Bilateral multilevel laminectomy with or without posterolateral fusion for cervical spondylotic myelopathy: relationship to type of onset and time until operation


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The authors retrospectively evaluated the relationship of several preoperative factors in 69 patients who had myelopathy due to multilevel cervical spondylosis without ossification of the posterior longitudinal ligament treated with Kirita’s bilateral wide laminectomy. In 34 patients with focal instability or malalignments, posterolateral fusion was also combined. The clinical results at an average follow-up period of 3.5 years (range 1–10 years) after operation in the groups that had and had not undergone fusion were equally satisfactory, and preoperative focal instability was believed to be the sole useful indication for adding posterolateral fusion. The patients were classified in three groups according to the acuteness of the onset. The type of onset and time until operation were found to be the factors most strongly related to prognosis, and clinical outcome was correlated with the duration after onset when plotted as days in the acute, months in the subacute, and years in the insidious onset groups. Wide laminectomy with or without posterolateral fusion is a simple operation that is recommended, provided that it is performed early enough according to the type of onset.

KEY WORDS • cervical spine • myelopathy • cervical spondylosis • decompressive cervical laminectomy • fusion
following trauma such as a fall or a blow. 2) Subacute onset group (41 patients): initial symptoms were numbness of extremities (32 patients), gait disturbance (11), clumsiness of the hand (six), or micturition disturbances (five). Myelopathies such as hypertonicity (31 patients), gait disturbances (20), hypesthesia (19), disturbance in fine motor movement (16), or sphincter disturbances (seven) developed and progressed within a few months. The time between the onset of symptoms and operation was 7.4 months (range 1.7–23 months). 3) Insidious onset group (22 patients): patients in this group had visited the outpatient clinic initially an average of 3.2 years (range 41 days–10 years) after the onset of symptom(s) such as numbness of extremities (16 patients), gait disturbance (five), clumsiness of the hand (four), muscle weakness (one), limb pain (one), or neck pain (one). Myelopathies such as hypertonicity (15 patients), hypesthesia (11), disturbance of fine motor functions (eight), or sphincter disturbances (two) developed and progressed gradually over the course of an average of 1.9 years, and the patients had agreed to undergo operation. The average time between the onset of symptoms and operation was 5.1 years (range 1.5–12 years).

**Clinical Evaluation**

The assessment scale proposed by the Japanese Orthopaedic Association (JOA) was used for clinical evaluation (JOA score: 17 points for symptom-free condition; Table 1). The percent improvement was calculated using the following formula of Hirabayashi, et al.\(^6\) (post-operative score – preoperative score)/(17 – preoperative score) × 100.

**Method of Operation**

We performed Kirita’s bilateral wide laminectomy as follows: the paravertebral musculature was dissected away periosteally from the laminae. Before the intraspinal ligaments were incised, spinal instability was examined by pulling each set of neighboring spinal processes apart using two towel clips. The spinal processes were excised and laminae thinned using a bone rongeur and high-speed air drill with a steel bar. A central gutter was made in the midline of the laminae and deepened with a diamond bar until the inner periosteum and yellow ligament were exposed. Lateral gutters were made bilaterally on the pedicles, then deepened to the inner periosteum and yellow ligament as well until each hemilamina showed lateral mobility (Fig. 1 upper). The central gutter was opened longitudinally as quickly as possible along the whole length with hemostasis achieved using a bipolar coagulator. The opened gutter usually expands spontaneously due to high intracanal pressure and pulsation becomes visible. When posterolateral fusion was unnecessary, both laminae were excised by sharply cutting the inner periosteum and yellow ligament. Free fatty tissue was grafted on the dural tube.

**Posterolateral Fusion**

The excised spinal processes and laminae were chipped into matchsticklike struts and saved for grafting. In the
Kirita’s bilateral cervical laminectomy

first nine patients, graft bones were placed in the lateral gutters on the pedicles made for excision of the laminae. In the 25 patients treated more recently, other lateral gutters were made on the middle portions of the facets in an attempt to build the bone bridge more posteriorly on the wider graft base (Figs. 1 lower and 2). Bone grafting was performed for the whole length of the laminotomy except in the four patients treated most recently; only the levels of instability or malalignment received extensive bone grafting. Iliac bone was obtained for long fusion. Bilateral fusions were performed for the whole length of the laminotomy except with posterolateral facet fusion.

Postoperatively, the patients were allowed to sit up with a high neck brace or with a vest brace with maxillary and temporal supports from the 3rd week after laminectomy or with a high neck brace or with a vest brace with maxillary and temporal supports from the 3rd week after laminectomy or from the 5th week after posterolateral fusion.

Statistical Analysis

Correlation coefficients and regression analysis were used to evaluate the relationship between the time before operation and the percent improvement, and paired or unpaired two-tailed t-tests were also used for statistical analysis. A probability value of less than 0.05 was accepted as a significant difference.

Results

The clinical score was significantly increased (p = 0.0001), by 5.1 points (range −1 to 12 points) at follow-up review. Three patients’ conditions deteriorated by 1 point. Eleven patients who showed improvement of 25% or less as well as an absolute change of JOA score of 2 points or less were classified as unimproved. Therefore, sustained clinical improvement was achieved in 58 patients (84%). The results of laminectomy in the patient groups with and without posterolateral fusion are summarized in Table 2. The retrospective analysis revealed that the posterolateral fusion group was significantly younger (p = 0.004) and had significantly lower preoperative JOA scores (p = 0.022). The improvement in the laminectomy group was similar (50.8%) to that in the fusion group (51.2%). The results in seven patients who had undergone an anterior operation prior to laminectomy tended to be poorer (35%) compared to those without prior operation (53%; not significant (NS)). Gender, age at operation, preoperative score, or postoperative days until follow-up review were not correlated with improvement or deterioration.

Postoperative Complications

Temporary motor paresis was observed postoperatively in the right arm and in the right shoulder of one patient each. The final percents of improvement were 20% (aggravated by late cerebral infarction) and 58%, respectively. In another patient, a 73-year-old woman, both the right upper and lower extremities were paralyzed temporarily, possibly due to focal kyphosis at the fourth and fifth vertebral level preserved postoperatively resulting in posterior shift and tethering of the spinal cord observed on magnetic resonance images. Her final improvement was 60%.

Radiographic Assessment

Nonfusion Group. One patient developed intervertebral instability with focal gooseneck deformity, and one developed only instability. Four patients lost lordosis. Six patients had malalignments preoperatively, and one of them showed further aggravation of malalignment from loss of lordosis, with transition to kyphosis after laminectomy.

Posterolateral Fusion Group. Fusion performed in 26 patients to correct focal instabilities did stabilize spines in 24, but failed to stabilize them in two patients. Possible pseudoarthrosis of the fused mass was observed in one of these two patients. Pseudoarthrosis was suspected in six others based on the functional lateral views of x-ray films. None of these six patients, however, showed aggravation of the alignments or instabilities. The total successful fusion rate was 80% (27 of 34 patients).

Although eight patients had undergone fusion because of malalignment without instability, the straight spine became kyphotic postoperatively in two of them despite completion of the fusion. Cervical lordosis was somewhat more prominent in three, and normal lordosis was regained in one of the patients in the posterolateral fusion group. The overall incidence of postoperative malalignments was 17% (six of 35 patients) in the nonfusion group, and 12% (four of 34 patients) in the fusion group. There was no tendency for those who developed malalignment to show lower scores or less marked clinical improvement compared with those who did not show curvature deterioration postoperatively. The overall im-
Postoperative improvement in the seven patients with postoperative instability (two with and five without fusion) was 65%, and somewhat better than that in those without instability (53%; NS).

**Group Analysis**

**Acute Onset Group.** Postoperative improvement tended to be dependent on the number of days from trauma to the operation ($r = 0.71$; NS) (Fig. 3 upper left).

**Subacute Onset Group.** Postoperative improvement was significantly correlated with the number of months from the onset of myelopathy until the operation ($r = 0.57$; $p = 0.0001$) (Fig. 3 upper right).

**Insidious Onset Group.** Postoperative improvement was significantly correlated with the number of years from onset of myelopathy until the operation ($r = 0.82$; $p = 0.0001$) (Fig. 3 lower left).

Of the 11 patients classified as unimproved, two were in the acute, five in the subacute, and four in the insidious onset group. The time until operation was 90 days and 1867 days, respectively, in the two patients with acute onset, a mean of 14.1 months in the subacute, and a mean of 10.5 years in the insidious onset group.

**Discussion**

**Multilevel Cervical Wide Laminectomy With and Without Posterolateral Fusion**

Kirita introduced the high-speed air drill to multilevel cervical laminectomy in 1967 and proposed that bilateral laminectomy, in which the laminae are opened longitudinally and bilaterally along their entire length, would prevent focal swelling and resultant paresis of the spinal cord, which often had been encountered in opening laminae piece by piece using bone rongeurs. One of the complications of wide laminectomy, however, is thought to be the development of postoperative cervical instability and malalignment, particularly in children; this complication was also observed experimentally in growing animals.

**Indications for Adding Posterolateral Fusion**

Excessive focal intervertebral instability, either that suspected preoperatively based on functional lateral x-ray films or that found during operation, had been thought to be a risk factor and an indication for either focal or long posterolateral fusion. The outcomes in the two groups were almost equivalent and the soundness of the indication criteria was affirmed. Preoperative malalignment without instability did not prove to be a risk factor in fusion, because among eight patients with preoperative malalignments only one showed deterioration after laminectomy alone, whereas posterolateral fusion failed to prevent deterioration in two of eight patients.

Eleven patients (16%) were classified as unimproved, and the percentage of improved patients (84%) was comparable to that seen in other studies, including reports by Epstein, et al. (85%), Carol and Ducker (68%), and Snow and Weiner (74%).

**Grouping of Patients and Time Until Operation**

It is widely accepted that the preoperative duration of the symptoms has prognostic importance, and a critical threshold of 1 year has been suggested to afford superior outcome. No author, however, has recognized the differ-
ence in acuteness of onset of myelopathies. In this study, the type of onset and time until operation were found to be critical factors affecting prognosis, and the clinical outcome was correlated with the number of days (acute onset group), months (subacute onset group), and years (insidious onset group). The critical time appeared to be approximately 8 months in the subacute and 5 years in the insidious onset group. Slower progression of symptoms probably indicates slower development of irreversible cord damage and longer curable period by posterior decompression. A further survey using magnetic resonance images has revealed recently that the gap difference in the preoperative transverse area of spinal cord between compressed and neighboring noncompressed levels was less in the insidious onset group than that in the subacute onset group and that expansion of the spinal cord after decompression hardly occurred in either group.

References


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