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Guest editorial

Laminectomy membrane formation in dogs: Is the answer still elusive?

Spinal disease is common in dogs and is frequently associated with devastating neurological deficits. The acute paraplegic patient is a large part of the case-load in many neurology referral centres, and is most commonly the chrondrodystrophoid dog with a Hansen type I (Hansen, 1952) thoracolumbar disc herniation. Laminectomy is usually the treatment of choice for these patients. Both dorsolateral hemilaminectomy and dorsal laminectomy are performed although hemilaminectomy may be more effective because it is easier to remove extruded disc material (Muir et al., 1995; Gage and Hoerlein, 1968; McKee, 1992).

Laminectomy membrane formation (also termed epidural/constrictive fibrosis or scarring, postlaminectomy stenosis or scar) is a recognised complication of spinal surgery in both humans and dogs and can result in lack of recovery or worsening of neurological status following laminectomy. In a recent issue of *The Veterinary Journal*, Dr. Ronaldo da Costa and his colleagues at the Federal University of Santa Maria, Brazil, investigate a new method of potentially protecting the spinal cord from this serious pathological event and compare it with the routinely used free fat graft (da Costa et al., 2006).

During post-operative healing of a laminectomy site, a haematoma fills the bone defect, followed by development of a fibrous callus which then undergoes metaplasia to cartilage and then bone (Trotter et al., 1988). Adhesion and fibrosis is part of this healing process, which can involve the dura and nerve root if no attempt is made to protect them after the laminectomy. In humans, considerable post-operative morbidity may occur due to adhesion around nerve roots (Songer et al., 1990) and the level of pain may be correlated to the amount of scar tissue observed on MRI (Ross et al., 1996). Adhesions can also lead to severe spinal cord compression, and this can lead to significant neurological dysfunction.

Despite improvements in microsurgical techniques and diagnostic neuroradiological modalities, the development of epidural fibrosis after lumbar and lumbosacral surgery for disc herniation remains a common reason for failed back surgery in humans. Furthermore, epidural adhesions make re-exposure of the same operative area technically difficult and dangerous because the risk of nerve root injury and dural tears are greatly increased. Various synthetic and organic materials have been implanted into laminectomy defects to act as a barrier between the exposed dura mater and surrounding muscles to prevent epidural fibrosis (Gill et al., 1979; Songer et al., 1990). Generally, the results of previous studies have only been moderately successful in inhibiting epidural fibrosis. Complete prevention of epidural scar formation and dural adhesion has not yet been achieved.

da Costa et al. (2006) reported that both free fat graft and biosynthetic cellulose membrane implant partially prevented laminectomy membrane formation. However, they showed that application of free fat graft onto the laminectomy bone defect was associated with significant neurological deficit and spinal cord compression compared to animals without graft. Free fat graft placement is a method used routinely by many veterinary neurosurgeons all over the world, and several other studies found that free fat grafts had better overall results (Gill et al., 1979) although other reports indicate either no benefit from free fat graft (Songer et al., 1995) or that free fat graft does not prevent dural adhesions (Trevor et al., 1991). Furthermore, da Costa et al. (2006) demonstrated that the use of a biosynthetic cellulose membrane implant, although associated with less neurological deficits following the surgery than free fat graft, still led to more evidence of spinal dysfunction than with no implant at all.

The results provided by da Costa et al. (2006) question the rationale of the use of either fat or cellulose membrane in covering the laminectomy site following dorsal laminectomy, since dogs had less complications if the bone defect was left uncovered. Other widely used substances such as Gelfoam have also been associated with an increase in epidural fibrosis (Songer et al., 1990, but also see Trotter et al., 1988). It should be pointed out that at least 35 techniques have been described in an attempt to reduce epidural fibrosis, perhaps suggesting that none of them is ideal. Although neurosurgeons routinely cover the laminectomy site with various substances, associated neurological prob-

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lems may not be noticed because most patients have profound neurological deficits before surgery. It is also possible that covering the site may prolong recovery, which in the clinical setting is extremely difficult to investigate since spinal patients vary considerably in size, breed, aetiology of spinal lesion, size and site of lesion. Also, since most spinal patients recover, histopathological examination of the laminectomy site can only rarely be done.

Although the Barzil group's findings further question the use of implants to prevent laminectomy membrane formation it is important to note that in their study, dorsal laminectomy was used rather than dorsolateral hemilaminectomy (da Costa et al., 2006). Many surgeons prefer dorsolateral hemilaminectomy for the treatment of acute disc herniation because it has milder effects on the mechanical properties of the spine (Smith and Walter, 1988), it is more appropriate for decompression of lateralised lesions (Gage and Hoerlein, 1968), is less frequently associated with formation of constrictive laminectomy membrane (Gage and Hoerlein, 1968) and hence at least short-term recovery may be more rapid (Muir et al., 1995).

At the Royal Veterinary College, hemilaminectomy technique is far more commonly used then the dorsal laminectomy at the thoracolumbar site. In our experience, post-surgical scarring may be limited by making the laminectomy defect as small as possible. We use dorsal laminectomy frequently for cervical disease in such lesions as articular facet and ligamentum flavum hypertrophy, which often requires dorsal laminectomy over several disc spaces. The formation of scar tissue is a challenging complication for a successful outcome in these cases, and a solution for prevention of laminectomy membrane formation has still to be found.

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