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Evaluation of the effectiveness of the short-segment thoracolumbar instrumentation: a single-center study

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ABSTRACT

Aims: This prospective study aimed to compare the long-term follow-up findings of patients with short-segment thoracolumbar instrumentation with the long-term follow-up findings results of patients with long-segment thoracolumbar instrumentation.

Methods: Patients who underwent surgery for a thoracolumbar junction spine fracture were included in this study. The patient's age, gender, and neurological impairment, "AOSpine Classification Scale", "Visual Analog Scale (VAS)", "modified Japanese Orthopedic Association (mJOA)" and "Oswestry Disability Index (ODI)" scores, pedicle and/or pars interarticularis fractures, anterior, middle, and posterior height loss of the fractured vertebral body (mm), the height loss rate of the fractured vertebra, angulation degree, sagittal and axial spinal canal diameters (mm) and presence of bone fragment extending into the spinal canal on CT images were recorded at admission to the hospital, and the end of the sixth month after surgical intervention. Duration of anesthesia and surgery time, the amount of bleeding during the surgery, the radiation level (mGy) released by fluoroscopy, performing laminectomy, length of stay in the intensive care unit, and hospital were recorded. Additionally, the stability and integrity of the instrumentation were examined with dynamic X-ray images.

Results: Preoperative fractured vertebra collapse rates ($t=4.175$, $p=0.001$) and surgery times ($t=4.175$, $p=0.001$) were different between groups. In the long-segment group, preoperative VAS scores ($Z=-2.687$, $p=0.007$), mJOA scores ($Z=-2.585$, $p=0.010$), and ODI scores ($t=53.253$, $p<0.001$) were different from postoperative long-term follow-up values. In addition, in the short segment group, preoperative VAS scores ($Z=-2.214$, $p=0.027$), mJOA scores ($Z=-2.333$, $p=0.020$), and ODI scores ($t=48.338$, $p<0.001$) were different from the postoperative long-term follow-up values. ROC-curve analysis and Logistic Regression analysis results revealed that any study parameter could not predict the decision-making for inserting screws into the fractured vertebra, the need for laminectomy, the risk of developing postoperative instability, or the worse prognosis risk of mJOA.

Conclusion: This study's results showed that short-segment instrumentation, which is performed by inserting a screw into the fractured vertebra, is as effective as long-segment instrumentation in providing both clinical and radiological improvement in patients. At the same time, it has advantages such as less operating time, less surgical bleeding, and short anesthesia time. However, it was determined that no parameter of the study could predict the placement of screws in the fractured spine, the need for laminectomy, the risk of postoperative instability, or the prognosis risk of mJOA. Therefore, it was concluded that conducting this study on a larger patient population would be appropriate.

Keywords: Thoracolumbar junction, short segment instrumentation, posterior thoracolumbar approach

INTRODUCTION

Today, anterior, posterior, and combined surgical approaches are still applied in thoracolumbar vertebra fractures to restore spinal stability, prevent deformity, and provide spinal canal decompression. For this purpose, posterior approaches are mostly preferred for short or long-segment instrumentation due to ease of application, less blood loss, and small surgical area.[1,2]

Although some advantages such as tighter fixation and better canal healing in long-segment instrumentation have been reported, this intervention requires exposure to larger surgical fields, which increases surgical trauma, and bleeding, and extends the surgery time.[3,4] For these reasons, spine surgeons prefer short-segment instrumentation by screwing the fractured vertebra. It has been noticed that this method has some advantages such as protecting mobile segments, reducing the kyphosis angle, preventing the increase in anterior vertebra collapse, providing small surgical incisions with a few muscle dissection and a low amount of bleeding, and shortening surgical time. It is also claimed that screws placed in the fractured vertebra can prevent vertebral collapse by providing a mass effect.[5-9] However, little information is available in the literature about the advantages and disadvantages of this new method compared to long-segment instrumentation.[9-11] In addition, there is little information available in the literature on the type of patients to whom this method can be applied.[12]

This prospective study was aimed to compare the long-term follow-up findings of patients with short-segment thoracolumbar instrumentation, in which a fractured vertebra was screwed, with the long-term follow-up findings results of patients with long-segment thoracolumbar instrumentation, in which the fractured vertebra was skipped. In addition, this study aimed to explore the clinical and or radiological markers in predicting which patient group would be treated with short-segment instrumentation.

METHODS

Ethics

This prospective clinical research study was done after approval by the Clinical Research Ethics Committee of the university to which the authors are affiliated (Date: 11.03.2021, Decision No: 2021.02-05). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. In addition, this study was supported by the Scientific Research Projects Coordination Unit of the university to which the authors are affiliated, within the scope of "Directed Project" (Project acceptance date: 27.05.2021, Project number: 2021/065).

Patients

Patients who had a thoracolumbar junction spine (T12, L1, L2) fracture for various reasons (such as falling from a height, a traffic accident, etc.) between May 2021 and May 2023 and who underwent surgery for this fracture were included in this study. Patients with pathological fractures (such as tumors, osteoporosis, and rheumatological diseases) and pediatric patients (under 15 years old) were excluded from the study. Patients were then grouped as follows:

- Short-segment group (formed from patients who underwent instrumentation by placing screws in the fractured spine, n=6)
- Long-segment group (created from patients who underwent instrumentation by omitting the fractured vertebra, n=9)

In addition, patients were grouped according to their gender.

Materials

The patients' age, gender, and neurological deficiency levels, "AOSpine Classification Scale", "Dennis's Classification Scale", "Visual Analog Scale (VAS)", "modified Japanese Orthopedic Association (mJOA)" and "Oswestry Disability Index" scores, pedicle fractures and pars interarticularis fractures, anterior, middle, and posterior height loss of the fractured vertebral body (mm), the height loss rate of the fractured vertebra, degree of angulation, the sagittal and axial spinal canal diameter (mm) and presence of bone fragment extending into the spinal canal on CT images were recorded at the time of admission to the hospital, and the end of the sixth month after surgical intervention. The pedicle diameters of the vertebrae (mm) were also recorded. The anesthesia time applied to the patients during the surgery and the duration of the surgery, the amount of bleeding during the surgery, the radiation level (mGy) released by fluoroscopy, performing laminectomy, length of stay in the intensive care unit, and hospital were recorded. Additionally, the stability

Figure 1. The pictures show the measurement techniques of the anterior, middle, and posterior height loss of the fractured vertebral body (mm), the height loss rate of the fractured vertebra, and the sagittal and axial diameter of the spinal canal (mm) on the preoperative (**1A**) and postoperative long-term follow-up (**1B**) CT images of a patient who underwent short-segment instrumentation

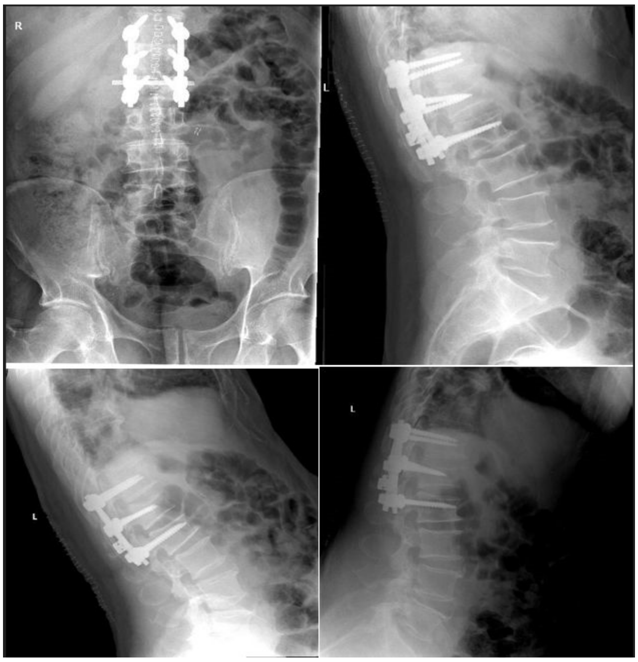

Figure 2. The pictures show no instability in the postoperative long-term follow-up X-ray images of a patient who underwent short-segment instrumentation, and the instrument's structural integrity is preserved

and integrity of the instrumentation were examined with dynamic X-ray images (Figure 1, Figure 2, Figure 3, Figure 4).

The ratio between the height of the vertebra above the broken vertebra and the height of the broken vertebra was calculated.

Additionally, the ratio between the height of the vertebra below the broken vertebra and the height of the broken vertebra was calculated. The collapse rate in the fractured vertebra was obtained by averaging these two values. The spinal canal diameters were measured from front to back of the narrowest part of the spinal canal at the fractured vertebra level. The angulation degree in the broken spinal segment, reflecting the kyphosis, was measured between the upper and lower end plates of the broken vertebra.

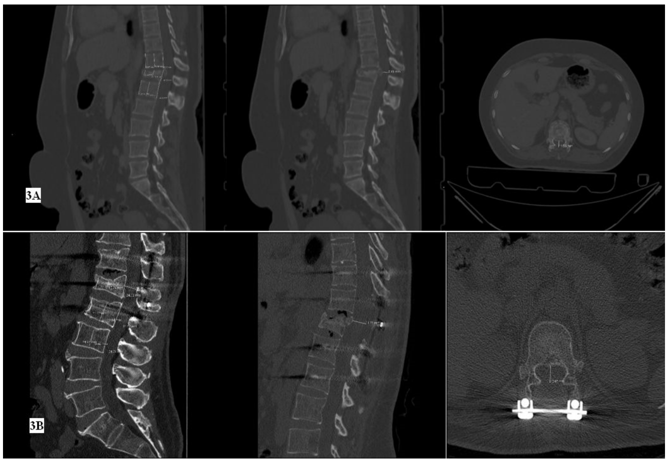

Figure 3. The pictures show the measurement techniques of the anterior, middle, and posterior height loss of the fractured vertebral body (mm), the height loss rate of the fractured vertebra, the sagittal and axial diameter of the spinal canal on the preoperative (**3A**) and postoperative long-term follow-up (**3B**) CT images in a patient who underwent long-segment instrumentation

Figure 4. The pictures show no instability on the postoperative long-term follow-up X-ray images of a patient who underwent long-segment instrumentation and the instrument's structural integrity is preserved

Surgery

Under general anesthesia, the injured spinal segment was explored through the standard posterior midline approach. Then, under fluoroscopy (Philips C-Arm Image Intensifier BV Vectra 718400, Product ID: 84343616, Serial Number: 200038), bilateral pedicle screws were inserted into the broken spine segment with (short segment) or without (long segment) screw placement into the fractured vertebra. Ligamentotaxis was also performed. Then, kyphosis was corrected and the screws were locked with distraction and cross-link was applied. If CT images revealed the spinal canal narrowing and/or a bone fragment in the spinal colon, total laminectomy and foraminotomy were performed if necessary.

Statistical Analysis

Study data were analyzed using SPSS v. 20.0 (IBM).

Independent Samples t-test was used to analyze the parametric study findings ($p<0.05$). Mann-Whitney U test was used to compare the non-parametric study findings ($p<0.05$). Categorical variables were analyzed using the Pearson chi-square test ($p<0.05$). The statistical correlation between the data was analyzed by Spearman's rho correlation ($p<0.05$). Paired Samples t-test and Wilcoxon Signed Ranks test were used to analyze repeated data ($p<0.05$). The ROC-curve test was applied to determine the predictive variable(s) in decision-making for inserting a screw into the fractured vertebra. Binary Logistic Regression analysis was used to reveal the best predictive variable(s) ($p<0.05$).

RESULTS

The average age of all patients included in the study was 48 years (minimum 20 years, maximum 87 years), and of these patients, 4 were female and 11 were male. When the preoperative findings of all patients were examined, it was determined that most of the patients had an L1 corpus fracture (73.3%), whereas most patients did not have a pars interarticularis fracture (80%) or pedicle fracture (73.3%) and most of the patients had no neurological impairment (73.3%). On the other hand, it was found that most patients had a bone fragment extending into the spinal canal (86.7%).

Preoperative fractured vertebra collapse rates ($t=4.175$, $p=0.001$) and surgery times ($t=4.175$, $p=0.001$) were found different between the short-segment and long-segment groups. However, no statistical difference was found between the two groups in terms of age, sex, broken vertebra level, pedicle and pars interarticularis fracture, bone fragment extending into the spinal canal, presence of the neurological impairment, AOSpine and Dennis's classification scores, preoperative VAS, mJOA and ODI scores (Table 1, Table 2).

In the long-segment group, preoperative VAS scores ($Z=-2.687$, $p=0.007$), mJOA scores ($Z=-2.585$, $p=0.010$), and ODI scores ($t=53.253$, $p<0.001$) were different from postoperative long-term follow-up values. In addition, in the short segment group, preoperative VAS scores ($Z=-2.214$, $p=0.027$), mJOA scores ($Z=-2.333$, $p=0.020$), and ODI scores ($t=48.338$, $p<0.001$) were different from the postoperative long-term follow-up values (Table 3).

On the other hand, no study parameter value was different between the male and female patient groups.

A positive correlation was found between the pedicle fracture and duration of anesthesia ($r=0.683$, $p=0.005$), duration of surgery ($r=0.687$, $p=0.007$), radiation dose ($r=0.725$, $p=0.027$), length of stay in intensive care unit ($r=0.649$, $p=0.009$) and length of hospital stay ($r=0.556$, $p=0.031$). A positive correlation was detected between pars fracture and the mid-height of the fractured vertebra ($r=0.656$, $p=0.008$), AOSpine score ($r=0.593$, $p=0.020$) and length of stay in the intensive care unit ($r=0.782$, $p=0.001$). A negative correlation was detected between the mid-height of the fractured vertebra and the collapse rate of the fractured vertebra ($r=-0.913$, $p<0.001$) and the presence of intracanal fragments ($r=-0.545$, $p=0.036$). A negative correlation was found between the anterior height of the fractured vertebra and laminectomy ($r=-0.756$, $p=0.001$). There was a positive correlation between AOSpine scores and length of stay in the intensive care unit ($r=0.570$, $p=0.027$). A negative correlation

Table 1. Distribution table of patients' demographic, radiological, and clinical data by groups

Variable		Long-segment Mean ± SD/ Median (min-max)/ n (%)	Short-segment Mean ± SD/ Median (min-max)/ n (%)	t/ Z/ X2	p
Age		51.00±19.01	45.50±16.86	0.573*	0.576
Sex	Female	3 (20.0%)	1 (6.7%)	0.511‡	0.475
	Male	6 (40.0%)	5 (33.3%)		
Fractured vertebra	T12	2 (13.3%)	0 (0.0%)	1.553‡	0.460
	L1	6 (40.0%)	5 (33.3%)		
	L2	1 (6.7%)	1 (6.7%)		
Pedicle fracture	No	5 (33.3%)	6 (40.0%)	3.636‡	0.057
	Yes	4 (26.7%)	0 (0.0%)		
Pars interarticularis fracture	No	7 (46.7%)	5 (33.3%)	0.069‡	0.792
	Yes	2 (13.3%)	1 (6.7%)		
Bone fragment in the spinal canal	No	0 (0.0%)	2 (13.3%)	3.462‡	0.063
	Yes	9 (60.0%)	4 (26.7%)		
Neurological impairment	No	5 (33.3%)	6 (40.0%)	3.636‡	0.057
	Yes	4 (26.7%)	0 (0.0%)		
AOSpine score	A3	4 (26.7%)	3 (20.0%)	5.774‡	0.217
	A4	1 (6.7%)	1 (6.7%)		
	B1	0 (0.0%)	2 (13.3%)		
	B2	3 (20.0%)	0 (0.0%)		
	C	1 (6.7%)	0 (0.0%)		
Dennis's Classification score	2 colons	5 (33.3%)	4 (26.7%)	0.185‡	0.667
	3 colons	4 (26.7%)	2 (13.3%)		
Preoperative VAS score		9 (7-10)	8.5 (6-9)	-0.754†	0.451
Preoperative mJOA score		13 (10-18)	13 (13-13)	-0.505†	0.613
Preoperative Oswestry score		58.11±2.03	56.33±1.75	1.751†	0.103

(*) t value, Independent Samples t test; (†) Z value, Mann Whitney U test; (‡) X2 value, Pearson Chi-square test; p<0.05
(SD: standard deviation, min: minimum, max: maximum, N: number of patients, VAS: Visual Analog Scale, mJOA: modified Japanese Orthopaedic Association)

was found between spinal canal sagittal diameter and anesthesia duration (r=-0.578, p=0.024), number of screws (r=-0.542, p=0.037), and hospitalization duration (r=-0.655, p=0.008). A positive correlation was found between the presence of neurological deficiency and duration of anesthesia (r=0.596, p=0.019), duration of surgery (r=0.570, p=0.033), amount of bleeding (r=0.734, p=0.002), number of screws (r=0.564, p=0.029), and the duration of stay in the intensive care unit (r=0.649, p=0.009). A positive correlation was found between anesthesia duration and laminectomy (r=0.554, p=0.032) and the number of screws (r=0.839, p<0.001). A positive correlation was found between surgery time and radiation dose (r=0.807, p=0.009), laminectomy (r=0.592, p=0.026), and the number of screws (r=0.843, p<0.001). A negative correlation was found between laminectomy and mJOA prognosis scores (r=0.608, p=0.016).

As a result of the ROC-curve analysis and Binary Logistic Regression analysis, it was determined that no study parameter could predict the inserting of screws into the fractured vertebra, the need for laminectomy, the risk of developing postoperative instability, or the worse prognosis risk of mJOA.

DISCUSSION

Conventional methods of stabilizing the spine involve two vertebrae above and two vertebrae below the injured vertebra to supply enough stabilization to allow early mobilization and recovery without incurring post-traumatic kyphosis risk, instrument fracture, and late neurological impairment. However, besides these advantages, they also cause immobilization of the spine due to the immobilization of at least five vertebral segments which may lead to insufficient long-term reduction and instrumentation failure along with kyphosis.[11,12] To prevent these unfavorable events, some authors advocate the placement of peduncular screws in fractured vertebrae to strengthen the structure.[3,5,7,13]

This study showed no statistical difference between the long-segment and short-segment groups in the preoperative period in terms of age, gender, fractured vertebra level, pedicle fracture, pars fracture, preoperative kyphotic degree, spinal canal diameters, pedicle diameters, presence of the fractured bone fragment extending into the spinal canal, and presence of the neurological impairment. In addition, AOSpine Classification, Dennis's Classification, VAS, mJOA, and ODI scores were also similar between these two groups. On the other hand, it was found that the collapse rates of fractured vertebrae were lower in the short-segment group. With these findings, it was thought that the two groups had a similar and homogeneous structure.

In addition, it was observed that the duration of the anesthesia, amounts of bleeding, and radiation doses applied during surgery were similar between these two patient groups, but short-segment instrumentation procedures took

Table 2. Distribution table of preoperative, intraoperative, and postoperative long-term follow-up radiological and clinical data of the patients according to groups

		Long segment Mean ± SD/ Median (min-max)/ N (%)	Short segment Mean ± SD/ Median (min-max)/ N (%)	t/ Z/ X2	p
Preoperative values					
Fractured vertebra anterior height		19.16±4.15	20.19±2.01	-0.559*	0.585
Fractured vertebra middle height		12.31±3.54	14.32±5.06	-0.910*	0.380
Fractured vertebra posterior height		25.32±0.85	26.46±4.05	-0.746*	0.469
Fractured vertebra compression rate		45.46±15.15	37.20±19.17	4.175*	**0.001**
Angulation degree		1.03±9.93	2.55±10.11	-0.288*	0.778
Spinal canal sagittal diameter		8.43±1.99	10.03±1.76	-1.592*	0.135
Spinal canal axial diameter		9.95±2.82	12.49±1.68	-1.966*	0.071
Right pedicle diameter		6.51±1.91	6.55±1.84	-0.039*	0.969
Left pedicle diameter		6.85±1.86	6.82±1.56	0.031*	0.975
Follow-up values					
Multiaxial screws number	6	1 (6.7%)	6 (40.0%)	11.429‡	**0.001**
	8	8 (53.3%)	0 (0.0%)		
Laminectomy	No	4 (26.7%)	5 (33.3%)	2.269‡	0.132
	Yes	5 (33.3%)	1 (6.7%)		
Fractured vertebra anterior height		18.72±4.15	16.93±2.00	0.979*	0.346
Fractured vertebra middle height		10.76±3.64	11.66±4.17	-0.445*	0.664
Fractured vertebra posterior height		24.74±2.04	24.84±3.26	0.076*	0.941
Fractured vertebra compression rate		50.47±17.97	48.90±15.35	-0.175*	0.864
Anesthesia time (minute)		205.33±86.53	162.00±21.68	-1.188*	0.256
Surgery time (minute)		182.62±35.73	115.33±18.73	4.175*	0.001
Bleeding volume (mL)		519.44±457.66	244.17±137.13	1.416*	0.180
Radiation dosage (mGy)		15.47±5.37	9.69±3.44	1.856*	0.106
Follow-up instability	No	9 (60%)	4 (26.7%)	3.462‡	0.063
	Yes	0 (0%)	2 (13.3%)		
Postoperative VAS score (1 day)		6 (2-7)	3.50 (2-7)	-1.752†	0.080
Follow-up VAS score (6 months)		0 (0-2)	0 (0-2)	-0.455	0.649
Postoperative mJOA score (1 day)		17 (11-18)	17 (13-18)	0.000†	1.000
Follow-up mJOA score (6 months)		18 (13-18)	18 (14-18)	-0.253†	0.800
mJOA score improvement rate		100 (37.5-100)	100 (20-100)	-0.084†	0.933
Postoperative Oswestry score (1 day)		42.44±6.39	39.67±3.33	0.973*	0.348
Follow-up Oswestry score (6 months)		11.33±2.18	11.33±2.16	0.000*	1.000
Duration of stay in intensive care unit		0 (0-4)	0 (0-0)	0.232†	0.529
Duration of stay in hospital		6 (3-10)	4.5 (4-7)	-0.909†	0.363

(*) t value, Independent Samples t test; (†) Z value, Mann Whitney U test; (‡) X2 value, Pearson Chi-square test; p<0.05
(SD: standard deviation, min: minimum, max: maximum, N: number of patients, VAS: Visual Analog Scale, mJOA: modified Japanese Orthopaedic Association)

less time. With these findings, it was thought that applying short-segment instrumentation was easier and less tiring for the surgeon. However, when looking at the numerical data, although no statistically significant difference was found, it was seen that the duration of anesthesia applied during surgery, the amount of bleeding due to surgery, and the radiation doses applied were less in patients who received short segment instrumentation. Thus, it was argued that applying short-segment instrumentation could be an advantage for both surgeons and patients.

On the other hand, in patients who underwent long-segment instrumentation, there was no difference between the preoperative and long-term follow-up findings in terms of anterior, middle, and posterior height loss of the fractured vertebra and collapse rates of the fractured vertebra. In this patient group, a meaningful decrease in VAS and ODI scores and a meaningful increase in mJOA scores were detected in the long-term follow-up. Thus, it was determined that long-segment instrumentation provided both clinical and radiological improvement in these patients. In addition, in patients who underwent short-segment instrumentation, anterior and posterior height values of the fractured vertebra in the long-term follow-up slightly decreased compared to the preoperative values, but the mid-height values of the fractured

Table 3. Comparison table of preoperative radiological and clinical data of each group with postoperative long-term follow-up data

Group	Variable	Preoperative Mean ± SD/ Median (min-max)	Follow-up Mean ± SD/ Median (min-max)	t/ Z	p
Long segment	Fractured vertebra anterior height	19.16±4.15	18.72±4.15	0.324*	0.754
	Fractured vertebra middle height	12.31±3.54	10.76±3.64	1.523*	0.166
	Fractured vertebra posterior height	25.32±0.85	24.74±2.04	1.199*	0.265
	Fractured vertebra compression rate	45.46±15.15	50.47±17.97	-1.112*	0.299
	VAS score	9 (7-10)	0 (0-2)	-2.687†	**0.007**
	mJOA score	13 (10-18)	18 (13-18)	-2.585†	**0.010**
	Oswestry score	58.11±2.03	11.33±2.18	53.253†	**<0.001**
Short segment	Fractured vertebra anterior height	20.19±2.01	16.93±2.00	3.076*	**0.028**
	Fractured vertebra middle height	14.32±5.06	11.66±4.17	1.620*	0.166
	Fractured vertebra posterior height	26.46±4.05	24.84±3.26	2.717*	**0.042**
	Fractured vertebra compression rate	37.20±19.17	48.90±15.35	-2.011*	0.101
	VAS score	8.5 (6-9)	0 (0-2)	-2.214†	**0.027**
	mJOA score	13 (13-13)	18 (14-18)	-2.333†	**0.020**
	Oswestry score	56.33±1.75	11.33±2.16	48.338†	**<0.001**

(*) t value, Paired Samples t test; (†) Z value, Wilcoxon Signed Ranks test; p<0.05
(SD: standard deviation, min: minimum, max: maximum, VAS: Visual Analog Scale, mJOA: modified Japanese Orthopaedic Association)

vertebra did not change. In this patient group, a meaningful decrease in VAS and ODI scores and a meaningful increase in mJOA scores were detected in the postoperative long-term follow-up compared to preoperative values. Thus, it was determined that short-segment instrumentation provided both clinical and radiological improvement in these patients. Besides, it was seen that the preoperative collapse rates were similar in both patient groups and did not increase in the postoperative long-term follow-up and instability did not develop. There was a meaningful decrease in postoperative VAS and ODI scores and a significant increase in mJOA scores and these values were not different between the groups preoperatively and postoperatively. With these findings, it could be suggested that patients in both groups could benefit from these surgeries significantly, and short-segment instrumentation could be as effective as long-segment instrumentation in both the clinical and radiological recovery of patients.

On the other hand, ROC analysis and Binary Logistic Regression analysis showed that any study parameter could not predict the decision-making for inserting the screws into the fractured vertebra, the necessity of laminectomy, the development risk of postoperative instability, or worse prognosis risk. On the other hand, it was observed that no screw was sent to the fractured vertebra of any patient with a pedicle fracture. However, it was determined that a pedicle screw was inserted into the fractured vertebra of a patient with a pars interarticularis fracture. It was also observed that no screw was inserted into the fractured vertebra in any patient with an AOSpine classification score of B1 or above. Thus, it was thought that pedicle fracture and high AOSpine score may be a risk for performing screws to the fractured vertebra, while pars interarticularis fracture may be a relative risk. Finally, based on this, it was thought that the experience of the surgeon, as well as the patient's clinical and neurological conditions and radiological findings, may be important in deciding which patient can receive short-segment instrumentation.

Limitations

This study had some limitations. First, the number of patients included in the study was very small, and therefore it was assumed that the results of this study could not reflect the general population. Second, since the study did not include a pediatric patient group, no idea could be obtained about the results in these patients. Third, this study did not contain the outcomes of other surgical interventions (such as anterior corpectomy and cage placement). Fourth, very long-term (two years or more) surgical outcomes of the patients were not included in the study. Finally, since this study was conducted in a single center, the experiences of other external center surgeons and their results were not included in this study. However, despite all these limitations, the study findings were quite interesting, and therefore, it was concluded that conducting this study in a multi-center with a larger patient population would be appropriate.

CONCLUSION

This study's results showed that short-segment instrumentation, which is performed by inserting a screw into the fractured vertebra, is as effective as long-segment instrumentation in providing both clinical and radiological improvement in patients. At the same time, it has some advantages such as less operating time, less surgical bleeding, and short anesthesia time. However, it was determined that no study parameter could predict the placement of screws into the fractured vertebra, the need for laminectomy, the risk of postoperative instability, or the worse prognosis risk of mJOA. Therefore, it was concluded that conducting this study on a larger patient population would be appropriate.

Declaration of Interest

There is no "conflict of interest" among the authors. Furthermore, through any of the products used in this research, no financial engagement has been established with any company that makes and/or markets these products or with any corporation that produces and/or markets a competing product.

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ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Kırıkkale University Non-invasive Ethics Committee (Date: 11.03.2021, Decision No: 2021.02.25).

Informed Consent: All patients signed and free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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