MEDICAL SCIENCE MONITOR

CLINICAL RESEARCH

e-ISSN 1643-3750
© Med Sci Monit, 2019; 25: 1164-1168
DOI: 10.12659/MSM.912332

Received: 2018.07.27
Accepted: 2018.10.02
Published: 2019.02.12

A Comparative Study on Functional Recovery, Complications, and Changes in Inflammatory Factors in Patients with Thoracolumbar Spinal Fracture Complicated with Nerve Injury Treated by Anterior and Posterior Decompression

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

C 1 Yongqiang Jiang
CD 2 Fang Wang
A 1 Xinguang Yu
AB 3 Zhijun Li
BD 4 Lu Liang
DE 4 Wensheng Ma
EF 4 Guili Zhang
FG 4 Ruihan Dong

1 Department of Neurosurgery, General Hospital of People's Liberation Army (PLA), Beijing, P.R. China
2 Department of Obstetrics and Gynecology, Inner Mongolia Autonomous Region People's Hospital, Hohhot, Inner Mongolia, P.R. China
3 Digital Medical Center, Inner Mongolia Medical University, Hohhot, Inner Mongolia, P.R. China
4 Department of Surgery, Baotou Central Hospital, Baotou, Inner Mongolia, P.R. China

Corresponding Authors: Xinguang Yu, e-mail: xinguangyu5ry@163.com, Zhijun Li, e-mail: zhijunlidf@163.com
Source of support: This work was supported by the Study on the Digital 3-dimensional Morphogenesis of the Spinal Joints of 13- and 17-year-olds, National Natural Science Foundation No. 81560348.

Background: The aim of this study was to evaluate 2 methods to treat patients with thoracic lumbar spine fracture with merging spinal cord injury, including complications of surgery and the influence of inflammatory factors.

Material/Methods: Eighty patients were randomly divided into an anterior decompression group (study group) or a posterior decompression group (control group) to observe perioperative complications, evaluate preoperative and postoperative nerve function, and evaluate the 6-month injured vertebral height and Cobb angle of the vertebral bodies. The expression level of TGF-β_2 on day 1, day 7, day 15, and day 30 after treatment was detected by enzyme-linked immunosorbent assay (ELISA).

Results: The nerve function sensation score, the height of the vertebral body, and the recovery of Cobb angle were better for the anterior decompression group than the posterior decompression group and the effect was significant ($P<0.05$). The complication rate for the posterior decompression group was lower than the anterior decompression group. The level of TGF-β_2 in the anterior decompression group was higher than in the posterior decompression group for the same times: after day 1, day 7, day 15, and day 30 after treatment ($P<0.05$).

Conclusions: Patients who had thoracic lumbar spine fracture with merging spinal cord injury and who had anterior fixation achieved a good fixation effect; their neurologic and vertebral injury recovery was better. However, this relatively complex and traumatic surgery must consider the clinical manifestations and fractures of the patients and select the appropriate surgical approach.

MeSH Keywords: Decompression • Recovery of Function • Spine

Full-text PDF: https://www.medscimonit.com/abstract/index/idArt/912332

1573 4 2 20

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Background

The thoracolumbar segment of the spine is prone to sudden force-induced burst fractures due to its large activity range, lack of chest and rib protection, and poor spinal bearing capacity. Fractures that are embedded into the spinal canal, and spinal canal stenosis and compression often result in spinal cord injury [1,2]. Patients clinically manifest with local pain, limb numbness, and sphincter dysfunction, or disability in severe cases. The surgical therapy is primarily selected to relieve the compression of the spinal cord and recover neural function [3–5]. However, how to choose the surgical mode remains controversial [6]. This study aimed to compare the clinical effects of 2 therapies by observing the surgical outcome influences of anterior decompression versus posterior decompression on functional recovery, complications, and changes in inflammatory factors in patients with thoracolumbar spinal fracture complicated with spinal cord injury, and thus provide information for clinical practice.

Material and Methods

General data

A total of 80 patients with thoracolumbar spinal fracture complicated with spinal cord compression who visited our hospital from January 2017 to October 2017 were selected for inclusion in this study. Patients were randomly divided into an anterior decompression group and a control group (posterior decompression group). Patients were included in the study if their patient history of trauma, clinical signs and symptoms, and imaging diagnosis met the diagnostic criteria for thoracolumbar spinal fracture complicated with spinal cord compression as described in the Practice of Orthopedics guide [7]. Patients with severe organ dysfunction or contraindications were excluded. This study was pre-approved by the ethical committee of General Hospital of PLA. Prior to the start of this study, patients signed informed consent.

Research methods

Anterior decompression with internal fixation was considered the study group [8], while posterior decompression with internal fixation was considered the control group [9]. Preoperative routine examinations were completed in both groups. The specific location and degree of the fracture were determined according to the results of x-ray, computed tomography (CT), and magnetic resonance imaging (MRI) studies, and then a suitable surgical procedure was selected. After the surgery, infection prevention was carried out, and patients were guided to perform functional exercises.

Observational indexes

The surgical conditions and incidence rates of complications in the 2 groups were observed and compared. Functional evaluation at 6-months after surgery was performed using the American Spinal Injury Association (ASIA) guideline [10], and the height of the injured vertebral body and Cobb angle were examined using x-ray images.

Statistical methods

Statistical Product and Service Solutions (SPSS) 20.0 software (IBM) was used for statistical analysis. Measurement data were expressed as median ± standard deviation, and *t*-test was adopted for comparisons between the 2 groups. Enumeration data were expressed by percentage, and chi-square test was utilized. $P<0.05$ suggested that the difference was statistically significant.

Results

Comparisons of surgical conditions between the 2 groups

The comparisons of surgical conditions between the 2 groups revealed that the surgical duration, intraoperative bleeding volume, and incision size were 180.2±22.3 minutes, 255.4±30.6 mL, and 18.1±3.7 cm, respectively, in the anterior decompression group; and were 117.8±15.1 minutes, 152.3±25.5 mL, and 16.0±3.1 cm in the posterior decompression group. This suggests that the surgical trauma degree in the anterior decompression group was greater than that in the posterior decompression group, and the difference was statistically significant ($P<0.05$) (Table 1).

Comparisons of neural functional ASIA motor score and tactile score between the 2 groups

The light tactile score and motor score in the anterior decompression group and posterior decompression group were 92.07±4.76 versus 83.53±5.11 points and 86.26±4.48 versus 72.55±4.77 points, respectively, at the postoperative 6th month, indicating that the neural function of the injured spine was better ameliorated in the anterior decompression group (Table 2).

Comparisons of postoperative height of the injured vertebral body and Cobb angle between the 2 groups

The height of the injured vertebral body and Cobb angle in the anterior decompression group and posterior decompression group were 3.69±1.11 cm versus 2.61±0.96 cm and 42.35±4.66 cm versus 31.19±4.15 cm, respectively, suggesting that the improved degree of the injured vertebral body in the

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Table 1. Comparisons of surgical conditions between the 2 groups.

Group	Case	Surgical duration	Intraoperative bleeding volume	Incision size
Anterior decompression group	40	180.2±22.3	255.4±30.6	18.1±3.7
Posterior decompression group	40	117.8±15.1*	152.3±25.5*	16.0±3.1*

Versus anterior decompression group, * $p<0.05$.

Table 2. Comparisons of ASIA Light Tactile Score and Motor Score between the 2 groups.

Group	Case	Light tactile score		Motor score	
		Before treatment	After treatment	Before treatment	After treatment
Anterior decompression group	40	52.19±2.98	92.07±4.76#	46.25±2.33	86.26±4.48#
Posterior decompression group	40	51.77±3.12	83.53±5.11#*	45.66±2.78	72.55±4.77#*

Versus anterior decompression group, * $P<0.05$, versus before treatment, # $P<0.05$. ASIA – American Spinal Injury Association.

Table 3. Comparisons of postoperative height of the injured vertebral body and Cobb angle between the 2 groups.

Group	Case	Cobb angle (°)		Height of the injured vertebral body (cm)	
		Before treatment	After treatment	Before treatment	After treatment
Anterior decompression group	40	21.74±3.46	42.35±4.66#	1.60±0.76	3.69±1.11#
Posterior decompression group	40	21.21±3.62	31.19±4.15#*	1.59±0.88	2.61±0.96#*

Versus anterior decompression group, * $P<0.05$, versus before treatment, # $P<0.05$.

anterior decompression group was superior to that in the posterior decompression group (Table 3).

Comparison of incidence rate of complication between the 2 groups

The results of this study found hemopneumothorax, pulmonary infection, intercostal neuralgia, abdominal distension, and constipation occurred in both the anterior decompression group and the posterior decompression group, but the incidence rate of complications was decreased in the posterior decompression group compared with the anterior decompression group (20% versus 9%) ($P<0.05$) (Figure 1).

Comparisons of clinical effects

The clinical effect (cured, improved, and e ective) in the 2 groups were analyzed; the effective rate was 90.0% in anterior decompression group, which was higher than that of 82.5% in the posterior decompression group (Table 4).

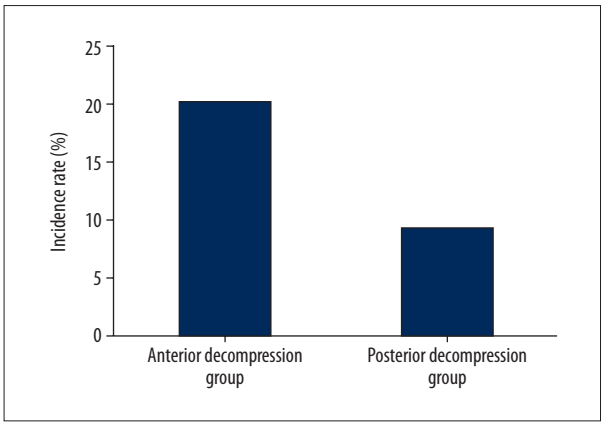

Figure 1. Comparison of incidence rate of complication between the 2 groups.

Comparisons of expression levels of inflammatory factor transforming growth factor (TGF)-β_2 at different time points between the 2 groups

The comparison of expression levels of inflammatory factor TGF-β_2 at different time points between the 2 groups showed that the expression levels of TGF-β_2 at day 1, day 7, day 15 and

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Table 4. Comparisons of clinical effects between the 2 groups (%).

Group	Case	Cured	Improved	Effective	Total effective rate
Anterior decompression group	40	11 (27.5)	14 (35.0)	15 (37.5)	36 (90.0)
Posterior decompression group	40	8 (20.0)	11 (27.5)	21 (52.5)	33 (82.5)

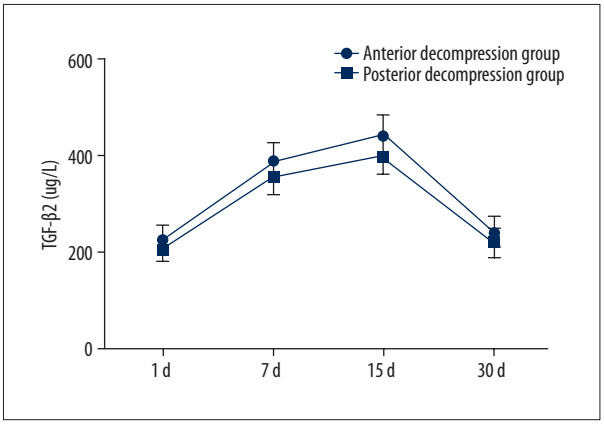

Figure 2. Comparisons of expression levels of inflammatory factor TGF-β_2 at different time points between the 2 groups.

day 30 after treatment in the anterior decompression group were higher than those in the posterior decompression group (P<0.05) (Figure 2).

Discussion

The thoracolumbar segment is located at the physiological radians and stress concentration points of spine, and spinal fractures that occur there are often complicated with spinal cord injury [11]. The surgical approach used in clinical practice should be able to remove fracture fragments, effectively relieve the compression of spinal cord, and promote the recovery of neural function and fracture healing [12,13].

The traditional posterior surgery used in clinical practice is relatively mature and minimally invasive [14]. The comparisons of surgical conditions between the 2 groups in this study revealed that surgical duration, intraoperative bleeding volume, and incision size were 180.2±22.3 minutes, 255.4±30.6 mL, and 18.1±3.7 cm in the anterior decompression group; and 117.8±15.1 minutes, 152.3±25.5 mL, and 16.0±3.1 cm in the posterior decompression group, respectively, suggesting that the degree of surgical trauma in the anterior decompression group was greater than that in the posterior decompression group. Hemopneumothorax, pulmonary infection, intercostal neuralgia, abdominal distension, and constipation were detected in both groups, however, the incidence rate of complications in the posterior decompression group was lower than that in the anterior decompression group (20% versus 9%). The main reason was likely due to the need with the anterior approach to cut the ribs and peel off the periosteum layer by layer in addition to insertion of screws, thus the trauma was relatively large, and the technical requirements higher.

Injury to the anterior and middle column of the spine is the main cause of spinal cord injury in thoracolumbar fractures [15,16]. On the one hand, anterior decompression can reduce the pressure on the nerve and spinal cord by removing bone fragments, and can decrease the damage to the posterior column structure, which is beneficial to the recovery of neural function and the prevention of re-injury. Anterior decompression can also avoid traction injury of the spinal cord caused by posterior decompression, thus reducing the occurrence of associated complications [17]. The intervertebral disc and bone fragments cannot be effectively removed by posterior decompression due to the occlusion of the spinal cord and surrounding tissues, thus spinal cord compression cannot be directly relieved. The results of this study found that the light tactile score and motor score in the anterior decompression group and posterior decompression group were 92.07±4.76 versus 83.53±5.11 points and 86.26±4.48 versus 72.55±4.77 points, respectively, indicating that the neural function of the injured spine was better ameliorated in the anterior decompression group. The height of the injured vertebral body and the Cobb angle in the anterior decompression group and the posterior decompression group were 3.69±1.11 cm versus 2.61±0.96 cm and 42.35±4.66 cm versus 31.19±4.15 cm, respectively, suggesting that the improved degree of the injured vertebral body in the anterior decompression group was superior to that in the posterior decompression group. The clinical effects in the 2 groups were statistically analyzed, and the results indicated that the total effective rate was 90.0% in the anterior decompression group, which was significantly higher than that in the posterior decompression group (82.5%) (P<0.05), implying that the total clinical effect was better in the anterior decompression group.

Growth factor plays an important role in fracture healing [18]. TGF-β_2 can regulate the proliferation and differentiation of various bone cells (mesenchymal cells, osteoblasts, osteoclasts, and chondrocytes) [19]. The comparisons of expression levels of inflammatory factor TGF-β_2 at different time points between

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

the 2 groups showed that the expression levels of TGF-β_2 on day 1, day 7, day 15 and day 30 after treatment in the anterior decompression group were higher than the levels in the posterior decompression group, with statistically significant differences between the 2 groups. This may be because the bone mass implanted during anterior decompression was highly consistent with the loss of the injured vertebrae, and the blood transportation was relatively smooth, which is known to be conducive to the correction of spinal deformities and the promotion of fracture healing [20].

Conclusions

Compared to posterior decompression with internal fixation, anterior decompression had a good fixation effect on patients with thoracolumbar spinal fracture complicated with spinal cord injury, resulting in better neural function and recovery of the injured vertebral body. However, the surgery was relatively complex and traumatic, thus, an appropriate operative approach should be selected according to the clinical manifestations and fracture classification of each patient.

Conflict of interest

None.

References:

1. Hashimoto M, Mochizuki M, Yamazaki M et al: C5 palsy following anterior decompression and spinal fusion for cervical degenerative diseases. Eur Spine J, 2010; 19(10): 1702–10
2. Ramieri A, Domenicucci M, Ciappetta P et al: Spine surgery in neurological lesions of the cervico-thoracic junction. Eur Spine, 2014; (Suppl.1): S13–19
3. Wand F, Zhu Y: Treatment of complete fracture-dislocation of thoracolumbar spine. J Spinal Disord Tech, 2013; 26(8): 421–26
4. Chen SL, Huang YH, Wei TY et al: Motor and bladder dysfunctions in patients with vertebral fractures at the thoracolumbar junction. Eur Spine J, 2012; 21(5): 844–49
5. Park SR, Na HY, Kim JM et al: More than 5-year follow-up results of two-level and three-level posterior fixations of thoracolumbar burst fractures with load-sharing scores of seven and eight points. Clin Orthop Surg, 2016; 8(1): 71–77
6. Liu Z, Li Z, Xing D et al: Two different surgery approaches for treatment of thoracolumbar fracture. Int J Clin Exp Med, 2015; 8(12): 22425–29
7. Imagama S, Matsuyama Y, Ishiguro N et al: C5 palsy after cervical iaminoplasty: A multicentre study. Bone Jt Surg Br, 2010; 92(3): 393–400
8. Cui H, Guo J, Yang L et al: Comparison of therapeutic effects of anterior decompression and posterior decompression on thoracolumbar spine fracture complicated with spinal nerve injury. Pak J Med Sci, 2015; 31(2): 346–50
9. Charles YP, Steib JP: Management of thoracolumbar spine fractures with neurologic disorder. Orthop Traumatol Surg Res, 2015; 101(Suppl. 1): S31–40
10. Dimitriou R, Mataliotakis GI, Angoules AG et al: Complication following autologous bone graft harvesting from the iliac crest and using the RIA: A systematic review. Injury, 2011; (42): S3–15
11. Liu B, Chen ZM, Guo ZM et al: Anterior approach versus posterior approach with subtotal corpectomy, decompression, and reconstruction of spine in the treatment of thoracolumbar burst fractures: A prospective randomized controlled study. J Spinal Disord Tech, 2011; 22(7): 65–67
12. Haq MI, Khan SA, Aurangzeb A et al: Radiological outcome of transpedicular screws fixation in the management of thoracolumbar spine injury. J Ayub Med Coll Abbottabad, 2015; 27(1): 171–73
13. Wu H, Wang CX, Gu CY et al: Comparison of three different surgical approaches for treatment of thoracolumbar burst fracture. Chin J Traumatol, 2013; 16(1): 31–35
14. Cowan RE, Nash MS: Cardiovascular disease, SCI and exercise: Unique risks and focused countermeasure. Disabil Rehabil, 2013; 32(26): 2228–36
15. Lin B, Chen ZW, Guo ZM et al: Anterior approach versus posterior approach with subtotal corpectomy,decompression,and reconstruction of spine in the treatment of thoracolumbar burst fractures: a prospective randomized controlled study. J Spinal Disord Tech, 2011 [Epub ahead of print].
16. Wu H, Wang CX, Gu CY et al: Comparison of three different surgical approaches for treatment of thoracolumbar burst fracture. Chin J Traumatol, 2013; 16(1): 31–35
17. Zhang S, Thakur JD, Khanis et al: Anterior stabilization for unstable traumatic thoracolumbar spine burst fractures. Clin Neurosurg, 2014; 11(2): 86–90
18. Cetrella M, McCarthy TL: Transforming growth factor-beta is a bifunctional regulator of replication and collagen synthesis in osteoblast-enriched cell cultures from fetal rat bone. J Biol Chem, 1987; 262: 2869–74
19. Joyce ME, Jingushi S, Bolander ME: Transforming growth factor beta in the regulation of fracture repair. Orthop Clin North Am, 1990; 21(2): 199–209
20. Ge CM, Wang YR, Jiang SD et al: Thoracolumbar burst fractures with a neurological deficit treated with posterior decompression and interlaminar fusion. Eur Spine J, 2011; 20(12): 2195–201

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]