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Clinical Study

Posterior decompression with transforaminal interbody fusion for thoracic myelopathy due to ossification of the posterior longitudinal ligament and the ligamentum flavum at the same level

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ABSTRACT

Our objective was to evaluate the clinical efficacy and feasibility of posterior decompression with transforaminal thoracic interbody fusion (PTTIF) for thoracic myelopathy caused by ossification of the ligamentum flavum (OLF) and ossification of the posterior longitudinal ligament (OPLL) at the same level. Between March 2004 and December 2008, 13 patients (five men and eight women, average age: 56 years, range: 39–72 years) who underwent PTTIF for concurrent OLF and OPLL were studied retrospectively. The clinical efficacy, operative time, blood loss, sagittal alignment and complications were investigated. Cerebrospinal fluid leakage occurred in three patients, all of whom healed well after repair. One patient developed a urinary tract infection and one developed a wound infection, but both were cured with appropriate antibiotic therapy. Neurological symptom deterioration occurred in one patient, but she returned to her preoperative baseline after completing methylprednisolone therapy. After an average 36.8 months follow up, the mean Japanese Orthopaedic Association (JOA) score significantly increased from 4.3 ± 1.3 preoperatively to 7.2 ± 1.8 at 3 months after the operation and 8.5 ± 1.7 at the final follow-up ($P < 0.01$), with an overall recovery rate of 63.2 ± 21.8%. Postoperative imaging demonstrated an improvement in the local kyphosis ($P < 0.01$), and as of the final follow up no cases of spinal instability or instrument loosening had occurred. We conclude that PTTIF provides satisfactory neurological recovery and stabilises the thoracic fusion through a single posterior approach. However, this procedure is not complication free and demands advanced technical expertise on the part of practitioners, particularly to avoid catastrophic spinal cord injuries.

1. Introduction

Thoracic myelopathy caused by ossification of the posterior longitudinal ligament (OPLL) and ossification of the ligamentum flavum (OLF) at the same level constitutes a surgical dilemma because the ossified tissue compresses the thoracic cord simultaneously, anteriorly and posteriorly.

Surgical intervention for combined thoracic OPLL and OLF has generally been accepted to result in minimal neurological improvement,[1–3] and be accompanied by high risk, including the real possibility of postoperative paraplegia. Until now, many surgeons have performed a variety of surgical procedures to treat this disease.[4–8] Unfortunately, no consistent procedure for the surgical treatment of combined thoracic OPLL and OLF has yet been established.

In the present study, we present posterior decompression with transforaminal thoracic interbody fusion (PTTIF) as an approach to address this troublesome condition. The efficacy and safety of the procedure is evaluated, with a special focus on any complications that occurred over the course of treatment.

2. Materials and methods

2.1. Patient population

A total of 13 patients (five men and eight women) with thoracic myelopathy secondary to OPLL and OLF were studied retrospectively from March 2004 to December 2008, and the patients were followed for 36.8 months (range: 28 to 47 months). The average age was 56 years (range: 39 to 72 years), and the mean body mass index (BMI) was 27.7 ± 3.5 kg/m.^{2} Patients with a space-occupying lesion, ankylosing spondylitis, tandem OPLL or cervical/lumbar myelopathy were excluded from the study.

Seven patients presented with progressive symptoms for a mean of 16 months before admission to our Institute. All patients

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had gait disturbance and lower limb numbness in various degrees. Five patients could stand with assistance but were unable to walk. Three patients had sphincter dysfunction. One patient who could walk with a crutch acutely presented with complete paraplegia and paresthesia of the lower limbs after a minor slip-and-fall injury (Patient 3). Back pain was not a feature in any of the patients, but zonesthesia of the chest and abdomen was obvious in four patients.

2.2. Surgical technique

Under general anaesthesia, the patient was placed on the operating table in the prone position with the abdomen suspended in midair to decrease blood loss during the operation. After the dorsal tissues were dissected, the laminae were resected entirely with the aid of a high-speed burr and a small-angled Kerrison rongeur. All of the facet joints, parts of the pedicle if necessary, and the pars interarticularis were removed bilaterally to free up space between the lateral side of the dural sac and the pedicles to allow for the manipulation of the OPLL via the posterior approach. With the help of a narrow osteotome, inverse curette and nucleus pulposus clamp, the posterior portions of the vertebral bodies were excavated to lower the ossified ligament into the vertebral body or intervertebral space, and then the OPLL was detached from the dura using a nerve dissector and extracted safely from the cavity. Finally, posterior instrumentation was implanted and a bone graft combined with a titanium cage was inserted into the intervertebral space to obtain firm interfusion and kyphosis correction (Fig. 4).

2.3. Radiological evaluation

Evaluation of the procedure included plain radiographs, CT scans and MRI studies. Typical ossified tissues were observed around the foramen of the nerve root canal on lateral X-ray films (Fig. 1). MRI and CT scans revealed the spinal cord to be compressed by the OPLL anteriorly and by the OLF posteriorly (Figs. 2 and 3). Based on the OPLL segment, lesions were at T5/6 in three patients, T10/11 in three patients, T4/5 in two patients, and T11/12 in two patients, whereas three each were at T6/7, T8/9, and T9/10.

The efficacy of the spinal cord decompression and kyphosis correction based on postoperative imaging was assessed by two independent radiologists blinded to the surgical outcomes. Local kyphosis at the surgically stabilised area was determined using the Cobb angle method.

2.4. Neurological assessment

The dysfunction resulting from myelopathy was assessed using a modified Japanese Orthopaedic Association (JOA) scoring system (11 points for a full score, which excludes upper extremity function; Table 1).[9,10] The recovery rate after treatment was calculated using the Hirabayashi method: ([postoperative JOA score – preoperative JOA score]/[11 – preoperative JOA score] × 100%).[11]

2.5. Statistical analysis

The analysis was performed using Statistical Package for the Social Sciences for Windows, version 13.0 (SPSS Inc., Chicago, IL, USA). Repeat analysis of variance tests were used to assess the statistical significance of any change in parameters between the preoperative and postoperative states. A P value of less than 0.05 was considered to be statistically significant.

Fig. 1. Preoperative lateral radiograph showing the ossified tissues in "beak-like" formation around the foramen of the nerve root canal at the T5–6 segment (Patient 12).

Fig. 2. Preoperative MRI showing ossification of the ligamentum flavum (OLF) at the T3–4, T5–7 and T8–9 levels. The most seriously affected segment was T5–7, where the spinal cord was pinched by concurrent OLF and ossification of the posterior longitudinal ligament.