

Surgical aspects of central spinal stenosis

Indications and principles

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The term central spinal stenosis is sometimes used to refer to the patient with such advanced spinal stenosis, that not only the nerve root in the lateral recess is compressed, but the whole cauda equina at one or more motion segments of the spine, to the extent that the patient has bilateral sciatica and sometimes sphincter disturbance. Sphincter disturbance may present in a number of ways, i.e. recurrent urinary incontinence or bowel disturbance.

Sphincter disturbance is often viewed as an absolute indication for spinal decompression, whereas intractable sciatic pain, with or without significant and progressive muscle weakness, are considered relative indications for surgery.

The aim of surgery is clearly to obtain adequate decompression without compromising spinal stability. The principles of surgery lead us to a careful assessment of what are these structures compressing the nerves in the stenotic spinal canal and addressing our surgery to these offending structures.

The ligamentum flavum itself may be considerably thickened, but it also transmits the compression from the facet joint osteophytes. The nerves are squeezed between these posterior compressing structures and a bulging anulus. Part of the nucleus may have sequestered and lie some distance away from the disc space. The hypertrophic nonunion of a pars interarticularis defect may also cause compression, as may also ganglia or synovial cysts arising from the facet joint, which are usually found in the muscle as one approaches the spinal canal, but which are sometimes found entering the spinal canal.

Whilst approaching and excising the offending structures, one should take care not to damage the vital structures which maintain the stability and strength of the spine to reduce the incidence of postoperative back pain. The supraspinous and interspinous ligaments do not need to be removed, nor does the proximal one third of the lamina. Only the osteophytes from the facet joints need to be removed and the facet joints themselves should be left. The pars interarticularis should be assessed as the decompression proceeds and

one should take care not to remove this important structure or reduce it to the point where it may fracture. If possible, the discs should be preserved and if the anulus is simply bulging, then the contained nucleus should not be removed since this will only result in further bulging in the long term as the disc space collapses. The epidural space must be restored and preserved to allow free movement of the nerve roots which is essential for their recovery. The offending structures all lie in the motion segment and the vital structures constitute the fixed segment.

The constriction in even the most severe stenosis affects only the motion segment and the canal dilates above and below this to its normal dimension. This principle applies even in the most severe form of developmental stenosis. Since stenosis affects only the motion segment, there is no indication for a total laminectomy in the vast majority of patients with spinal stenosis.

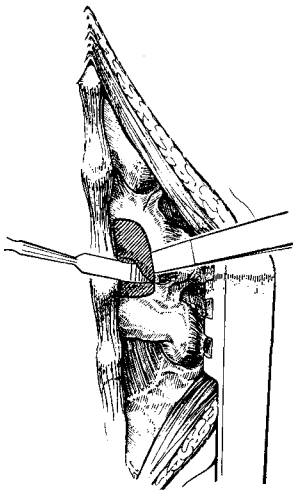
The operation is planned preoperatively, just as one would study a road atlas carefully before setting out on a journey to avoid arriving in a place you did not wish to go. We do not want to start one operation only to find half way through that we should have been doing another.

The principles of surgery are numerous, but the following six principles are essential:

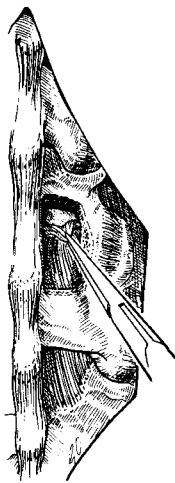
1. The positioning of the patient on the operating table is one of the most important principles of surgery on the lumbar spine. First, the abdomen should be completely free to avoid filling of Batson's plexus of epidural veins. This is not always easy, particularly in obese patients. The second principle here is to have the hips and knees flexed to relax the sciatic nerve to facilitate nerve root mobilisation and retraction. Thirdly, one should take care not to allow the patient's spine to extend or be twisted during transfer because this may cause further damage to the cauda equina in an already stenotic spinal canal. The patient with an osteoarthritic hip and fixed flexion deformity is particularly at risk.

2. Long, unsightly scars are quite rightly unfashionable amongst both patients and surgeons. It is possible

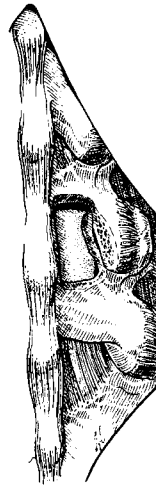
Figure 1. The technique for minimally invasive decompression of spinal stenosis.



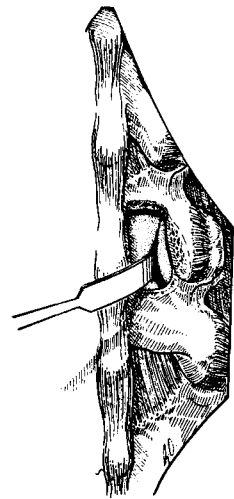
A. Removal of medial osteophyte inferior facet.



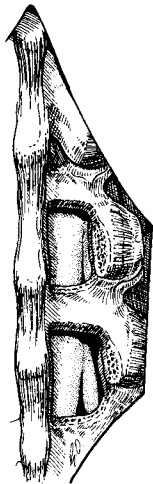
B. Excision lower two thirds of lamina, allowing the ligamentum flavum to be peeled downwards. No sharp instruments enter the spinal canal.



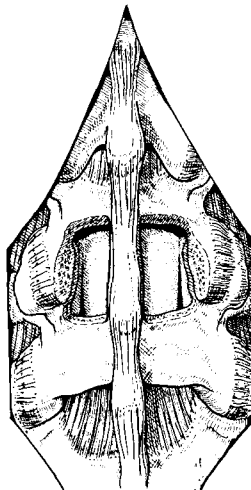
C. The osteophyte on the medial aspect of the superior facet then becomes apparent and is resected using an osteotome (below).



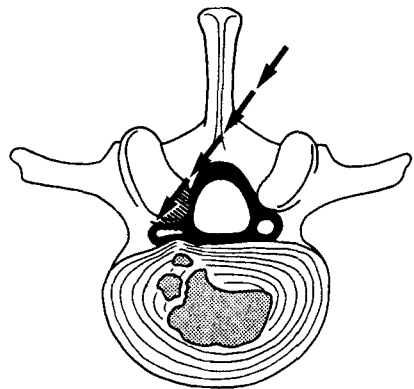
D. The nerve root is then exposed.



E. This procedure can be repeated at different levels



F. On the opposite side the skin and muscle exposure is less than illustrated in the drawing and in fact extends only from the spinous process above to the spinous process below the level of decompression.



to decompress one degenerate segment of the spine through a midline incision of 3–4 cm. It is essential to use a headlight and some form of magnification, such as loupes. Entry into the stenotic spinal canal is initially prevented by massive enlargement of the facet joint and shingling or overlap of the laminae.

3. The level must be carefully identified before, and not after, entering the spinal canal. One of the commonest errors in spinal surgery is to perform the right operation at the wrong level. The lumbo-sacral space

can normally be identified at surgery quite easily because of the gap in the supraspinous ligament at this level. The L5 spinous process is shaped often like an inverted 'v' and the lower border of the L5 lamina has a sharp edge to it. If one compares an AP radiograph of the spine with the feel and shape of the spinous processes, one can usually identify the level. Percussion of the sacrum reveals a dull note whereas percussion of L5 is resonant. Bachaus clips can be used to check the mobility of the spine and look for motion segments

or abnormal mobility. This is particularly useful where there are transitional vertebra. The L5/S1, L4/5 and possibly L3/4 levels can be identified by working up from the sacrum. However, upper lumbar levels need to be identified using a radiographic marker.

4. One of the most frequently met hazards of surgery inside the spinal canal is of bleeding. This obscures vision, lengthens the operation and increases the risk of damaging nerve structures. The most important way of controlling bleeding is to avoid any pressure on the abdomen when positioning the patient on the operating table. By using the headlight and magnification, one can visualize epidural veins quite easily and gently tease them away from the operation field, rather than cutting through them. Following removal of osteophytes and the lower part of the lamina, bleeding from bone can be controlled by the judicious application of bone wax.

5. There is no such thing as a completely safe technique for spinal decompression. All techniques require the use of meticulous care and attention to detail at all times.

I personally enter the spinal canal, as did Verbiest, using a fine osteotome (Figure 1). Others prefer to use broad rongeurs or sharp curettes or even an ultrasonic curette. Some prefer to use a burr or a shielded drill. Whichever instrument is used, it is essential that no sharp instrument should ever blindly enter the spinal canal.

6. Finally, when closing the wound, one should restore the dorso-lumbar fascia. Having preserved the supraspinous and intraspinal ligament by cutting down each side of the spinous process and ligaments, one can then reattach the dorsolumbar fascia to the ligaments to preserve their protective function.

Bipivocain into the skin and muscle layers, encourages the patient, since they are relatively pain-free on recovering from the anesthetic.

The aim of this operation is to relieve pressure on the cauda equina, without compromising essential spinal structures. The days of wide, extensive laminectomies have gone and we should direct our attention now to the minimally invasive techniques of segmental spinal decompression.