

What is lumbar spinal canal stenosis?

This condition involves the narrowing of the spinal canal, and of the lateral recesses (recessus laterales) and exit openings (foramina intervertebralia) for the exiting spinal nerve roots in the lumbar spine.

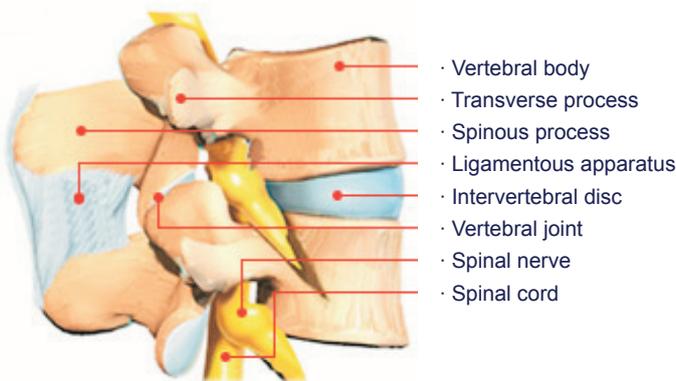
What causes it?

Degenerative changes in the intervertebral disc with a loss of height in the intervertebral disc space result in far-reaching changes within the corresponding mobile segment. There are bony transformations in the vertebral bodies (spondylosis), the facet joints are arthrotically transformed by the resulting pathological load stress, the articular surfaces are destroyed, and the joint capsule thickens (spondylarthrosis). The mobile segment is destabilized by these changes; the stabilizing ligamentous apparatus of the spinal column loses its physiological tautness in the affected segments. The yellow ligament (ligamentum flavum) and posterior longitudinal ligament (ligamentum longitudinale posterius) thicken in particular.

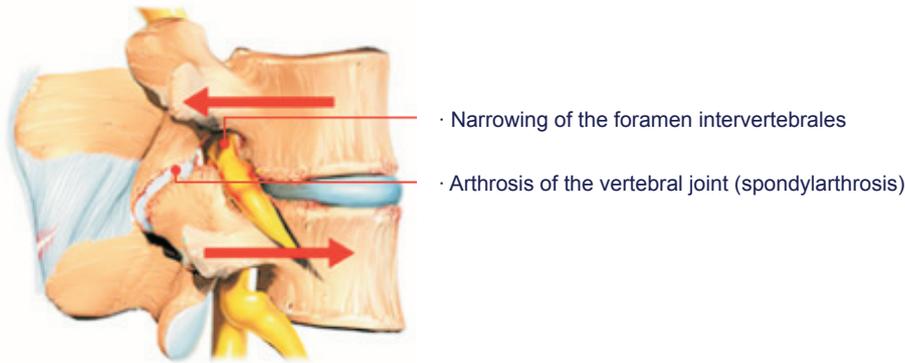
Doctors differentiate between a central spinal canal stenosis and stenosis of the lateral canals of the exiting spinal nerve roots (stenosis of the lateral recesses). The structural transformation mechanisms at work within the mobile segment contribute to a central stenosis of the spinal canal due to the thickening of the ligamentum flavum and facet joints. A narrowing of the lateral recesses is caused by the outgrowth of osteophytes along parts of the rear edge of the vertebral body and vertebral arches, along with parts of the facet joint and pedicle. If intervertebral disc disease occurs in several mobile segments, the physiological curvature of the lumbar spine may be lost. The loss of this lumbar lordosis shifts the axial weight focus of the spinal column towards the front. This change in weight focus in turn alters the forces acting upon the spinal column (bending, rotating and shearing forces).

An existing instability of the mobile segment combined with an even wearing of the intervertebral discs (symmetrical degeneration) by the changed dynamic forces can cause a vertebra to slide forward (spondylolisthesis), which can also lead to the narrowing of the spinal canal.

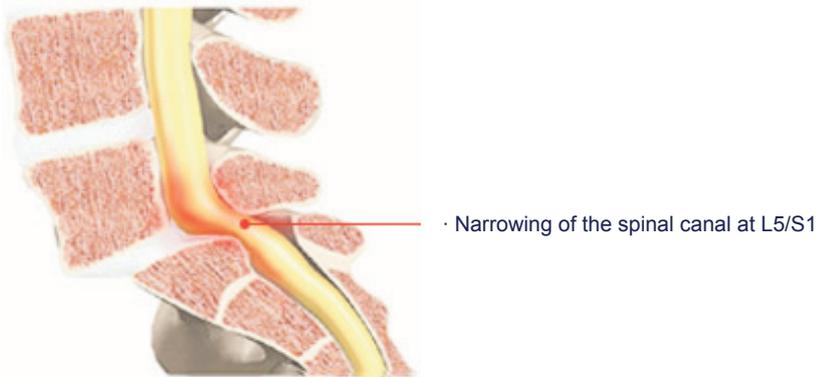
• Normal mobile segment of the lumbar spine



- The altered application of forces due to instability causes a shifting of the vertebra (translation)

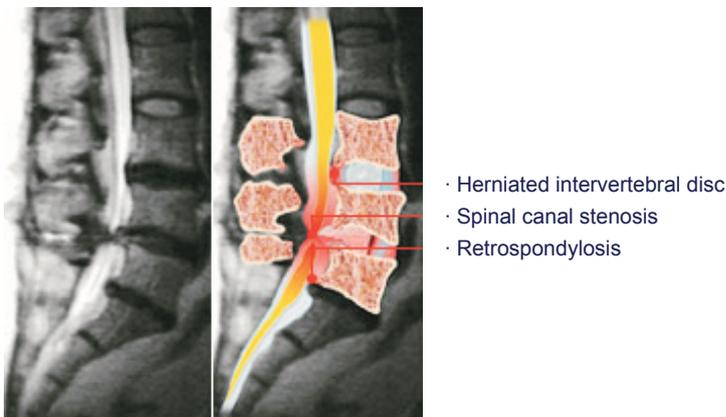


- The shifting of a vertebra towards the front (spondylolisthesis) results in a narrowing of the spinal canal



Instability combined with uneven wear (asymmetrical degeneration) of the intervertebral discs may induce rotational forces that result in the formation of a degenerative lumbar scoliosis. All potential changes result in a narrowing of the space available to the spinal cord and exiting nerves, which exerts pressure on these neural structures.

- Lumbar spinal canal narrowing at L3/4 and L4/5



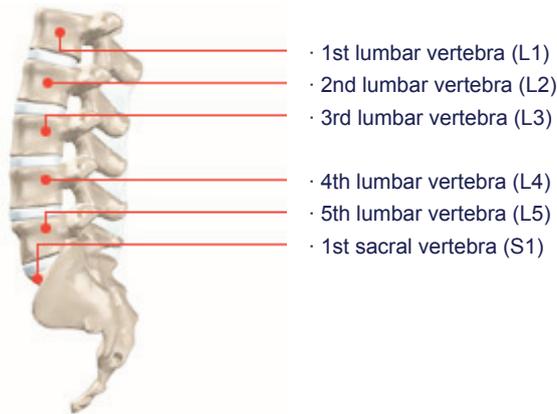
What are the symptoms?

Pain in the affected segment, hardening of the muscles of the back in the lumbar region, pain in the buttocks, tender trigger points, and restricted mobility nearly always occur.

When seated or in postures in which the lumbar spine is inclined towards the rear (kyphosed), the symptoms often subside, since this position stretches the ligamentous apparatus of the spinal column segments, enlarging the spinal cord space and decompressing the spinal cord.

Symptoms such as local and radiating (radicular) pains, sensorimotor dysfunctions, or even paralytic symptoms, depend on the respective height of the spinal column segments affected.

• Lumbar vertebral segments



• Pain distribution patterns and sensory dysfunctions resulting from radicular symptoms due to nerve root compression in the lumbar spine segments



- The areas in which pain and sensory dysfunctions are felt, as well as the muscles in which motor dysfunctions are experienced, are listed in the following table

Lumbar spine segment	Region in which pain and dysesthesias are felt	Characteristic muscle with motor dysfunction	Reflex weakened	Nerve extension pain
L1/L2	groin	Iliopsoas		Extension pain in nervus femoralis
L3	Outer and front side of thigh	Iliopsoas, quadriceps	Patellar (knee jerk) reflex	Extension pain in nervus femoralis
L4	Outer and front side of thigh, inner side of calf and foot	Quadriceps	Patellar (knee jerk) reflex	Extension pain in nervus femoralis, positive Lasègue
L5	Outer side of lower leg, inner side of top of the foot, big toe	Extensor hallucis longus		positive Lasègue
S1	Back of the calf, heel, outer edges of toes 3-5	Triceps surae	Achilles (ankle jerk) reflex	positive Lasègue

Lateral spinal canal stenoses compress the spinal nerves, causing monolateral or multilateral radicular symptoms that correspond to the height of the affected vertebral segment. Central spinal canal stenoses cause diffuse pain and leg weakness when walking or standing, where symptoms improve when lying down or sitting. These types of symptoms are classified as neurogenic claudication.

Massive pressure on the spinal cord may result in cauda syndrome, i.e. damage to the extension of the spinal cord, with paralysis in the legs and disturbances of bladder and colon function.

Are there other diseases with similar symptoms (differential diagnosis)?

Since lumbar spinal canal stenosis can have a broad spectrum of symptoms, it is possible for other diseases to produce the same symptoms.

Illnesses with similar symptoms:

Herniated lumbar intervertebral disc, spondylolisthesis, spinal tumors, inflammations (spondylodiscitis, epidural abscess, borreliosis), arthrosis of the sacroiliac joint, hip arthrosis, circulatory deficiency in the pelvic and femoral arteries, abdominal aortic aneurysm, neuropathies.

How is this condition diagnosed?

Following the thorough review of a 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.

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.

EMG and ENG neurophysiological examinations and evoked potentials are used to determine whether nerve tissue has been damaged by an existing compression. Doppler sonography can be used to obtain additional information on the vascular status of the cerebral arteries as well as any vascular stenoses.

How is it treated?

Conservative treatment:

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. Pure decompression surgical procedures, such as the opening of the lateral recesses, laminectomy, hemilaminectomy or laminotomy, can be used to relieve the pressure on the compressed 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. Depending on the initial findings, the following approaches are commonly used to surgically treat lumbar spinal canal stenoses:

- Monosegmental/bisegmental decompression and fusion using the TLIF (transforaminal lumbar interbody fusion) or ALIF (anterior lumbar interbody fusion) method
- Dorsal decompression with dorsolateral instrumented fusion
- Dorsal decompression with dorsal instrumentation and ventral support
- Corpectomy with lumbar spondylodesis