



## Review

## Comparison of the technique of anterior cervical distraction and screw elevating-pulling reduction and conventional anterior cervical reduction technique for traumatic cervical spine fractures and dislocations



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## H I G H L I G H T S

- This technology is more secure.
- This technique can reduce complications.
- Improved technical operation is simple, safe and reset results are satisfactory.
- Surgical procedures do not need to use special equipment and materials.

## A R T I C L E I N F O

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## A B S T R A C T

**Introduction:** To analyze and confirm the advantages of anterior cervical distraction and screw elevating-pulling reduction which are absent in conventional anterior cervical reduction for traumatic cervical spine fractures and dislocations.

**Materials and methods:** A retrospective study was conducted on 86 patients with traumatic cervical spine fractures and dislocations who received one-stage anterior approach treatment for a distraction-flexion injury with bilateral locked facet joints between January 2010 and June 2015. They were 54 males and 32 females with an age ranging from 20 to 73 years (average age,  $40.1 \pm 5.6$  years). These patients were distributed into group A and group B in the sequence of visits, with 44 cases of conventional anterior cervical reduction (group A) and 42 cases of anterior cervical distraction and screw elevating-pulling reduction (group B). Comparison of intraoperative blood loss, operation duration and vertebral reduction rate was made between the two groups. The follow-up time was 12–18 months, and the clinical outcomes of surgery were evaluated according to ASIA score, VAS score and JOA score.

**Results:** Statistically significant difference was revealed between group A and group B in the surgical time and the correction rate of cervical spine dislocation ( $p < 0.05$ ), with the results of group B better than those of group A. For the two groups, statistically significant difference was shown between the ASIA score, VAS score and JOA score before and after operation ( $p < 0.05$ ), with the results better after operation, while no statistically significant difference was revealed in such scores between the two groups ( $p > 0.05$ ), with the therapeutic effect of group A the same with that of group B.

**Conclusions:** Anterior cervical distraction and screw elevating-pulling reduction is simple with low risk, short operation duration, good effect of intraoperative vertebral reduction and well-recovered function after the operation. Meanwhile, as a safe and effective operation method for cervical spine fractures and dislocations, it can reduce postoperative complications and the risk of the iatrogenic cervical spinal cord injury caused by prying or facet joint springing during conventional reduction, having more obvious advantages compared to the conventional surgical reduction adopted by group A, with good cervical

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spine stability as shown in long-term follow-up. Therefore, it is suitable for clinical promotion and application.

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## 1. Introduction

The cervical spine fracture and dislocation caused by trauma is clinically common. As a very severe spinal injury, cervical spine fracture and dislocation often causes damage to the three-column structure of cervical spine, abnormal alignment of cervical vertebrae, cervical instability and spinal cord injury, which are serious with poor prognosis, leading to high mortality rate and disability rate [1]. To achieve reduction as early as possible is the most effective and direct method for relieving spinal cord compression, reducing neurocyte deaths and recovering neurological function. Greg-Anderson et al. [2,3] retrospectively reviewed 55 cases of unilateral or bilateral locked facet joints and dislocations and followed up for 5 years, and found that early surgical decompression and reduction has an obvious effect on the recovery of neurological function in young patients, however, surgical method is of no significance in the recovery. For patients with multiple traumas all over the body, one-stage anterior approach can reduce the risk of secondary spinal cord injury caused by moving them, and for patients with a thoracic or abdominal injury, it can prevent such effect of chest and abdomen compression on blood pressure, heart rate and respiration as is noted in those in a prone position. Anterior approach can fully remove fragmented intervertebral disc, directly decompress and cause fewer complications, for which it is popular among many spine surgeons, and anterior approach decompression and internal fixation has been recognized as the first choice [4]. However, there is a difficulty in performing conventional anterior approach reduction for locked facet joints, as prying reduction increases the risk of secondary spinal cord injury during the operation [5], therefore, better anterior approach reduction is needed. Now a comparative analysis is conducted on the surgical treatment of 86 patients with lower cervical spine fractures and dislocations who were hospitalized between January 2010 and June 2015, and the study is reported as follows.

## 2. Clinical data and methods

### 2.1. Case selection

A study was conducted on 86 patients with traumatic cervical spine fractures and dislocations who received one-stage anterior approach treatment for a distraction-flexion injury with bilateral locked facet joints between January 2010 and June 2015. Inclusion criteria were as follows: 1. Post-traumatic osteophyte at the posterior edge of the vertebra, associated with backward movement of the bone fragment, or spinal cord compression due to post-traumatic disc herniation; 2. Allen-Ferguson classification of distraction-flexion injuries: Degree III and IV; 3. Cooper classification of bone fractures by morphology: Type I-II. Exclusion criteria were as below: 1. Ankylosing spondylitis; 2. Facet joint fracture and dislocation; 3. Osteoporosis with  $T < -3.0$ ; 4. Old fracture and dislocation; 5. Intolerance to operation due to a poor general condition.

### 2.2. Objects of study

86 patients were included. They were 54 males and 32 females

with an age ranging from 20 to 73 years (average age,  $40.1 \pm 5.6$  years), among whom 26 were injured by traffic accidents, 8 by falling down and 52 by falling from a height. X-ray slides showed kyphosis angle of  $20\text{--}37^\circ$ , an average of  $24 \pm 4.3^\circ$ . Cervical vertebrae displaced by  $5\text{--}20$  mm, an average of  $13 \pm 3.7$  mm. CT scans showed the injured vertebra displaced backward, the sagittal diameter of the cervical spinal canal was narrow obviously, and the spinal cord and dural sac were compressed markedly. MRI indicated 61 cases of annulus fibrosus ruptures and nucleus pulposus herniations, 20 cases of spinal cord contusions and 5 cases of spinal cord signal interruptions. Based on Allen-Ferguson classification [6], there were 47 cases of injuries caused by simple flexion violence (degree III), in which more than 50% dislocation was noted at the vertebra, and there were 7 cases of severe fracture dislocations of C5 or C6 associated with posterior ligamentous complex ruptures (degree IV), caused by flexion-compression violence.

In group A (conventional surgical reduction), they were 27 males and 17 females with average age of  $39.7 \pm 6.4$  years, demonstrating kyphosis angle of  $25.2 \pm 1.7^\circ$  and cervical vertebrae displacement by  $13.6 \pm 3.6$  mm, on average. In group B (distraction and screw elevating-pulling reduction), they were 27 males and 15 females with average age of  $40.4 \pm 5.8$  years, demonstrating kyphosis angle of  $26.4 \pm 2.3^\circ$  and cervical vertebrae displacement by  $12.9 \pm 3.2$  mm, on average. There was no statistical difference between the two groups in general information such as sex ratio, age, vertebrae displacement and kyphosis angle ( $P > 0.05$ ). For the details about the injured area and neurological function, see Tables 1 and 2.

### 2.3. Operation method

After successful anesthesia and before the operation, all patients were placed in a supine position, with the shoulders and back elevated and the neck slightly stretched. The injured vertebra was localized with a G-arm X-ray machine. A transverse incision was made in the right side of the neck (Smith-Robinson approach). Blunt dissection was performed from the space between cervical vessel sheath and tracheoesophageal sheath to prevertebral fascia. The G-arm X-ray machine was used to determine the injured segment, displacement and the midline of the vertebral body.

For group A, the group of conventional anterior reduction, the operation was consistent with any other conventional anterior approach. In case of any difficulty in achieving reduction due to interlocking, the Penfield could be used for prying to achieve reduction, or with the inner edges of bilateral longus colli muscles as the border, the corpectomy of the dislocated vertebra and the excision of the intervertebral discs superior and inferior to such vertebra were performed and the tension of the retractor was re-

**Table 1**  
Data of the injured areas and neurological functions.

	Intervertebral disc injury	Spinal cord contusion	Spinal cord discontinuity	The injured area			
				C3/4	C4/5	C5/6	C6/7
Group A	32	8	4	7	6	20	11
Group B	29	12	1	2	10	18	12

Note: intergroup comparison:  $P > 0.05$ .

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