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Clinical Study

Is cervical lordosis relevant in laminoplasty?

Seok Woo Kim, MD, PhD[a], Dinh Manh Hai, MD[a], Shanmuga Sundaram, MS[a], Yong Chan Kim, MD[a], Moon Soo Park, MD[a], Sang-Hoon Paik, MD[a], Yoon-Hae Kwak, MD[b], Tae-Hwan Kim, MD[a,*]

[a]*Spine Center, Hallym University Sacred Heart Hospital, College of Medicine, Hallym University, 896, Pyeongchon-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-070, South Korea*

[b]*Orthopedic Department, Hallym University Sacred Heart Hospital, College of Medicine, Hallym University, 896, Pyeongchon-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-070, South Korea*

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Abstract

BACKGROUND CONTEXT: Laminoplasty aims to decompress the spinal cord and stabilize the cervical spine in patients with multilevel cervical lesions. Not every patient with cervical compressive myelopathy is a good candidate for laminoplasty. Most studies recommend that neutral or kyphotic alignments are contraindications for laminoplasty. However, cervical sagittal alignment does not have a strong and consistent effect on the clinical outcomes of laminoplasty. Moreover, many reports on the effect of cervical sagittal alignment did not designate the ideal definition of alignment and used different definitions of lordosis.

PURPOSE: To identify the effect of preoperative cervical alignment according to two different definitions after midline splitting double-door laminoplasty.

STUDY DESIGN: Retrospective cohort study.

PATIENT SAMPLE: From August 2008 to September 2010, 58 patients were diagnosed with cervical myelopathy and treated with midline splitting double-door laminoplasty.

OUTCOME MEASURES: The clinical results were assessed with the modified Japanese Orthopedic Association (JOA) score, neck disability index (NDI), and visual analog scale (VAS) and were compared to analyze the rate of change between preoperative and postoperative values. Postoperative radiological results at the final follow-up examinations were compared between groups to obtain the change in range of motion and sagittal alignment.

METHOD: The effect of cervical alignment on JOA, NDI, and VAS scales and also on change of alignment and change of range of motion (ROM) at the final follow-up examinations was analyzed statistically between two groups according to two different definitions such as Toyama classification and Cobb angle.

RESULTS: No difference was found between the two groups according to Toyama classification in terms of the postoperative improvement rate of the modified JOA score ($p=.086$), decreasing rate of the VAS ($p=.940$) or NDI ($p=.211$), postoperatively. Additionally, no difference was found for the decreasing rate of ROM ($p=.427$) or sagittal alignment ($p=.864$) based on the radiological evaluation results. Also, there was no difference between two groups according to Cobb angle in terms of the modified JOA score ($p=.743$), VAS ($p=.548$), or NDI ($p=.32$), postoperatively. Additionally, no difference was found for the ROM ($p=1.000$) or sagittal alignment ($p=.440$) based on the radiological evaluation results.

CONCLUSIONS: Despite nonlordosis cervical sagittal alignment, double-door laminoplasty would be effective for patients with cervical myelopathy because of cervical spondylotic myelopathy or ossification of the posterior longitudinal ligament. Furthermore, sagittal alignment is not the

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* Corresponding author. Spine Center, Hallym University Sacred Heart Hospital, College of Medicine, Hallym University, 896, Pyeongchon-dong, Dongan-gu, Anyang-si, Gyeonggi-do 431-070, South Korea. Tel.: (82) 10-7210-0460.

E-mail address: paragon0823@gmail.com (T.-H. Kim)

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absolute and sole factor that surgeons should consider when determining the optimal treatment strategy.

Keywords: Midline splitting double-door laminoplasty; Cervical myelopathy; Sagittal alignment; Laminoplasty

Introduction

Laminoplasty aims to decompress the spinal cord and stabilize the cervical spine in patients with multilevel cervical lesions, which are caused by cervical spondylotic myelopathy (CSM), ossification of the posterior longitudinal ligament (OPLL), and multiple intervertebral disc herniations with developmental spinal canal stenosis. This surgical technique preserves the integrity of the posterior bone-ligament structure and thus maintains stability immediately after surgery [1,2]. Several laminoplasty techniques have been developed to improve the surgical outcomes and reduce complications, including axial neck pain, C5 nerve palsy, and postoperative progression of kyphosis. In long-term studies, the clinical outcomes of the several types of laminoplasty were similar, which suggests that the neurological recovery achieved in the short term lasted over 10 years [3–6].

Not every patient with cervical compressive myelopathy is a good candidate for laminoplasty, and the optimal choice of the surgical technique for CSM or OPLL is not easily made for many reasons [7–11]. Generally, the number of involved segments, alignment of the cervical spine, type of OPLL, and instability of the subaxial cervical spine are main concerns [12–15]. Among these factors, cervical alignment was considered to play an important role in the maintenance of laminoplasty results. Most studies recommend that neutral or kyphotic alignments are contraindications for laminoplasty. Because laminoplasty is a type of indirect decompression, remaining anterior compressive structures may disturb neurological recovery [16–18]. Many studies have shown that a greater posterior shift achieved by lordotic alignment is correlated with an excellent clinical outcome [9,19–22]. Some authors emphasize that the posterior shift of the cord is an important role of laminoplasty and that the factors related to posterior drift are strongly prognostic, such as preoperative cervical sagittal alignment, the space available for the spinal cord at cephalad/caudal levels for the decompression, longitudinal distance index, and decompression scope [19,20,23–25]. However, cervical sagittal alignment does not have a strong and consistent effect on the clinical outcomes of laminoplasty [9,25,26]. Moreover, many reports on the effect of cervical sagittal alignment did not designate the ideal definition of alignment [17,18,27] and used different definitions of lordosis, such as Cobb angle with different values [9,28,29], vertical line at C2 and C7 [23], and K line [30]. In addition, most laminoplasty procedures addressed in many reports on cervical alignment were unilateral open-door laminoplasty procedures, also called the Hirabayashi technique.

According to the authors' experience, in more than 200 cases of double-door laminoplasty, a certain number of patients with preoperative kyphotic alignment had acceptable or satisfactory outcomes.

The purpose of the present study was to identify the effect of preoperative cervical alignment. We compared the clinical and radiological outcomes after double-door laminoplasty according to two different definitions of cervical alignment that were the most commonly used in the other reports.

Materials and methods

From August 2008 to September 2010, 58 patients in the authors' hospital who were diagnosed with cervical myelopathy and treated with double-door laminoplasty (a method used to decompress the spinal canal by splitting the midline of the spinous process) were analyzed retrospectively. Forty men and 18 women with an average age of 57.4 years (range 32–74 years) were enrolled in the study (Table 1). The mean clinical and radiological follow-up was 18.8 months (range 3–48 months). Exclusion criteria included kyphosis of more than 15° or more than 60 percent canal involvement of the posterior longitudinal ligament based on the radiological findings. Cervical kyphosis or lordosis was measured from the lower end plate of C2 to the lower end plate of C7 (Fig. 1). Additionally, patients with rheumatoid arthritis, tumor, trauma, infection, or congenital disorders were excluded from this study.

Preoperative cervical sagittal alignment of the cervical spine was assessed on a neutral, lateral radiograph. Preoperative radiographic evaluation included static and dynamic, flexion-extension X-ray in an upright position, computed tomography, and magnetic resonance imaging (MRI). Postoperative radiographs were obtained at each follow-up visit.

A posterior incision was made along the nuchal ligament to the line of the spinous processes. The semispinalis cervicis was partially detached from the lower margin of C2 spinous process. Cervical laminae were exposed laterally to the medial aspect of the facet joints, and the interspinous ligaments were removed. The involved spinous processes were split sagittally with a Tomita saw (T-saw; Medtronics, Memphis, TN, USA). The T-saw was 0.54 mm in diameter. It cuts along the midline epidural space in a caudal-to-cranial direction. The advancing tip of the polyethylene sleeve was grasped as it appeared in the flavectomy at the other end of the decompression zone. The T-saw was