ORIGINAL ARTICLE

Anterior Decompression and Fusion *via* the Extrapleural Approach for Thoracic Disc Herniation Causing Myelopathy

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(Received for publication on June 14, 1997)

Abstract. Anterior decompression and fusion *via* an extrapleural approach was performed for 33 patients with myelopathy arising from thoracic disc herniation and the clinical usefulness and problems related to this procedure were assessed on the basis of surgical results and complications. The severity of the myelopathy was evaluated by the Japanese Orthopaedic Association score, and the surgical results were based on the recovery rate. The upper-level limit of decompression and fusion *via* the extrapleural approach was T4–5. The recovery rate for the mean postoperative follow-up period of 41 months was 66.7%. An age of 60 years or more, long duration of illness and severe preoperative myelopathy were indicators of a poor prognosis. Two patients suffered from a postoperative transient pulmonary complication due to hemothorax. X-ray examinations revealed good bone union in all the patients. The present study indicates that anterior decompression and fusion *via* the extrapleural approach is a useful technique which can be used to achieve a high success rate in the surgical treatment of thoracic disc herniation, if intervention is early. (Keio J Med 46 (4): 173–176, December 1997)

Key words: anterior decompression and fusion, thoracic disc herniation, myelopathy, extrapleural approach

Introduction

Thoracic disc herniation is a rare disease, compared to cervical or lumbar disc herniations,¹ but surgical intervention is required because the disease may give rise to severe thoracic myelopathy and because conservative treatment is without effect.^{2–4} Anterior, lateral or posterior decompression is selected as one of the possible surgical techniques for the treatment of thoracic disc herniation, and its indications and results have been reported, but the technique is not yet established.^{1–11}

Thoracic myelopathy is caused by an anterior spinal cord lesion due to thoracic disc herniation, which is why anterior decompression and fusion *via* an extrapleural approach has been employed at our institution in the treatment of this entity since 1977.¹² The present study was designed to assess the clinical usefulness of this surgical technique and to identify its problems by analyzing the surgical results and complications.

Materials and Methods

Thirty-three patients who underwent anterior decompression and fusion *via* an extrapleural approach for thoracic disc herniation between 1977 and 1994 were included in the study. There were 4 women and 29 men, ranging in age from 20 to 75 years (mean, 47 years). Disc herniation was at the T4–5 level in 2 patients, at the T6–7 level in 2, at the T7–8 level in 3, at the T8–9 level in 2, at the T9–10 level in 3, at the T10–11 level in 1, at the T11–12 level in 12, at the T12–L1 level in 5, at the T10–11 and T11–12 level in 1, and at the T11–12 and T12–L1 level in 2. The follow-up period ranged from 25 to 114 months (mean, 41 months).

The severity of thoracic myelopathy was evaluated by the Japanese Orthopaedic Association (JOA) score which was modified to exclude the upper-extremity parameters. The normal JOA score for assessment of thoracic myelopathy is 11 points (Table 1). The recovery

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Table 1 Evaluation System for Thoracic Myelopathy (Japanese Orthopaedic Association Score)

Category	Score (point)
A. Lower extremity motor function	
Unable to stand up and walk by any means	0
Unable to walk without a cane or other support on a level	1
Walk independently on a level but needs support on stairs	2
Capable of fast walking but clumsily	3
Normal	4
B. Sensory function	
I. Lower extremity	
Apparent sensory loss	0
Minimal sensory loss	1
Normal	2
II. Trunk	
Apparent sensory loss	0
Minimal sensory loss	1
Normal	2
C. Bladder function	
Urinary retention and/or incontinence	0
Sense of retention and/or dribbling and/or thin stream	1
Urinary retardation and/or pollakiuria	2
Normal	3

Total for normal patients = 11

Recovery rate (%) = $\frac{\text{postoperative score} - \text{preoperative score}}{11 - \text{preoperative score}} \times 100$

rate was determined from the postoperative changes in the JOA scores, and the final result was classified as excellent for JOA scores of 75–100%, good for scores of 50–74%, fair for scores of 25–49%, unchanged for scores of 0–14%, and worse for scores of less than 0%. The relationships between the recovery rate and the patient's age at the time of surgery, the preoperative severity of the myelopathy, the duration of illness, the degree of spinal cord compression due to disc herniation, and other factors were assessed statistically by the Mann-Whitney's U-test and was considered significant when $p < 0.05$. The severity of motor disturbance in the lower extremities was used to assess the preoperative severity of myelopathy and the degree of spinal block seen in a myelogram was used to assess the degree of spinal cord compression. In addition, postoperative complications were investigated, and bone union was assessed radiologically.

Indications

Indications for the surgical technique under review were determined according to the severity of the thoracic myelopathy, particularly with respect to lower-

extremity motor and bladder dysfunction. When lower-extremity motor function or bladder function was scored as 2 or less, the condition was regarded as an absolute indication for surgery. The preoperative JOA scores for thoracic disc herniation in the 33 patients ranged from 0 to 7 (mean 4.4)

Surgical procedure for anterior decompression and fusion

One or two ribs superior to the interspace to be invaded were resected at the vertebral bodies, and the interspace was entered anteriorly, by an extrapleural approach. When the thoracic vertebral body was exposed anteriorly, the costal head was resected. While preserving the posterior longitudinal ligament, as much herniated disc as possible was removed. If, however, the posterior longitudinal ligament was ruptured, it was resected and the prolapsing disc tissue was removed. Upon completion of anterior decompression, anterior fusion was performed, utilizing the iliac bone or rib

Fig 1 Anterior decompression and fusion for thoracic disc herniation. A 43-year-old man had thoracic myelopathy resulting from disc herniation of T11–12. Anterior decompression and fusion of T11–12 was performed through the extrapleural approach. a: Preoperative lateral myelogram showing incomplete spinal block due to disc herniation of T11–12. b: Preoperative computed tomography (CT) scan showing anterior compression of the spinal cord. c: Postoperative lateral myelogram showing the anterior decompression of the spinal cord. d: Postoperative CT scan showing anterior decompression and fusion.

(Fig 1). The number of anteriorly decompressed interspaces in this series was 1 for 30 patients and 2 for 3 patients. The required time for surgery ranged from 2 hours and 24 min to 3 hours and 50 min (mean 2 hours and 48 min). Intraoperative blood loss was 119–642 g (mean 382 g).

Postoperative care

After the operation, patients were confined to their beds in a supine position. Three weeks after the operation, each patient was fitted with a plastic spinal orthosis and was permitted to leave the bed. The patients wore the orthoses for 12 to 16 weeks.

Results

The upper-level limit of anterior decompression and fusion *via* the extrapleural approach was the T4–5 level. The JOA scores were 4.4 ± 2.2 (mean $\pm$ S.D.) before surgery, 7.9 ± 2.3 at 3 months, 8.8 ± 1.9 at 1 year after surgery, and 8.7 ± 2.0 at the end of the follow-up period. The recovery rate was $53.1 \pm 20.9\%$ at 3 months, $68.2 \pm 18.3\%$ 1 year after surgery, and $66.7 \pm 19.7\%$ at the end of the follow-up period. The recovery rate was stable 1 year after surgery (Fig 2). The final result at the end of the follow-up period was excellent for 13 patients, good for 16, and fair for 4. None of the patients had a final result of unchanged or worse.

The recovery rate by factor was determined at the end of the follow-up period. The recovery rate by age was $71.3 \pm 21.3\%$ for patients aged 59 years and under ($n = 26$) and $46.8 \pm 17.6\%$ for patients 60 and over ($n = 7$); the recovery rate by preoperative severity of the disease was $70.4 \pm 22.2\%$ for patients with a lower-extremity motor function score of 1–2 points ($n = 25$)

and $52.3 \pm 19.4\%$ for patients with a score of 0 point ($n = 8$); the recovery rate by duration of illness was $69.3 \pm 24.8\%$ for patients who had been ill for less than 1 year ($n = 27$) and $51.6 \pm 18.7\%$ for patients who had been ill for more than 1 year ($n = 6$). There was a significant difference in the recovery rates between groups of patients divided by any of the above 3 factors ($p < 0.05$). By contrast the recovery rate was not related to the degree of spinal cord compression; there was no significant difference between the patients with incomplete spinal block, $71.2 \pm 22.5\%$ ($n = 24$), and patients with complete spinal block, $60.3 \pm 24.6\%$ ($n = 9$) (Fig 3).

Two patients suffered a transient respiratory disturbance due to hemothorax as a postoperative complication, but aggravation of thoracic myelopathy or leakage of cerebrospinal fluid was not observed. Radiological examination revealed good bone union in all the patients.

Discussion

The involvement of dynamic factors in thoracic myelopathy is limited because of anatomical thoracic vertebral stability provided by the thorax. In addition, the thoracic spinal canal is narrow and the blood supply to the thoracic cord is minimal.¹³ Once myelopathy develops in the thoracic spinal cord the combination of anatomical vertebral stability and physiological weak points in the thoracic spinal cord means that rapid progression and serious aggravation are likely outcomes. Thoracic myelopathy due to disc herniation holds little promise of recovery by conservative treatment when spinal cord compression, as a static factor, is involved to a greater extent than any dynamic factor and early surgical intervention is indicated.

Fig 2 Changes in Japanese Orthopaedic Association (JOA) scores and recovery rates. Postoperative JOA scores had increased significantly at each follow-up assessment compared with the preoperative JOA scores ($p < 0.01$). Significantly better JOA scores and recovery rates were obtained 1 year or more after surgery compared to the scores 3 months after the operation ($p < 0.01$). The JOA scores and recovery rates were not significantly different at the end of the follow-up period compared to the scores and rates 1 year after the operation. The final follow-up assessment was performed at an average of 3 years and 5 months after the operation.

Fig 3 Relationships between recovery rates and various patient factors. Patients who were over 60 years of age, who were unable to walk or who had had myelopathy for over 1 year had significantly lower recovery rates at the final follow-up assessment ($p < 0.05$); however, the degree of spinal cord compression (assessed by a preoperative myelogram) did not have a significant influence on the final results.

The aim of surgical intervention in thoracic disc herniation is complete decompression of the spinal cord and removal of the herniated disc without damage to the spinal cord. Anterior decompression for thoracic disc herniation is the ideal surgical outcome; however a variety of surgical techniques have been tried because of the technical difficulty of this procedure. In the surgical treatment of thoracic disc herniation laminectomy by a posterior approach,¹⁻³ transpedicectomy by a posterolateral approach,^{8,9} costotransversectomy by a lateral approach⁵⁻⁷ and thoracotomy by an anterior approach^{4,10-12} have been reported. The results obtained by using these techniques and their usefulness have been reported, but they are not yet established techniques. The transthoracic approach can be extrapleural or transpleural. We have used the extrapleural approach for ease of postoperative management.¹² Our intent in this study was to assess the clinical usefulness of anterior decompression and fusion *via* the extrapleural approach and to identify its problems. Our analysis of the clinical outcomes of 33 patients shows that both the clinical and radiological evaluations were favorable, without serious postoperative complications. This surgical technique is ideal for localized anterior lesions, but has limitations with respect to invasion above a certain level of the spinal cord.

Factors that adversely affect the results of this procedure were found to be advanced age of patients at the time of surgery, preoperative severity of the disease, and long duration of illness. To achieve a high rate of success by this technique, early intervention seems to be essential.

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