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Lumbar spinal canal stenosis diagnosis and treatment

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Abstract

Lumbar spinal canal stenosis is a syndrome of neurological symptoms that appear due to compression of the cauda equine nerve bundle and nerve roots, as a result of narrowing of the lumbar spinal canal through which the spinal nerve bundle passes, and accompanies the degeneration that occurs with aging. Specific causes related to narrowing and compression are degenerative bulging of an intervertebral disk; thickening of a vertebral arch, an apophyseal joint or the yellow ligament; and spondylolisthesis. All these factors, which are due to various diseases, cause narrowing of the spinal canal, resulting in compression of the spinal nerves inside the canal and inducing neurological symptoms. The main symptoms are sciatica and intermittent claudication that are treated with therapies based on the severity of the stenosis. These range from conservative treatment provided at pain clinics etc. and rehabilitation, to surgical treatment. Especially in recent years, lumbar spinal canal stenosis has been treated increasingly in the elderly.

Keywords: lumbar spine, low back pain, spinal, canal stenosis, intermittent claudication, sciatica, nerve root block

Introduction

What is Lumbar Spinal Canal Stenosis?

Lumbar spinal canal stenosis is a Syndrome of symptoms that appear due to compression of the cauda equine nerve bundle and nerve roots, as a result of narrowing of the lumbar spinal canal, and accompanies the degeneration that occurs with aging (Figs. 1 to 3).

Specific causes related to narrowing and compression are bulging of an intervertebral disk; thickening of a vertebral arch, an apophyseal joint or the yellow ligament; and spondylolisthesis.

These factors, due to various diseases, cause stenosis of the spinal canal, resulting in compression of the spinal nerves inside the canal, thus inducing neurological symptoms. Especially in recent years, lumbar spinal canal stenosis has been treated increasingly in the elderly.

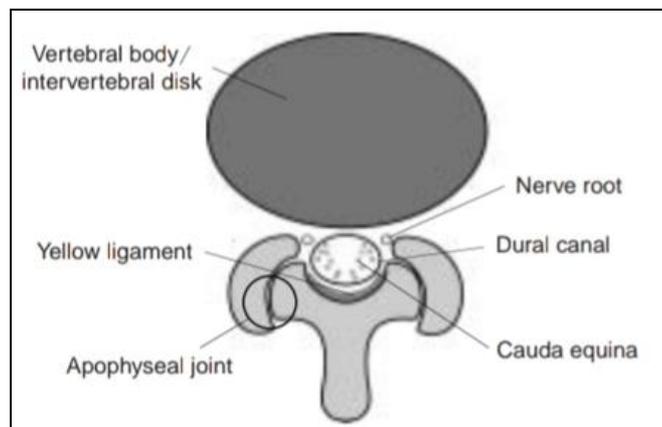


Fig 1: Structure of the lumbar spinal canal

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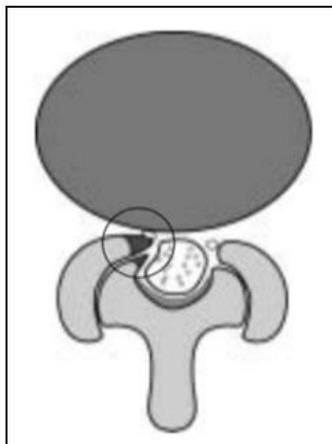


Fig 2: Intervertebral disk-level stenosis (nerve root type) The nerve root is compressed by a bone spur generated by deformity of an apophyseal joint.

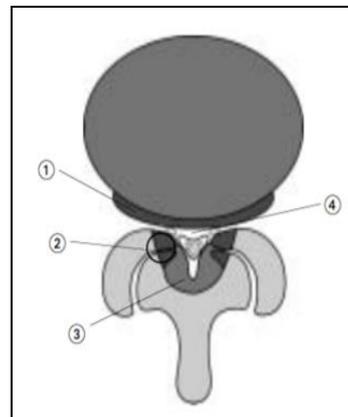


Fig 3: Intervertebral disk-level stenosis (cauda equina type) (1) Deformed and bulging intervertebral disk (2) Bone spur at the apophyseal joint part (3) Thickened yellow ligament (4) Compressed and flattened dural canal and nerve root

Table 1: Differentiation of Intermittent Claudication

		Neurogenic		Vascular
		Nerve root type	Cauda equina type	
Induction of claudication		Walking (symptoms reduced with a lordotic position)		Walking (symptoms unrelated to posture)
Symptoms	Character Region Paralytic symptoms	Mainly pain Mostly unilateral Single-level motor/ perception disturbance	Abnormal sensations such as numbness and cold sense Mostly bilateral Diversified, such as multi-level motor/perception disturbance	Mainly pain, cold sense Mostly unilateral None
Physical findings	Neurological findings Arterial pulse on dorsal foot	Single-level irritation/ deficiency symptom Normal	Bilateral Achilles tendon hyporeflexia Normal	None Deficient or weakened
Decisive supportive diagnostic method		MRC, CT, myelography, radiculography, block	MRI, myelography, CT	Arteriography

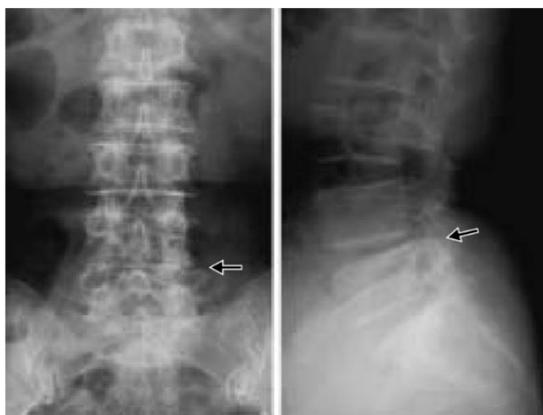


Fig 4: Nerve root type of intermittent claudication (Deformity in form of spur formation, intervertebral space reduction is noted in X-ray)

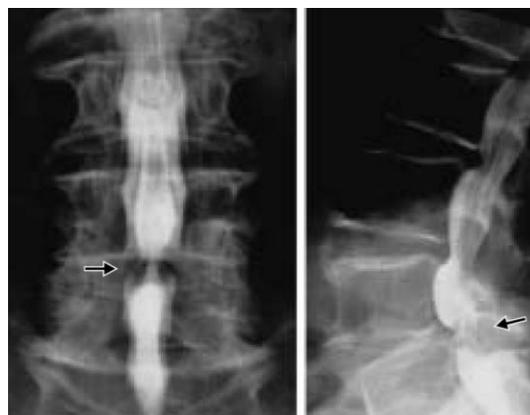


Fig 6: A case of Cauda equina type spinal canal stenosis at L4-L5 level

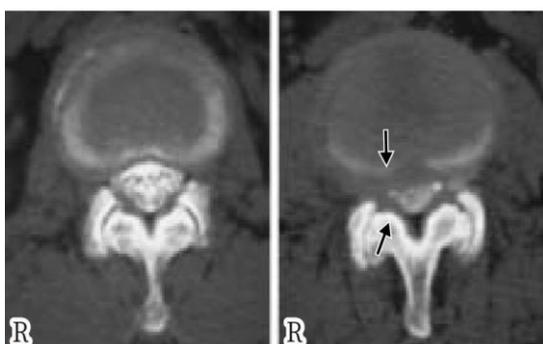


Fig 5: CT myelography showing significant canal stenosis on right side due to protrusion of disc and thickening of yellow ligament

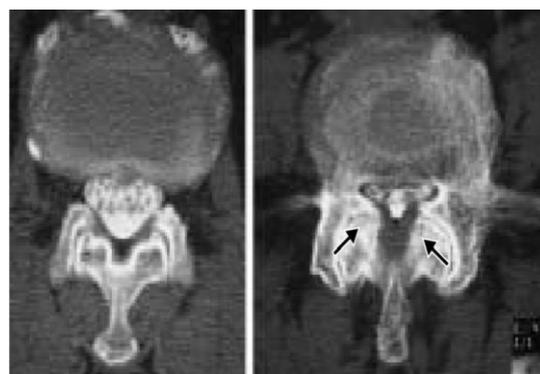


Fig 7: Cauda equina type of intermittent claudication. Canal compressed at L4-L5 level right side

What Kind of Clinical Symptoms Appear?

The main symptoms of lumbar spinal Canal stenosis are chronic, so-called “sciatica” (low back pain, leg pain, and feeling of numbness) that occurs on walking, and neurogenic intermittent claudication. These symptoms gradually progress over time alternatively deteriorating and improving. In other words, this disease is not accompanied by severe symptoms of nerve irritation or deficiency phenomenon, as with disk herniation; or by severe pain at rest, as with metastatic cancer in a vertebra or pyogenic spondylitis.

1. Neurogenic intermittent claudication

Neurogenic intermittent claudication is Pain, numbness, and weakness in the legs that occur and intensify on walking (caused by the load of the body weight on the spine), finally resulting in an inability to step forward. Furthermore, these symptoms improve by bending forward (lordotic position), where after the patient can walk again, which is a characteristic of this disease. (A patient can ride a bicycle for a long time if assuming a lordotic posture.) Sensory march is also noted, whereby abnormal sensation travels from the foot to the buttocks or perineal region, or descends from the buttocks to the lower limbs, with walking. In some cases, bladder and rectal disturbances, such as an increased urge to urinate, incontinence, and penile erection, occur on walking.

2. Differentiation of intermittent claudication

Neurogenic intermittent claudication Must be differentiated from vascular Intermittent claudication (arteriosclerosis obliterans and Buerger’s disease) (Table 1). Points of differentiation are improvement of the symptoms by assuming a lordotic posture, findings on palpation of the plantar arteries, and measurement of the upper limb/lower limb blood pressure ratio. Neurogenic intermittent claudication can be classified into the following three groups based on the clinical symptoms and the state of stenosis: 1) Nerve root-type intermittent claudication is a single-root disorder, and it is characterized by pain and numbness of the same lower limb as the responsible nerve root (Figs. 2, 4, 5). Most cases of lumbar spondylosis belong to this group.

2) In cauda equina-type intermittent claudication, the entire cauda equina becomes onstricted, resulting in a multi-root disorder with numbness of both legs as the chief complaint (Figs. 3, 6, 7). This disease is often accompanied by perineal perception disturbance, and/or bladder and rectal disturbances—and the absence of pain is characteristic.

3) Mixed-type intermittent claudication has a clinical picture including both the nerve root and the cauda equina types.

Objective Findings

Generally, there are few objective Findings compared with the subjective symptoms. In the nerve root-type disorder, nerve root irritation symptoms and nerve deficiency symptoms, such as perception disturbances, weakened muscle strength, and decreased lower limb deep tendon reflexes, are noted, as with herniation of a lumbar disk, which can be helpful in diagnosing the segment.

In cauda equina-type disorder, the Achilles tendon reflex is usually lost bilaterally, even at rest.

Even if the reflex is noted at rest, Achilles tendon reflexes disappear bilaterally in a load test.

What Should Be Observed by Which Test?

1. Image test

(1) Simple X-ray examination

On the simple X-ray examination (front and lateral views), observation should be made of the alignment of the lumbar spine and destructive changes (hypertrophic changes of the vertebral arches and apophyseal joints, spur formation of the posterior margin of the vertebral body, narrowing of the intervertebral spaces, shortening of the interpediculate distance, narrowing of the intervertebral foramen, etc.).

(2) MRI examination

On MRI examination with T1- weighted images the condition of the yellow ligament and peridural fat tissues are observed, and with T2-enhanced images, the range and degree of compression of the dural canal can be observed, because the cerebral spinal fluid shows a high intensity. However, bony tissues show low intensity, so CT is superior for observation of osseous lesions.

(3) Myelographic examination

Since myelography is a slightly invasive examination, it is now only used as supportive means in the case of clinical pictures that are difficult to judge by MRI and CT, unlike in the past.

Compared with MRI, this examination is useful for observing the dynamic factors that compress the cauda equina and nerve roots when the lumbar spine is bent forward and backward. It is suitable for observing the hourglass patterned compression image of the dural canal, complete block, the cystic image of nerve root deficiency, redundant nerves, and arachnitis.

2. Selective nerve root block Selective nerve root block is useful for specifying which vertebra is really responsible, even when many vertebrae seem to be narrowed, to secure the efficacy of the operation.

Treatment-What Kind of Choices Are Available?

Treatment varies depending on the type of stenosis. As a general treatment policy, conservative treatment is usually effective and is therefore the first choice for the nerve root type. On the other hand, for the cauda equina type, there is not a tendency of spontaneous remission. Therefore, for the cauda equina- and mixed types, the patients are first given conservative treatment for a while, and if it is shown to be ineffective, surgical treatment may be selected, after the patient understands fully.

1. Conservative treatment

With drug treatment, anti-inflammatory analgesics are first administered to reduce local inflammation and pain. Then, from the viewpoint of blood flow improvement, recovery, and promotion of affected nerve tissue regeneration, drugs that improve blood flow and vitamin preparations are administered.

Block treatment includes epidural block, caudal block, and nerve root block, and it is used for severe low back pain and leg pain.

Orthosis treatment aims to support and reinforce the spinal dorsolumbar musculature, which weakens with aging, decrease the forward curving of the lumbar spine and increase the abdominal pressure. A simple corset and a Williams orthosis (canvas corset) can be used for several months.

Exercise treatment includes various exercises that increase the dorsolumbar muscle strength.

2. Surgical treatment

When symptoms do not improve on various conservative therapies, surgical treatment is considered. The purpose of surgery is to conduct full decompression of the cauda equina and the nerve roots, while minimizing architectural destruction of the spine.

However, limited decompression is sometimes insufficient, and restenosis can occur. On the other hand, extensive decompression can cause instability after surgery, through architectural weakening of the spine.

Operative Treatment of Lumbar Spinal Canal Stenosis

1. Nerve root type: Decompression of responsible nerve roots is conducted by wide fenestration surgery. For this, it is necessary to confirm the responsible nerve roots by nerve root block before surgery. The effect of the treatment is apparent immediately after the operation.
2. Cauda equina type: Most cases do not respond to conservative treatment. Decompression of the entire dural canal is conducted by extensive laminectomy and spinal canal extended operation.
3. Mixed type: Decompression of the dural canal (cauda equina) and nerve roots is conducted.

Specifically, according to the condition of each case, decompression of the pressed dural canal and nerve roots is conducted through posterior wide fenestration surgery or extensive laminectomy. When vertebral instability (slipping) is also present, spinal fusion is also considered. If the sensation of warmth is restored to previously numb soles immediately after surgery, the efficacy of the operation is judged to be very good.

Intermittent claudication will quickly disappear. However, symptoms that used to be present at rest, especially numbness of the soles, and bladder and rectal disturbances, due to cauda equina-type disorder, take time to recover. The existence of neurological symptoms even at rest before surgery, regardless of the neurological disorder types, indicates that advanced stenosis had been present for many years. In such a case, the cauda equina nerve is relaxed or tortuous (root redundancy), and mild adhesive arachnoiditis occurs. As such, even with surgery, the symptoms may not necessarily be alleviated, and symptoms may relapse several years later.

Conclusion

The diagnosis of lumbar spinal canal stenosis is mainly based on the patient's subjective symptoms, which are not present at rest, but appear mostly in a standing position and when walking. This disease is therefore sometimes not easily understood by the people around the patient. In many cases, patients and their families stop treatment, considering the symptoms to be simple neuralgia due to aging.

Therefore, the pathology of this disease should be explained well to gain the understanding not only of the patients, but also their families. It is not true that the patients will be paralyzed, or that they will be forced to use a wheelchair, if the disease remains untreated. At the time point that symptoms do not improve with adequate conservative therapy, operative treatment should be considered. Today, as more old people want to maintain an active life, lumbar spinal canal stenosis is one of the diseases for which treatment opportunities will increase.

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