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Treatment options for degenerative lumbosacral stenosis

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INTRODUCTION
Degenerative lumbosacral stenosis (DLSS) can best be considered a syndrome, in which clinical signs of lumbosacral pain and deficits in function of the cauda equina result from degeneration of structures forming the junction between the L7 and S1 vertebrae. Clinical signs result from compression and irritation of the nerve roots of the cauda equina within the vertebral canal or the L7 nerve roots as they exit the vertebral canal through the intervertebral foramina. Because of the variety of structures that can contribute to the disease process and clinical signs it is crucial that a precise diagnosis is acquired prior to surgical intervention.

PATHOGENESIS
The clinical signs of DLSS arise because of compression of the nerve roots arising through:
• ‘Type II’ degeneration and protrusion of the dorsal annulus of the L7 disc
• Ventrally directed impingement of the interarcuate (flaval) ligament because of hypertrophy or redundancy
• Attenuation of the intervertebral foramen (between L7 and S1) because of dorsolateral disc protrusion, and, or, degenerative joint disease in the synovial joint between articular facets
• Subluxation between L7 and S1 that occurs because of degenerative disc disease
• Osteochondritis dissecans of the cranial aspect of the sacrum - typically in young German Shepherd dogs.

In general, reduction in the vertebral canal height (because of disc protrusion, interarcuate ligament impingement, vertebral subluxation or sacral OCD) causes signs of pain initially, sometimes progressing to signs of dysfunction in the tail, anus and bladder. In contrast, reduction in the size of the intervertebral foramen will cause signs of unilateral or bilateral limb weakness and neurological lameness often associated with very severe pain. Typically, this lameness will worsen with exercise.

DIAGNOSIS
Great care must be taken in the diagnosis of this condition, since many of the clinical signs can be mimicked by orthopaedic disorders (notably coxofemoral joint pain) or other neurological deficits, such as generalised neuropathies, or even myopathies. It must be remembered that DLSS is simply ONE cause of cauda equina compression, and other possibilities, most notably neoplasia, must be considered.

Furthermore, imaging studies can be misleading, since lumbosacral spondylosis is a common incidental finding on radiographs of middle aged / old large breed dogs and apparent protrusion of the dorsal annulus of the L7 disc is very commonly observed on sagittal MRI scans in asymptomatic animals.

MEDICAL TREATMENT
In our practice the vast majority of diagnosed cases of DLSS respond very satisfactorily to medical management. In most DLSS cases, the only sign is pain, which is often moderate and transient, meaning that it can be managed with pulsed non-steroidal anti-inflammatory drug therapy and intermittent restriction of exercise to on-leash only for periods of up to six weeks. Dogs that fail to have the signs controlled on this regime, or that have neurological deficits are candidates for surgical intervention. Dogs that exhibit incontinence in association with DLSS should be treated immediately by surgical decompression.

SURGICAL OBJECTIVES AND METHODS
The primary objective of surgery for DLSS is to alleviate compression of the cauda equina nerve roots. Theoretically, it is possible to enlarge the vertebral canal and foramina by two methods: direct decompression (removal of compressive material) or indirect decompression (by altering the alignment of the vertebrae). Both techniques are applied in practice.

a) Direct decompression of the cauda equina within the vertebral canal
Dorsal laminectomy at the lumbosacral junction provides the most direct access for decompression of the nerve roots within the vertebral canal. Removal of the laminae and excision of the interarcuate ligament provide some decompression but, more importantly, allow access to the dorsal annulus of the L7 disc. This can be excised by retracting the cauda equina to each side in turn, allowing a scalpel blade to cut each half of the annulus so that it can be loosened and completely removed. This procedure is generally followed by extensive removal of the disc nucleus using curettes.
b) Direct decompression of the L7 root within the vertebral canal

Traditionally, the L7 root can be approached through a dorsal laminectomy, followed by enlargement of the foramen - i.e. foraminotomy - using a combination of high speed burr, rongeurs and curettes. Care must be taken to avoid trauma to the root during these procedures. In some cases, removal of the articular facet has been advocated to provide maximal access to the root as it traverses the foramen, but has been associated with a high rate of complications (see below).

c) Indirect decompression of the vertebral canal and foramina

Flexing the lumbosacral joint will open the foramina at L7/S1 and increase the effective height of the vertebral canal in DLSS cases that have dorsal protrusion of the L7 disc. The procedure of fixation-fusion of the L7/S1 interspace aims to provide long-term decompression of the cauda equina and L7 roots by stabilising the vertebrae in this position. The most common method is to use a cross pinning technique through the spinous process, articular facets and ilial wings.

RESULTS

In general, the clinical results of dorsal laminectomy are very good - many studies have documented a high rate of return to satisfactory (or better) function, including working dogs (Linn et al., 2003). However, force plate analysis of outcome demonstrates that operated dogs do not recover full weight-bearing capacity (Suwankong et al., 2007). It must also be stressed that dogs diagnosed with DLSS can still function well with medical or other conservative management.

The results reported for foraminotomy alone are very good, in terms of clinical outcome and complications are minimised (Godde and Steffen, 2007). The outcome following fixation-fusion surgery has not been reported in detail; anecdotal results are positive, although it would appear that the recovery period is prolonged.

COMPLICATIONS

During dorsal laminectomy and foraminotomy the major risk is iatrogenic damage to the nerve roots and the major complication excessive bleeding because of damage to the venous sinuses that run in the lateral ‘gutters’ of the vertebral canal. It is difficult to stop the bleeding using diathermy because they are thin walled and easily re-torn. Within a few days of surgery the most worrying complication is subluxation between L7 and S1, most often arising because of fracture of an articular facet, which is made more likely with extensive lateral bone removal, foraminotomy or facetectomy. Long term complications are few, although extrusion of previously unremoved nucleus pulposus is possible.

There are few complications of fixation-fusion, although it is possible to fracture the articular facets during pin insertion. Commonly the pins fracture and/or migrate, but rarely cause significant problems for the dog. Attempts to fix the lumbosacral joint in a grossly non-physiological flexed position are more liable to early failure.

MODIFICATIONS

Several modifications of dorsal laminectomy have been suggested recently, mainly with the aim of reducing complications associated with excessive bone removal. For instance, positioning the LS joint in flexion during surgery reduces the necessity for extensive removal of the lamina of L7 vertebra. An endoscopic approach to the L7/S1 foramen has been described in experimental dogs but results have not been reported in clinical cases (Wood et al., 2004).

CONCLUSIONS

Medical therapy is the first-line treatment for dogs that present with mild to moderate pain only and is very often all that is required. When necessary, surgical treatment of DLSS generally provides very satisfactory resolution of clinical signs, although great care must be taken in making a precise diagnosis prior to surgery. Intra-operatively, every effort should be made to reduce the amount of bone excised in order to prevent the severe complications that can occur following fracture and subluxation. Fixation-fusion is probably best reserved for cases in which ventral spondylosis is advanced, because it will aid in rapid bony stabilisation.

REFERENCES