Factors Affecting Optimal Postural Reduction in Posterior Percutaneous Screw Fixation for Neurological Intact in Thoracolumbar Burst Fracture

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Background: *Optimal reduction of kyphosis is a goal in the surgical treatment of thoracolumbar burst fracture. Several factors are known to limit the amount of posterior surgical reduction. However, few comprehensive assessments of postural reduction in posterior percutaneous screw fixation have been reported.*

Objectives: *To determine the relevant factors affecting the optimal anterior vertebral restoration in the percutaneous posterior surgical treatment of neurologically intact thoracolumbar burst fracture.*

Materials and Methods: *Seventy-seven consecutive patients who underwent posterior percutaneous screw fixation for thoracolumbar fracture (T11–L3) burst fracture were included. The patients were divided into sufficient reduction group (postoperative anterior vertebral height correction; AVH ratio ≥ 80%) and insufficient reduction group (postoperative anterior vertebral height correction; AVH ratio < 80%). Clinical characteristics including sex, age, body mass index, time to operation, injury level, and intraoperative blood loss, as well as radiologic characteristics including fracture morphology, fracture deformity, canal stenosis, and fixation techniques were investigated to determine the relevant factors.*

Results: *The mean AVH of insufficient reduction group (n = 21) was 72.03±5.46%, and sufficient reduction group (n=56) was 90.45±6.48%. The relevant factors for insufficient reduction, as identified by univariate analysis, were time to operation > 7 days (OR, 12.19; 95% CI, 1.42-104.89), preoperative kyphosis ≥ 20º (OR, 6.25; 95% CI, 1.86-20.96), preoperative anterior vertebral compression ratio ≥ 0.5 (OR, 2.67; 95% CI, 0.02-0.41), and preoperative canal stenosis ≥ 50% (OR, 0.14; 95% CI, 0.03-0.63). However, multivariate analysis demonstrated that time to operation > 7 days (OR, 9.28; 95% CI, 1.46-58.99), burst fracture type A4 (OR, 20.88; 95% CI, 1.08-402.02), comminution 30-60% (OR, 0.02; 95% CI, 0-0.44) and comminution > 60% (OR, 0.008; 95% CI, 0-0.37) were significant risk factors for insufficient postural reduction.*

Conclusions: *Insufficient postural reduction in posterior percutaneous screw fixation after thoracolumbar burst fracture affected by delayed operation time > 7 days, burst type A4 fracture and comminution more than 30%.*

Keywords: *Optimal postural reduction, posterior percutaneous screw fixation, thoracolumbar burst fracture, risk factor*

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Introduction

Thoracolumbar burst fracture caused by axial compression through the vertebral body with an associated flexion moment, creating kyphotic deformity. The posterior vertebral body is injured by definition, and in many cases it is retropulsed into the spinal canal[1]. Thus, management is determined by the degree of mechanical and neurological instability. A posterior approach is generally suggested for most unstable thoracolumbar burst fractures, unless incomplete neurological injury or severe vertebral comminution has occurred[2]. In the posterior approach, ligamentotaxis can indirectly achieve correction of kyphosis, restoration of vertebral height, and clearing of canal compromise[3]. The mechanism and efficacy of ligamentotaxis in thoracolumbar burst fractures have been well described[4,5]. Tensing of the posterior longitudinal ligament (PLL) reduces retropulsed fragments that are still attached to a ligamentous structure or the outermost annular layer of the intervertebral disk via Sharpey's fiber[6]. Several radiologic and clinical conditions, including destruction of the PLL or the outermost annular layer of the intervertebral disk, severe canal compromise, and delayed surgical timing are known to limit the amount of anterior vertebral restoration and canal clearance[4,7-10].

At this time, minimally invasive surgery including percutaneous pedicle screw fixation (PPSF) is becoming increasingly widespread in the spine surgery[11-13]. However, there are few studies available in regard to PPSF which assess the effects of radiologic conditions on the amount of postural kyphosis reduction have been reported[13,25].

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Moreover, the significance of postural reduction is not fully understood. The aim of this study was to determine the relevant factors affecting the optimal anterior vertebral restoration in the percutaneous posterior surgical treatment of neurologically intact thoracolumbar burst fracture.

Materials and Methods

This study involved a retrospective analysis of 95 consecutive neurological intact patients who underwent surgical treatment with a posterior percutaneous screw fixation for thoracolumbar fracture at a department of orthopedic surgery in a tertiary hospital between March 2016 and July 2018. All included patients were evaluated with plain radiographs, pre-/postoperative computed tomography (CT), and neurological examination at the time of presentation. Thoracolumbar fractures with preexisting spinal deformity, no spinal canal violation, involving more than 1 level, progressive neurodeficit and previous history of malignancy, inflammatory disease or infection were excluded. Surgical treatment was determined by calculating the thoracolumbar injury severity score (TLICS; TLICS = 4 or TLICS $\geq$ 5). In this study, the integrity of posterior ligamentous complex (PLC) was categorized as definitely disruption by palpable gap between spinous process, interspinous widening on plain films and reconstructed CT evaluation. Indeterminate disruption of PLC was defined by tenderness at the injury area, but no palpable gap between spinous process or interspinous widening on plain films[26]. A total of 77 patients met these requirements, but 18 patients were excluded because 6 patients had progressive neurodeficit, 7 patients were no spinal canal violation and 5 patients had fracture involved more than 1 level. The ethical committee of the hospital reviewed and approved the design of this study (IRB approval number 100/2019).

Information on each patient's age, sex, body mass index, time from injury to operation, neurological status, and other medical conditions were obtained from the medical records. The morphology of burst fractures was categorized as AO spine injury classification using preoperative CT images[15] : A2 was the fracture of both endplates without involvement of the posterior wall of the posterior body, A3 was the fracture with any involvement of the posterior wall; only a single endplate fracture, A4 was the fracture with any involvement of the posterior wall and both endplates. Angular deformity of the burst fractures was measured on preoperative supine anteroposterior (AP) and lateral plain radiographs using the Cobb technique,[13] taken from the superior endplate of the vertebra 1 level above the fractured vertebra to the inferior endplate of the vertebra 1 level below the fractured vertebra. Compression deformity of the fractures was also calculated by measuring the anterior and posterior vertebral compression ratios (VCRs) at the level of injury to the estimated normal height using the vertebra above and below the injury (Figure 2)[16]. The degree of canal stenosis was calculated by measuring the ratio of cross-sectional area at the level of injury to the estimated normal canal dimensions at that level on axial CT images (Figure 2)[16]. All radiologic parameters were measured by 2 orthopedic surgeons not involved with the care of the study subjects.

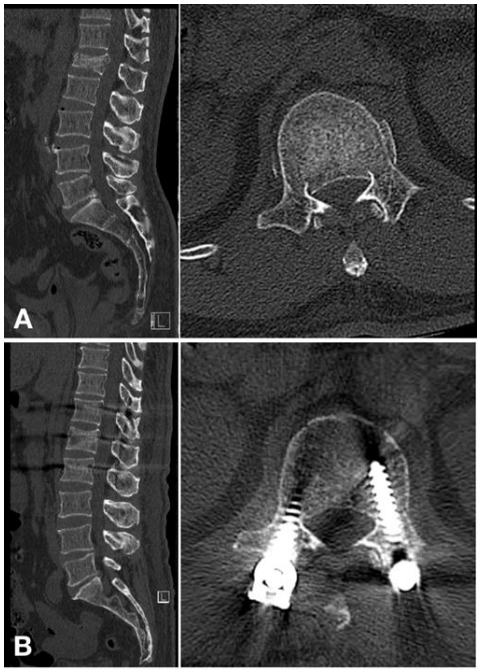

Fig.1 A, A 56-year-old male patient showed a complete burst fracture at L1. B, Postoperative CT images after postural reduction and posterior percutaneous screw fixation.

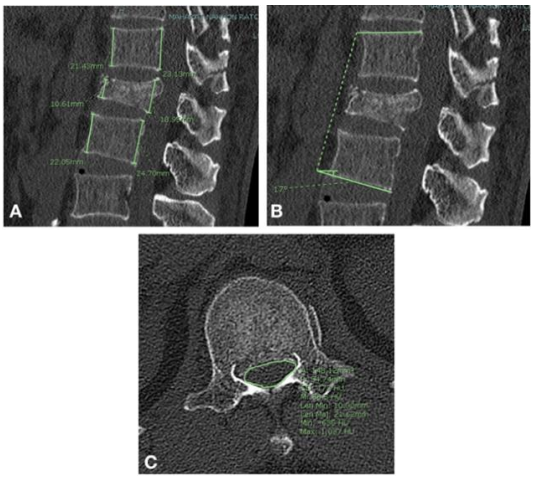

Fig.2 Measurements of radiographic parameters. A: Anterior vertebral height (mm.) and posterior vertebral height(mm.). B: Regional kyphotic angle. C: Central canal area.

Early post-traumatic kyphosis and failure of reduction was the primary reason for re-collapse[27]. Malcolm et al[28] reported that postoperative kyphotic deformity commonly occurred in cases of preoperative local kyphosis (>30°) and loss of body height (>30%) in the T-L region. Therefore, we attempted to evaluate the factors affecting the optimal anterior vertebral restoration. We divided the patients into sufficient reduction group (postoperative anterior vertebral height correction; AVH ratio ≥ 80%) and insufficient reduction group (postoperative anterior vertebral height correction; AVH ratio < 80%).

Surgical Technique

Following the induction of general anesthesia, each patient was placed in a prone position supported by a chest roll and an ASIS roll. The operation was done on a radiolucent table (or a Jackson frame) and accurate AP and lateral true views are obtained. When the pedicle of the desired vertebra is localized, the skin entry point is marked 1 cm lateral to the pedicle. As a more convergent and straightforward pedicle screw trajectory is preferred, the entry point should be at 2–3 o'clock in the right pedicle and 9–10 o'clock in the left pedicle. The Jamshidi needle is then advanced into the pedicle with simultaneous control on the AP and lateral views: when the Jamshidi needle is in the middle of the pedicle on the AP view, it should have passed the middle of the pedicle on the lateral view, and when the tip of the needle arrives at the posterior border of the vertebral body on the lateral radiograph. The tip of the needle is only allowed to touch the inner pedicle wall on the AP radiograph when it has passed the posterior wall. The needle should always be parallel to the vertebral endplates on lateral film when advancing into the vertebra.

The guide wire was advanced into the vertebral body with care not to pass the anterior cortex. The Jamshidi needles were removed and then the screws were inserted. The guide wire removed after the tip of the pedicle screw passes the posterior border of the vertebral body on the lateral radiograph. We chose the short or long fixation by the load sharing classification. In the short fixation patients, we decided to insert intermediate PPSF if the pedicle of injured vertebra was intact. And the polyaxial PPSF were chosen in all cases. For reduction technique, a distraction maneuver was performed using a distractor device, which was applied to the polyaxial screw sleeves at the adjacent levels above and below the fracture. An extension of the screw sleeve was used to mimic the final position of the rod when seated in the screw head. The rod was contoured to mimic the normal sagittal spinal alignment of the affected region with the help of the screw sleeves and extensions. Rods were inserted from a caudal to cephalad direction and locked in place. Deep fascia and skin were closed.

Final AP and lateral imaging should be obtained to control the construct.

Statistical analysis

Continuous variables were reported as mean±standard deviations (SD), whereas non-contiguous data were presented as number or ratio. Normality of the continuous data was tested using the Kolmogorov-Smirnov test. Normally distributed values were analyzed by one-way analysis of variance or Student t test. Skew-distributed values were analyzed by Kruskal-Wallis test, whereas the statistical significance of non-contiguous data was performed by Pearson chi-square test. Reliability of the measurement of radiologic parameters among the 2 orthopedic surgeons was evaluated by calculating the interclass correlation coefficients for numeric variables and k-values for categorical variables. For risk factor analysis, we identified variables for each regression model via univariate screening with $p < 0.20$. We derived independent predictors that showed significant odds ratio (OR) and 95% confidence interval (CI) through multivariable logistic regression analysis using stepwise backward elimination. A *P*-value < 0.05 was statistically significant. Statistical analysis was carried out using Stata Statistical Software (version 14; StataCorp LP., College Station, TX).

Result

Demographics

The study sample comprised 52 men (67.53%) and 25 women (32.47%) with a mean age of 44.5±13.6 (range, 16-68) years. The mean body mass index was 22.4±3.4 kg/m^2. The mean time from injury to operation was 6.6±3.0 days. The most frequently injured level was L1 (43 cases) followed by L2 (17 cases), T12 (13 cases), and L3 (4 cases). The morphologies of burst fracture (following AOSpine Classification) included 53 (68.83%) AO burst type A4 fracture and 24 (31.17%) AO burst type A3 fracture. The mechanism of injuries were fall from height 50 (64.94%), traffic injury 24 (31.17%) and body assault 3 (3.9%). The mean operative time was 65.09±17.27 minutes. The intraoperative blood loss was 91.17±81.19 mL (Table 1).

Relevant Factors for Insufficient Reduction

Our series included the mean AVH correction of 21 (27.27%) insufficient group was 72.03±5.46%, all of which were postoperative anterior vertebral height correction < 80%. And, 56 (72.73%) sufficient group with a mean AVH correction was 90.45±6.48%. The results of our univariate analysis suggested that time to operation > 7 days (OR,12.19; 95% CI, 1.42-104.89),

preoperative kyphosis ≥ 20° (OR, 6.25; 95% CI, 1.86-20.96), preoperative anterior vertebral compression ratio ≥ 0.5 (OR, 2.67; 95% CI, 0.02-0.41), and preoperative canal stenosis ≥ 50% (OR, 0.14; 95% CI, 0.03-0.63) were significant risk factors for insufficient postural reduction. No significant difference was found in age (p=0.55), sex (p=0.324), BMI (p=0.914), fracture level (p=0.937), burst type morphology (p=0.167), fixation technique (p=0.442), comminution (p=0.596) or apposition (p=0.499) (Table 2).

The multivariate analysis results demonstrated that time to operation > 7 days (OR, 9.28; 95% CI,1.46-58.99), Burst fracture type A4 (OR, 20.88; 95% CI,1.08-402.02), comminution 30-60%(OR, 0.02; 95% CI, 0-0.44) and comminution > 60% (OR, 0.008; 95% CI,0-0.37) were significant risk factors for insufficient postural reduction. However, the preoperative kyphosis ≥ 20°, preoperative anterior VCR ≥ 0.5 and preoperative canal stenosis ≥ 50% were significant risk factors in the univariate analysis, but not in the multivariate analysis (Table 3).

Reliability for Radiologic Parameters

The interclass correlation coefficients of interobserver agreement for radiologic measurements were 0.72-0.78 (fair to good) for measurement of the Cobb angle, 0.7-0.78 (fair to good) for measurement of the VCR, and 0.66-0.72 (fair to good) for measurement of the cross-sectional area of canal encroachment.

Table 1 Demographics of Study Participants.

Variables	N = 77
Demographics	
Sex (y)	
Male	52 (67.53%)
Female	25 (32.47%)
Age (year), mean ± SD	44.5±13.6
BMI (kg/m^2)	22.4±3.4
Cause of injury	
Fall from height	50 (64.94%)
Traffic injury	24 (31.17%)
Body assault	3 (3.9%)
TLIC (Thoracolumbar Injury Classification and Severity Score)	
4	65 (84.42%)
5	12 (15.58%)
Fracture level	
T12	13 (16.88%)
L1	43 (55.84%)
L2	17 (20.08%)
L3	4 (5.19%)
Burst type morphology (AOSpine Classification)	
A3	24 (31.17%)
A4	53 (68.83%)
Screw number	
4	9 (11.69%)
5	1 (1.3%)
6	47 (61.04%)
7	2 (2.6%)
8	18 (23.37%)
ASA Classification	
1	6 (7.79%)
2	56 (72.73%)
3	15 (19.48%)
Time to operation (Day)	6.6±3.0
Operative time (minute)	65.09±17.27
Intraoperative blood loss (ml)	91.17±81.19

Table 2 Univariate Analysis of Insufficient Postural Reduction.

	Insufficient reduction (n = 21)	**Sufficient reduction (n = 56)**	**Odds Ratio (95% CI)**	***P*-value**
Mean age (y)				
< 65	20 (95.23%)	51 (91.07%)	Reference	
≥ 65	1 (4.76%)	5 (8.92%)	0.51 (0.06-4.64)	0.55
Sex				
Male	16 (76.19%)	36 (64.28%)	Reference	
Female	5 (23.8%)	20 (35.71%)	0.563 (0.18-1.76)	0.324
BMI (kg/m^2)				
Normal (18.5 - ≤ 25)	16 (76.19%)	42 (75%)	Reference	
Overweight (25 - ≤ 30)	5 (23.8%)	14 (25%)	0.938 (0.29-2.57)	0.914
Time to operation (Day)				
0-3	1 (4.76%)	13 (23.21%)	Reference	
4-7	5 (23.8%)	27 (48.21%)	2.41 (0.25-22.76)	0.443
> 7	15 (71.43%)	16 (28.57%)	12.19 (1.42-104.89)	0.023
Fracture level				
T12	3 (14.28%)	10 (17.86%)	Reference	
L1	14 (66.66%)	29 (51.78%)	1.61 (0.38-6.79)	0.517
L2	3 (14.28%)	14 (25%)	0.71 (0.12-4.30)	0.713
L3	1 (4.76%)	3 (5.36%)	1.11 (0.08-15.04)	0.937
Burst type morphology				
A3	4 (19.04%)	20 (35.71%)	Reference	
A4	17 (80.96%)	36 (64.29%)	2.36 (0.7-7.99)	0.167
Fixation technique				
Short fixation	3 (14.28%)	6 (10.72%)	Reference	
Short fixation (+intermediate screw)	14 (66.66%)	34 (60.71%)	0.82 (0.18-3.76)	0.802
Long fixation	4 (19.06%)	16 (28.57%)	0.50 (0.09-2.93)	0.442
Comminution				
< 30%	3 (14.28%)	4 (7.14%)	Reference	
30-60%	5 (23.8%)	25 (44.64%)	0.27 (0.05-1.58)	0.145
> 60%	13 (61.92%)	27 (48.22%)	0.64 (0.12-3.30)	0.596
Apposition*				
1	1 (4.76%)	5 (8.92%)	Reference	
2	7 (33.33%)	21 (37.5%)	1.67 (0.17-16.81)	0.665
3	13 (61.91%)	30 (53.58%)	2.17 (0.23-20.42)	0.499
Preoperative kyphosis (deg.)				
< 20	12 (57.14%)	50 (89.28%)	Reference	
≥ 20	9 (42.86%)	6 (10.72%)	6.25 (1.86-20.96)	0.003
Preoperative compression ratio				
< 0.5	6 (28.57%)	3 (5.35%)	Reference	
≥ 0.5	15 (71.43%)	53 (94.65%)	0.14 (0.03-0.63)	0.011
Canal stenosis (%)				
< 50	4 (19.04%)	3 (5.35%)	Reference	
≥ 50	17 (80.96%)	53 (94.65%)	0.23 (0.05-1.14)	0.072

*Apposition ; 1 : Non-displace (<1mm.), 2 : 2 mm.&<50%, 3 : >2mm.&>50%

Table 3 Significant Factors in Insufficient Postural Reduction. Determined by Multivariate Logistic Regression Analysis.

	Odds Ratio (95%Confidence Interval)	*P*-value
Time to operation (Day)		
0-3	Reference	
4-7	5.3 (0.38-74.11)	0.21
> 7	26.25 (2.02-339.97)	0.01
Burst fracture type		
A3	Reference	
A4	20.88 (1.08-402.02)	0.04
Comminution		
< 30%	Reference	
30-60%	0.02 (0-0.44)	0.015
> 60%	0.008 (0-0.37)	0.014
Preoperative kyphosis (deg.)		
< 20	Reference	
≥ 20	3.71 (0.53-25.57)	0.18
Preoperative compression ratio		
< 0.5	Reference	
≥ 0.5	0.19 (0.03-10.93)	0.18
Canal stenosis (%)		
< 50	Reference	
≥ 50	0.59 (0.03-10.93)	0.72

Discussion

Many different techniques including anterior, posterior, or combined approaches in the surgical treatment of thoracolumbar burst fractures, indicating that controversy remains regarding the optimal surgical technique. Because thoracolumbar burst fractures are created by axial compression and flexion forces, reduction can be achieved by extension and distraction forces[18].

In the past decade, there has been an apparent trend to minimize soft tissue injury during spinal surgery. Posterior indirect reduction with percutaneous transpedicular screws are currently used in the treatment of thoracolumbar fractures[19]. In the posterior approach, indirect reduction is generated by postural and instrumental traction[7,20]. Few reports have examined the relevant factors affecting the optimal anterior vertebral restoration in the percutaneous posterior transpedicular screws[13,25].

In our study, time to operation > 7 days and comminution > 30% were the significantly relevant factors to determine insufficient postural reduction. According to Sjostrom et al[21] reported that indirect canal decompression was effective when performed within the first 48 hours. Also, Gertzbein et al[4] suggested that distraction and ligamentotaxis was less useful when operated more than 3 days. However, there was no significant difference between the operation within 72 hours and 4 to 7 days in this study. We presumed this reason based on the fracture healing process. They typically go through three stages of healing. The inflammatory phase, also called fracture hematoma formation, is the first stage of healing that occurs immediately after the injury and ends approximately one week after the fracture. Then, the repairing or reparative phase begins within the first few days after the bone fracture and lasts for about 2 - 3 weeks. During this time, the body develops cartilage and tissue in and around the fracture site. These growths are known as soft calluses, and their purpose is to stabilize the fracture[24]. These factors may explain why the postural reduction in posterior percutaneous screw fixation was more difficult after 7 days.

From previous study, Chang HJ et al[22] reported that a burst-split fracture morphology played an important role in the reduction of kyphosis and compression deformity. Nonetheless, a burst fracture type A4 was also significant in our multivariate analysis. This explained that a complete burst type fracture (A4 burst type morphology), the fracture was involved the posterior wall and both endplates. And, the continuity of ALL and PLL was probably ruptured[22]. Thus, this postural reduction with PPSF may not be used to distract across the injury site to indirect decompression the neural elements and correct kyphotic deformity through ligamentotaxis.

In this study, the sufficient postural reduction was not affected by the preoperative degree of canal stenosis. This finding is explained

by the different mechanisms of kyphotic reduction and indirect canal decompression. Extension force generated from postural reduction may produce a sufficient reduction load through the vertebral body, with the exception of ligamentotaxis[6].

The strengths of this study include the comprehensive assessment of the effects of radiologic and clinical conditions on the amount of postural kyphotic reduction. However, this study has several limitations. First, the retrospective nature of this study precluded complete analysis of some potentially important relevant factors for insufficient postural reduction, such as the reduction technique and the integrity of the ALL and PLL using preoperative magnetic resonance images. Second, the analysis did not significantly confirm a surgical variable (long versus short segment pedicle screw instrumentation for fractured vertebra). It was relatively small sample size to conduct the statistical analyses. Thus, larger populations are needed for validation of the model. Third, the clinical and radiologic outcomes were not provided. Additional studies are warranted to determine whether these technical factors are associated with postural kyphotic reduction during posterior percutaneous transpedicular screw fixation of thoracolumbar burst fractures.

Conclusions

In the present study, timing to operation > 7 days, burst fracture type A4 and comminution > 30% were significant relevant factors to determine insufficient postural reduction in posterior percutaneous transpedicular screw fixation.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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ปัจจัยที่มีผลต่อการจัดกระดูกสันหลังให้เข้าที่ด้วยวิธีการจัดท่านอนคว่ำและทำการผ่าตัดแบบเจาะรูผิวหนังเพื่อยึดสกรูในผู้ป่วยที่ไม่มีการบาดเจ็บของเส้นประสาทระดับส่วนนอกและเอวหักจากอุบัติเหตุ

เทอดพงษ์ ธนาวิริยะชัย, พบ, คงธัช ชูวงศ์โกมล, พบ, อุรวิศ ปิยะพรมดี, พบ, วีระ สุดประเสริฐ, พบ, ศรุต จงกิจธนกุล, พบ

บทนำ: การผ่าตัดดัดกระดูกสันหลังปล้องที่ยุบให้มีความสูงเข้าที่ใกล้เคียงเดิม ถือว่าเป็นหลักสำคัญในการผ่าตัดรักษากระดูกสันหลังระดับอกและเอวหักจากอุบัติเหตุ มีการกล่าวถึงปัจจัยที่อาจจะมีผลต่อการดัดกระดูกสันหลังปล้องที่ยุบด้วยวิธีการผ่าตัดแบบเปิดและใส่สกรู แต่อย่างไรก็ตามปัจจุบันยังไม่มีการศึกษาปัจจัยที่มีผลต่อการจัดกระดูกสันหลังให้เข้าที่ใกล้เคียงเดิมในผู้ป่วยที่ไม่มีการบาดเจ็บของเส้นประสาท ด้วยวิธีการผ่าตัดแบบเจาะรูผิวหนังเพื่อยึดกระดูก

วัตถุประสงค์: เพื่อปัจจัยที่มีผลต่อการจัดกระดูกสันหลังระดับส่วนอกและเอวหักจากอุบัติเหตุในผู้ป่วยที่ไม่มีการบาดเจ็บของเส้นประสาท ด้วยวิธีการผ่าตัดแบบเจาะรูผิวหนังเพื่อยึดกระดูก

วัสดุและวิธีการ: จากการสืบค้นได้กลุ่มผู้ป่วยทั้งหมด 77 คน ด้วยวิธีการจัดท่านอนคว่ำและทำการผ่าตัดแบบเจาะรูผิวหนังเพื่อยึดสกรู ในผู้ป่วยที่ไม่มีการบาดเจ็บของเส้นประสาทระดับส่วนอกและเอวบริเวณ T11–L3 โดยแบ่งกลุ่มผู้ป่วยเป็น 2 กลุ่ม กลุ่มแรกคือ กลุ่ม sufficient reduction (สัดส่วนการยุบตัวของกระดูกสันหลังทางด้านหน้าหลังจากผ่าตัด ≥ 80%) และกลุ่มที่สองคือ insufficient reduction (สัดส่วนการยุบตัวของกระดูกสันหลังทางด้านหน้าหลังจากผ่าตัด < 80%) มีการเก็บข้อมูลของผู้ป่วยได้แก่ เพศ, อายุ, ดัชนีมวลกาย, ระยะเวลาผ่าตัด, ระดับของการบาดเจ็บ และ ปริมาณการเสียเลือดในระหว่างผ่าตัด รวมไปถึงการเก็บข้อมูลภาพถ่ายทางรังสี ได้แก่ ลักษณะการหักของและยุบตัวของกระดูกสันหลัง, การกดเบียดโพรงกระดูกสันหลัง, และเทคนิคการยึดกระดูก

ผลการศึกษา: กลุ่ม insufficient reduction มีทั้งหมด 21 คน มีค่าเฉลี่ยของการยุบตัวของกระดูกทางด้านหน้า 72.03±5.46% และ กลุ่ม sufficient reduction มีทั้งหมด 56 คน มีค่าเฉลี่ยของการยุบตัวของกระดูกทางด้านหน้า 90.45±6.48% พบว่าปัจจัยที่มีผลต่อการจัดดึงกระดูกสันหลัง จากการวิเคราะห์แบบตัวแปรเดียว (univariate analysis) ได้แก่ ระยะเวลาก่อนที่จะผ่าตัดมากกว่า 7 วัน (OR,12.19; 95% CI, 1.42-104.89), มีการยุบตัวของกระดูก มากกว่าหรือเท่ากับ 20^{o} (OR, 6.25; 95% CI, 1.86-20.96), มีการยุบตัวของกระดูกสันหลังทางด้านหน้ามากกว่าหรือเท่ากับ 50 % (OR, 2.67; 95% CI, 0.02-0.41), และ ก่อนผ่าตัดมีการกดเบียดของกระดูกสันหลังเข้าไปในโพรงไขสันหลังมากกว่าหรือเท่ากับ 50% (OR, 0.14; 95% CI, 0.03-0.63) แต่อย่างไรก็ตามหลังจากวิเคราะห์โดยใช้การวิเคราะห์แบบหลายตัวแปร (multivariate analysis) พบว่า ระยะเวลาก่อนที่จะผ่าตัดมากกว่า 7 วัน (OR, 9.28; 95% CI,1.46-58.99), ลักษณะกระดูกสันหลังหักยุบชนิด A4 (OR, 20.88; 95% CI,1.08-402.02), กระดูกแตกย่อย 30-60% (OR, 0.02; 95% CI, 0-0.44) และกระดูกแตกย่อย > 60% (OR, 0.008; 95% CI,0-0.37) ที่ส่งผลต่อการจัดดึงกระดูกสันหลังให้เข้าที่เหมาะสม

สรุป: ระยะเวลาที่รอคอยการผ่าตัดมากกว่า 7 วัน, ลักษณะกระดูกสันหลังหักยุบชนิด A4 และ กระดูกแตกย่อย มากกว่า 30% มีผลต่อการจัดดึงกระดูกสันหลังระดับอกและเอวหักยุบตัวให้เข้าที่เหมาะสม ด้วยวิธีการผ่าตัดแบบเจาะรูผิวหนังเพื่อยึดสกรู