Preoperative and Postoperative Factors Affecting Patient Satisfaction with Double-Door Laminoplasty for Cervical Spondylotic Myelopathy

Takaki Yoshiyama[1)], Shunsuke Fujibayashi[2)], Bungo Otsuki[2)], Takayoshi Shimizu[2)], Koichi Murata[2)] and Shuichi Matsuda[2)]

1) Department of Orthopaedic Surgery, Osaka Red Cross Hospital, Osaka, Japan
2) Department of Orthopaedic and Musculoskeletal Surgery, Graduate School of Medicine, Kyoto University, Kyoto, Japan

Abstract:

Introduction: Few articles have investigated patient satisfaction with laminoplasty in patients with cervical spondylotic myelopathy (CSM) alone, excluding other diseases, such as ossification of the posterior longitudinal ligament. In this study, we aimed to investigate patient satisfaction after double-door laminoplasty for CSM and determine the preoperative and postoperative factors that affect patient satisfaction.

Methods: We retrospectively reviewed cases of laminoplasty for CSM. We measured sagittal imaging parameters (cervical lordosis [CL], C2-C7 cervical sagittal vertical axis [cSVA], and T1 slope [T1S]), Japanese Orthopaedic Association (JOA) score, and patient-reported outcomes (PROs) such as the neck disability index (NDI) and visual analog scale (VAS) preoperatively, 3 months postoperatively, and 1 year postoperatively. In addition, a multiple regression analysis was performed to investigate factors affecting patient satisfaction.

Results: Ninety patients were included in the analysis. After surgery, CL decreased significantly ($p<0.01$), whereas cSVA increased significantly ($p<0.01$). No significant differences were observed in the preoperative and postoperative T1S values ($p=0.61$). The JOA, NDI, and VAS scores significantly improved postoperatively ($p<0.01$). The median patient satisfaction was 85 (range, 12-100) at 1 year postoperatively and 80 (range, 25-100) at 3 months postoperatively. In the multiple regression analysis, lower-extremity sensory disorder in the JOA score at 1 year postoperatively ($p<0.01$) and VAS scores for neck pain preoperatively and 1 year postoperatively ($p=0.01$ and $p<0.01$, respectively) were determined as factors affecting patient satisfaction.

Conclusions: Cervical laminoplasty is a useful and satisfactory surgical procedure to restore patient function. However, patients with severe preoperative and postoperative neck pain and those with severe postoperative sensory disorders of the lower extremities may be less satisfied with the procedure. It is important to keep these things in mind when treating patients.

Keywords:

cervical spondylotic myelopathy, Japanese Orthopaedic Association score, patient-reported outcomes, visual analog scale, neck pain, patient satisfaction

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Introduction

Cervical laminoplasty is a well-established treatment for myelopathies with relatively good results in terms of improving neurological findings[1)] and symptoms and a high degree of satisfaction even in cases of relatively mild preoperative myelopathy[2)]. To the best of our knowledge, most previous studies have included multiple diseases such as ossification of the posterior longitudinal ligament (OPLL) and cervical disk herniation (CDH), and there are a few studies investigating postoperative satisfaction and patient-reported outcomes (PROs) in patients with cervical spondylotic myelopathy (CSM) alone[3,4)].

In this study, we aim to examine postoperative patient satisfaction with double-door laminoplasty for CSM and to identify preoperative and postoperative factors affecting sat-

Corresponding author: Takaki Yoshiyama, takaki.yoshiyama@gmail.com
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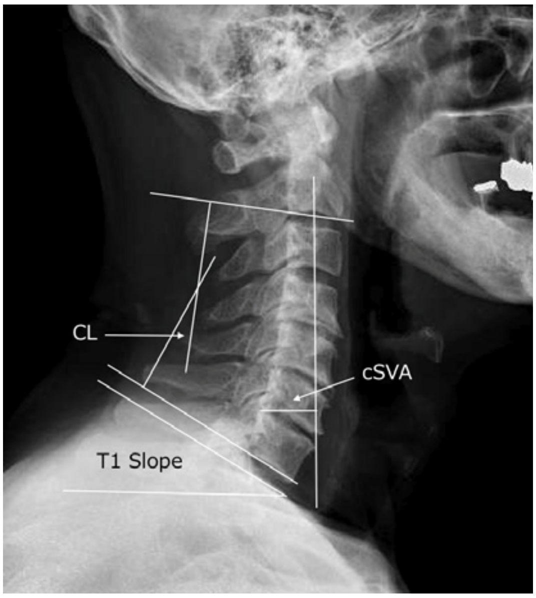

Figure 1. Sagittal imaging parameters.
Cervical lordosis (CL): inclusion angle of the tangent between C2 and C7 inferior edges;
C2–C7 sagittal vertical axis (cSVA): distance between vertical axis of C2 sagittal plane and posterior superior edge of C7;
T1 slope (T1S): intersection angle between upper edge of T1 and horizontal line

isfaction using Japanese Orthopaedic Association (JOA) scores and PROs, such as the neck disability index (NDI) and visual analog scale (VAS).

Materials and Methods

1. Patient sample

This was a retrospective cohort study. Ninety patients who underwent cervical laminoplasty for CSM at Kyoto University Hospital between October 2016 and December 2020 and were followed up for 1 year were included in this study. Patients who underwent cervical laminoplasty for reasons other than CSM, such as OPLL or CDH, were excluded. For the survey, we referred to the medical records, imaging studies, and nursing records at the Kyoto University Hospital and investigated age, sex, intervertebral space, surgeon who operated on patients, intervertebral space with the greatest stenosis, presence of intramedullary T2 high-intensity lesions on magnetic resonance imaging (MRI) postoperatively, and incidence of postoperative C5 paralysis. The presence of lumbar spinal disease was not evaluated preoperatively. This research has been approved by the Institutional Review Board of the authors' affiliated institutions.

2. Double-door laminoplasty

All surgeons and assistants were skilled spine surgeons, and they used identical techniques. A median longitudinal incision was made, the cervical laminae were exposed bilaterally to the medial side of the facet joints, and a diamond bar was used to divide the central part of the laminae longitudinally. Bilateral gutters were then made at the transitional area between the facet joint and lamina, and the ligament flava was detached from the dural canal to enlarge the spinal canal[5]. Muscles attached to the spinous processes of C2 and C7 are preserved as much as possible. Anchors were inserted bilaterally into the lateral masses and sutured to the opened laminae. All patients wore a soft collar for 2 weeks postoperatively.

3. Outcome measures and questionnaires

Three cervical sagittal imaging parameters in the middle position were measured preoperatively, 3 months postoperatively, and 1 year postoperatively (Fig. 1). We measured cervical lordosis (CL), which is the inclusion angle of the tangent between C2 and C7 inferior edges; C2-C7 cervical sagittal vertical axis (cSVA), which is the distance between the vertical axis of the C2 sagittal plane and posterior superior edge of C7; and the T1 slope (T1S), which is the intersection angle between the upper edge of T1 and the horizontal line. Functional assessment of the patient was performed at the same time.

We also investigated the JOA score[6] and PROs (NDI, VAS) based on the questionnaire. Patient satisfaction was measured twice, that is, at 3 months and 1 year after surgery, and patients completed a self-assessment using a 100-point scale.

4. Statistical analysis

Sagittal imaging parameters were compared at three time points as follows: preoperatively, 3 months postoperatively, and 1 year postoperatively. Each parameter was determined to be normally distributed because it did not reach significance as per the Shapiro-Wilk test. Mauchly's sphericity test was also deemed insignificant, confirming the assumption of sphericity; moreover, repeated-measures analysis of variance was performed. When significant differences were detected, multiple comparisons (corresponding t-test with Bonferroni adjustment) were performed. The JOA scores and PROs were similarly compared in groups at the three aforementioned time points (preoperative, 3 months postoperative, and 1 year postoperative). As these variables were not normally distributed, Friedman test was performed. Multiple comparisons were also performed in the same manner. Finally, to examine the factors affecting patient satisfaction, a multiple regression analysis was performed. Age, sex, CL, the most stenosed vertebra, functional impairment of the lower extremity (lower extremity item of the JOA score), and intensity of neck pain (VAS) were determined as explanatory variables, which we considered clinically important based on previous studies[3,4].

All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), a graphical user interface for R (R Foundation for Statistical Computing, Vienna, Austria). More precisely, it is a

Table 1. Characteristics of Study Population.

	N=90
Age (year), mean (SD)	68.7 (11.4)
Gender	
Male	59
Female	31
Surgical Level (N)	
C3-7	38
C3-6	16
C4-7	9
C4-6	5
C5-7	5
C2-7	5
Others	12
Surgeon (N)	
Surgeon No.1	30
Surgeon No.2	27
Surgeon No.3	13
Surgeon No.4	11
Surgeon No.5	8
Surgeon No.6	1
The intervertebral space with the strongest stenosis (N)	
C3/4	31
C4/5	19
C5/6	26
C6/7	8
Others	6
Presence of T2 high lesion	
Yes	51
No	39
Postoperative C5 palsy	
Yes	6
No	84

SD standard deviation

modified version of the R commander designed to add statistical functions frequently used in biostatistics[7].

Results

1. Demographics

Patient background data are presented in Table 1. Data on patient satisfaction 1 year after surgery were available for 90 patients, and their records were used for analysis. The mean age of the patients was 68.7 years; 59 patients were male and 31 were female. The greatest stenosis was most commonly observed at C3/C4 (n=31; 34.4%), and T2 high lesions on preoperative MRI were observed in 39 patients (43.3%). Postoperative C5 paralysis was observed in 6 patients (6.7%); however the paralysis improved in all patients during the follow-up period.

2. Cervical sagittal imaging parameters

Analysis of the cervical sagittal imaging parameters revealed that the cervical vertebrae had moved in the direction of the anterior thrust postoperatively, as shown in Table 2. Repeated-measures analysis of variance demonstrated significant differences between the preoperative and postoperative CL and cSVA values ($p<0.01$ and $p<0.01$). Multiple comparisons revealed a significant difference between the preoperative and 3-month postoperative CL values ($p<0.01$). It also revealed significant differences between the preoperative period and 3 months and between the preoperative period and 1 year in terms of cSVA values ($p<0.01$ and $p<0.01$); repeated-measures analysis of variance for T1S showed no significant changes ($p=0.61$).

The JOA, NDI, and VAS scores are presented in Table 2. The Friedman test showed that surgery significantly improved all functional assessment scores postoperatively (p<

Table 2. Preoperative and Postoperative Changes in Sagittal Imaging Parameter, the Japanese Orthopaedic Association (JOA) Score and Patient Reported Outcome (PROs) [mean (SD)].

Parameter	Preoperative assessment	Postoperative assessment (3 month)	Postoperative assessment (1 year)	p value
CL	12.8 (11.3)	9.9 (12.5)	11.6 (13.4)	<0.01
cSVA	25.8 (11.8)	30.0 (12.5)	30.6 (12.3)	<0.01
T1S	27.7 (8.9)	26.7 (8.9)	27.8 (9.5)	0.61
JOA	11.3 (2.8)	13.9 (1.9)	14.2 (2.0)	<0.01
NDI	24.5 (18.7)	19.4 (15.5)	16.0 (14.8)	<0.01
VAS				
Neck	24.6 (24.3)	17.8 (21.0)	14.4 (19.1)	<0.01
Upper Ex	32.4 (28.9)	25.1 (25.5)	20.7 (25.3)	<0.01
Numbness	55.4 (26.7)	34.3 (26.5)	32.4 (26.7)	<0.01
Satisfaction		78 (22.5)	85 (22.8)	

SD standard deviation; *CL*, cervical lordosis; *cSVA*, cervical sagittal vertical axis; *T1S*, T1 slope; *JOA*, Japanese Orthopaedic Association; *NDI*, Neck Disability Index; *VAS*, Visual Analog Scale

Table 3. Multiple Regression Analysis between Satisfaction (3 Months) and Postoperative Parameters.

Variable	Unstandardized Coefficients		Standardized Coefficients	*p* value
	B (95% CI)	Std.Error	β	
Intercept	98.77 (55.41-142.14)	21.67		0.000027
Age	−0.63 (−1.09- −0.16)	0.23	−0.32	0.0094
Sex (Male)	3.44 (−8.37-15.26)	5.9	0.07	0.56
CL (3 months)	0.29 (−0.19- 0.76)	0.24	0.16	0.23
Intervertebral space with the strongest stenosis (C3/4 and others)	−2.83 (−14.73-9.08)	5.95	−0.06	0.64
JOA SL (3 months)	10.64 (−3.01-24.28)	6.82	0.19	0.12
VAS Neck (3 months)	−0.14 (−0.41-0.14)	0.14	−0.13	0.32

Note: R^2=0.185 Adj. R^2=0.101, F-statistics: 2.199, DF: 6 and 58, *p* value: 0.056, the coefficient of determination: 0.24
B, partial regression coefficient; β, standard regression coefficient, R^2 coefficient of determination; *CI*, confidence interval; *JOA*, Japanese Orthopaedic Association; *SL*, sensory function in lower extremities; *VAS*, visual analog scale

0.01).

Significant differences in JOA scores were detected between all groups. Significant differences were detected between the NDI values preoperatively and at 1 year postoperatively and between those at 3 months and 1 year postoperatively (p<0.01 and p=0.02). Significant differences were detected between the preoperative VAS neck pain scores and those at 3 months postoperatively and between the preoperative scores and those at 1 year postoperatively (p=0.03 and p <0.01). Further, significant differences were noted between the VAS scores for upper extremity pain preoperatively and at 1 year postoperatively (p<0.01). Significant differences were also detected between the VAS scores for numbness preoperatively and at 3 months postoperatively and between those preoperatively and at 1 year postoperatively (p<0.01 and p<0.01). The median patient satisfaction score at 3 months after surgery was 78 (range, 25-100; standard deviation, 22.5), and that at 1 year after surgery was 85 (range, 12-100; standard deviation, 22.8), as shown in Table 2.

Table 3, 4, 5 present the results of the multiple regression analysis. Table 3 shows the results with the objective variable set to patient satisfaction 3 months after surgery, whereas Table 4 shows that of 1 year after surgery. As per the multiple regression analysis performed for the parameter values at 3 months, no significant differences were detected in either of these values. On the contrary, although the coefficient of determination was 0.24, which is not high, the results of the analysis of variance were significant, and two factors were determined as influencing factors for patient satisfaction after 1 year, that is, the value of lower limb sensory impairment in the JOA score after 1 year and the VAS of neck pain after 1 year. Although not included in the tables, a multiple regression analysis with the surgeon as an explanatory variable was also performed. The results show that there is no significant difference in terms of satisfaction at 3 months and 1 year postoperatively, even if the surgeon is different.

Finally, to examine whether postoperative satisfaction can be predicted based on the preoperative parameters, multiple regression analysis was performed using patient satisfaction at 1 year as an objective variable and with age, sex, preoperative CL, the site of the greatest stenosis, preoperative JOA lower-extremity sensory disturbance, and preoperative VAS score for neck pain as the explanatory variables (Table 5). Although the coefficient of determination was low at 0.044, the results of the analysis of variance were deemed significant, and the VAS score for preoperative neck pain was found as a factor influencing patient satisfaction at 1 year.

Discussion

In this study, we collected data from 90 patients with CSM; examined changes in sagittal imaging parameters and functional assessment scores; measured postoperative satisfaction at 3 months and 1 year postoperatively; evaluated the JOA score, PROs, and sagittal imaging parameters; and examined the factors affecting satisfaction using preoperative and postoperative factors. The current study has excluded patients with OPLL and focused solely on patients with

Table 4. Multiple Regression Analysis between Satisfaction (1 Year) and Postoperative Parameters.

Variable	Unstandardized Coefficients		Standardized Coefficients	p value
	B (95% CI)	Std.Error	β	
Intercept	76.21 (33.94-118.47)	21.12		0.00064
Age	−0.36 (−0.8-0.07)	0.22	−0.18	0.101
Sex (Male)	2.08 (−8.46-12.62)	5.27	0.04	0.691
CL (1 year)	0.36 (−0.02-0.74)	0.19	0.21	0.061
Intervertebral space with the greatest stenosis (C3/4 and others)	−3.43 (−13.61-6.75)	5.09	−0.07	0.51
JOA SL (1 year)	17.34 (4.74-29.95)	6.3	0.28	0.0078
VAS Neck (1 year)	−0.33 (−0.57-0.09)	0.12	−0.28	0.00701

Note: R^2=0.31 Adj. R^2=0.24, F-statistics: 4.49, DF: 6 and 59, *p* value: 0.000825
B, partial regression coefficient; β, standard regression coefficient, R^2 coefficient of determination; *CI*, confidence interval; *JOA*, Japanese Orthopaedic Association; *SL*, sensory function in lower extremities; *VAS*, visual analog scale

Table 5. Multiple Regression Analysis between Satisfaction (1 Year) and Preoperative Parameters.

Variable	Unstandardized Coefficients		Standardized Coefficients	p value
	B (95% CI)	Std.Error	β	
Intercept	110.14 (71.38-148.9)	19.43		0.000003
Age	−0.42 (−0.9- 0.06)	0.24	−0.21	0.086
Sex (Male)	0.67 (−10.64-11.97)	5.67	0.01	0.91
CL (preoperative)	−0.05 (−0.57-0.47)	0.26	−0.02	0.85
Intervertebral space with the strongest stenosis (C3/4 and others)	−4.51 (−15.51-6.49)	5.51	−0.09	0.42
JOA SL (preoperative)	3.74 (−6.7-14.18)	5.23	0.09	0.48
VAS Neck (preoperative)	−0.27 (−0.48-−0.05)	0.11	−0.29	**0.014**

Note: R^2=0.125 Adj. R^2=0.506, F-statistics: 1.67, DF: 6 and 70, *p* value: 0.140, the coefficient of determination: 0.044
B, partial regression coefficient; β, standard regression coefficient, R^2 coefficient of determination; *CI*, confidence interval; *JOA*, Japanese Orthopaedic Association; *SL*, sensory function in lower extremities; *VAS*, visual analog scale

CSM to standardize the patient background. Additionally, the study's outcome measure is not dichotomous with "satisfactory" or "unsatisfactory" categories, but rather a continuous variable with a maximum score of 100.

After cervical laminoplasty, the CL decreased at 3 months, increased again, and then returned to baseline at 1 year. The cSVA increased due to surgery and remained high at 1 year. This result may indicate that the neck pain drops due to loss of extension muscle strength[8] and that the neck is pulled slightly ahead postoperatively, thus compensating for the lordosis of the upper cervical vertebrae. It has already been reported that laminoplasty changes the parameters of the cervical spine. Smaller preoperative extension capacity and larger T1 slope have been shown to result in greater postoperative lordosis reduction[9].

All JOA scores and PROs improved significantly after surgery. Patient satisfaction at 3 months and 1 year after surgery was also good, with scores of 80-85 out of 100. According to a previous report from Japan that investigated patient satisfaction with cervical laminoplasty, including other diseases such as OPLL and CDH, there was a significant postoperative improvement in JOA scores and PROs, and 81.9%-71% patients answered that they were "satisfied" with the surgery[3,4]. We thus believe that this study demonstrates that good surgical outcomes and high satisfaction can be achieved even when the survey is limited to patients with CSM.

Multiple regression analysis revealed that postoperative lower-extremity disorder, postoperative neck pain, and preoperative neck pain were factors that can decrease patient satisfaction at 1 year postoperatively. In this study, postoperative kyphosis of the cervical spine and the stenosis site were determined to have no significant effect on postoperative satisfaction.

According to Ohya et al.[4], patients with poor recovery of lower-extremity function after surgery may have lower satisfaction. Although it has been reported that axial pain caused by surgery affects patients' quality of life[10], it is important to note that this study showed that preoperative neck pain also significantly affected postoperative satisfaction. Preoperative neck pain evaluation is considered to include several factors such as disc[11], muscles[12], intervertebral joints, and posterior rami[13]; in this study, since all patients had CSM, it is thus reasonable to assume that cervical spondylotic changes had some influence on preoperative neck pain. It would be important to consider that neck pain may lead to reduced surgical satisfaction when treating patients.

Several reports have compared the results of cervical laminoplasty and surgery with fusion; two meta-analyses have compared their postoperative VAS scores[14,15]. One study compared laminoplasty with laminectomy and fusion for multilevel cervical compressive myelopathy and found no significant difference in the postoperative VAS scores between the two groups[14]. Another study has compared posterior decompression and fusion (PDF) and laminoplasty in patients with OPLL; therefore, the patient population was different from that in the current study. Interestingly, in that study, the PDF group had a higher postoperative VAS scores[15]. They reported that PDF might have caused more postoperative axial pain because it caused more damage to the posterior spinal structures.

In patients with CSM who had severe preoperative neck pain, it remains controversial whether surgery with fusion is superior to laminoplasty in terms of patient satisfaction and postoperative neck pain. Future studies are expected to elucidate this issue.

This study has several limitations. First, this study did not assess the patients' mental state; according to Oshima et al., patients with severe neck pain after laminoplasty had a significantly lower postoperative mental state. These patients also tended to have severe preoperative neck pain and a lower mental state[16]. Past research suggests that pain and depression are highly intertwined, and thus, can exacerbate physical and psychological symptoms[17]. Mental state may influence the degree of neck pain.

The presence or absence of preoperative opioids or other analgesic medications, as well as their volume, was not investigated in this study; however, considering that none of these patients underwent fusion surgery before laminoplasty, cervical pain may have been less critical than the other symptoms in most patients.

Second, it should be noted that sagittal alignment was measured only in the sitting position, whereas T1S values differed between the sitting and standing positions. Although sagittal alignment was not identified as a factor significantly affecting satisfaction in this study, previous studies have reported that sagittal parameters may affect postoperative function and quality of life[18,19].

Third, we did not exclude diseases such as lumbar diseases and blood circulation disorders. Such diseases may affect the diseases that cause lower-extremity sensory disorders, in addition to cervical myelopathy.

Finally, there is the issue of follow-up rate and duration of follow-up. Although this study was conducted with a 1-year follow-up, ideally, 2-year or longer follow-up would be desirable to evaluate long-term outcomes. Therefore, we are planning a longer-term study.

Conclusion

Laminoplasty is a satisfactory surgical procedure that is useful in restoring patient function. However, patients with severe preoperative and postoperative neck pain and those with severe postoperative sensory disorders of the lower extremities may be less satisfied with this procedure. Thus, it is important to keep these things in mind when treating patients.

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Shunsuke Fujibayashi: Writing-Review & Editing, Supervision, Project administration

Bungo Otsuki: Software, Validation, Formal analysis, Supervision

Takayoshi Shimizu: Supervision
Koichi Murata: Supervision
Shuichi Matsuda: Supervision

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Informed Consent: A comprehensive agreement for academic use of information acquired during their treatments was obtained from the patients by the hospital at the time of their hospitalization, and no identifiable information of the participants is included in this manuscript.

References

1. Oshima Y, Miyoshi K, Mikami Y, et al. Long-term outcomes of cervical laminoplasty in the elderly. Biomed Res Int. 2015;2015: 713952.
2. Neo M, Fujibayashi S, Takemoto M, et al. Clinical results of and patient satisfaction with cervical laminoplasty for considerable cord compression with only slight myelopathy. Eur Spine J. 2012; 21(2):340-6.
3. Kimura A, Endo T, Inoue H, et al. Preoperative predictors of patient satisfaction with outcome after cervical laminoplasty. Global Spine J. 2014;4(2):77-82.
4. Ohya J, Oshima Y, Takeshita K, et al. Patient satisfaction with double-door laminoplasty for cervical compression myelopathy. J Orthop Sci. 2015;20(1):64-70.
5. Miyata M, Neo M, Fujibayashi S, et al. Double-door cervical laminoplasty with the use of suture anchors: technical note. J Spinal Disord Tech. 2008;21(8):575-8.
6. Japanese Orthopedic Association. Scoring system for cervical myelopathy. J Jpn Orthop Assoc. 1994;68:490-503.
7. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. Bone Marrow Transplant. 2013;48(3): 452-8.
8. Fujibayashi S, Neo M, Yoshida M, et al. Neck muscle strength before and after cervical laminoplasty: relation to axial symptoms. J Spinal Disord Tech. 2010;23(3):197-202.
9. Kim BJ, Cho SM, Hur JW, et al. Kinematics after cervical laminoplasty: risk factors for cervical kyphotic deformity after laminoplasty. Spine J. 2021;21(11):1822-9.
10. Kimura A, Endo T, Inoue H, et al. Impact of axial neck pain on quality of life after laminoplasty. Spine. 2015;40(24):E1292-8.
11. Malik KM, Cohen SP, Walega DR, et al. Diagnostic criteria and treatment of discogenic pain: a systematic review of recent clinical literature. Spine J. 2013;13(11):1675-89.
12. Kim JY, Kwag KI. Clinical effects of deep cervical flexor muscle activation in patients with chronic neck pain. J Phys Ther Sci. 2016;28(1):269-73.
13. Falco FJ, Manchikanti L, Datta S, et al. Systematic review of the therapeutic effectiveness of cervical facet joint interventions: an update. Pain Physician. 2012;15(6):E839-68.
14. Huang M, Gao X, Cheng J, et al. Laminoplasty versus laminectomy and fusion for multilevel cervical compressive myelopathy: a meta-analysis. Medicine. 2016;95(23):e03588.
15. Xu P, Sun GD, Xun L, et al. Posterior decompression and fusion versus laminoplasty for cervical ossification of posterior longitudinal ligament: a systematic review and meta-analysis. Neurosurg Rev. 2021;44(3):1457-69.
16. Oshima Y, Matsubayashi Y, Taniguchi Y, et al. Mental state can influence the degree of postoperative axial neck pain following cervical laminoplasty. Global Spine J. 2019;9(3):292-7.
17. IsHak WW, Wen RY, Naghdechi L, et al. Pain and depression: a systematic review. Harv Rev Psychiatry. 2018;26(6):352-63.
18. Rao H, Huang Y, Lan Z, et al. Does preoperative T1 slope and cervical lordosis mismatching affect surgical outcomes after laminoplasty in patients with cervical spondylotic myelopathy? World Neurosurg. 2019;130:e687-93.
19. Oe S, Togawa D, Nakai K, et al. The influence of age and sex on cervical spinal alignment among volunteers aged over 50. Spine. 2015;40(19):1487-94.