Surgical Outcomes of Short-Segment Fixation for Thoracolumbar Fracture Dislocation

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Background: Currently long-segment pedicle instrumentation for a thoracolumbar (T-L) fracture-dislocation is gaining in popularity. Otherwise, short-segment fixation may be chosen as an another treatment method. This article evaluates the efficacy and complications of short-segment fixation for the treatment of thoracic or lumbar spine fracture-dislocation.

Methods: Twenty patients with thoracic or lumbar spine fracture-dislocation were included in the study. The mean follow-up period was 3 years. Clinical, neurologic, radiologic (angle of deformity, displacement percentage, fusion rate), and complication outcomes were analyzed retrospectively.

Results: The rate of failure, defined as an increase of 10° or more in local kyphosis, an increase of 10% or more in displacement percentage, the development of pseudarthrosis, and/or implant failure, was analyzed. Short-segment instrumentation had a higher failure rate in the lower lumbar region (L3-L5) and a lower rate at the thoracolumbar junction (T11-L2).

Conclusion: Thoracolumbar fracture-dislocation required firmer fixation especially in the low lumbar region, and short-segment fixation resulted in a high failure rate. Circumferential anterior and posterior fusion often played a role in certain severely injured cases. Good postoperative spinal alignment is crucial to a good outcome.

(Chang Gung Med J 2002;25:253-9)

Key words: thoracolumbar spine, low lumbar spine, fracture-dislocation, short-segment fixation, complications.

Thoracolumbar fracture-dislocation is a trauma of high energy which generally is treated with long-segment stabilization. In the literature, a few articles have reported on short-segment fixation for thoracolumbar fracture-dislocations.[1-5] This study analyzes the efficacy of short-segment pedicle screw fixation for thoracolumbar fracture/dislocation.

METHODS

Between July 1995 and June 1998, a consecutive series of 26 cases with thoracolumbar fracture-dislocation treated with short-segment pedicle screw fixation was recruited. Among them, 6 patients were lost to follow-up. In total, 20 patients were ultimate-

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Received: Jun. 12, 2001; Accepted: Nov. 23, 2001

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ly analyzed. The mean follow-up period was 3 years (range, 2 to 5 years). There were 16 males and 4 females. Eight patients fell from a height, 6 were struck by heavy objects, and the remaining 6 patients were injured in traffic accidents. Eight patients (40%) had other associated injuries including of the head, chest, and belly as well as limb fractures. All were treated with short-segment pedicle screw immobilization for spinal injuries. In addition to clinical evaluations, radiographic parameters including translation angle, translation percentage (Fig. 1),[6-7] and Cobb's angle were assessed.

The injuries were mainly (14 cases) distributed in the thoracolumbar (T-L) junction area (T11 to L2), while only a few (6 cases) were distributed in the lower lumbar region (L3 to L5) (Fig. 2). As to neurological evaluations, 50% of patients were fully paralyzed, while some were only partially disabled (Fig. 3).

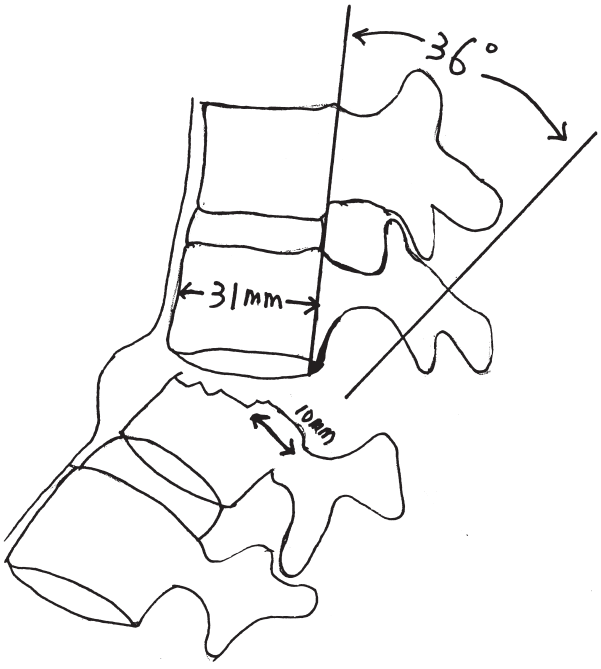

Fig. 1 Angle of deformity (36° in the drawing) and displacement percentage (10 divided by 31 equals a 32% displacement). A modification from an article in J Bone Joint Surg Am 1978;60:801.[6]

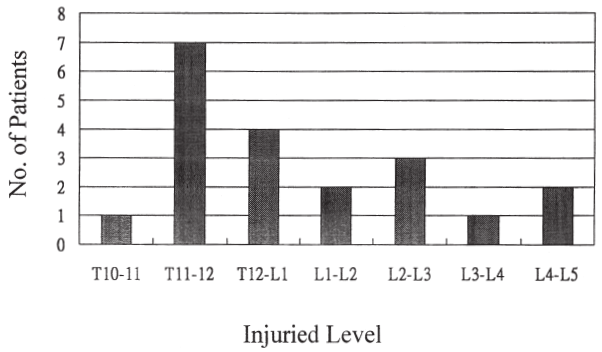

Fig. 2 Most injuries were at the level of the thoracolumbar junction.

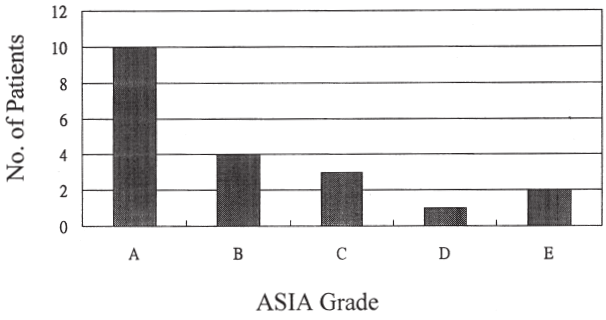

Fig. 3 Most patients had serious neurological damage (90% with partial or complete neurological deficit). ASIA: American Spinal Injury Association.

RESULTS

After the operation, patients were requested to wear a Taylor brace or a body jacket support for a period of 3 months. Any patient in need of further rehabilitation treatment was transferred to the rehabilitation department. The current authors consider complications to have occurred in patients with pseudarthrosis, implant failure, progressive kyphosis angle larger than 10° or translation angle larger than 10°, and initial postoperative alignment angle larger than a normal spinal alignment angle by 10°. The results show a total complication rate of 60% (12 of 20 cases). Among these, 3 cases of loss of reduction accounted for 15%, 4 cases of implant failure accounted for 20%, 2 cases of pseudarthrosis

accounted for 10%, and 5 cases of poor initial post operation alignment accounted for 25%.

We analyzed these complications and found that 80% of patients with poor initial postoperative alignment had a poor outcome, which was mostly caused by implant failure, loss of reduction, or development of pseudarthrosis. Therefore, the initial postoperative alignment after surgical reduction is extremely important to a patient's outcome. However, concerning postoperative alignment, posterior reduction can attain better anatomic alignment than can anterior reduction alone.

We divided the injuries into those occurring at the level of the thoracolumbar junction region and the lower lumbar region. The complication rate of the T-L junction group was only 26%, so it was easy to attain good postoperative alignment (Fig. 4). The complication rate of the lower lumbar region was

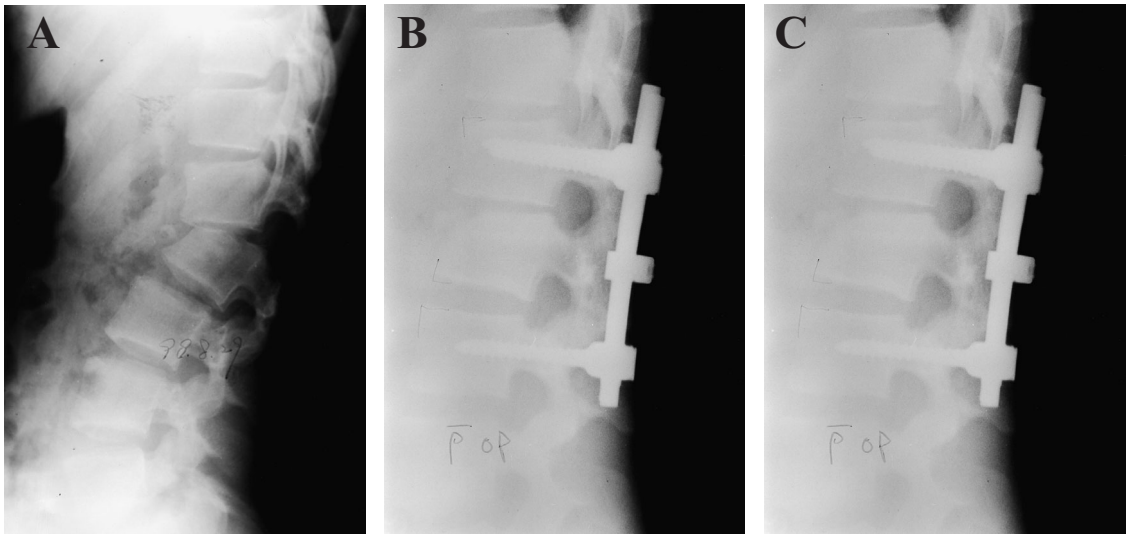

Fig. 4 L1-L2 fracture dislocation in a 16-year-old woman. (A) Preoperative lateral view. (B) Postoperative lateral view. (C) Two-year follow-up showing well-maintained alignment and fixation.

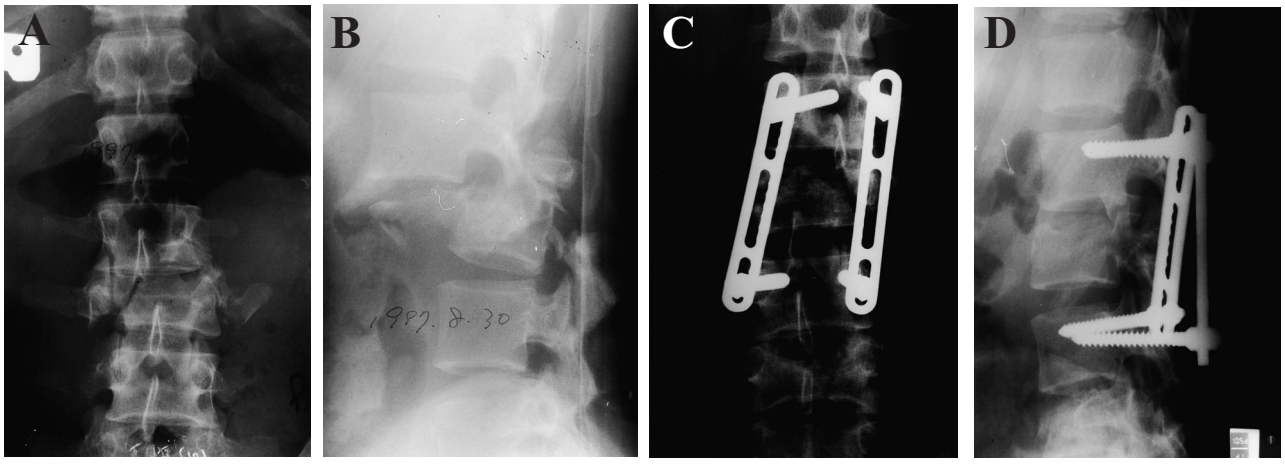

Fig. 5 L2-L3 fracture dislocation in a 23-year-old man. (A) Anterior-posterior (AP) view. (B) Lateral view. Postoperative malalignment in AP (C) and lateral views (D).

83%. In particular, it was difficult to attain good postoperative alignment when applying short-segment fixation to fracture-dislocations of the lower lumbar spine (Fig. 5).

Despite the high complications, not many patients required additional surgery for reconstruction. Among them, only 2 cases accepted anterior and posterior spinal fusion due to intractable pain caused by pseudarthrosis and implant failure. Among other patients with complications, because of serious neurological damage, they had little normal activity. With the less-ideal but already fused alignment, they could generally resume daily activities and did not require additional reconstruction surgery.

DISCUSSION

Patients with serious neurological damage are in need of long-term rehabilitation treatment but are easily lost to follow-up. If there is not very good communication and contact, they tend to be lost to follow-up. In addition, after surgery or rehabilitation in these patients, obvious improvements might not appear. However, because the patients are worried, they may seek help from other hospitals or divine help of some kind, and ultimately are lost to follow-up. Also, patients with full paralysis may lose their will to survive. Without conscientious care from the community and their families, they absolutely will not maintain contact with outside parties. Therefore, community concern and welfare are extremely important for the post-surgical education of these patients.[8-9]

As to the diagnostic aspects of spinal injuries, we can only rely on the x-ray analysis of a patient after his/her arrival at the hospital. We cannot accurately know the seriousness of a patient at the very moment he/she was injured. Perhaps, a case which was basically a dislocation during the handling process may naturally relocate or turn out to be more serious. Using existing diagnostic tools, it is absolutely impossible to know the level of force a patient suffered in practice. We can only evaluate or imagine it by means of a physical inspection of the patient after his/her arrival at the hospital. Similarly, we cannot determine a definite degree of severity of the neurological damage through x-ray or CT discoveries. Thus, we can only diagnose, treat, and evaluate these patients by means of the information retrieved from these physical inspections.[10-12]

A patient with poor initial postoperative alignment is more likely to experience further complications, either further kyphosis, translation, pseudarthrosis, or implant failure. Therefore, the initial postoperative alignment is extremely important in the overall treatment process. However, it is worth mentioning that although a case with good postoperative initial alignment normally turns out to have good postoperative fusion, in some cases, because of insufficient support of the anterior spine, there is a loss of reduction or implant failure (Fig. 6). A spine fracture-dislocation is a 3-column injury.[4,13-15] Support by the anterior column is a considerably important factor in the long-term recovery. Therefore, in many spinal injury cases, anterior spinal interbody fusion plays a very important role. Deciding when to perform anterior interbody fusion can be evaluated by the score of the load sharing classification.[16-20]

As to the postoperative alignment skill, if it relies on an implant, then long-segment spinal fixation can achieve relatively close alignment to a normal spinal line. If it is aligned using short-segment fixation, then there may be a discrepancy in the line of 2 points from the integral anatomic alignment. Based on our experience at this time, the alignment should normally be conducted manually, and then be fixed with implants in order to attain an optimal alignment.[21-22]

We achieved better results for cases affecting the T-L junction than for low lumbar cases. Irregardless of considering the initial alignment or the failure rate after long-term follow-up, lower lumbar cases showed a very high complication rate (87%). We found that surgical reduction was not easy for cases with lower lumbar spine fracture-dislocation. Besides considering lordosis of the lower lumbar spine and displacement of the joint space, we further discovered that a larger pulling force was required to attain better alignment. In daily life, the lower lumbar region is subjected to larger loads and a greater activity scope. Therefore, short-segment fixation may lead to a higher number of failures because is not as strong.[23-25]

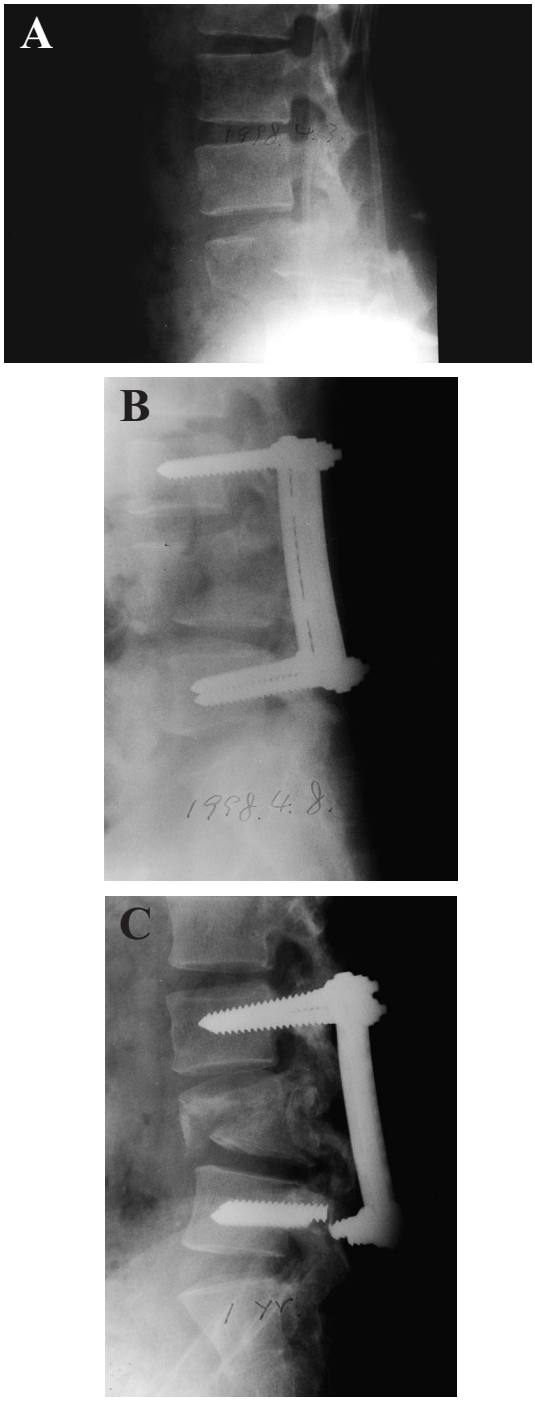

Fig. 6 L3-L4 fracture dislocation in a 26-year-old man. (A) Lateral view. (B) Initial postoperative alignment showing severe anterior body destruction. (C) One-year follow-up showing loss of reduction and implant failure. Insufficient support by the anterior spine might have caused a loss of reduction and implant failure.

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短節鋼釘固定胸腰椎骨折併脫臼的手術結果

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背 景： 胸腰椎骨折併脫臼的病例，一般以長節鋼釘來固定。而短節鋼釘固定是否也可當作另一種治療方式的選擇？本篇主要探討短節固定胸腰椎骨折併脫臼的病例可能產生的利益或併發症。

方 法： 共有20例胸腰椎骨折併脫臼的病例，加以追溯探討，分析其臨床上、神經學上、放射線上及併發症上的評估，平均追蹤三年。

結 果： 在追蹤的過程中，只要發現脊椎前屈的角度增加10度以上，移位的程度增加10個百分比以上，鋼釘或鋼架的損壞，假關節的形成，都以併發症的方式來加以分析。結果發現短節固定胸腰椎骨折併脫臼的病例中，在下腰部（腰椎第3、4、5節）有很高的併發症。

結 論： 在治療胸腰椎骨折併脫臼的病例時，往往需要更牢靠的固定，而且短節固定往往會造成很高的失敗率。在有些受損很嚴重的病例，往往需要前後骨融合術的方式來治療。而且術後最初的脊椎體位的好壞，對最後的癒後也有很重要的影響力。

(長庚醫誌 2002;25:253-9)

關鍵字：胸腰椎，下腰椎，骨折併脫臼，短節固定，併發症。

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