

What is cervical spinal canal stenosis?

It is a narrowing of the spinal canal in the cervical spine, in most cases caused by wear (degeneration) of the mobile segments. This narrowing constricts the spinal cord (myelon), and the resulting pressure on the myelon and exiting nerve roots may cause neurological symptoms.

How does cervical spinal canal stenosis develop?

In rare cases, cervical spinal canal stenosis may be congenital, caused by deformed vertebrae, spina bifida or meningoceles. It can also be caused by tumor growth, inflammatory processes, fractures, or post-surgical adhesions.

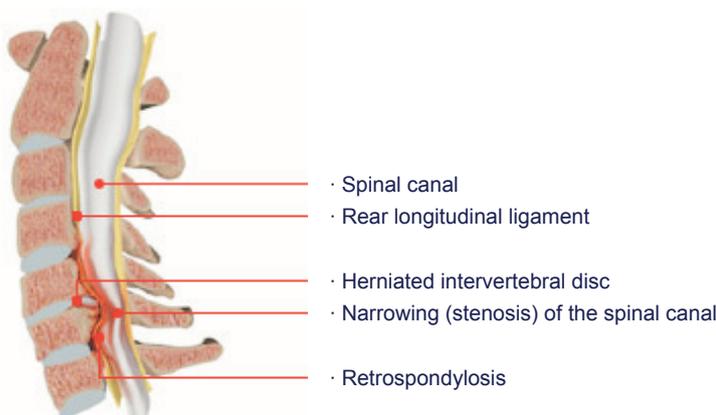
In most cases, however, cervical spinal canal stenosis develops due to degenerative changes (wear) of various structures in the mobile segment.

The cervical spinal canal is widest at the level of the 1st cervical vertebra (C1), narrowing as it descends. The narrowest section starts at the 5th cervical vertebra (C5), which is the reason spinal canal stenoses in the cervical spine frequently occur below C4.

Wear on intervertebral discs and the resulting reduction in the height of the intervertebral disc space changes the statics of the mobile segment, leading to structural changes. New bony outgrowths (osteophytes) appear at the rear edges of the vertebral bodies, a condition known as retrospondylosis. The vertebral joints (facet joints) undergo a bony transformation, the joint capsules thicken, and the articular surfaces are arthrotically destroyed (spondylarthrosis). The processi uncinati undergo bony transformation and the process of uncarthrosis begins. The increasing instability of the mobile segment also alters the load dynamic acting upon the ligamentous apparatus of the vertebral segments. The ligaments thicken, in particular the yellow ligament stretched between the vertebral arches (ligamentum flavum) and the posterior longitudinal ligament (ligamentum longitudinale posterius). In addition to these factors, the space available for the myelon and spinal nerves can also be reduced by an intervertebral disc protrusion or herniation.

All of these potential structural transformations result in a narrowing of the spinal canal, spinal nerve canals and the foramina through which they exit, which can in turn result in pressure on the spinal cord and spinal nerves with accompanying symptoms.

• Cervical spinal canal stenosis



What symptoms are caused by cervical spinal canal stenosis?

Compression of the exiting spinal nerve roots causes pain that radiates into the arm (brachialgia) corresponding to the area supplied by the compressed nerve. Such symptoms resulting from nerve root compression are known as radicular symptoms. Increased compression results in dysesthesias (tactile hallucinations) even to the point of paralysis, and reflexes may fail. In spinal canal stenosis resulting from degeneration, these symptoms gradually worsen, whereas they occur in an acute form with a herniated intervertebral disc.

- Areas of pain radiation depend on the vertebral segment affected, and are listed in the table below

Segment	Areas of pain or dysesthesias	Characteristic muscle	Reflex weakened
C5	Shoulder and side upper arm	m.deltoideus	
C6	Radial upper and lower arm, thumb	m.biceps, m.brachioradialis	Radius periosteum
C7	Back of lower arm, middle and index fingers	Ball of the thumb, m. pronator teres	Triceps
C8	Back of lower arm, pinky and ring finger	Ball of pinky, mm. interossei, digital flexor	

- Radicular pain radiation resulting from cervical spine root compression



In the Spurling provocation test, the pain is worsened on the affected side by inclining the cervical spine to the side, compressing, and extending the cervical spine. Pressure and percussion pains may result. Longer periods of compression of the spinal cord may result in damage to the spinal cord (myelopathy). Cervical myelopathy results from a combination of damage due to pressure exerted on the spinal cord by the narrowing of the spinal canal, made worse by flexion, and the impairment of the blood supply to the spinal cord, since the pressure constricts arterial flow and slows venous flow. The increased pressure in the area may result in formation of an edema (excessive accumulation of fluid) in the spinal cord.

Such damage to the spinal cord may cause the following symptoms:

- Uncertain gait, weakness in legs
- Weakness and dysesthesias (tactile hallucinations) in hands
- Loss of bladder and colon control
- Impotence

- Fine motor dysfunctions
- Weakened or absent reflexes
- Positive Lhermitte's sign (when the head is bent over sharply, an electrifying sensation occurs that may radiate from the neck over the shoulders and spinal column into the arms and legs)
- Pathological reflexes
- The radicular symptoms listed in the table may also occur

How is cervical 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.

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 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 cervical spinal canal stenosis treated?

Acute and worsening neurological deficits require immediate surgery. If radicular symptoms and pain persist despite adequate conservative treatment, patients may be advised to undergo surgery, assuming that the radiological and clinical findings concur.

Conservative treatment:

- Short-term stabilization with a soft immobilization collar
- Application of heat to tensed neck muscles
- Medication with steroidal antiphlogistics, analgesics, muscle relaxants
- After pain subsides, careful physical rehabilitation with physiotherapeutic exercises, isometric tensing exercises and massages
- CT-controlled infiltration treatment of facet joints or nerve root blocks

Surgical procedures:

The objective of the operation is to relieve the pressure on the spinal cord and spinal roots (decompression) and to surgically reinforce the unstable segment (spondylodesis).

Depending on the specific findings, surgical access may be from the back (dorsal) or from the front (ventral).

Ventral surgical access allows for the clear exposure of all of the front elements of the cervical spine including the arteria vertebralis. Preparation can be carried out within the local soft tissue septa with minimal traumatization to the soft tissues of the neck.

The drawback to ventral access to the upper cervical spine is the potential for damaging the following anatomical structures:

- hypoglossal nerve
- superior laryngeal nerve.
- inner carotid artery
- carotid glomus

The drawback to ventral access to the lower cervical spine is the potential for damaging the following:

- stellate ganglion
- recurrent laryngeal nerve

Drawbacks to dorsal access to the cervical spine:

- Extensive soft tissue trauma resulting from the necessary muscle displacement, with potential damage to the following muscles
- Rectus capitis posterior minor muscle
- Rectus capitis posterior major muscle
- Obliquus capitis inferior muscle
- Possible damage to the arteria vertebralis in the area of the upper cervical spine

Factors influencing the choice of ventral or dorsal access, or a combination thereof:

- Position and extent of existing processes
- Extent of operative destabilization
- Choice of instruments used
- Sagittal profile

Depending on the specific initial findings, the following surgical techniques can be used to treat cervical spinal canal stenoses:

- Cloward-Robinson ventral fusion
- Dorsal decompression with cervical fusion
- Ventral corpectomy with cervical spondylodesis