A new method of stabilising the elevated laminae in open-door laminoplasty using an anchor system

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We treated 12 patients with multilevel stenosis of the cervical canal after spondylosis or ossification of the posterior longitudinal ligament by an expansive open-door laminoplasty, stabilised by using an anchor system.

The preoperative sagittal diameter of the canal was 9.8 mm (±2.2) which was increased to 16.1 mm (±2.9) after surgery. The mean expansion ratio of the canal was 64% (42 to 100). The anchoring systems did not fail during the follow-up period (mean 29.5 months), and the decompression was maintained. The use of anchor systems to stabilise the posterior elements after laminoplasty is a simple and effective technique for maintaining the increased sagittal diameter of the canal.

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Extensive cervical laminectomy is required in the treatment of cervical myeloradiculopathy due to stenosis of the cervical canal, spondylosis, ossification of the posterior longitudinal ligament and tumours of the spinal cord. The procedure carries the risk of potential instability in the form of cervical kyphosis, swan-neck deformity, or subluxation at more than one level, which may exacerbate neurological symptoms.1-4 To avoid these complications Hirabayashi et al5 devised a new surgical technique, called ‘expansive open-door laminoplasty’, as an alternative to ordinary laminectomy of the cervical spine. Several studies suggest that the results of open-door laminoplasty are better than those of laminectomy,6,7 but reports of severe neck pain and motor paresis of the shoulder girdle after laminoplasty are attributed to displacement of osteomised laminae or the reclosure of the opening.8,9

We present a modification of the technique using anchor systems to stabilise the posterior elements in the open position.

Patients and Methods

We carried out operations on patients with multilevel stenosis of the cervical canal after spondylosis or ossification of the posterior longitudinal ligament (Fig. 1). There were nine men and three women with a mean age at the time of surgery of 62.6 years (54 to 71). The mean postoperative follow-up was 28.4 months (24 to 39). The causes of the myelopathy were ossification of the posterior longitudinal ligament in four patients and multisegmental spondylosis in eight. Ten patients also had symptoms of radiculopathy.

Operative technique. The patient is placed in the prone position with the neck slightly flexed. A standard posterior midline approach allows exposure of the cervical laminae from the caudal edge of C2 to the cranial edge of T1 and laterally to the medial aspect of the facet joints. Care is taken to preserve the capsules of the facet joints and the soft-tissue attachments of the lateral masses. Each spinous process is removed and kept for bone grafting. Two channels are made in the laminae just medial to each articular process using a high-speed drill with a 3 mm spherical cutting burr. Each channel is cut to the depth of the inner cortex, but not through. Holes for the anchors are drilled on the side chosen for the hinge. The entry point is the centre of the lateral mass of C3, C5 and C7 (Fig. 2) and holes of 2.4 mm diameter and 14.2 mm depth are drilled. The GII anchor (Mitek, Westwood, Massachusetts) with non-absorbable suture material is inserted into each hole. The tunnels for the passage of sutures are made in the stumps of the spinous processes of C3, C5 and C7. On the side to be opened, the channel is cut to the depth of the inner cortex, but not through it.

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opening side, as required, to elevate the posterior elements. When the ‘open-door’ has been established by gentle levering on the laminae, it is secured by the anchor system. Threading of one end of the suture through the spinous process is done from the side of the hinge; the other end of the suture is passed over the spinous process.

After the sutures are tied, bone chips, made from the spinous processes, are placed over the hinge (Fig. 2). A Philadelphia brace is used for six weeks after surgery, and gentle mobilisation is encouraged.

Radiological and morphometric analysis. The anteroposterior (AP) diameter of the canal on a lateral radiograph was measured as the distance between the middle of the posterior surface of the vertebral body and the innermost cortical surface of the lamina at the C5 level. The radiographs were taken at a distance of 1.25 m. CT was performed after six months to assess bony union on the hinge side.

The mean duration of the operation was 143 minutes and the average blood loss 387.5 ml.

Results

Clinical findings. The clinical details are shown in Table I. The symptoms of radiculopathy improved in all ten patients so affected. Significant improvement in the symptoms of myelopathy were seen in seven patients and moderate

Fig. 1a

Case 9. MRI showing a) multilevel compression of the cord and b) postoperative expansion of the spinal canal.

Fig. 1b

Fig. 2

Diagram of open-door laminoplasty stabilised by an anchor system.
improvement in four. In the remaining patient (case 4) there was no change.

We used the system of evaluation for cervical myelopathy established by the Japan Orthopaedic Association. The mean preoperative score in all 12 patients was 7.1 points (3 to 11) and the mean score after operation 13.8 points (8 to 18). According to the criteria of Odom, Finney and Woodhall, five patients had excellent, five good, and two a fair result. There were no postoperative complications.

Radiological findings. These are shown in Table I. The mean preoperative AP diameter of the canal at the C5 level was 9.8 mm (6 to 13). Postoperatively, the mean diameter was 16.1 mm (11 to 19), the mean extent of the enlargement of the spinal canal, measured on the lateral projection, was 6.3 mm (4.5 to 9.0), and the mean expansion ratio of the canal 64% (42 to 100). Expansion of the spinal cord is shown by MRI in Figure 1b. Radiographs taken at regular intervals during the follow-up period have not revealed significant (>2 mm) loss of expansion of the canal obtained at the time of surgery, or any failure of the anchors. There has been no change in sagittal alignment since the initial postoperative radiographs. CT carried out six months after operation showed bony union on the side of the hinge in every case (Fig. 3).

Discussion

Various techniques have been described to prevent recurrent stenosis. Hirabayashi et al supported the hinge side by three or four sutures through muscle sheaths to prevent closure. In our experience, however, the muscle sheath does not seem to be strong enough to hold the laminae. Itoh and Tsuji developed a bone block held by wire to maintain the open position and Frank and Keene and O'Brien et al used titanium plates to secure the posterior elements. Although they gave satisfactory results, these techniques are intricate, requiring implants with the danger of injury when introduced.

We attempted to stabilise the elevated laminae using an anchor system. The operative technique is relatively easy, as shown by the operating time and the blood loss (Table I). These systems are versatile, quick, easy to apply and are safer.

Although the increase in the sagittal diameter of the spinal canal is an important factor in relieving compression of the cord in cervical stenotic myelopathy, excessive opening should be avoided to prevent breaking the hinge. Hirabayashi et al showed that widening of the sagittal diameter by approximately 4 or 5 mm is sufficient to obtain a good result. Herkowitz reported no correlation between excellent or good results and the amount of expansion of the canal obtained. By contrast, poor results were related to loss of the width obtained at the time of surgery. We achieved enlargement of the spinal canal of a mean of 6.3 mm in the sagittal plane and a mean expansion ratio of 64%. Although quantitatively the enlargement of the spinal canal in our study was less than that achieved in others, excellent or good results were obtained in 83.3% of our

Table I. Clinical and radiological data of the 12 patients

<table>
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<tr>
<th>Case</th>
<th>Age (yr)</th>
<th>Gender</th>
<th>Diagnosis*</th>
<th>Operating time (min)</th>
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<th>Follow-up (mth)</th>
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Mean ± SD 62.6 ± 5.6 143.0 ± 24.0 387.5 ± 187.2 28.4 ± 5.3 9.8 ± 2.2 16.1 ± 2.9 7.1 ± 2.7 13.8 ± 3.3

* OPLL, ossification of posterior longitudinal ligament; CS, cervical spondylosis
† Japan Orthopaedic Association

Fig. 3

CT after six months showing solid bony fusion on the side of the hinge.
patients and there was no recurrence of symptoms during the follow-up period. We believe that the maintenance of an enlarged canal diameter is an important factor in the management of cervical compressive myelopathy and that this technique achieves that end.

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.

References


