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ORIGINAL ARTICLE

Modified expansive open-door laminoplasty technique improved postoperative neck pain and cervical range of motion

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C5 palsy;
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postoperative axial neck pain

Background/Purpose: Expansive open-door laminoplasty (EOLP) is a useful technique for multiple-level cervical spondylotic myelopathy. The common postoperative complications of EOLP include moderate to severe neck pain, loss of cervical lordosis, decrease of cervical range of motion, and C5 palsy. We modified the surgical technique to lessen these complications. This study is aimed to elucidate the efficacy of modified techniques to lessen the complications of traditional procedures.
Methods: We collected data from 126 consecutive patients treated at our institution between August 2008 and December 2012. Of these, 66 patients underwent conventional EOLP (CEOLP) and the other 60 patients underwent modified EOLP (MEOLP). The demographic and preoperative data, axial pain visual analog scale scores at 2 weeks and 3 months postoperatively, clinical outcomes evaluated using Nurick score and Japanese Orthopedic Association recovery rate at 12 months postoperatively, and radiographic results assessed using plain films at 3 months and 12 months postoperatively for both groups were compared and analyzed.
Results: There were no significant differences regarding the preoperative condition between the CEOLP and MEOLP groups ($p > 0.05$). The Japanese Orthopedic Association recovery rate of the MEOLP group was 70.3%, comparable to the result of the other group (70.2%). Postoperative axial neck pain, loss of range of motion, and loss of lordosis of cervical curvature

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decreased significantly in the MEOLP group ($p < 0.05$). The complications of temporary C5 nerve palsy found in the CEOLP group did not exist in the MEOLP group.
Conclusion: MEOLP is a minimally invasive surgical method to treat multiple-level cervical spondylotic myelopathy, which decreases postoperative complications effectively.

Introduction

The natural course of multiple-level cervical spondylotic myelopathy (MCSM) is characterized by a slow, stepwise decline in function. Without surgical intervention, only 30—50% of MCSM patients are expected to stabilize.[1] Expansive open-door laminoplasty (EOLP) is a useful technique for enlarging the spinal canal area for spinal cord decompression, by retaining the dorsal elements of the cervical spine for support, and preventing invasion of the postlaminectomy membrane.[2] Previous research showed that the use of titanium miniplates to augment the EOLP procedure is efficient in treating MCSM.[3] Several postoperative complications of EOLP have been reported: axial neck pain,[4] loss of lordosis,[5] 4.7% mean incidence of C5 nerve palsy,[6] loss of neck range of motion (ROM),[7] and 34% lamina closure in patients who received EOLP without plates or spacers on the open sides.[8] The incidence of complications can be reduced either by reducing surgical dissection or by encouraging early neck extension exercise. The first part involves preserving the paraspinal musculature,[9] repairing the semispinalis cervicis (SC) attached to the C2 spinous process,[10] preserving the C7 spinous process,[11] and decreasing the violation of the facet joint.[12]

The overall Japanese Orthopedic Association (JOA) recovery rate following EOLP is approximately 50%.[13] In our initial series of EOLP (conventional EOLP or CEOLP), although we had comparable neurologic recovery outcomes, similar complications were also observed.[14] Approximately 50% of CEOLP patients presented moderate to severe postoperative axial neck pain, and the mean loss of neck ROM was 35%. To reduce the occurrence of these complications, we implemented a modified EOLP (MEOLP) procedure. This study was conducted to compare the surgical results of CEOLP and MEOLP.

Materials and methods

Study population

This retrospective study was conducted after receiving approval from the Research Ethics Committee of Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (IRB101-100), Hualien, Taiwan. We modified the CEOLP procedures from April 2011. We collected the data of 66 consecutive cases that had undergone CEOLP from August 2008 to March 2011, and 60 consecutive cases that had undergone MEOLP from April 2011 to December 2012. The inclusion criteria were as follows: (1) positive myelopathic signs and symptoms, such as increased tendon reflexes in the extremities, clumsiness in the hands, and impaired toe-to-heel tandem gait; and (2) C3—7 stenosis. The exclusion criteria included the following: (1) existence of segmental instability, local kyphosis, or major anterior pathology; (2) a history of cervical spinal surgery; and (3) presence of myelopathy caused by spinal cord injuries, tumors, or infections. All 126 patients were diagnosed with MCSM based on clinical symptoms and magnetic resonance imaging (MRI) results, and had undergone surgery once. The follow-up duration was at least 12 months.

Surgical procedure

For CEOLP, the conventional laminoplasty technique used in our study had been reported previously and is briefly described here.[14] The bilateral paraspinal musculatures were dissected and gutters were created at the laminofacet junctions. The C3—7 laminae were elevated and then secured using five titanium miniplates. For the MEOLP, after the unilateral paraspinal musculature was dissected (Fig. 1A), we cut down the C3—6 spinous process to approach to the other side with an angled saw (Fig. 1B). Bilateral gutters were created medially without violating the facet joints. C7 partial laminectomy was performed (Fig. 1C), and C3—6 laminae were then elevated and secured using four titanium miniplates. In both the procedures, the SC was carefully detached from the C2 spinous process and then reattached using stout sutures. In the modified procedure, the hinge-side SC was less detached. Fig. 2 shows finished pictures of both procedures.

Outcome measurement

The clinical and radiographic aspects of the surgical outcomes are detailed as follows. The clinical outcomes were assessed based on the JOA, Nurick, and visual analogue scale (VAS) scores. We evaluated the JOA recovery rates at 12 months following surgery using the following formula: (12-month JOA score - preoperative JOA scores)/(17 - preoperative JOA score) × 100%. Axial neck pain was evaluated based on the VAS scores at 2 weeks and 3 months following surgery. Complications were also recorded.

The radiographic outcomes were evaluated based on the Pavlov ratio (canal—body ratio), cervical curvature (i.e., the lordotic angle between the lower edge of C2 and the upper edge of C7 at true lateral plain films), and ROM (i.e., the difference in the cervical curvature on maximal flexion—extension lateral radiographical view). The loss rates of cervical curvature and ROM were evaluated using the following formulas: