practically all cases.

Symptoms such as local and radiating (radicular) pains, sensorimotor deficits or even paralysis depend on the specific segment affected. These symptoms are discussed in the chapters on cervical and lumbar spinal canal stenosis.

How is it treated?**Conservative:**

Not every spinal canal stenosis confirmed by radiology causes symptoms requiring therapy. Conservative therapy with analgesics, infiltration of local anesthetics into the facet joints, medication with antiphlogistics (anti-inflammatory) and cortisone medications in combination with physical therapy are the initial methods used to treat existing symptoms.

Physiotherapy, manual therapy, acupuncture, and neurostimulation may help relieve symptoms.

Surgical treatment:

In clinical cases including paralyses and sensorimotor dysfunctions, the compressed spinal cord must be surgically freed without delay (decompression) to avoid permanent damage. Spinal canal stenoses with no symptomatic improvement despite an extended period of adequate conservative treatment are also generally treated surgically. Depending on the radiological findings, decompression surgery may be performed in one or more spinal segments, on one or both sides, or pure decompression surgical techniques such as laminectomy, hemilaminectomy or laminotomy can be used to relieve the pressure on the constricted spinal cord and spinal nerves.

If damage has occurred at multiple levels and supportive bony vertebral structures have to be removed to achieve decompression, spinal column fusion surgery is also performed to avoid instability in the spinal column. In the chapters on “cervical spinal canal stenosis” and “lumbar spinal canal stenosis” we describe the various surgical procedures used for the treatment of spinal canal stenoses.