VI. 研究成果の刊行に関する一覧表

研究成果の刊行に関する一覧表
【H26.4.1～H27.3.31】

書籍

著者氏名	論文タイトル名	書籍全体の編集者名	書　籍　名	出版社名	出版地	出版年	ページ
Msao Koda, Takeo Furuya, Taigo Inada, Koshiro Kamiya, Mitsutoshi Ota, Satoshi Maki, Akihiko Okawa, Kazuhisa Takahashi, and Masashi Yamazaki.	Granulocyte Colony-Stimulating Factor-Mediated Neuroprotective Therapy for Spinal Cord Injury.	Kenzo Uchida, Masaya Nakamura, Hiroshi Ozawa, Shinsuke Katoh, Yoshiaki Toyama	Neuroprotection and Regeneration of the Spinal Cord	Springer		2014	P.141
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小林祥，松山幸弘	術中脊髄機能モニタリングの現在	脊椎脊髄ジャーナル	27(4)	309-313	2014
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伊藤全哉，松山幸弘、四宮謙一、川端茂徳、安藤宗治、寒竹司、齊藤貴徳、高橋雅人、小林祥、藤原靖、木田和伸、山田圭、和田簡一朗、山本直也、里見和彦、谷俊一	胸椎OPLL手術において術後麻痺を防ぐには？-麻痺を呈する操作及びアラームポイント：全国多施設研究	脊髄機能診断学	35(1)	In press	2015
小林祥，松山幸弘、四宮謙一、川端茂徳、安藤宗治、寒竹司、齊藤貴徳、高橋雅人、伊藤全哉、藤原靖、木田和伸、山田圭、和田簡一朗、山本直也、里見和彦、谷俊一	術中脊髄モニタリング(Br(E)-MsEP)の術前麻痺患者におけるアラームポイント～脊椎脊髄病学会モニタリング委員会による多施設前向き研究～	脊髄機能診断学	35(1)	In press	2015
山田圭、小林祥、長濱賢、田所伸朗、和田簡一郎、村本明生、岩崎博、寒竹司、関庄二、平尾雄二郎、溝田敦子、安藤宗治、大田亮、松山幸弘	側弯症の病態別に見た術中モニタリングのアラームポイントの検討	脊髄機能診断学	35(1)	In press	2015
藤原靖，泉文一郎，真鍋英喜，川井和美	脊髄髄内腫瘍摘出術に対する術中脊髄モニタリング	脊髄機能診断学	35(1)	In press	2015
加藤啓，國府田正雄，古矢丈雄，大河昭彦，高橋和久，山崎正志	【運動器疼痛治療における最近の話題】脊髄障害性疼痛に対する顆粒球コロニー刺激因子（G-CSF）の効果.	ペインクリニック	35(8)	1027-1034	2014

古矢丈雄，藤由崇之，國府田正雄，小西宏昭，山崎正志	【特集：頚部脊髄症の診察】頚部脊髄症に対する後方除圧固定術	MB Orthopaedics	27(2)	55-62	2014
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Ⅶ. 研究成果の刊行物・別刷

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CERVICAL SPINE

Modified K-line in Magnetic Resonance Imaging Predicts Clinical Outcome in Patients With Nonlordotic Alignment After Laminoplasty for Cervical Spondylotic Myelopathy

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Study Design. Retrospective single-center study.

Objective. To investigate whether a preoperative index predicts clinical outcome after laminoplasty for cervical spondylotic myelopathy.

Summary of Background Data. This is the first study using the modified K-line, which connects the midpoints of the spinal cord at the C2 and C7 levels on midsagittal magnetic resonance imaging, to assess the relationship between postoperative clinical outcome and anticipated degree of spinal cord shifting.

Methods. Sixty-one consecutive patients who underwent laminoplasty for the treatment of cervical spondylotic myelopathy between 2000 and 2011 at our hospital were retrospectively reviewed. The interval between the preoperative mK-line and the anterior structure of the spinal canal at each segment of the C3 to C6 levels (INT_n, n = 3–6) were measured on sagittal T1-weighted magnetic resonance imaging, and the sum of the INT_n (INT_{sum}) was then calculated. The degree of posterior cord shift was defined as follows: $\%C_{sum} = \Sigma C_n$; $C_n = (B_n - A_n) \times 100/A_n$ (n = 3–6; A_n and B_n represent the preoperative and postoperative intervals between the midpoint of the spinal cord and the anterior impingement at each segment on sagittal T1-weighted magnetic resonance imaging, respectively). In addition, we defined INT_{min} as the minimum interval of the INT_n in each patient. All patients were divided into lordotic and nonlordotic groups on the basis of lateral neutral radiography. The Japanese Orthopaedic Association (JOA) scoring system and recovery rate of the JOA score for cervical myelopathy was evaluated as clinical outcomes.

Results. The recovery rate of the JOA score was 48.1%. The lordotic and nonlordotic groups contained 38 and 23 patients, respectively. Linear regression analysis revealed that INT_{min} was significantly correlated with the recovery rate of the patients in the nonlordotic group, whereas INT_{sum} was not associated with recovery of the JOA score.

Conclusion. We identified INT_{min} as a predictive factor for clinical outcomes in patients with nonlordotic alignment after laminoplasty.

Key words: cervical spondylotic myelopathy, laminoplasty, spinal cord anterior clearance, postoperative anterior compression.

Level of Evidence: 4

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Many reports[1–3] have addressed laminoplasty (LAMP) for the treatment of patients with myelopathy since Oyama and Hattori[4] first described the procedure in 1973. Several modifications have been made, and the procedure has been adopted by many spine surgeons as an effective and relatively safe method to decompress the spinal cord[5] and achieve sufficient stability for multisegmental cervical lesions that cause cervical spondylotic myelopathy (CSM).[6] Many reports have indicated that decompression by LAMP leads to long-lasting neurological recovery.[7,8] However, LAMP occasionally fails to relieve anterior compression of spinal cord caused by cervical kyphosis and/or intervertebral disc bulging,[9–11] which prevents neurological recovery, because the decompression mechanism depends only on the posterior shifting of the spinal cord. Therefore, it is important for spine surgeons to acknowledge this issue and determine risk factors

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for ineffective or incomplete decompression before selecting a surgical treatment. We previously reported that the modified K-line (mK-line) in magnetic resonance imaging (MRI) is an effective tool to predict residual anterior compression of the spinal cord after LAMP.[12] In this study, we further investigated whether preoperative factors determined according to the mK-line could predict postoperative spinal cord shifting and clinical outcomes after LAMP in patients with CSM.

MATERIALS AND METHODS

Patients and Methods

We conducted a retrospective, observational, single-center study of posterior decompression with LAMP for the treatment of CSM. The study was conducted with the approval of the Institutional Ethics Committee of Tokyo Medical and Dental University (#1681). Patients with cervical myelopathy caused by spondylosis were included in the study. Exclusion criteria were myelopathy caused by single-level disc herniation or ossification of posterior longitudinal ligament, a history of cervical spine surgery, postoperative epidural hematoma, and cases in which preoperative and postoperative magnetic resonance (MR) images could not be obtained. Patients who had cervical kyphosis in which the sagittal lordotic angle was greater than 13° were not enrolled in this study.[13] Sixty-one consecutive patients in our hospital who underwent LAMP for the treatment of CSM between 2000 and 2011 were reviewed. All patients were followed up for more than 2 years. Patient demographic data are shown in Table 1. The mean patient age was 65.8 years (range: 42–82 yr). The decompression was performed from C3 to C7 in 46 patients, from C3 to C6 in 11 patients, from C4 to C6 in 1 patient, and from C4 to C7 in 3 patients. The mean Japanese Orthopaedic Association (JOA) score before surgery was 8.6 points (range: 3.5–13.5). The mean JOA score at the final visit was 12.5 points (range: 6.5–16.5), yielding a mean recovery rate (RR) of 48.1% (range: 0–94.4). None of these patients presented a worsened neurological outcome after surgery. The average C2–C7 lordotic angle was 14.3° of lordosis (range, 10.8° of kyphosis to 37.1° of lordosis). Cervical alignment was categorized according to criteria defined by Kamata *et al*[14,15] in all patients (Figure 1A). Regarding alignment, 38 patients were lordotic, 7 straight, 5 kyphotic, 8 sigmoid, and 3 reversed-sigmoid. These 61 patients were divided into a lordotic group (n = 38) and a nonlordotic group (n = 23).

TABLE 1. Demographic Data

	Mean ± SD
Age at surgery, yr	65.8 ± 9.8
Sex (M:F)	44:17
No. of patients	
C3–C7	46
C3–C6	11
C4–C6	1
C4–C7	3
Pre-JOA score	8.6 ± 3.0
Post-JOA score	12.5 ± 3.2
JOA recovery rate (%)	48.1 ± 26.8
Preoperative C2–C7 lordotic angle (degrees)	17.6 ± 14.3
Global sagittal alignment	
Lordosis	38
Straight	7
Kyphosis	5
Sigmoid	8
Reversed sigmoid	3

JOA indicates The Japanese Orthopaedic Association.

Operative Technique

Expansive LAMP was performed as described by Miyazaki and Kirita.[16] Briefly, this procedure performed at C3–C7 included removing the C4–C6 processes, splitting the laminae at the center, making bilateral gutters from C3 to C6, and fenestration at the cephalad portion of the lamina of C7 using a high-speed air-burr drill. LAMP at C3–C6 comprised splitting the laminae at C3–C6 without fenestration at the C7 laminae. The laminae were kept open with anchor sutures in the deep fascia, and small bone chips obtained from the spinous processes were inserted into the gap between the laminae and the facets and into the bilateral gutter. Patients were instructed to wear a neck collar for 2 to 4 weeks postoperatively.

Evaluations

Clinical Findings

The JOA scoring system[17] was used to evaluate the severity of cervical myelopathy before and after surgery. The RR was calculated using the method of Hirabayashi *et al*[18] to compare pre- and postoperative JOA scores. The duration of preoperative symptoms was also investigated. The segment responsible for myelopathy was diagnosed on the basis of radiological, electrophysiological, and neurological findings.

Radiological Evaluations

Radiographical studies were conducted in all patients and results were evaluated by 2 independent spine surgeons. MR image was obtained both before and within 3 months after surgery for all patients. All MR images were obtained on a 1.5-Tesla scanner (Signa HDxt 1.5T; GE Healthcare, Waukesha, WI), and the MRI protocol consisted of the following conventional MR sequences: sagittal T1-weighted spin-echo (SE): repetition time (TR)/echo time (TE): 480/9 milliseconds, spacing 3 mm; sagittal T2-weighted SE: TR/TE: 3000/85 milliseconds, spacing 3 mm; transaxial T1-weighted SE: TR/TE: 460/10 milliseconds; and transaxial T2-weighted SE: TR/TE: 4020/110 milliseconds. As we previously reported,[12] the