



Alternating cervical laminoplasty for cervical spondylotic myelopathy

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We present a novel method of performing an 'open-door' cervical laminoplasty. The complete laminotomy is sited on alternate sides at successive levels, thereby allowing the posterior arch to be elevated to alternate sides. Foraminotomies can be carried out on either side to relieve root compression. The midline structures are preserved.

We undertook this procedure in 23 elderly patients with a spondylotic myelopathy. Each was assessed clinically and radiologically before and after their operation.

Follow-up was for a minimum of three years (mean 4.5 years; 3 to 7). Using the modified Japanese Orthopaedic Association scoring system, the mean pre-operative score was 8.1 (6 to 10), which improved post-operatively to a mean of 12.7 (11 to 14). The mean percentage improvement was 61% (50% to 85.7%) after three years. The canal/vertebral body ratio improved from a mean of 0.65 (0.33 to 0.73) pre-operatively to 0.94 (0.5 to 1.07) post-operatively.

Alternating cervical laminoplasty can be performed safely in elderly patients with minimal morbidity and good results.

Cervical spondylosis most commonly affects segments C4-C7. The resulting osteophyte formation, facet joint hypertrophy and ossification of the posterior longitudinal ligament can combine to compress the cord and cause a myelopathy.

In 1968, Hirabayashi first used 'open-door' cervical laminoplasty to treat multilevel cervical spondylotic myelopathy and achieved good decompression of the spinal cord without the post-operative kyphosis or late instability previously seen after laminectomy.¹⁻⁴ Since then, various techniques have been described by others,^{5,6} including Hattori,⁷ Nakano,⁸ Iwasaki and Ducker.^{9,10} We have further modified the technique and now report the results.

Patients and Methods

Between 1998 and 2003 we treated 23 patients with cervical spondylitic myelopathy by alternating cervical laminoplasty. There were 12 women and 11 men, with a mean age of 67.1 years (65 to 71). Each patient had been followed for a mean of 4.5 years (3 to 7). The diagnosis was established both clinically and radiologically. Each patient had been symptomatic for between three and 24 months pre-operatively. No patient had a cervical kyphosis before surgery. At follow-up after six months, one year and three years, their clinical condi-

tion was graded using the modified Japanese Orthopaedic Association (JOA) scoring system.¹¹

Surgical technique. We modified the technique of open-door laminoplasty by alternating the side of the complete laminotomy and hence the side to which the 'door' opens. The operation is carried out through a standard posterior approach to the cervical spine. The levels at which the laminoplasty is to be performed are established radiologically. A complete laminotomy is carried out on one side at the first level and a partial laminotomy on the other. These are alternated at successive levels. A foraminotomy can be performed on either side to relieve root compression. The ligamenta flava are sectioned to allow the laminae to be elevated on alternate sides as the laminoplasty proceeds. The interspinous and supraspinous ligaments are maintained in continuity but are inevitably stretched. The cervical fascia is therefore sutured to each spinous process 3 cm from the midline so as to keep the laminoplasty patent (Figs 1 and 2). The wound is then closed in layers over a suction drain.

The C2-C7 angle and Ishihara's curvature^{12,13} index were measured on plain radiographs, and the change in cervical canal diameter by CT or MRI (Figs 3 to 5).

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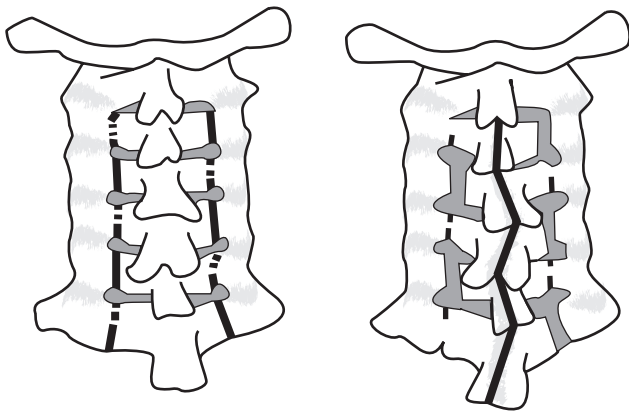


Fig. 1

Alternating cervical laminoplasty. A complete laminoplasty is carried out on alternate sides at successive levels. The posterior arch is then elevated to the side of the partial laminotomy. The interspinous and supraspinous ligaments are under strain but intact.

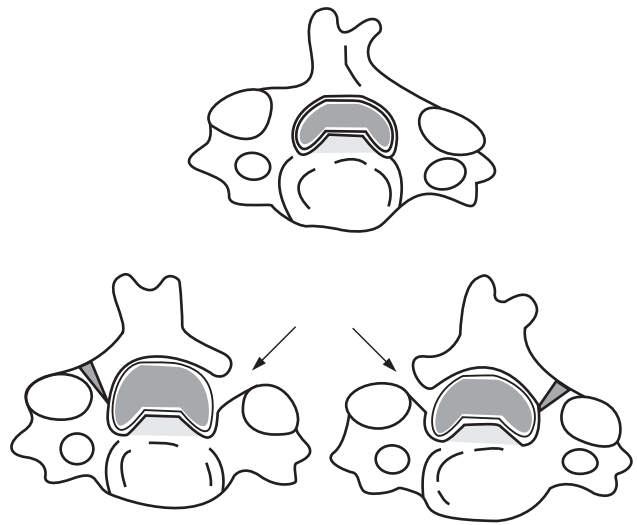


Fig. 2

Alternating cervical laminoplasty. Axial views.

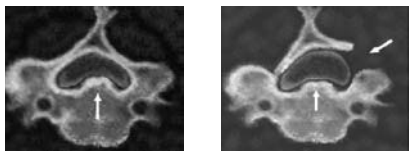


Fig. 3a

Fig. 3b

Axial CT scans a) before and b) after the alternating laminoplasty, showing the enlargement of the cervical spinal canal.

Results

The JOA score increased from a mean of 8.1 (6 to 10) pre-operatively to a mean of 11.6 (10 to 13) after one year and to a mean of 12.7 (11 to 14) after three years. No patient's condition was worsened by the procedure. There was no persistent neck or shoulder pain, or stiffness post-operatively.

The percentage improvement was calculated using the formula,¹²

$$\frac{\text{Post-operative score} - \text{pre-operative score}}{\text{Full recovery (17)} - \text{pre-operative score}} \times 100.$$

After the first year the mean percentage improvement was 41.4% (22.2% to 67%) and after three years this had further improved to a mean of 61% (50% to 85.7%). At one year, the 16 patients who had improved by more than 50% were rated 'good' and the seven who had improved by less than 50% as 'fair'. Apparent poor results, in one case with a recovery rate of 22.2% and in three cases each with a recovery rate of 33%, are not in concordance with the clinical aspects after surgery, because of the initial clinical state. There were no peri-operative or post-operative complications.

There was no significant difference between the pre-operative and post-operative C2-C7 angles or Ishihara's curvature index. No segmental instability was noted.

The mean ratio of canal to vertebral body improved from 0.65 (0.33 to 0.73) pre-operatively to 0.94 (0.5 to 1.07) post-operatively. There was good correlation between the improvement in this ratio and the clinical results after one year. The worst of the fair results were seen in patients with severe symptoms lasting more than six months pre-operatively.

Discussion

The treatment of cervical spondylotic myelopathy remains controversial. Laminectomy and interbody fusion can produce good results, but post-operative kyphotic changes and late instability may occur and some patients develop a compressive laminectomy membrane.¹⁴ Cervical laminoplasty is a surgical technique that avoids these problems. It may be indicated for multiple-level ossification of the posterior longitudinal ligament, congenital spinal canal stenosis, multilevel cervical stenosis and dorsal ligamentous hypertrophy.^{15,16}



Fig. 4a

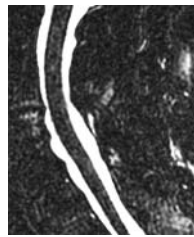


Fig. 4b

a) Pre-operative and
b) post-operative
MRI cervical myelo-
gram.



Fig. 5b



Fig. 5b

a) Pre-operative and
b) post-operative
sagittal MRI scan of
the cervical spinal
cord, showing no
change in C2-C7
angle.


All our patients were over 65 years of age and had a spondylotic myelopathy secondary to multiple posterior intervertebral disc protrusions.

The major advantage of this approach is that it allows the surgeon to carry out foraminoplasties on both sides of the spine as part of a laminoplasty. A foraminotomy can be made on the side of the radicular pain, whether this is the side of the complete or partial laminotomy. There was no significant neck pain or stiffness, or shoulder pain post-operatively.¹⁷ The alternating cervical laminoplasty preserves the posterior midline structures and only partially resects the ligamenta flava thereby maintaining the normal cervical lordosis.¹⁸ It prevents kyphosis and instability, as do all laminoplasty techniques, but avoids post-laminectomy membrane formation, arachnoiditis, and restenosis by refixing the spinous processes to the fascia more laterally. Preservation of the posterior cervical arches does not influence the long-term outcome of cervical myelopathy after laminoplasty.¹⁹

The results of this operation were good or fair in our hands and were determined by the increase in the canal/vertebral body ratio as noted by other authors.²⁰

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

Supplementary Material

 A table showing the demographic details and Japanese Orthopaedic Association scores are available with the electronic version of this article on our website at www.jbjs.org.uk

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