ELSEVIER

The Spine Journal 7 (2007) 273–279

THE SPINE JOURNAL

Adjacent segment disease following expansive lumbar laminoplasty

Yoshiharu Kawaguchi, MD*, Hirokazu Ishihara, MD, Masahiko Kanamori, MD, Taketoshi Yasuda, MD, Yumiko Abe, MD, Shigeharu Nogami, MD, Shoji Seki, MD, Takeshi Hori, MD, Tomoatsu Kimura, MD

Department of Orthopaedic Surgery, Faculty of Medicine, University of Toyama, Toyama, Japan

Received 4 October 2005; accepted 7 April 2006

Abstract

BACKGROUND CONTEXT: We developed the technique of expansive lumbar laminoplasty in 1981. In the procedure of laminoplasty, the spinal canal is decompressed by rotatory elevation of the laminae, and bone grafts from the spinous process and posterior iliac bone are placed on the surface of the operated laminae. Therefore, adjacent segment disease due to mechanical stress could be anticipated in the long-term follow-up.

PURPOSE: To investigate the incidence of symptomatic adjacent segment disease after expansive lumbar laminoplasty, to identify the factors which are related to the development of this disease, and to discuss the treatment of this postoperative problem.

STUDY DESIGN/SETTING: This is a retrospective cohort study.

PATIENT SAMPLE: Seventy-one patients (53 men and 18 women with a mean age of 55.7 years) underwent expansive lumbar laminoplasty for the treatment of spinal stenosis. The average length of follow-up was 5.4 years with a range of 2 to 13 years.

OUTCOME MEASURES: Follow-up evaluation was primarily by means of clinical visits.

METHODS: The incidence of adjacent segment disease which resulted in the deterioration of Japanese Orthopaedic Association score was analyzed. The diagnosis of symptomatic adjacent segment disease was based on both newly developed clinical symptoms and radiological lesions at the disc levels adjacent to the lumbar laminoplasty. We evaluated the correlation between the incidence of symptomatic adjacent segment disease and the clinical parameters and radiological parameters.

RESULTS: Eight patients (11%) showed deterioration in the lesions at the segment adjacent to laminoplasty. The disease-free survival rates by Kaplan-Meier survival analysis were 95.7% at 5 years, 63.1% at 10 years, and 42.1% at 13 years. The incidence of spondylolisthesis in the disease group was higher than that in the disease-free group. The preoperative range of motion of L1–L5 in the disease group was significantly higher than that in the disease-free group. In five patients in whom conservative treatment failed for adjacent segment disease, reoperations were performed and they were effective.

CONCLUSIONS: It should be taken into account that adjacent segment disease occurs after expansive lumbar laminoplasty. Spondylolisthesis might be a risk factor for the disease. Although reoperation was effective, it is necessary to consider the patient's age and physical condition before choosing further surgical therapy.

Keywords: Lumbar laminoplasty; Lumbar spinal stenosis; Adjacent segment disease

Introduction

Expansive lumbar laminoplasty has been reported to be effective in the treatment of patients with spinal stenosis [1–3]. We have used this operative method in patients who are physically active with combined lumbar stenosis, including degenerative stenosis, spinal stenosis with multiple ossification of intraspinal ligaments or herniated nucleus pulposus, spondylolisthesis, and degenerative

FDA device/drug status: not applicable.

Nothing of value received from a commercial entity related to this research.

* Corresponding author. Department of Orthopaedic Surgery, Faculty of Medicine, University of Toyama, 2630 Sugitani, Toyama 930-0194, Japan. Tel.: +81-76-434-7353; fax: +81-76-434-5035.

E-mail address: zenji@ms.toyama-mpu.ac.jp (Y. Kawaguchi)

1529-9430/07/$ – see front matter
doi:10.1016/j.spinee.2006.04.003

stenosis accompanied by segmental instability. The best indications for lumbar laminoplasty are young and active patients with central spinal stenosis [1]. In the procedure of laminoplasty, the spinal canal is decompressed by rotatory elevation of the laminae and placement of bone grafts from the spinous process and posterior iliac bone on the surface of the operated laminae [4,5]. As a result of the bone grafts, over 40% of the patients show interlaminar fusion in the follow-up study. Even in the patients who did not achieve laminar fusion, the range of motion of the operated area was reduced to over 50% of the preoperative range [1]. Therefore, adjacent segment disease due to mechanical stress was anticipated in the long-term follow-up. In fact, we encountered several patients who had adjacent segment disease after lumbar laminoplasty. The purpose of the present study was to analyze the incidence of symptomatic adjacent segment disease after expansive lumbar laminoplasty, to identify the factors related to the development of this disease, and to discuss the treatment of this postoperative problem.

Materials and methods

Patients

Eighty patients underwent expansive lumbar laminoplasty between 1981 and 2002 at our university hospital. This operation was carried out in 71 patients for the treatment of lumbar spinal stenosis. All patients with a follow-up of more than 2 years were included in this study. Final follow-up was made by physical examination in 65 patients. Six patients who could not come to our hospital were checked via a telephone interview. There were 53 males and 18 females with an average age of 55.7 years at the time of operation (range: 33–82 years). Clinical diagnosis was made by physical examination, plain radiography, computed tomography (CT), myelography, and magnetic resonance imaging (MRI). All patients presented with lumbar spinal stenosis characterized by cauda equina claudication, leg pain, or numbness caused by multilevel spinal stenosis. Three patients with cauda equina tumor were excluded. Four patients having previous lumbar surgeries and two patients who had lesions in the cervical and thoracic spine were also excluded from this study. The local pathological findings included 36 patients with degenerative stenosis, 14 with combined stenosis, and 8 with hyperostotic stenosis such as ossification of the posterior longitudinal ligament and ossification of ligamentum flavum. Combined stenosis was defined as the coexistence of disc herniation which required the removal of herniation with spinal stenosis. Fifteen patients had spondylolisthesis. Two patients with hyperostotic stenosis had spondylolisthesis. Degenerative scoliosis (Cobb angle $>10^{\circ}$) was observed in 17 patients. The average length of follow-up was 5.4 years with a range of 2 to 13 years.

Operative procedure

Expansive lumbar laminoplasty, as proposed by Tsuji [4], was used for the decompression of the spinal nerve in all patients (Fig. 1). The detailed surgical technique and postoperative management were previously described [1,5]. Laminae expansion was performed in an average of 3.1 ± 0.7 laminae (2–5 laminae). Nine patients were operated on 2-laminae levels, 47 patients were on 3-laminae levels, 12 were on 4-laminae levels, and 3 were on 5-laminae levels.

Clinical and radiological analysis

The neurological evaluation was graded using the scale devised by the Japanese Orthopaedic Association (JOA score) (Table 1) [6]. The rate of recovery, which indicates the degree of normalization after surgery, was calculated using the following formula:

$$(\text{postop score} - \text{preop score}) \times 100/\{29(\text{full score}) - \text{preop score}\}$$

In the patients who showed neurological deterioration during follow-up, the cause of deterioration was evaluated.

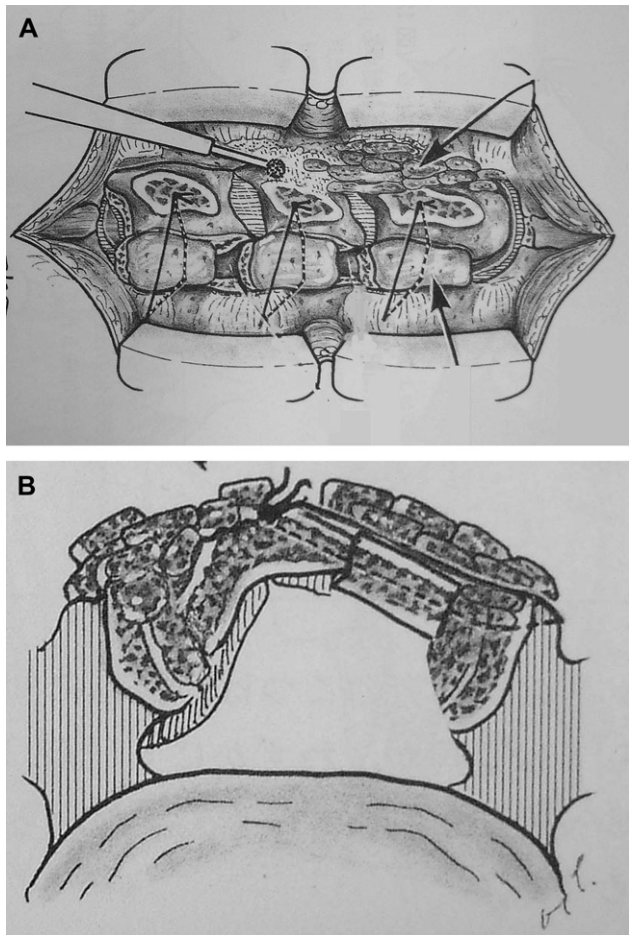

Fig. 1. (A, B) Schematic representation of the procedure of expansive lumbar laminoplasty. Reprinted with permission (Nankodo Co., Ltd., Tokyo).