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Clinical commentary

Comparative study of perioperative complication rates of cervical laminoplasty performed by residents and teaching neurosurgeons

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ABSTRACT

Early surgical education is required for neurosurgical residents to learn many surgical procedures. However, the participation of less experienced residents may increase perioperative complication rates. Perioperative complication studies in the field of neurosurgery are being increasingly published; however, studies have not yet focused on cervical laminoplasty. The study population included 193 consecutive patients who underwent cervical laminoplasty in Tokyo Metropolitan Neurological Hospital between 2008 and 2014. Patient and surgeon background factors, as well as perioperative complication rates were retrospectively compared between resident and board-certified spine neurosurgeon groups. Deteriorated or newly developed neurological deficits and surgical site complications within 30 days of cervical laminoplasty were defined as perioperative complications. Out of 193 patients, 123 (64%) were operated on by residents as the first operator and 70 (36%) by board-certified spine neurosurgeons. No significant differences were observed in patient and surgeon factors between the two groups, except for hyperlipidemia (13 vs 17, p = 0.02). Furthermore, no significant differences were noted in perioperative complication rates between the two groups (7 [5.7%] vs 4 [5.7%], p = 1). Cervical laminoplasty performed in a standardized manner by residents who received their surgical training in our hospital did not increase perioperative complication rates, and ensured the safety of patients.

1. Introduction

Early surgical education is required for neurosurgical residents to learn many surgical procedures. However, the participation of less experienced residents may increase perioperative complication rates, and it currently remains unclear whether the safety of patients is ensured [1]. Comparative analyses of the perioperative complication rates of spinal surgery performed by residents and teaching neurosurgeons are being increasingly reported. These studies have mainly focused on the complication rates of laminectomy with or without spinal fixation [3–6,9–11]. Cervical laminoplasty is an alternative procedure to laminectomy for cervical spondylotic myelopathy [2,7,12]; however, the complication rates of laminoplasty with the participation of residents have not yet been reported. Therefore, the purposes of the present study were to describe the surgical education system in our hospital and compare the perioperative complication rates of laminoplasty performed by residents and teaching neurosurgeons.

2. Methods

This study protocol was approved by the Institutional Review Board at the Tokyo Metropolitan Neurological Hospital. Since this was a retrospective and non-invasive study, written patient informed consent was not obtained. A public notice that provided information on this study was instead given on the Tokyo Metropolitan Neurological Hospital website.

2.1. Patient population

The study population included 193 consecutive patients who underwent cervical laminoplasty at Tokyo Metropolitan Neurological Hospital between 2008 and 2014. Medical records were retrospectively reviewed by M.N. and all records were independently reviewed a second time by K.T. for accuracy. A resident was defined as a trainee in the Japanese Society of Neurosurgery, and a board-certified spine neurosurgeon was defined as an experienced neurosurgeon certified by the Neurospinal Society of Japan. During the study period, 20 residents (4–7 years of training) and 5 board-certified spine neurosurgeons (10–28 years of experience) were involved in this study.

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2.2. Resident training and surgical procedure

In the surgical education of cervical laminoplasty, residents were assigned to study the anatomy of the cervical spine and posterior cervical muscles (Fig. 1) as well as surgical procedures for laminoplasty by using previous surgical videos of other patients (Fig. 2). Prior to becoming the first operator, residents were assigned to obtain experience of at least 3 surgeries as an assistant. After every surgery, the residents were assigned to edit the operative video in order to review the surgical procedures. Edited videos were saved in the computer every time and used as instructions. Residents performed cervical laminoplasty under supervision by the board-certified spine neurosurgeon.

Modified Kurokawa's double door laminoplasty or modified Hirabayashi's open door laminoplasty was performed under an operative microscope. The procedure for double door laminoplasty was performed in a standardized manner (Fig. 2). The cervical spinous processes and laminae were recognized by identifying the attachments of the cervical muscles: the trapezius, splenius capitis muscles, the semispinalis cervicis muscles, and the multifidus muscles. Spinous processes were split in the midline and bilateral hinges were made by creating gutters through the outer cortical bone of the lamina-facet borders. The spinal laminae were opened bilaterally, and hydroxyapatite spacers were fixed by threads. The trapezius and splenius capitis muscles were sutured in the midline, while the semispinalis cervicis muscles were left intact. In modified Hirabayashi's open door laminoplasty, a unilateral hinge was made. The spinal laminae were opened unilaterally and fixed by titanium plates.

2.3. Statistical analysis

Patient and surgeon background factors as well as complication rates were compared between resident and board-certified spine neurosurgeon surgery groups. The number of laminae treated, operative time, operative blood loss, and the postoperative dependent status were analyzed as surgeon background factors. Perioperative complications were defined as neurological (deteriorated or new neurological deficits) and surgical site complications within 30 days of cervical laminoplasty. Paresthesia without paralysis was excluded in neurological deficits. The chi-squared test (or Fisher's exact test if there were less than ten variables) was used for categorical variables, and the *t*-test was used for continuous variables. P values <0.05 were considered to be significant. Easy R (version 3.2.2; http://www.jichi.ac.jp/saitama-sct/SaitamaHP.files/statmed.html) was used for statistical analyses.

3. Results

3.1. Patient and surgeon factors

A total of 193 patients who underwent cervical laminoplasty were identified, 123 (64%) of whom were operated on by residents and 70 (36%) by board-certified spine neurosurgeons as the first operator. No significant differences were observed in patient and surgeon factors between the two groups, except for hyperlipidemia (13 vs 17, respectively; p = 0.02, Tables 1 and 2). Furthermore, no significant differences were noted in surgical difficulty in terms of the number of laminae treated because the mean number of laminae treated were 3.4 spinal levels in the resident group and 3.6 in the board-certified spine neurosurgeon group (p = 0.23).

3.2. Surgical outcomes

No significant differences were observed in perioperative complication rates between the two groups (7 [5.7%] vs 4 [5.7%], p = 1,

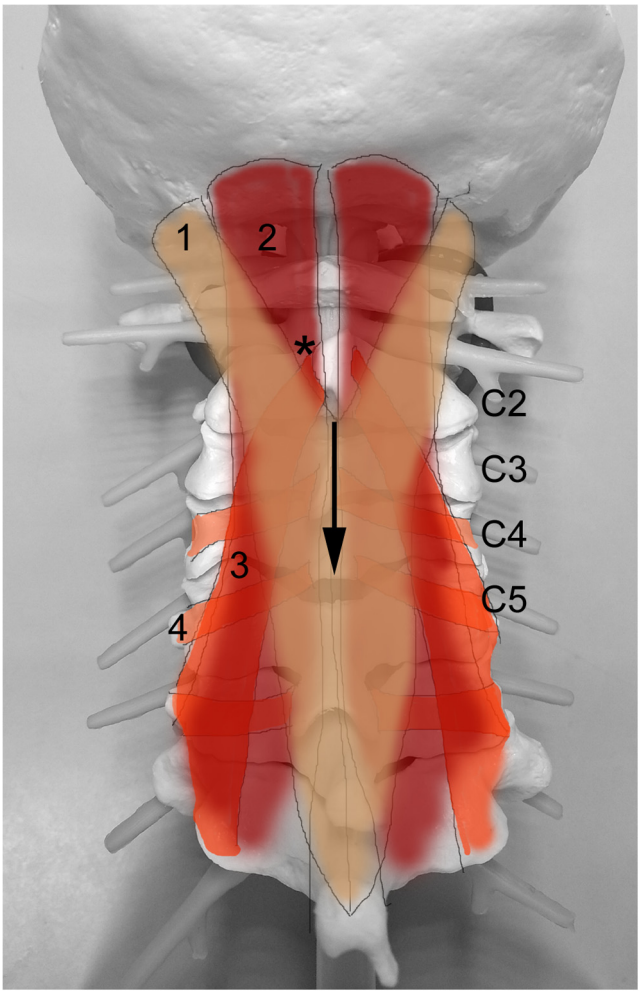

Fig. 1. Illustration showing the anatomy of the cervical spine and posterior cervical muscle layers: 1 the splenius capitis muscle; 2 the semispinalis capitis muscle; 3 the semispinalis cervicis muscle; and 4 the multifidus muscle. The midline is recognized by identifying the border between two longitudinal axis of semispinalis capitis muscles at the C2 level (asterisk), then the splenius capitis muscles are incised caudally in the midline (arrow).

Table 3). Two patients in the resident group and 1 patient in the board-certified spine neurosurgeon group developed postoperative C5 palsy. In the resident group, C5 palsy was improved by rehabilitation in 1 patient, whereas it did not improve in the other patient. In the patient in the board-certified spine neurosurgeon group, C5 palsy improved after additional anterior cervical decompression and fusion.

4. Discussion

To the best of our knowledge, the present study is the first to compare the perioperative complication rates of cervical laminoplasty performed by residents and board-certified spine neurosurgeons. Cervical laminoplasty performed in a standardized manner by residents who received their surgical education in our hospital did not increase perioperative complication rates, and, thus, ensures the safety of patients.

Cervical laminectomy is a common surgical procedure performed worldwide for patients with cervical myelopathy. On the other hand, cervical laminoplasty was developed in Japan, and has become widespread in Eastern Asia as an alternative to laminectomy [2,7,12]. Perioperative complication studies in the

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