

Clinical Study

# Surgical outcome and prognostic factors of anterior decompression and fusion for cervical compressive myelopathy due to ossification of the posterior longitudinal ligament

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## Abstract

**BACKGROUND CONTEXT:** Anterior decompression and fusion (ADF) for ossification of the posterior longitudinal ligament (OPLL) is technically demanding and associated with complications. Although various factors affecting clinical outcome have been investigated in posterior decompression, prognostic factors of ADF remain unclear.

**PURPOSE:** The purpose of the study was to identify surgical outcome and prognostic factors of ADF for cervical myelopathy due to OPLL.

**STUDY DESIGN:** This was a retrospective case study.

**PATIENT SAMPLE:** Between 2005 and 2012, 913 patients underwent decompression surgery for cervical OPLL at our institution. Among them, 131 who underwent ADF and 221 who underwent laminoplasty were enrolled. Inclusion criteria were (1) diagnosis of OPLL; (2) cervical compressive myelopathy; and (3) no trauma, infection, tumor, or previous surgery. We excluded 60 patients with ADF and 157 patients with laminoplasty owing to inadequate follow-up or absence of preoperative myelopathy. Finally, 71 patients with ADF and 64 patients with laminoplasty were enrolled in this study (mean follow-up, 48 vs 41 months).

**OUTCOME MEASURES:** Neurologic assessment was conducted using the Japanese Orthopedic Association (JOA) scoring system for cervical myelopathy. Rate of neurologic improvement was calculated by comparing preoperative and postoperative JOA scores.

**METHODS:** We investigated the effects of such variables as age, gender, body mass index (BMI), presence of diabetes mellitus (DM), smoking history, type of OPLL, shape of the ossified lesion, occupying ratio of OPLL, presence of intramedullary increased signal intensity (ISI) on magnetic resonance imaging (MRI), and sagittal alignment of the cervical spine on surgical outcome. Severity of ISI was classified into three groups based on T2-weighted sagittal MRI as follows: Grade 0, none; Grade 1, ISI limited to one disc level; or Grade 2, ISI beyond one disc level. This work was supported by the 2013 Korea Health Technology R&D Project of the Ministry of Health and Welfare of the Republic of Korea (A120254).

**RESULTS:** In patients with an occupying ratio  $\geq 60\%$  or with presence of ISI on MRI, ADF yielded better surgical outcome than laminoplasty. A higher ISI grade ( $B = -28.5$ ,  $p = .000$ ) and a higher occupying ratio ( $B = 0.88$ ,  $p = .04$ ) were significantly associated with a lower recovery rate ( $R = 0.56$ ,  $p = .006$ ). Older age also was associated with a lower recovery rate. Gender, BMI,

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presence of DM, smoking history, type of OPLL, shape of the ossified lesion, and cervical alignment were not associated with recovery rate.

**CONCLUSION:** Anterior decompression and fusion has favorable outcome in patients with an occupying ratio  $\geq 60\%$  or with presence of ISI on MRI. Presence of higher ISI grade, higher occupying ratio, and older age were associated with a poor long-term surgical prognosis. Therefore, evaluating ISI and occupying ratio on preoperative MRI is important for selecting the appropriate surgical approach and for predicting clinical outcome after surgery for cervical compressive myelopathy due to OPLL. © 2015 Elsevier Inc. All rights reserved.

**Keywords:**

Cervical ossification of the posterior longitudinal ligament; Prognostic factors; Anterior decompression and fusion; Laminoplasty; Compressive myelopathy; Magnetic resonance imaging

## Introduction

Ossification of the posterior longitudinal ligament (OPLL) has been recognized as an important clinical entity that causes compressive myelopathy of the cervical spine. Although the clinical features of cervical OPLL are similar to those of cervical spondylotic myelopathy or cervical disc herniation, it has unique characteristics. For example, cervical OPLL usually involves multiple levels. In addition, it occasionally progresses after surgery because complete removal of the ossified lesion through a direct anterior approach can be difficult [1]. Despite the clinical importance of OPLL, studies focusing on this disease entity are rare. Furthermore, most previous studies have regarded cervical compressive myelopathy due to OPLL to be the same as various other degenerative cervical diseases. It is important to investigate the unique characteristics of OPLL in its clinical course in patients with compressive myelopathy [2,3].

The mainstay treatment of cervical OPLL is surgical decompression. Several reports on surgical management have been reported, with options including a posterior, an anterior, or a combined anterior-posterior approach. Some controversy exists over the appropriate surgical technique, however. A posterior approach is relatively simple and has a low complication rate. However, such an approach has a risk of OPLL progression and limited effectiveness in cases with severe kyphotic deformity and/or large OPLL. The advantages of an anterior approach are that excision of OPLL enables complete decompression of the spinal cord, and that spinal fusion can maintain suitable alignment of the cervical spine. Some authors have shown the benefit of anterior decompression in cases with a high occupying ratio of OPLL [4]. However, such approach has a high complication rate and limitation in cases with long-segment OPLL or OPLL involving the C2. In general, anterior corpectomy and fusion is technically difficult and associated with a high incidence of surgery-related complications.

Although most studies have shown anterior decompression and fusion (ADF) to be effective, poor results are frequently reported, indicating that various clinical factors may be related to or could affect the operative outcome. These factors also influence the surgeon's decision regarding treatment of cervical OPLL. Recently, various factors affecting clinical outcome have been investigated in posterior decompression, but there are few studies regarding

prognostic factors in ADF. [3,4,5]. Moreover, the results of these studies have been inconclusive and even conflicting. It is critical to understand the significance of such prognostic factors and to determine their relationship to surgical outcomes of cervical OPLL.

The goals of this study were to identify neurologic outcomes of ADF and to investigate prognostic factors of ADF for cervical myelopathy due to OPLL.

## Methods

### *Patient population*

Between 2005 and 2012, 913 patients underwent decompression surgery for cervical OPLL at our hospital. The authors selected two patient groups based on surgical procedure: ADF or laminoplasty. The ADF group comprised patients who had undergone anterior cervical corpectomy and fusion for direct removal of OPLL. The laminoplasty group comprised patients who had undergone posterior open-door laminoplasty for decompression. Initially, 131 ADF patients and 221 laminoplasty patients were selected; 105 patients in the ADF group had cervical myelopathy and 154 patients in the laminoplasty group with cervical myelopathy. The inclusion criteria were (1) diagnosis of OPLL; (2) cervical compressive myelopathy; and (3) no trauma, infection, tumor, or previous surgery. Patients in both groups underwent the first surgical procedure at various spinal levels at our hospital. Twenty-six patients in the ADF group were excluded for the following reasons: neck pain, radiculopathy, or nonspecific symptoms without myelopathy. Sixty-seven patients in the laminoplasty group were excluded for similar reasons. Thirty-four additional patients in the ADF group could not be followed because of unavailability of contact information, disagreement of patients, newly developed neurologic comorbidity, or death. In particular, the neurologic status of two patients could not be clearly evaluated because of associated comorbidity, such as cerebrovascular disease (Fig. 1). Finally, 71 patients were followed in the ADF group (mean follow-up, 48 months). Ninety additional patients in the laminoplasty group could not be followed for similar reasons. Finally, 64 patients were followed in the laminoplasty group (mean follow-up, 41 months).

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