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흉추 전이성 척수 압박에서 추체제거 및 전방 재건술 유무에 따른 후방 감압 및 안정술: 후향적 비교 연구

Posterior decompression and stabilization with or without corpectomy and anterior column reconstruction for metastatic spinal cord compression in the thoracic spine: A retrospective comparative study

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Abstract

Posterior decompression and stabilization with or without corpectomy and anterior column reconstruction for metastatic spinal cord compression in the thoracic spine: A retrospective comparative study

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Objective: To compare the characteristics and outcomes of patients with metastatic spinal cord compression (MSCC) in the thoracic spine who underwent posterior decompression and fixation with or without corpectomy and anterior column reconstruction; the aim of which was to identify patients who required corpectomy and anterior column reconstruction.

Methods: Consecutive patients who underwent single-stage posterior decompression and stabilization for thoracic MSCC in a single tertiary institution from May 2013 to October 2017 were included. All patients were divided into the "corpectomy group" or "laminectomy-only group" according to whether corpectomy and anterior column reconstruction was performed. We compared the

preoperative factors, operative findings, and postoperative outcomes of the two groups.

Results: Forty-one patients with a mean age of 61.2 (range, 36-82) years were analyzed. In total, 17 patients were classified in the corpectomy group, and 24 in the laminectomy-only group. There were no significant differences in the demographics, follow-up periods, and primary cancers between the two groups. Preoperatively, the corpectomy group tended to have better performance status (higher Karnofsky Performance Score (KPS), lower Eastern Cooperative Oncology Group performance status scale (ECOG PS)) than the laminectomy-only group, but the difference was not statistically significant. Radiologically, the corpectomy group had more severe vertebral collapse (larger kyphotic angle (10.7 ± 7.3 *vs.* 7.2 ± 4.1) and smaller anterior (0.70 ± 0.28 *vs.* 0.84 ± 0.20) and posterior (0.84 ± 0.16 *vs.* 0.89 ± 0.13) vertebral height ratios) than the laminectomy-only group, but the difference was not statistically significant. Moreover, the operation time (minutes) was longer (262.0±75.1 *vs.* 184.7±69.8, p = 0.001) and blood loss (mL) was larger (1708.8±1098.3 *vs.* 752.1±431, p = 0.001) in the corpectomy group. Postoperatively, the KPS was higher in the

corpectomy group (65.3±17.1 *vs.* 51.4±21.0, p = 0.025). The improvement in KPS following the operation was also significantly greater in the corpectomy group (6.4 ± 8.0 *vs.* 0.9 ± 12.5, p = 0.041). When comparing the performance status before and after surgery, KPS (p=0.015) and Frankel grade (p=0.004) improved statistically significantly in the corpectomy group. In the Laminectomy-only group, only Frankel grade (p=0.001) showed statistically significant improvement. There was no significant difference in the postoperative survival between the two groups. In the laminectomy-only group, there were three cases of instrumentation failure. There were four patients in the corpectomy group and one in the laminectomy-only group who underwent re-decompression

Conclusions: Corpectomy and anterior column reconstruction may be considered in patients who have a performance status good enough to endure a relatively invasive surgery. Despite increased surgical burden, anterior column reconstruction seems to result in a better performance status and provide more mechanical stability postoperatively.

Keywords: spinal metastasis, thoracic metastasis, corpectomy, anterior column reconstruction, decompression

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MSCC: Metastatic spinal cord compression

KPS: Karnofsky Performance Score

ECOG PS: Eastern Cooperative Oncology Group performance status scale

SINS: Spinal Instability Neoplastic Score

MRI: Magnetic resonance imaging

CT: Computed tomography

EBL: Estimated blood loss

RBC: Red blood cell

RTx: Radiotherapy

Introduction

The incidence of spinal metastasis is increasing with the simultaneous increase in the incidence of cancer and patients are surviving longer. The skeletal system is the third most common site for metastasis after the lung and liver, and the spine is the most common site of skeletal metastatic disease.[1] The thoracic spine is the most common site for spinal metastasis and is vulnerable to metastatic spinal cord compression (MSCC), which can cause pain and neurologic deficit. Treatment for spinal metastatic disease is multidisciplinary and involves pain management, radiotherapy, chemotherapy, and surgery.[2-4] The purpose of surgical treatment in patients with spinal metastasis is to maintain the quality of life during the remaining survival period by preserving ambulation and reducing pain.[5]

Posterior approaches are preferred while treating tumors located in the thoracic spine, and corpectomy with anterior column reconstruction could be considered during posterior decompression and stabilization. The advantages of corpectomy followed by anterior column reconstruction include 1) circumferential spinal cord decompression through corpectomy and 2) enhanced stability

through anterior column support.[6] However, these additional procedures can increase surgical morbidity by prolonging the operation time and increasing blood loss during the operation.[7] Therefore, the need for corpectomy followed by anterior column reconstruction as a treatment for MSCC of the thoracic spine is controversial. Moreover, few studies have directly compared the two surgical procedures on the basis of whether corpectomy and anterior column reconstruction was performed.[8, 9]

In this study, we compared the preoperative factors, operative findings, and postoperative outcomes of two groups of patients who underwent posterior decompression and fixation with or without corpectomy and anterior column reconstruction. The aim of the study was to identify patients who could benefit more from these additional surgical procedures.

Methods

Study subjects

In this retrospective comparative study, we enrolled consecutive patients who underwent posterior decompression and stabilization surgery for MSCC in the thoracic spine from May 2013 to October 2017 in a single tertiary hospital. Among them, patients who were followed up for at least 12 months after surgery or until death were analyzed. The exclusion criteria included patients who underwent 1) posterior stabilization surgery without decompression, 2) total *en bloc* resection (including spondylectomy) of solitary metastatic lesion for curative purposes, and 3) combined lung resection. Patients with an MSCC involving multiple spinal levels were also excluded from the study. Ethical approval and a waiver of consent by the Institutional Review Board of the authors' center were obtained for conducting this study.

Surgical methods

All enrolled patients underwent total laminectomy and pedicle screw instrumentation (via open or percutaneous technique) using a single-stage posterior only approach. Patients were divided

into the "corpectomy group" or "laminectomy-only group" according to whether corpectomy and anterior column reconstruction was performed. We performed corpectomy using either costotransversectomy or a transpedicular approach from the more affected side. Following corpectomy, a metallic mesh or expandable cage filled with allograft bone chips was inserted in the defect of the anterior vertebral body for anterior column reconstruction. No strut bone graft was used for anterior support, and posterior fusion was not performed.

Preoperative factors

The preoperative clinical and radiological factors of the two groups were collected. Clinically, information on the patients' neurological and functional statuses was evaluated using the Frankel grade, Karnofsky Performance Score (KPS), and the Eastern Cooperative Oncology Group performance status scale (ECOG PS).[10] Patients were also assessed and stratified using the revised Tokuhashi score,[11] Tomita score,[12] and the Spinal Instability Neoplastic Score (SINS).[13] Radiologically, the kyphotic angle and the ratio of the vertebral height relative to the vertebral heights of the adjacent levels (anterior and posterior) for the involved vertebral

body were measured using T2-weighted sagittal magnetic resonance imaging (MRI) as depicted in Figure 1. In T2-weighted axial MRI images, the proportion of tumor involvement in the vertebral body (<50%, >50%), epidural tumor extension, and spinal cord compression by Bilsky grade were evaluated.[14] Finally, the tumor appearance (osteolytic, osteoblastic, mixed) was evaluated by computed tomography (CT) scan.

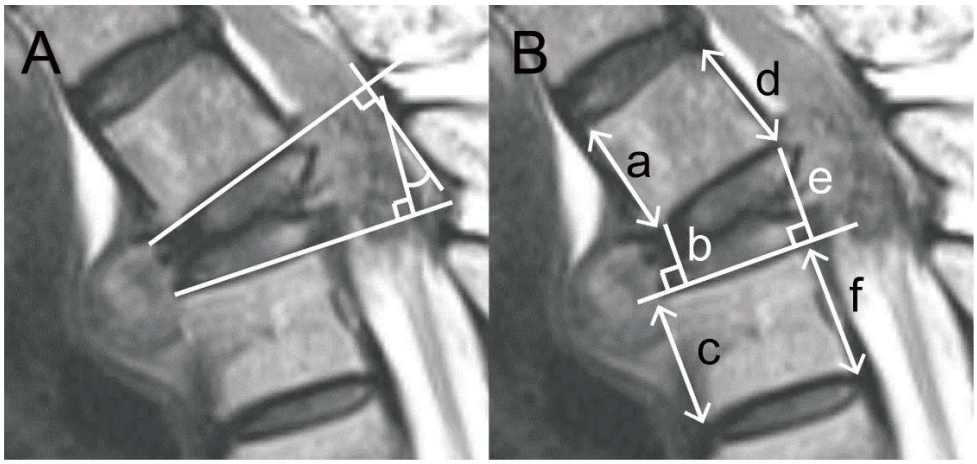

Figure 1. Radiological measurements using T2 weighted sagittal MRI. (A) The kyphotic angle is measured as the angle between the lower endplate of the vertebra above and the upper endplate of the vertebra below to the involved vertebra. (B) The vertebral height ratio was measured and calculated as follows: anterior vertebral height ratio = b/((a+c)/2), posterior vertebral height ratio = e/((d+f)/2)

Operative factors and postoperative outcomes

Operative findings, including operation time (minutes), estimated blood loss (EBL, mL), and amount of red blood cell (RBC) transfusion packs, were reviewed and compared. Regarding postoperative outcomes, the changes in the neurological and functional statuses (Frankel grade at postoperative 1 month and KPS and ECOG PS at postoperative 6 months) following surgery, postoperative survival, and the rate and causes for re-operation were assessed and compared between both groups.

Statistical analysis

Student's t-test, paired t-test, Mann-Whitney test, Chi-square test, and Fisher's exact test were used to compare the differences between the two groups. Kaplan-Meier curve analysis with log-rank test was used for survival analysis. A p-value <0.05 was considered statistically significant. All analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

Results

Demographic data

Forty-one patients (26 males and 15 females) were included in the study. The mean age of the patients was 61.2 years (range, 36-82) and the mean follow up period was 20.9 months (range, 0.4-69.4). The most common location of primary cancer was the lung (n = 12, 29.3%), followed by the breast (n = 7, 17.1%), liver (n = 6, 14.6%), and prostate gland (n = 4, 9.8%). Of the 41 patients, 17 (41.5%) underwent corpectomy and anterior column reconstruction (" corpectomy group "), and 24 (58.5%) underwent only laminectomy without corpectomy ("laminectomy-only group"). Of the 41 patients, 12 underwent palliative radiotherapy, and 19 underwent postoperative radiotherapy. Four patients in the corpectomy group and eight in the laminectomy-only group underwent palliative radiotherapy. Nine patients in the corpectomy group and 10 patients in the laminectomy-only group underwent postoperative radiotherapy. There were no significant differences in the demographics, follow-up periods, and primary cancers between the two groups (Table 1).

Table 1. Demographics and primary cancers

		Total (n = 41)	Corpectomy group (n = 17)	Laminectomy −only group (n = 24)	P−value
Age (years)¶		61.2 ± 12.1	58.3 ± 12.7	63.2 ± 11.4	0.228†
Sex (M:F)		26:15	10:7	16:8	0.607‡
Follow−up (months)¶		23.75 ± 19.07	25.9 ± 21.6	22.8 ± 19.9	0.685†
Primary cancer	Lung	12	6	6	
	Breast	7	4	3	
	Liver	6	3	3	
	Prostate	4	1	3	
	Others	12	3	9	
Radiotherapy					
Palliative		12 (29.3%)	4 (23.5%)	8 (33.3%)	0.502†
Postoperative		19 (46.3%)	9 (52.9%)	10 (41.7%)	0.481†

†p−value from Mann−Whitney test, ‡p−value from Chi−square test,

¶mean±standard deviation

Preoperative factors

The differences in preoperative factors between the two groups are summarized in Table 2. The corpectomy group showed a better preoperative performance status than the laminectomy-only group (higher KPS, lower ECOG PS), but the difference was not statistically significant (p = 0.112 and p = 0.334, respectively). The proportion of patients with a Frankel grade of D or E was higher in the corpectomy group than that in the laminectomy only group, but this was also not statistically significant (52.9% *vs.* 37.5%, p = 0.326). The corpectomy group showed a higher revised Tokuhashi score, lower Tomita score, and lower SINS score than the laminectomy only group, although this was not statistically significant (p = 0.359, 0.345, 0.670, respectively).

Radiologically, the corpectomy group had a larger kyphotic angle (10.7 ± 7.3 *vs.* 7.2 ± 4.1) and smaller anterior (0.70 ± 0.28 *vs.* 0.84 ± 0.20) and posterior (0.84 ± 0.16 *vs.* 0.89 ± 0.13) vertebral height ratios than the laminectomy-only group, but the difference was not statistically significant (p = 0.106, p = 0.157, and p = 0.190, respectively). There were no significant differences between the two groups in terms of vertebral body involvement, Bilsky grade in axial MRI, and tumor appearance on CT.

Table 2. Comparison of preoperative factors

		Corpectomy group (n = 17)	Laminectomy-only group (n = 24)	P-value
Performance status	KPS¶	58.9 ± 19.7	50.5 ± 19.1	0.112†
	ECOG PS¶	2.6 ± 1.2	3.0 ± 0.9	0.334†
	Frankel grade (B : C : D : E)	1 : 7 : 3 : 6	1 : 14 : 5 : 4	0.605‡
	(B+C : D+E)	8 : 9	15 : 9	0.326§
Scoring system	Tokuhashi (revised)¶	7.6 ± 3.3	6.4 ± 3.3	0.359†
	Tomita¶	6.3 ± 3.0	7.2 ± 2.8	0.345†
	SINS¶	10.6 ± 2.6	11.3 ± 2.4	0.670†
Radiologic findings	Kyphotic angle¶	10.7 ± 7.3	7.2 ± 4.1	0.106†
	Vertebral height ratio (anterior)¶	0.70 ± 0.28	0.84 ± 0.20	0.157†
	Vertebral height ratio (posterior)¶	0.84 ± 0.16	0.89 ± 0.13	0.190†
	Vertebral body involvement (> 50%:< 50%)	11:6	18:6	0.475§
	Appearance (osteolytic:osteo blastic:mixed)	10:6:1	17:4:3	0.478‡
	Bilsky grade (1b : 1c : 2 : 3)	2 : 1 : 5 : 9	2 : 0 : 10 : 12	0.672‡

†p-value from Mann-Whitney test, ‡p-value from Fisher's exact test, §p-value from Chi-square test, ¶mean±standard deviation

Operative findings

Comparison of the operative findings between the two groups is described in Table 3. The average operation time (minutes) was longer (262.0 ± 75.1 *vs.* 184.7 ± 69.8, p = 0.001) and EBL (mL) was larger (1708.8 ± 1098.3 *vs.* 752.1 ± 431.2, p = 0.001) in the corpectomy group than those in the laminectomy-only group. The amount of RBC transfusion packs was greater in the corpectomy group, although no statistical significance was found (4.1 ± 4.5 *vs.* 3.0 ± 2.7, p = 0.516). Regarding operative complications, two patients (one in each groups) required an embolization following the operation owing to excessive postoperative bleeding into the closed suction drain. In the laminectomy-only group, there was one case each of pneumonia and cerebral infarction.

Table 3. Comparison of operative findings

	Corpectomy group (n = 17)	Laminectomy-only group (n = 24)	P-value†
Operation time (min)¶	262.0 ± 75.1	184.7 ± 69.8	0.001
EBL (ml)¶	1708.8 ± 1098.3	752.1 ± 431.2	0.001
RBC transfusion (packs)¶	4.1 ± 4.5	3.0 ± 2.7	0.516
Perioperative complications (< 2 weeks)	Embolization due to an excessive bleeding: 1 case	Embolization due to an excessive bleeding: 1 case Pneumonia: 1 case Cerebral infarction: 1 case	

†p-value from Mann-Whitney test, ¶mean±standard deviation

Postoperative outcomes

Postoperative KPS was significantly higher (better performance) in the corpectomy group than that in the laminectomy-only group (65.3 ± 17.1 *vs.* 51.4 ± 21.0, p = 0.025). The improvement in KPS following the operation was also significantly greater in the corpectomy group (6.4 ± 8.0 *vs.* 0.9 ± 12.5, p = 0.041). The ECOG scale was lower (better performance) in the

corpectomy group but showed no statistical significance (2.3 ± 1.0 *vs.* 2.8 ± 1.2, p = 0.222) (Table 4). Regarding the neurological status, 9 of 17 (52.9%) patients in the corpectomy group and 10 of 24 (41.6%) patients in the laminectomy-only group showed an improvement of one Frankel grade after the operation (Figure 2). When comparing the performance status before and after surgery, KPS (p=0.015) and Frankel grade (p=0.004) improved statistically significantly in the corpectomy group. In the Laminectomy-only group, only Frankel grade (p=0.001) showed statistically significant improvement. (Table 5) There was no significant difference in the postoperative survival between the two groups in the survival analysis, which used a log rank test and Kaplan-Meier curves (p = 0.516) (Figure 3). There were three cases of reoperation due to instrumentation failure (pull-out of pedicle screws) in the laminectomy-only group, with a mean interval of 3.3 months between the operation and the failure. Furthermore, there were four patients in the corpectomy group and one in the laminectomy-only group who underwent re-decompression (Table 4).

A

Preoperative \ Postoperative	A	B	C	D	E
A	-	-	-	-	-
B	-	-	1	-	-
C	-	-	-	7	-
D	-	-	-	2	1
E	-	-	-	-	6

B

Preoperative \ Postoperative	A	B	C	D	E
A	-	-	-	-	-
B	-	-	1	-	-
C	-	-	5	9	-
D	-	-	-	5	-
E	-	-	-	-	4

Figure 2. Frankel' s grid of (A) the corpectomy group and (B) the laminectomy group. Numbers in the boxes on the upper right half indicate the numbers of patients with an improved neurological status following surgery (Frankel grade B to C, for example). The gray-colored boxes indicate patients whose Frankel grade is unchanged after the operation. There was no patient with a deteriorated Frankel grade following an operation in this series (the lower left half of the grid).

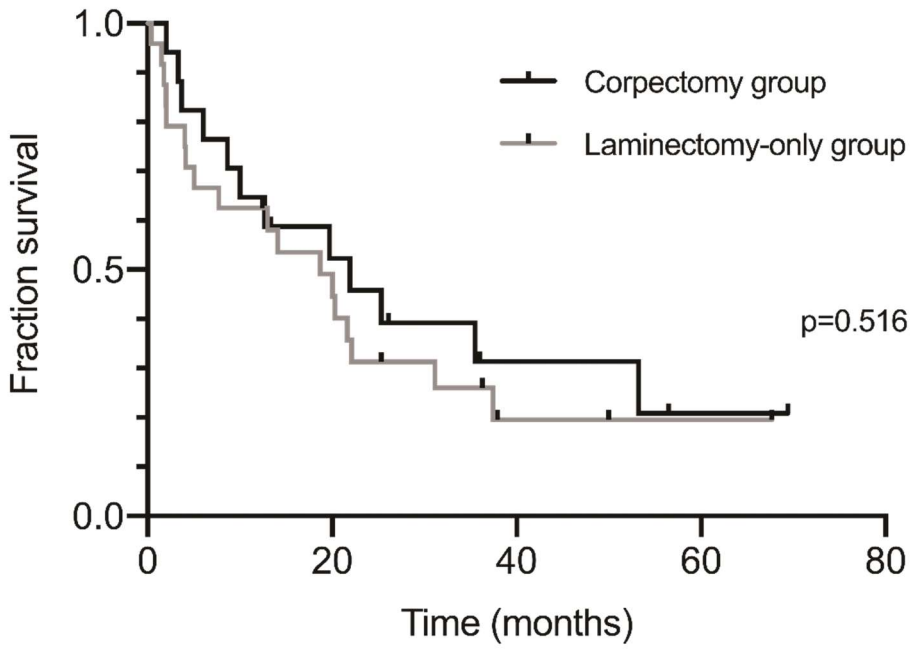

Figure 3. Kaplan-Meier survival curves of the corpectomy and laminectomy-only group. There was no statistically significant difference in the survival rates of the two groups (log-rank test, p = 0.516).

Table 4. Comparisons of postoperative outcomes

		Corpectomy group (n = 17)	Laminectomy-only group (n = 24)	P-value
Performance status	KPS[¶]	65.3 ± 17.1	51.4 ± 21.0	0.025[†]
	ECOG PS[¶]	2.3 ± 1.0	2.8 ± 1.2	0.222[†]
	Frankel grade (B : C : D : E)	0 : 1 : 9 : 7	0 : 6 : 14 : 4	0.110[‡]
	(B+C : D+E)	1 : 16	6 : 18	0.207[‡]
Re-operation	Instrument failure (screw pull-out)	0 case	3 cases	0.253[‡]
	Re-decompression	4 cases	1 case	0.141[‡]

[†]p-value from Mann-Whitney test, [‡]p-value from Fisher's exact test, [¶]mean±standard deviation

Table 5. Differences in performance status between two groups of patients before and after surgery

		Performance status		
		KPS	ECOG PS	Frankel grade (B+C : D+E)
Corpectomy group (n = 17)	Preoperative	58.9 ± 19.7	2.6 ± 1.2	8 : 9
	Postoperative	65.3 ± 17.1	2.3 ± 1.0	1 : 16
	†P-value	0.015	0.055	0.004
Laminectomy-only group (n = 24)	Preoperative	50.5 ± 19.1	3.0 ± 0.9	15 : 9
	Postoperative	51.4 ± 21.0	2.8 ± 1.2	6 : 18
	†P-value	0.423	0.162	0.001

†p-value from paired t-test

Discussion

Deciding the treatment of spinal metastasis requires a multi-disciplinary approach. Multiple factors, such as the patient's performance status, life expectancy, and neurologic status, are considered to determine the most appropriate treatment. All patients enrolled in the current study was treated according to a plan decided by a multi-disciplinary tumor board (comprising a medical oncologist, a radiation oncologist, a radiologist, a pathologist, an orthopedic oncologist, and an orthopedic spine surgeon), except in cases of emergency surgery. Although there were no statistically significant differences, the patients in the corpectomy group showed better preoperative performance than those in the laminectomy only group. We assume that these tendencies result from the decision-making process described above. In other words, more aggressive surgical treatment was performed on patients who could endure it and had a better expected prognosis. In addition, since the patients in the corpectomy group had a greater mean kyphotic angle and vertebral height loss before the surgery, a corpectomy with anterior column reconstruction may have been chosen to correct such problems for these patients.

When interpreting the differences in postoperative outcomes between the two treatment groups, particularly with respect to the functional status, the discrepancies in preoperative status, as mentioned above, should be considered. Since there is a selection bias due to the differences in preoperative conditions between the two groups, a better postoperative outcome in the corpectomy group does not simply mean that the corpectomy with anterior column reconstruction is superior to the laminectomy-only surgery. However, it should be noted that not only the postoperative net score, but also the amount of improvement in the KPS, was significantly greater in the corpectomy group than in the laminectomy-only group. Also, in the corpectomy group, KPS showed statistically significant improvement before and after surgery, but not in the laminectomy-only group. In Frankel grade, C and D are divided according to whether the patient's motor function is useful. Therefore, based on this, it is likely that the patient's quality of life is better when Frankel grade is D or E than B or C. In both groups, the proportion of Frankel grade D or E was significantly increased after surgery, but the percentage of patients who improved to D or E after surgery was greater in the corpectomy group. This result may suggest a greater potential for recovery of functional status in the corpectomy group.

A significant disadvantage of the addition of corpectomy followed by anterior column reconstruction is the increased surgical morbidity. In our study, the corpectomy group had a significantly longer mean operation time and increased blood loss than the laminectomy-only group. In the literature, many authors have emphasized the need for corpectomy and anterior column reconstruction, but also have warned of high complication rates associated with this additional surgical procedure. In a systemic review by Molina and colleagues, the mean percentage of patients with surgical complications from their reviewed articles was higher in the transpedicular corpectomy group than the posterior laminectomy group (25.0% *vs.* 13.5%).[7]

Although corpectomy and anterior column reconstruction increases surgical morbidity, it can provide enhanced stability which leads to improved pain and function. In 2012, Chong et al. published an article that retrospectively reviewed 105 patients who underwent a single-stage posterior decompression and stabilization with or without anterior column reconstruction.[8] In their study, postoperative pain improvement was significantly increased in patients who underwent anterior column reconstruction ($p = 0.02$). The authors suggested that this result was due to the enhanced immediate

stability provided by the anterior column reconstruction. After reviewing 113 prospectively enrolled patients with spinal metastasis, de Ruiter and colleagues found that the postoperative quality of life measures did not differ significantly according to different surgical procedures (corpectomy *vs.* laminectomy-only surgery).[9]

The effect of enhanced stability also seems to result in a decreased rate of implant failure and re-operation. Reoperation rates due to a failure of instrumentation following the surgical treatment of spinal metastases are reported to be 1.9%-16.0% in the literature.[15-17] Among the 41 patients in our study, there were 3 (7.3%) cases of instrumentation failure in the laminectomy group, owing to lack of stability shortly after surgery (mean interval = 3.3 months). All 3 patients had a lytic lesion in the CT scan and received fixation of 4 or less segments (Table 6). Two of these 3 patients received palliative radiotherapy, which is considered as significant risk factor for instrumentation failure in spinal metastasis patients (Figure 4).[17] In contrast, there were no cases of instrumentation failure in patients who underwent corpectomy and anterior column reconstruction in our series. However, no statistical significance was found due to the small sample size of the current study.

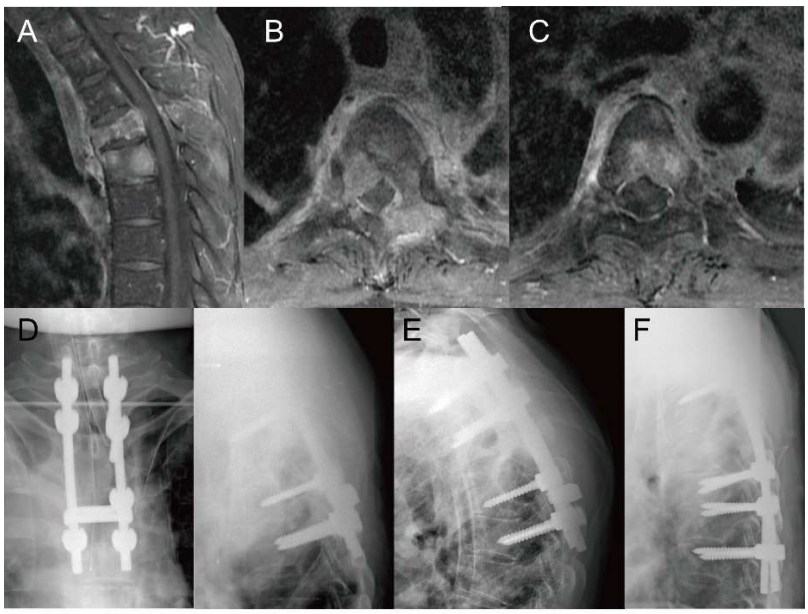

Figure 4. A descriptive case of instrumentation failure following a laminectomy-only surgery: A 52-year old male with a spinal metastasis of non-small cell lung cancer. (A) Preoperative sagittal MRI shows pathologic fracture and spinal cord compression at the T4 level. In the axial MRI, (B) the anterior and posterior components are involved at the T4 level, and (C) the anterior (left side) component is involved with metastasis at the T5 level. (D) The patient underwent a posterior laminectomy and stabilization from T2 to T6. (E) Two months after the initial surgery, pedicle screws at the T5-6 level had pulled out. The patient received postoperative radiotherapy at the T4-5 level after the surgery. (F) Revision surgery was performed, and the posterior instrumentation was extended distally to the T7 level.

Table 6. Characteristics of instrumentation failure cases in the laminectomy-only group

	Case 1	Case 2	Case 3	Total 41 patients
Age/ sex	52/M	47/F	74/M	-
Location of tumor	T4	T2	T12	-
Primary tumor	Lung	Rectal	Lung	-
Tumor appearance	Osteolytic	Osteolytic	Osteolytic	Osteolytic: 65.9%
No. of fixed levels	4	3	4	4.53
Palliative RTx.	O	O	X	12 cases 29.3%
Postoperative RTx.	O	O	X	19 cases 46.3%
Kyphotic angle (°)	11.00	9.87	8.78	8.53
SINS	13	10	16	10.9

RTx: radiotherapy

Re-decompression was performed in 4 cases in the corpectomy group and in 1 case in the laminectomy only group. However, there were 3 more cases of spinal cord compression in the laminectomy only group, in which additional re-decompression was not performed considering the patient's general and oncological status. Therefore, the number of cases that required re-decompression did not differ significantly between the two groups. Further investigations with a larger sample size are required in the future to clarify the effect of anterior column reconstruction on the rate of reoperation.

As mentioned in the introduction, in most cases, the purpose of surgery in MSCC patients is to improve the quality of life of the patient's remaining life, not cure. Therefore, although corpectomy and anterior column reconstruction has surgical morbidity, it is a considerable option because it has advantages such as improved KPS after surgery, improved neurological stats with a Frankel grade of D or higher, and less reoperation by providing stability.

The current study has several limitations. First, because it is a retrospective study, there may be selection bias and confounding factors that have not been considered. Second, the small sample size may have lowered the statistical significance of this study. Due to

these limitations, we cannot suggest specified indications for corpectomy and anterior column stabilization in spinal metastasis based on the findings of this study. However, we believe that our comparison between the two groups of patients who underwent spinal metastasis surgery with or without corpectomy and anterior column reconstruction can add useful information to the decision-making process regarding the treatment of spinal metastases.

Conclusion

In this retrospective comparative study on MSCC of the thoracic spine, patients who underwent corpectomy with anterior column reconstruction tended to have a better performance and oncological status and more vertebral collapse preoperatively than patients who received laminectomy-only surgery, although these results were not statistically significant. Despite the increased surgical burden, anterior column reconstruction seems to result in a better performance status and provide more mechanical stability postoperatively. Therefore, anterior column reconstruction should be considered in patients who have a general condition that good enough to endure a relatively aggressive surgery, more severely collapsed vertebral height, osteolytic metastases, and history of previous radiotherapy.

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국문 초록

목적: 흉추의 전이성 척수 압박 (MSCC)으로 후방 감압 및 안정술을 시행 받은 환자들을 추체제거 및 전방 재건술 여부에 따라 임상적 특성 및 결과를 비교하였다. 이를 통해 추체제거 및 전방 재건술이 필요한 환자의 특징을 알아보고자 하였다.

방법: 2013년 5월부터 2017년 10월까지 단일 3차 기관에서 MSCC로 후방 감압 및 안정술을 시행 받은 환자들을 대상으로 하였다. 환자들은 추체제거 및 전방 재건술 시행 여부에 따라 “추체제거 그룹”과 “후궁절제 그룹”으로 나뉘었다. 우리는 이 두 그룹의 수술 전 요인, 수술소견, 그리고 수술 후 결과를 비교하였다.

결과: 총 41명의 환자를 대상으로 분석하였으며 평균 나이는 61.2세(범위36-82)였다. 이 중 추체제거 그룹은 17명, 후궁절제 그룹은 24명이었다. 두 그룹 사이에 인구학적 특성, 추시 기간, 그리고 원발암의 종류는 차이가 없었다. 수술 전 요인에서 추체제거 그룹이 후궁절제 그룹보다 더 나은 활동 상태(더 높은 KPS(Karnofsky Performance Score), 더 낮은 ECOG PS(Eastern Cooperative Oncology Group performance status scale))를 보였으나 통계적으로 유의하지는 않았다. 영상의학적으로 추체제거 그룹이 후궁절제 그룹 보다 더 심한 추체의 붕괴(더 큰 후만각, 더 작은 전방 및 후방 추체 비율)을 보였으나 통계적으로 유의하

지는 않았다. 또한 추체제거 그룹에서 수술시간이 더 길었고(262.0±75.1 *vs.* 184.7±69.8, p = 0.001), 출혈이 더 많았다(1708.8±1098.3 *vs.* 752.1±431, p = 0.001). 수술 후 KPS는 추체제거 그룹에서 더 높았고(65.3±17.1 *vs.* 51.4±21.0, p = 0.025), 수술 후 KPS의 개선 역시 추제제거 그룹에서 더 높았다(6.4 ± 8.0 *vs.* 0.9 ± 12.5, p = 0.041). 수술 전후의 활동 상태를 비교할 때, 추체제거 그룹에서 KPS (p = 0.015)와 Frankel 등급 (p = 0.004)이 통계적으로 유의하게 향상되었다. 후궁절제 그룹에서는 Frankel 등급 (p = 0.001) 만 통계적으로 유의미한 개선을 보였다. 두 그룹 사이의 수술 후 생존율은 차이가 없었다. 후궁절제 그룹에서는 3 케이스의 고정기기 실패가 있었다. 추체제거 그룹에서 4명, 후궁절제 그룹에서 1명의 환자가 재감압술을 시행받았다.

결론: 추체제거 및 전방 재건술은 상대적으로 침습적인 수술을 견디기에 충분한 활동 상태의 환자들에서 고려해 볼 수 있다. 수술적 부담이 증가함에도 불구하고, 전방 재건술은 수술 후 더 나은 임상적 상태와 기계적인 안정성을 제공할 것으로 생각한다.