

Clinical Study

Risk factors associated with upper extremity palsy after expansive open-door laminoplasty for cervical myelopathy

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Received 13 June 2012; revised 1 April 2013; accepted 13 July 2013

Abstract

BACKGROUND CONTEXT: Postoperative paresis, so-called C5 palsy, of the upper extremities is a common complication of cervical surgery. There have been several reports about upper extremity palsy after cervical laminoplasty for patients with cervical myelopathy. However, the possible risk factors remain unclear.

PURPOSE: To investigate the factors associated with the development of upper extremity palsy after expansive open-door laminoplasty for cervical myelopathy.

STUDY DESIGN: A retrospective review of medical records.

PATIENT SAMPLE: A total of 102 patients (76 men and 26 women) were eligible for analysis in this study. The mean age of the patients was 58.7 years (range 35–81 years). Sixteen patients (13 men and 3 women, average age 62.8 years) with palsy were categorized as Group P, and eighty-six patients (63 men and 23 women, average age 57.8 years) without palsy as Group C.

OUTCOME MEASURES: The demographic data collected from both groups were age, sex, duration of symptoms, disease, and type of surgical procedure. Cervical curvature index, width of the intervertebral foramen (WIF) at C5, anterior protrusion of the superior articular process (APSAP), number of compressed segments, high-signal intensity zone at the level corresponding to C3–C5 (HIZ:C3–C5), and posterior shift of the spinal cord (PSSC) were also evaluated.

METHODS: Upper extremity palsy was defined as weakness of Grade 4 or less of the key muscles in the upper extremity by manual muscle test without any deterioration of myelopathic symptoms after surgery. Comparisons were made with screen for the parameters with significant differences, and then we further analyzed these parameters by logistic regression analysis (the forward method) to verify the risk factors of the upper extremity palsy.

RESULTS: Significant differences in diagnosis, the type of procedure, WIF, APSAP, and HIZ:C3–C5 were observed between the two groups. No statistical difference in PSSC between the groups was noted (2.06 vs. 2.53 mm, $p=.247$). In logistic regression analysis, ossification of the posterior longitudinal ligament (OPLL), cervical open-door laminoplasty together with posterior instrumented fusion (CLP+PIF), and WIF were found to be significant risk factors for postoperative upper extremity palsy.

CONCLUSIONS: Patients with preoperative foraminal stenosis, OPLL, and additional iatrogenic foraminal stenosis because of CLP+PIF were more likely to develop postoperative upper extremity palsy. Attention should be given to the WIF determined on preoperative computed tomography of the C5 root. To prevent iatrogenic foraminal stenosis, appropriate distraction between spine segments should be provided during placement of the rod. © 2014 Elsevier Inc. All rights reserved.

Keywords:

Cervical myelopathy; Ossification of the posterior longitudinal ligament; Open-door laminoplasty; Postoperative complication; Upper extremity palsy

FDA device/drug status: Not applicable.

Author disclosures: **FLW:** Nothing to disclose. **YS:** Nothing to disclose. **SFP:** Nothing to disclose. **LZ:** Nothing to disclose. **ZJL:** Nothing to disclose.

No funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of the manuscript.

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EVIDENCE & METHODS

Context

C5 palsy following laminoplasty is a well-documented phenomenon. The authors aimed to identify risk factors.

Contribution

In this report of 102 patients undergoing laminoplasty, 16 had C5 palsies. Risk factors identified were preoperative foraminal stenosis at C5, the presence of OPLL, and iatrogenic stenosis.

Implications

The findings might be helpful for the informed consent of patients and for surgical planning, such as consideration of C5 foraminotomy and the avoidance of instrumentation in certain circumstances.

—The Editors

Introduction

Laminoplasty is a well-recognized surgical approach for multilevel cervical myelopathy and is associated with favorable clinical outcomes [1,2]. However, postoperative upper extremity palsy, especially C5 palsy, is a relatively frequent complication after laminoplasty. Two main hypotheses of the pathogenesis of upper extremity palsy after laminoplasty have been presented. One is nerve root injury caused by traction of the nerve root [3,4]. The other is segmental spinal cord disorder caused by the ischemia and/or reperfusion injury [5,6]. However, which is the primary cause is still controversial [7].

The incidence of C5 palsy has been reported to be 4.6% but varies from 0% to 30.0% in different studies [7]. Hence, it is worthwhile to determine the underlying factors related to the development of upper extremity palsy. The objective of this study was to review the clinical and radiological findings in patients after cervical laminoplasty and to determine risk factors for its occurrence.

Subjects and methods

A consecutive case series of 130 patients with cervical compressive myelopathy treated by laminoplasty at the authors' institution between 2009 and 2010 were reviewed. Exclusion criteria were weakness of Grade 3 or less of the deltoid or biceps brachii in a manual muscle test (MMT) preoperatively (4 cases); no paralysis, but sensory deficit or pain alone at the C5 dermatome postoperatively (4 cases); previous cervical surgery (13 cases); and preoperative and postoperative magnetic resonance (MR) imaging were not interpretable because of motion/metal artifacts or poor quality (7 cases). In total, 102 patients (76 men and 26 women) were eligible for analysis in this

study. The mean age of the patients was 58.7 years (range 35–81 years), and the mean follow-up period was 16.3 months (range 12–20 months).

Surgical management

All patients had multiple-level cord compression and/or spinal canal stenosis based on imaging studies and were eligible for cervical laminoplasty. All patients underwent posterior cervical open-door laminoplasty (CLP) as described by Hirabayashi et al. [8] or Tani et al. [9]. Local kyphosis was diagnosed if there was more than 5° difference between adjacent vertebrae on a cervical spine lateral radiograph [10]. Instability was defined as a horizontal displacement more than 10% of the sagittal diameter of the vertebral body in relation to an adjacent vertebra. The ratio of the slippage distance and the vertebral sagittal diameter was used in this study because of the variation of the vertebral body size in populations [11].

Indications for instrumentation were reducible cervical kyphosis (kyphosis was not fixed by bony fusion and did not need anterior corpectomy to reduce cervical kyphosis to a neutral position) [12] and instability. In 44 patients who had multilevel cervical myelopathy with straightening/kyphosis of the cervical curvature or instability, cervical open-door laminoplasty with posterior instrumented fusion (CLP+PIF) using the Magerl technique [13] was performed to correct cervical curvature and strengthen stability. All rods were contoured into lordosis. Surgeries were performed by four specialist spine surgeons (four authors) whose individual experiences were more than 100 cases in each surgical procedure.

Postoperatively, patients were routinely kept at bed rest for 2 or 3 days to protect the wound and to improve recovery. After removal of drains, patients were allowed to mobilize with a soft cervical collar, which they wore for 2 to 6 weeks depending on the severity of their neck pain.

Radiographic analysis

The involved patients underwent pre- and postoperative images with consent, and images were analyzed using a single picture archiving and communications system viewer and imaging software (Centricity; GE Medical Systems, Jiang su province, China). Anatomic measurements were performed using digital calipers in a uniform magnification of 200%.

Pre- and postoperative cervical alignments were measured using the cervical curvature index as described by Ishihara [14] (Fig. 1). Pre- and postoperative computed tomography (CT) images were used to measure the height and width of the intervertebral foramen (WIF) at C4–C5, and the anterior protrusion of the superior articular process (APSAP) of C5 was measured according to the method described by Sunago et al. [15] (Fig. 2). The images were acquired in the horizontal plane of the intervertebral disc.

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