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“The Cutting Edge in Veterinary Orthopaedics CE”

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INTRODUCTION
The large number of reported techniques for cervical spondylopathy-associated disc protrusion reflects the difficulty of managing this condition. Direct decompression (ventral slot, dorsal laminectomy), indirect decompression (vertebral distraction-stabilisation), vertebral stabilisation without distraction, and intervertebral disc fenestration techniques have been described. It is difficult to compare results because there are no control groups, cases are generally not consecutive and numbers of cases are usually small. Furthermore the historical, clinical, radiographic, surgical, peri-operative, postoperative and long-term follow-up details vary considerably (Jeffery and McKee 2001). The choice of distraction-stabilisation or ventral slot decompression techniques is primarily dependent on the nature of the compression (i.e. traction responsive or traction non-responsive). Additional factors include the number of sites of spinal cord compression, the degree of vertebral malformation and the presence or absence of thoracic limb lameness (spinal nerve compression). Both approaches have their own potential advantages and disadvantages (McKee and Sharp 2003). Polymethylmethacrylate (PMMA) bone cement plugs have probably been the most commonly used intervertebral spacers used in vertebral distraction-stabilisation techniques over the last decade.

CEMENT PLUG WITH ENDPATE ANCHOR HOLES
Dixon and others (1996) described an intervertebral cement plug technique in 22 dogs. Anchor holes were burred in the vertebral endplates to prevent ventral displacement of the cement. Vertebral distraction was achieved with modified Gelpi or Scoville-Haverfield retractors placed in adjacent intervertebral discs spaces or the vertebral bodies. Eighteen dogs had a postoperative neck brace. Follow-up ranged from three to 60 months (mean 21, median 18 months). Nineteen of 21 dogs (90%) were reported to have a successful outcome (this included paraparetic dogs that remained paraparetic). Complications included ventral plug displacement (1 dog) and discospondylitis (1 dog). There was no change in cement plug position in 19 of 20 dogs. Bony fusion was complete or progressing towards completion in all dogs one to two months following surgery. No dogs had additional disc protrusions.

CEMENT PLUG WITH RETENTION SCREWS
McKee and Sharp (2003) described an alternate intervertebral cement plug technique. Retention screws are placed in the caudal vertebral body to prevent ventral displacement of the cement. Vertebral distraction was performed in 52 Dobermanns (McKee and others 2008). Age ranged from four to 10.5 years (mean 6.9, median 7) and weight from 24 to 54 kg (mean 36.5, median 35). Duration of clinical signs ranged from three days to 20 months (mean 2 months, median 4 months). Forty-four dogs were tetra/paraparetic and eight were non-ambulatory tetraparetic. Neck pain was a feature in 35 dogs and 11 exhibited thoracic limb lameness attributable to spinal nerve compression. Spinal cord compression was associated with C6-C7 protrusion in 47 dogs, C5-C6 protrusion in four dogs and C5-C6-C7 protrusions in one dog. Forty-five lesions were traction responsive and eight were traction non-responsive. Vertebral distraction was achieved with a bespoke distractor placed in adjacent intervertebral disc spaces. An adjacent intervertebral disc was foraged and bone grafted in 27 cases. No dogs had a postoperative neck brace. Duration of postoperative hospitalisation ranged from one to seven days (mean 2.4, median 2). One dog was euthanised prior to discharge. Forty-eight dogs were examined between four and six weeks postoperatively. Neurological function was normal in four, improved in 41 and unchanged in three. Neck pain had resolved in 30, was improved in two and was unchanged in one. Thoracic limb lameness had resolved in eight, improved in two and was unchanged in one. Seven of eight non-ambulatory dogs regained the ability to ambulate three to 11 days following surgery. The remaining dog was euthanised.
Follow-up radiographs were obtained six to 12 weeks postoperatively in 40 dogs. A variable loss of vertebral distraction was evident in all cases. Cement plug fracture with ventral displacement was a coincidental finding in two dogs. Eight dogs had an acute deterioration in neurological function three days to
12 weeks following surgery. Radiographs revealed cement plug displacement +/- fracture and / or vertebral endplate fracture. Seven were euthanatised (three following revision surgery). Three dogs deteriorated neurologically four to 16 months following surgery and were euthanatised without investigations. Nine dogs deteriorated four to 33 months (mean 16, median 13) postoperatively due to protrusion of an adjacent cervical disc. The cement plug technique was effective at improving neurological function and managing neck pain and thoracic limb lameness in the majority of Dobermans in the short-term. However, acute implant-bone failure occurred in 15% of dogs within three months of surgery and additional disc protrusions developed in 17% of dogs between four and 33 months postoperatively. The material and structural properties of the cement plug, excessive vertebral distraction, and fenestration of adjacent discs may have been contributing factors.

COMPARISON OF CEMENT PLUG TECHNIQUES

The differences in outcomes between the two cement plug techniques may have been due to a number of factors, for example, the number of cases, number of surgeons, case selection, use of a neck brace, degree of vertebral distraction, and fenestration of adjacent discs.

THE FUTURE OF INTERVERTEBRAL SPACERS

An important requirement for intervertebral spacers / spinal fusion devices is that they provide sufficient stability and have a low subsidence risk. It is unlikely that cement plug techniques will ever achieve this. A recent experimental study in sheep concluded that intervertebral cement plug stabilisation, albeit in combination with ventral slot decompression, did not maintain distraction of the disc space and bony union between vertebrae was not achieved (Fransson and others 2007). Two key areas of interest are prevention of acute implant-related complications and prevention of additional disc protrusions (adjacent segment disease).

ACUTE IMPLANT-RELATED COMPLICATIONS

A number of factors should be considered in an attempt to reduce the incidence of acute implant-related complications: (1) excessive vertebral distraction should be avoided, (2) the interbody material should have an elastic modulus compatible with vertebral bone, (3) the interbody material should be biologically to enable vertebral fusion for long-term vertebral stability. The author has used tantalum spinal fusion blocks (BioMedtrix) in dogs with cervical spondylopathy-associated disc protrusion. The elastic modulus and bone ingrowth characteristics may be more physiological than bone cement (Bobyn and others 1999). Tantalum (“trabecular metal”) is osteoconductive and the spinal implants are 80% porous. Fixation of the block within the distracted intervertebral disc is necessary to prevent displacement. Early results show a degree of deformation of the spinal block. Subsidence is not eliminated, however, it appears to be less than with cement plugs. Cervical spinal fusion cages are commonly used in people. These interbody cages are hollow and may enable vertebral distraction and bony fusion (Wilke and others 2002). The use of AO SynGages and Cervical Spinal Locking Plates (CSLP) has been reported in dogs (Matis 2002). Monocortical screws have not provided long-term vertebral stability in the author’s experience. This problem has been previously reported (Voss and others 2006).

ADDITIONAL DISC PROTRUSIONS

Fenestrating adjacent intervertebral discs to distract affected vertebrae may decrease vertebral stability and contribute to disc degeneration and protrusion (Macy and others 1999). Disc fenestration should thus be avoided. Instead the distractor should be anchored in holes in the vertebral bodies. It is also possible that degeneration and protrusion of additional discs is directly related to vertebral malformation rather than vertebral distraction-stabilisation and that, as in humans, C5-6 and C6-7 are both high-risk discs (Hilibrand and others 1999). Routinely placing interbody spacers at both C5-C6 and C6-C7 may be advantageous. It appears that foraging and bone grafting adjacent discs is not effective at preventing protrusion.

REFERENCES


