

Percutaneous short-segment pedicle screw placement without fusion in the treatment of thoracolumbar burst fractures: is it effective?: comparative study with open short-segment pedicle screw fixation with posterolateral fusion

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Received: 5 March 2013 / Accepted: 20 August 2013 / Published online: 10 September 2013
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Abstract

Background Since introduction of the pedicle screw-rod system, short-segment pedicle screw fixation has been widely adopted for thoracolumbar burst fractures (TLBF). Recently, the percutaneous pedicle screw fixation (PPSF) systems have been introduced in spinal surgery; and it has become a popularly used method for the treatment of degenerative spinal disease. However, there are few clinical reports concerning the efficacy of PPSF without fusion in treatment of TLBF. The purpose of this study was to determine the efficacy and safety of short-segment PPSF without fusion in comparison to open short-segment pedicle screw fixation with bony fusion in treatment of TLBF.

Methods This study included 59 patients, who underwent either percutaneous ($n=32$) or open ($n=27$) short-segment pedicle screw fixation for stabilization of TLBF between December 2003 and October 2009. Radiographs were obtained before surgery, immediately after surgery, and at the final follow-up for assessment of the restoration of the spinal column. For radiologic parameters, Cobb angle, vertebral wedge angle, and vertebral body compression ratio were assessed on a lateral thoracolumbar radiograph. For patient's pain and functional assessment, the visual analogue scale

(VAS), the Frankel grading system, and Low Back Outcome Score (LBOS) were measured. Operation time, and the amount of intraoperative bleeding loss were also evaluated.

Findings In both groups, regional kyphosis (Cobb angle) showed significant improvement immediately after surgery, which was maintained until the last follow up, compared with preoperative regional kyphosis. Postoperative correction loss showed no significant difference between the two groups at the final follow-up. In the percutaneous surgery group, there were significant declines of intraoperative blood loss, and operation time compared with the open surgery group. Clinical results showed that the percutaneous surgery group had a lower VAS score and a better LBOS at three months and six months after surgery; however, the outcomes were similar in the last follow-up.

Conclusions Both open and percutaneous short-segment pedicle fixation were safe and effective for treatment of TLBF. Although both groups showed favorable clinical and radiologic outcomes at the final follow-up, PPSF without bone graft provided earlier pain relief and functional improvement, compared with open TPSF with posterolateral bony fusion. Despite several shortcomings in this study, the result suggests that ongoing use of PPSF is recommended for the treatment of TLBF.

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Keywords Percutaneous pedicle screw fixation · Short segment · Thoracolumbar burst fracture

Introduction

Thoracolumbar burst fractures (TLBF) are the most common spinal injuries caused by an axial load, with or without flexion force, affecting anterior and middle columns of a vertebral body [11]. They occur predominantly in young patients,

accounting for 10 % to 20 % of all spinal fractures, and representing from 21 % to 58 % of all thoracolumbar spinal fractures [8, 9]. They are associated with kyphotic deformity and spinal canal encroachment caused by retropulsion of fracture segments. If treatments for TLBF are not performed adequately, kyphotic deformity of the spinal column and the patient's neurologic state might be aggravated, resulting in a significant impact on patient's physical and occupational activities [21]. Some have advocated that non-operative treatments for TLBF without neurologic deficit show good clinical results, although residual kyphotic angle remained significant, compared with the angle in the group treated with surgical correction [27, 32]. On the other hand, non-operative treatments were associated with late neurologic decline in 10–20 % of patients with TLBF, who were then frequently treated with surgical intervention [11].

Since the introduction of the posterior transpedicular screw fixation (TPSF) system, good radiologic and clinical outcomes have been reported with posterior instrumentation and reduction [2, 12, 15, 24]. Initially, long-segment TPSF, including two levels above and two levels below the fractured level, was performed widely for TLBF. With development of the pedicle screw fixation system, short-segment TPSF has frequently been used for TLBF in an effort to reduce fixation and fusion level. Posterolateral bony fusion was usually performed with posterior pedicle instrumentation for stabilization of a fractured vertebra. However, recent studies have reported that there was no significant difference in clinical and radiologic results between fusion and non-fusion groups after posterior pedicle fixation for TLBF [8, 25, 30].

To reduce surgical damage to normal muscular structure during pedicle instrumentation, a C-arm guided percutaneous pedicle screw fixation (PPSF) technique had been introduced; and it has become a popularly used method for the treatment of degenerative spinal disease; however, there are few clinical reports concerning the efficacy of PPSF without fusion in treatment of TLBF [22, 23]. To determine the efficacy and safety of short-segment PPSF without fusion for treatment of TLBF, the author conducted a comparative study with those of open short-segment TPSF with bony fusion. In this study, the hypothesis was that posterolateral bony fusion may not be necessary in some kind of TLBF, and short-segment PPSF without fusion may be a safe and effective alternative to the traditional open technique in TLBF.

Materials and methods

Study population

In this study the author enrolled 59 patients, who underwent either percutaneous ($n=32$) or open ($n=27$) short-segment TPSF for treatment of TLBF between December 2003 and

March 2011 in the department of neurosurgery of Chonnam National University hospital. For classification of TLBF, the criteria of Denis for burst fractures were applied [10]. The indication of surgery for either percutaneous or open posterior short-segment technique was the same; regional kyphosis greater than 30°, regional kyphosis with posterior bony or ligamentous injury, vertebral body collapse greater than 50 %, vertebral three column injury, or spinal canal encroachment <40 % without significant neurological symptoms. The inclusion criteria were as follows: single level fracture on the thoracolumbar region (T11–L2); time to operation after trauma being less than one week. Patients with severe osteopenia (bone mineral density (BMD) t score <−2.5), pathologic fractures, pedicle fractures, or previous spine surgery due to trauma were excluded from this study. Patients requiring direct spinal canal decompression due to neurologic deficits were also excluded.

Surgical procedure (Open short-segment pedicle screw fixation with fusion)

With the patient in a prone position under general anesthesia, the conventional posterior approach was performed. After clean exposure of posterior spinal elements, pedicle screws were inserted into the vertebral body one level above and below the fractured vertebra, and the fractured vertebra was included in the pedicle screw fixation. After insertion of the pedicle screws, the outer cortical bone of posterior elements, including the lamina and the wall of the facet, were decorticated by a high speed drill. Autogenous bone graft or bone substitutes for fusion were then put onto the decorticated bone of the posterior elements. Rods were contoured to protect thoracolumbar sagittal curvature, and compression or distraction was used for correction of kyphosis; locking nuts were then tightened into position. All patients were braced postoperatively by thoraco-lumbar-sacral orthosis (TLSO) for two months, and early ambulation or rehabilitation was encouraged.

Surgical procedure (Short-segment PPSF without fusion)

Under general anesthesia, patients were positioned prone on a radiolucent table for spine surgery with chest, abdomen, and pelvis supported by gel pads. Under posteroanterior (PA) fluoroscopic guidance, the initial skin incision was made approximately 1–2 cm lateral from the pedicle for screw fixation, and then underlying fascia was split and paraspinous muscle dissection was performed by finger. A “J” type bone marrow needle was positioned to the lateral and slightly cranial margin of the pedicle for instrumentation with the sense of bone touch in the PA view. Under true PA view, the needle was inserted to a slightly medial direction. When the needle tip was located in the medial border of the pedicle in the true PA view, fluoroscopy was turned on in order to see the lateral view. If the needle

was passed in the pedicle without violation of the medial border of the pedicle, the needle was slowly advanced into the vertebral body (Fig. 1a and b). A guide wire was inserted into the vertebral body through the needle, and the needle was carefully removed. The dilation tube was placed through the guide wire, and tapping was done for screw insertion. After tapping to the junction of the pedicle and vertebral body, a cannulated percutaneous pedicle screw was advanced through the guide wire into the pedicle and vertebral body; the guide wire was then removed after adequate positioning of the screw. Using the same approach, pedicle screws were inserted into above and below the fractured vertebra including the fractured level. Under PA and lateral fluoroscopic guidance, an adequately sized rod was placed in the percutaneous pedicle screw heads through a small incision made on the thoracic region (Fig. 1c). If compression was required for spinal alignment, it was performed prior to placement of locking nuts (Fig. 1d). Incisions for screws and rods placement were irrigated and closed. All patients were braced postoperatively by TLSO for two months, and early ambulation or rehabilitation was encouraged.

Radiologic assessment

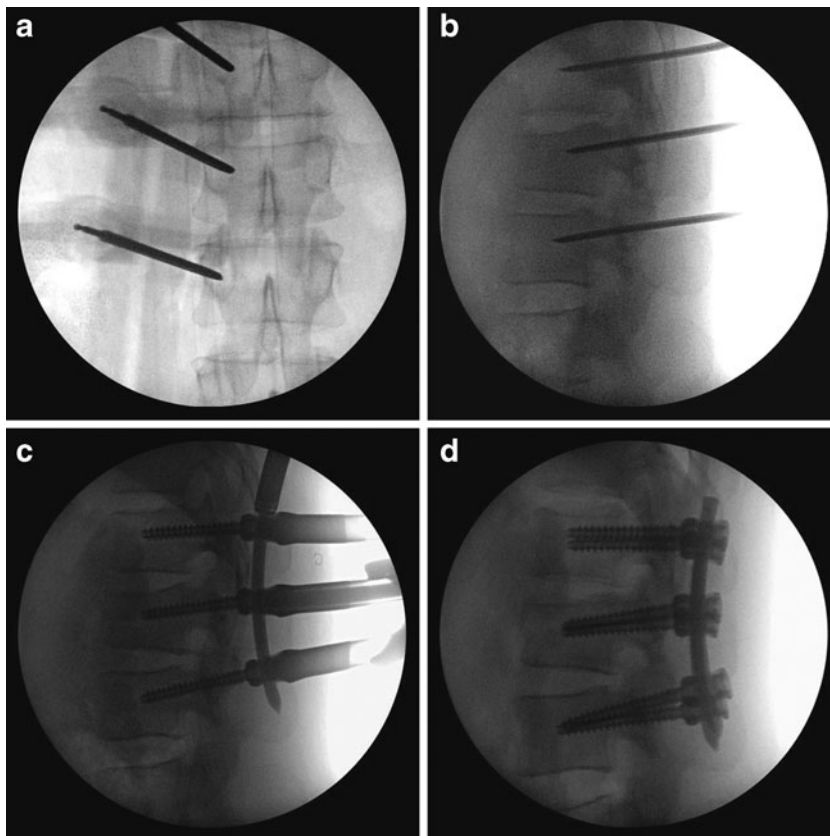
Plain radiographs were obtained before surgery, immediately after surgery, and at the final follow up. Cobb angle, vertebral

body compression ratio, vertebral wedge angle, and difference between vertebral wedge angle and Cobb angle (DbVC) were measured on neutral lateral radiographs (Fig. 2). Cobb angle, which generally reflects changes in the segmental curve, was measured between the superior endplate of the upper and the inferior endplate of the lower adjacent vertebrae of the fracture site. The vertebral wedge angle was measured between the superior endplate and the inferior endplate of the fractured vertebra body. They generally reflect the anatomical shape of the fractured vertebral body. Preoperative computed tomography (CT) scans were used for classification of the fracture type according to the classification of Denis burst fracture and load-sharing classification (LSC) for comparison of burst fracture severity [10, 20].

Clinical assessment

Clinical assessment included operation time, intraoperative blood loss, neurologic status, and low back function. Evaluation of neurologic state and low back function was performed at three, six, and 12 months and every year thereafter. Neurologic assessment was performed using the grading scale of Frankel [13]. Pain and work status was determined using the low back outcome score (LBOS) devised by Greenough and Fraser [14]. This scale is used for assessment of back pain and function through thirteen parameters, which

Fig. 1 True posteroanterior (a) and lateral (b) views show that the “J” type bone marrow needles were located in vertebral bodies through respective pedicles. An adequately sized rod is placed via a small incision through the percutaneous pedicle screw heads (c). After compression and nut locking during surgery, a lateral view showed a well aligned spinal column with kyphosis correction (d)



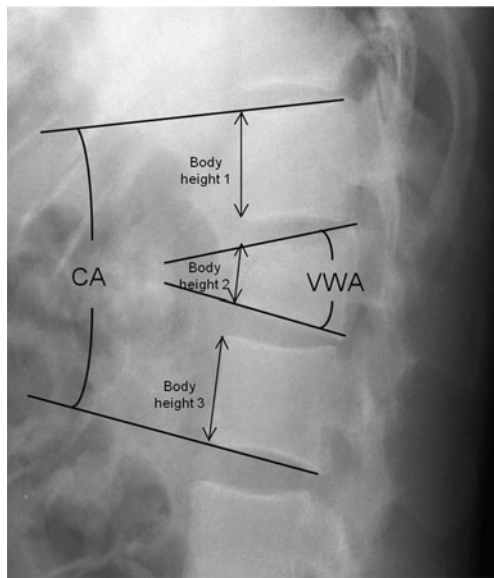


Fig. 2 Measurement of radiological parameters measured on a lateral neutral radiograph. *CA* Cobb angle, *VWA* vertebral wedge angle; Vertebral body compression ratio= $[1-(2 \times \text{body height } 2) / (\text{body height } 1+3)] \times 100$

are the visual analogue scale (VAS), employment, domestic chores or “odd jobs”, sport or active social activities, resting, treatment or consultation with a health care provider, analgesia, sex life, sleeping, walking, sitting, traveling, and dressing. The LBOS produce a maximum score of 75. The VAS scores had been measured for assessment of a patient’s back pain at the preoperative time, three, six months and every year after surgery. For evaluation of back function, LBOS was measured at three, six months and at the last follow-up.

Statistical analysis

Demographic, radiographic parameters and clinical outcomes of surgery with short-segment PPSF without bony fusion were compared with those of open short-segment pedicle screw fixation with bony fusion. Data were analyzed using the SPSS program for Windows V17.0 (SPSS, Chicago, IL, U.S.A.); the paired *t* test, independent *t*, and Mann–Whitney *U* test were used for analyses. Data are presented as the mean \pm standard deviation. For all analyses, a *p*-value of <0.05 was considered statistically significant.

Results

The average follow up period was 30.2 months (range 24–43 months) and 39.7 months (range 27–72 months) in the percutaneous and open surgery group respectively. No significant differences concerning age, sex, fracture site, and cause of injury were observed between the two groups. Preoperatively, the percutaneous and open surgery groups were similar with

regard to Cobb angle, vertebral wedge angle, vertebral body compression ratio, DbVC, Denis type, and LSC score (Table 1).

Radiologic outcomes

Preoperative Cobb angles in the percutaneous and open surgery groups were significantly decreased after surgery in both groups, respectively, and these were well maintained until the last follow-up ($p < 0.05$). The correction losses of kyphosis in the percutaneous and open surgery groups were 3.1 ± 1.9 and $3.5 \pm 2.7^\circ$, and there were no significant differences of correction loss ($p = 0.628$).

The average vertebral wedge angles of the percutaneous and open surgery groups were 20.2 ± 5.7 and $22.3 \pm 4.6^\circ$ respectively, which decreased significantly after surgery in both groups ($p < 0.05$), and these had been well maintained at the last follow-up with mild correction loss (Table 2).

Clinical outcomes

There was no statistical significance in preoperative neurologic states between the percutaneous and open surgery groups ($p > 0.05$). Follow-up neurologic states by Frankel classification showed no cases involving aggravation of neurologic function in either group (Table 3).

Preoperatively, VAS scores for back pain were 8.0 ± 2.6 and 8.4 ± 2.3 points in the percutaneous and open surgery groups, respectively, and these were significantly decreased in both groups during follow-up period ($p < 0.05$). VAS scores at three and six months in the percutaneous surgery group were more significantly improved than the VAS score in the open surgery group, however, there was no significant difference of VAS

Table 1 Patient’s demographics according to age, sex, preoperative radiologic features, LSC, and Denis classification

	Percutaneous group	Open group	<i>P</i> value
Follow-up duration	30.2 months	39.7 months	
Number	32	27	
Sex (M/F)	20/12	19/8	0.627
Age	45.6 ± 15.7	48.2 ± 12.3	0.784
Preop CA	15.8 ± 8.2	16.7 ± 7.6	0.748
Preop VWA	20.2 ± 5.7	22.3 ± 4.6	0.822
Preop VBCR	38.2 ± 8.7	40.1 ± 10.9	0.546
Denis type (A/B)	12/20	12/15	0.178
LSC scores	5.4 ± 1.3	5.9 ± 1.6	0.798
DbVC	5.2 ± 4.6	5.8 ± 4.1	0.376

CA Cobb angle, *VWA* vertebral wedge angle, *VBCR* vertebral compression ratio, *LSC* load-sharing classification, *DbVC* difference between CA and VWA

* $P < 0.05$

Table 2 Measurement of Cobb angle, vertebral wedge angle, and correction loss

	Percutaneous	Open	P value (I)
Preop CA	15.8±8.2	16.7±7.6	0.748
Postop CA	6.2±5.1	6.5±3.9	0.952
Last CA	9.3±5.7	9.9±5.2	0.532
P value (II)	P<0.001*	P<0.001*	
Preop VWA	20.2±5.7	22.3±4.6	0.822
Postop VWA	9.8±3.4	10.4±3.1	0.274
Last VWA	11.9±3.8	12.7±2.1	0.372
P value (III)	P<0.001*	P<0.001*	
Correction loss at last follow-up (CA)	3.1±1.9	3.5±2.7	0.628

CA cobb angle, VWA vertebral wedge angle

P value (I): statistical results of radiologic parameters between percutaneous and open surgery group

P value (II): statistical results within same group between preoperative and last follow-up CA

P value (III): statistical results within same group between preoperative and last follow-up VWA

* $P<0.05$

score at the last follow-up between both groups ($P=0.445$) (Table 4).

In the percutaneous group, LBOSs were significantly higher than those of the open surgery group at three and six months after surgery ($P<0.05$). However, no significant difference of LBOSs was observed between the percutaneous and open surgery groups at the last follow-up ($P=0.228$) (Table 5).

Table 3 Neurologic outcomes according to Frankel classification in percutaneous and open surgery groups

		Frankel grade (Last)				
		A	B	C	D	E
Percutaneous surgery group						
Frankel grade (preop)	A					
	B					
	C			1	4	1
	D				3	7
	E					16
Open surgery group						
Frankel grade (preop)	A					
	B					
	C			1	3	1
	D				2	5
	E					15

Table 4 The changes of visual analogue scale

VAS Group	Preop	Three months	Six months	Last
Percutaneous	8.0±2.6	2.9±1.5	2.2±1.2	1.7±1.1
Open	8.4±2.3	4.0±1.3	3.5±1.6	1.9±1.4
P value	0.864	0.008*	0.003*	0.445

VAS visual analogue scale

* $P<0.05$

Operation time and intraoperative blood loss

Operation times in the percutaneous and open surgery groups were 83.2±26.1 and 154.9±39.2 min, and intraoperative blood losses were 262.5±86.9 ml and 684.3±239.9 ml, respectively. In the percutaneous surgery group, operation time and intraoperative blood loss were significantly lower than those in the open surgery group ($p<0.05$) (Table 6).

Surgery-related complications

One screw-rod failure with non-union and two postoperative infections developed in the open surgery group. Screw failure was treated conservatively due to clinically silent, and postoperative infections that were treated by reoperation for irrigation and debridement. All three complicated patients showed favorable outcomes at the last follow-up. On the other hand, one case of screw pull out was observed only in the percutaneous group. The patient was treated conservatively, and showed a favorable outcome at the last follow-up.

Discussion

Siebenga et al. [28] reported that non-operative treatment had increased regional kyphotic deformity from 13.1° to 19.5° in TLBFs without neurologic deficits; and it affected the poor clinical and functional outcome in their multicenter prospective randomized study with a 4.3 years follow-up period. In our study, preoperative Cobb angles were 15.8° and 16.7° in the percutaneous group and open surgery group, and these

Table 5 The changes of low back outcome score

LBOS Group	Three months	Six months	Last
Percutaneous	56.2±15.6	61.1±12.8	66.7±11.2
Open	47.2±17.2	50.6±16.8	61.4±13.9
P value	0.032*	0.011*	0.228

LBOS low back outcome score

* $P<0.05$

Table 6 The differences of operation time, and intraoperative blood loss between percutaneous and open surgery group

Results Group	Operation time (minutes)	Intraoperative blood loss (mls)
Percutaneous	83.2±26.1	262.5±86.9
Open	154.9±39.2	684.3±239.9
<i>P</i> value	0.004*	<0.001*

**P*<0.05

were 9.3° and 9.9° at the last follow-up in both groups, respectively. These facts indicate that short-segment posterior stabilization either percutaneous or open surgery could provide superior radiological outcome compared to nonoperative treatment in patients with thoracolumbar burst fractures. Some studies reported the disadvantages of short-segment TPSF, which included a relatively high rate of correction loss and screw failures including screw pullout and breakage [1, 19, 20]. To reduce postoperative failure after short-segment TPSF, the author inserted additional pedicle screws bilaterally at the level of the burst fracture in all patients in either the PPSF or open TPSF groups. The additional screws on the fractured vertebra could provide a protective effect by indirectly supporting the anterior column and improve biomechanical stability. Therefore, postoperative surgical failures, such as screw loosening, breakage, and correction loss of kyphosis, would decrease. Using traditional short-segment TPSF with fusion, Cho et al. [7] reported 6° of initial postoperative kyphosis correction, and Carl et al. [4] achieved 7° of initial kyphosis correction. However, most immediate postoperative kyphosis correction was lost on the final follow-up radiographs in those two groups. On the other hand, through use of a short-segment technique including fractured level, our results showed an initial kyphosis correction of 9.5±5.8 and 10.3±5.1° in the PPSF and open TPSF groups, respectively. In this study, correction losses of kyphosis were 3.1±1.9 and 3.5±2.7° in the PPSF and open TPSF groups, and no statistical difference was observed between the two groups. Regarding initial kyphosis correction and correction loss of kyphosis, a short-segment fixation technique including fractured level with either percutaneous or open surgery could be more effective, compared with traditional short-segment TPSF.

In this study, postero-lateral bony fusion was not performed in the PPSF group. Many authors recommend that posterior pedicle instrumentation must be supplemented with postero-lateral bony fusion for treatment of TLBF. However, there are several reports regarding short-segment TPSF without bony fusion. Sanderson et al. [25] advocated that simple pedicle fixation without postero-lateral bony fusion could achieve satisfactory radiologic and clinical results in TLBF. Wang

et al. [30] demonstrated that posterior TPSF without bony fusion showed better outcome in perioperative parameters, and no statistical differences of clinical and radiologic outcomes were observed between non-fusion and fusion groups in unstable TLBF. These results support the rationale for PPSF without bony fusion in the treatment of TLBF. Extensive paraspinal stripping is required for open posterior pedicle screw fixations and postero-lateral bony fusion. Extensive dissection and retraction can cause paraspinal muscle denervation and atrophy, which result in an increased risk of failed back surgery syndrome [29, 31]. Injured paraspinal muscles by initial trauma may have additional injury from a thermal effect and ischemia during dissection and retraction, leading eventually to sustained back pain or back muscle dysfunction. As a minimally invasive procedure, PPSF allows for avoidance of approach-related morbidity, such as iatrogenic extensive muscle denervation, as shown in a conventional open technique. Kim et al. [17] reported that PPSF caused less paraspinal muscle injury than open TPSF, and it showed positive clinical correlations with postoperative back muscle performance.

In this series, results of clinical outcome showed lower VAS scores and high LBOs in the PPSF group, compared with those in the open TPSF group at three and six months after surgery. However, there were no significant differences of VAS scores and LBOs between the two groups at the final follow-up. Therefore, these results suggest that early recovery of back muscle pain and function after surgery were associated with the use of minimally invasive surgical techniques, and the extent of paraspinal muscle dissection might play a leading role in early clinical outcomes. In the current study, intraoperative parameters including operation time (averaged 83.2 mins) and intraoperative blood loss (averaged 262.5 ml) were much less in the PPSF group, than those in open TPSF (averaged 154.9 mins and 684.3 cc). These results indicate that surgical procedure related traumas were less in PPSF, compared with open TPSF. In particular, the shorter operation time and less intraoperative blood loss are inspiring, because spinal trauma has frequently been associated with multiple organ injuries and unstable vital signs.

Instrumentation failure was observed in one case of the PPSF and in one case of open TPSF groups, respectively. Failure in the PPSF group was screw loosening above the fractured level, and the patient was observed closely with serial radiologic exams and clinical status. The patient's *t* score of BMD was -2.0, which might be associated with screw loosening. Therefore, screw loosening might be associated with a relatively low *t* score of BMD. Therefore, further study for TLBF with relatively low *t* score of BMD will be needed. In the open TPSF group, screw breakage was observed in one patient at three months follow up. Until follow-up of two years, the patient's radiologic outcomes with

regional kyphosis and clinical outcomes were favorable. In open TPSF with bony fusion, donor site complications can develop after bone harvesting. Donor site complications have been reported from 10 % to 39 % after bone grafting procedures, and have been associated with bad clinical outcomes [3, 6, 18, 26]. Donor site complications could be avoidable and favorable radiologic outcome can be achieved without postero-lateral bony fusion in PPSF. Although misplacement of the pedicle screw was not observed in either group, misplacement of the pedicle screw in PPSF was less, compared with open TPSF in the literature [5, 33]. Moreover, adequate screw positioning and kyphosis reduction could be achieved easily through direct fluoroscopic views during the operation in the PPSF group.

There are three limitations in the current study. First, the study was conducted retrospectively with non-randomized consecutive cases, although there were no significant differences of some preoperative clinical data between the two groups. In the future, a prospective randomized controlled study will be required for demonstration of the results in this study. Second, although there are some reports of histologic, enzymatic and radiologic evidences of paraspinal muscle damage or atrophy in degenerative spinal disease, the author did not demonstrate the extent of paraspinal muscle atrophy or damage through volumetric comparison of paraspinal muscles and changes of muscle enzymes between the two groups [16, 17]. In this study, direct visualization of paraspinal muscles at the operation level was difficult due to metal artifacts, and muscle enzymes were elevated preoperatively due to acute trauma. Third, the follow-up period between the two groups was relatively short. In particular, because bony fusion was not performed in the PPSF group, long-term follow-up results on instrumentation failure or kyphosis recurrence should be mandatory. Moreover, if possible, the study about the screw removal for regaining of spinal motion in the PPSF group will be mandatory to find the advantages of PPSF compared to open TPSF with bony fusion in TLBF.

Conclusion

The results of the current study showed that open and percutaneous short segment pedicle fixation were safe and effective methods for treatment of TLBF. Although both groups provided favorable clinical and radiologic outcomes at the final follow-up, PPSF without bony fusion provided earlier pain relief and functional improvement, compared to open TPSF with posterolateral bony fusion. Despite several shortcomings in this study, this result suggests that ongoing use of PPSF is recommended for the treatment of TLBF. For the future, whether PPSF in the treatment of TLBF is performed for temporary stabilization or not, study about the changes of

spinal motion and alignment after screw removal in PPSF group will be required.

Acknowledgments This study was supported by a grant (CRI11064-1) from the Chonnam National University Hospital Research Institute of Clinical Medicine.

Conflicts of interest None.

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Comment

Over the last decade, the “minimally invasive” spine surgery has been developing in the attempt to minimize the impact of spinal procedures on patients. Minimally invasive fixation techniques using a percutaneous approach have been also developed generally for degenerative spinal disorders.

This study supports the hypothesis that percutaneous spine fixation can be effectively applied to a subgroup of thoraco-lumbar spine fractures without neural compression and relevant spinal canal encroachment, producing a clinical advantage in terms of a reduction of immediate post-surgery and mid-term pain. Results of this non-randomized study also suggest that percutaneous surgery may limit bleeding and the need for blood transfusions, an issue that may increase the infection risk and the length of hospital stay.

The percutaneous technique may decrease muscle atrophy that causes postoperative pain and loss of muscle strength. This could possibly influence the degenerative process of adjacent levels over the long term, a point that was not analyzed in this study and so warranting further studies. Furthermore, this study does not address the issue of fixation without bony fusion in relation to different subtypes of thoraco-lumbar fractures with different degrees of disc and vertebral body involvement. Percutaneous fixation without grafting seems to be suitable for minimally displaced Magerl Type A1 and A2 fractures, Type A3 (but not A3.3 or complete burst) fractures and Type B2 fractures. For other fracture types, with disc disruption or extensive collapse of the vertebral body, a bone graft to be added through an anterior approach or by using combined miniopen/percutaneous techniques seems to grant better results in the long-term.

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The authors present a retrospective review of thoracolumbar burst fractures treated with percutaneous, short-segment, pedicle screw stabilization compared to a similar group of patients stabilized using an open technique with fusion. Although not specifically stated, the percutaneous group was compared to a historical control group based on a mean follow-up that was nearly a year longer. Both groups had similar improvement in sagittal alignment after reduction and stabilization. Furthermore, the improvement in Cobb angle was maintained through final follow-up in both groups. Finally, the neurologic outcomes were the same for both groups. This suggests that the percutaneous technique for pedicle screw placement in thoracolumbar burst fractures is equivalent to an open, short-segment, pedicle screw stabilization with posterior fusion. Several advantages are attained with the percutaneous technique including less soft tissue trauma, minimal blood loss, decreased risk of deep infection and avoidance of graft donor site complications. This study corroborates the maintenance of sagittal correction seen in other recent studies using short segment pedicle screw constructs as well as those comparing pedicle screw stabilization with and without fusion.

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