



An assessment system for evaluating the severity of thoracolumbar osteoporotic fracture and its clinical application: A retrospective study of 381 cases

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ABSTRACT

Objective: We put forward an assessment system of thoracolumbar osteoporotic fracture (ASTLOF) evaluating the severity of thoracolumbar osteoporotic fracture. This study was to investigate its efficacy in guiding clinical practice.

Methods: Three hundred and eighty-one patients with thoracolumbar vertebral osteoporosis fracture admitted to the hospital from January 2010 to December 2011 were enrolled in the study. All cases were evaluated by ASTLOF including evaluation of morphological changes, MRI, bone mineral density and pain. The patients were treated with different methods according to ASTLOF score. All patients were followed up on a regular basis. The treatment results were assessed by VAS and ODI.

Results: All patients were followed up with an average of 20.1 (range: 6–30) months. There were 91 cases of ASTLOF score < 4 points. Their average VAS score decreased from 8.0 ± 1.7 points to 2.0 ± 1.3 with statistical significance ($P < 0.05$) and the average ODI score decreased from 69.5 ± 2.8 to 38.1 ± 1.5 ($P < 0.05$). One hundred and thirty-two cases were with ASTLOF score = 4, with the average VAS score decreased from 8.2 ± 1.4 to 1.9 ± 1.2 ($P < 0.05$) and the average ODI score decreased from 71.5 ± 3.7 to 36.2 ± 2.5 ($P < 0.05$). There were 158 cases of ASTLOF score ≥ 5 , with the VAS score decreased from 8.0 ± 1.7 to 2.0 ± 1.3 and the ODI score decreased from 69.5 ± 2.8 to 38.1 ± 1.5 .

Conclusions: ASTLOF based on the severity of thoracolumbar osteoporotic fracture was suggested to be helpful in guiding clinical practice.

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1. Introduction

Osteoporosis is characterized with decrease of bone mineral and bone matrix and degradation of bone microstructure, which increases brittleness of bone and risk of bone fracture [1,2]. It often occurs in postmenopausal women [3]. Spine is the most common site of osteoporotic fracture without obvious trauma or small trauma. 85% of the patients with spinal osteoporosis fracture have the symptoms of pain; the remaining 15% were asymptomatic, which easily resulted in misdiagnosis [2]. In patients with osteoporosis, slight trauma may lead to compression fracture in one or more vertebrae. Its main clinical manifestations are pain in the

chest and back, height reduction and kyphosis deformity, with very different degrees of pain individually [4]. In some patients, the pain duration is short, even without obvious symptoms sometimes, which usually result in being ignored. In the existing literature research, there is no unified standard to systematically evaluate the severity of the thoracic lumbar osteoporotic fracture for the benefits of clinical treatment [5,6].

In the present study, we put forward an assessment system of thoracolumbar osteoporotic fracture (ASTLOF) evaluating the severity of thoracolumbar osteoporotic fracture. ASTLOF included the evaluation of morphological changes of the diseased vertebrae, vertebral MRI, bone mineral density and pain to determine the severity of thoracic lumbar vertebral osteoporotic fracture. This retrospective study investigated the treatment results of 381 cases with thoracic lumbar osteoporotic fracture. All the patients were evaluated with ASTLOF and treated with different methods according to the result of ASTLOF.

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Table 1

A summary of the patients' information.

Characteristic	Value
<i>Gender</i>	
Male	87
Female	294
<i>Age</i>	
Average	59.4
Range	54–90
<i>Follow-up (month)</i>	
Average	20.1
Range	6–30

Table 2

The assessment system of thoracolumbar osteoporotic fracture (ASTLOF).

Characteristic	Value
<i>Morphology</i>	
Normal	0
Compression fractures	1
Burst fracture	2
<i>MRI</i>	
Normal	0
Long T1 and T2 signal	1
Vacuum or effusion in vertebral body	2
<i>Bone mineral density</i>	
$T > -2.5$	0
$-2.5 > T > -3.5$	1
$T < -3.5$	2
<i>Pain</i>	
No obvious pain	0
Back and lower back pain	1
Sustained pain or spinal cord injury)	2
Total score	0–8

ASTLOF was put forward in the present study in order to guide the treatment of thoracolumbar osteoporotic fractures.

2. Patients and methods

2.1. Patients

The study was approved by the ethic committee of the hospital and the written informed consents of all patients were obtained. Three hundred and eighty-one patients (Table 1) with thoracolumbar vertebral osteoporosis fracture admitted to the hospital from January 2010 to December 2011 were enrolled in the study. The patients were diagnosed as thoracolumbar vertebral osteoporosis fracture according to the standard of diagnosis and treatment of osteoporosis recommended by World Health Organization (WHO) [7]. The main symptom of all the patients was pain in the back and lower back. The patients with violence injury, osteoporosis caused by drugs or medical disease, pathological fractures caused by primary vertebral tumor or vertebral metastasis, or infectious disease were excluded. All cases were evaluated by ASTLOF (Table 2).

2.2. Imaging examination and bone density check

X-ray, CT and MRI examination were performed to evaluate the diseased vertebrae.

To determine bone mineral density value, bone mineral density check was performed with dual-energy X-ray absorption method (DXA) according to WHO diagnostic criteria [8]. The lumbar spines and proximal hips were checked with bone mineral density measurement. The bone mineral (BMCg) and its density (BMD g/cm²) were obtained. The values were compared with those of the people

of the same height and age to obtain the *T* values and *z* values. *T* value of the patient was compared with WHO standard *T* value.

2.3. Scoring method

The morphological changes of the diseased vertebrae, MRI results of wounded vertebrae, bone density and pain (Table 2) were evaluated. The treatment method was determined according to their scores.

2.4. Treatment method

The patients with ASTLOF score <4 points were treated with conservative treatment. The therapeutic method was subcutaneous injection of 50 IU salmon calcitonin (Novartis Pharma Co. LTD, Switzerland) twice a week, and oral administration of calcitrate D (Wyeth Pharmaceuticals, America) two pieces per day and 0.25 µg calcitriol (Roche Pharma Co. LTD, China) twice a day for six months. After 4–6 weeks' treatment, the patients were encouraged to have some exercise. As for the patients with ASTLOF score = 4 points, their vital signs were firstly evaluated to determine if they could tolerate the surgery. Then conservative treatment or vertebroplasty/kyphoplasty was performed according to the patient's willing. The vertebroplasty/kyphoplasty was performed as the following procedures. Under C arm fluoroscopy, paracentetic needle was penetrated into the diseased vertebra unilaterally or bilaterally. Bone cement was injected into the vertebrae following fracture reduction. The patients with ASTLOF score ≥ 5 points were suggested to be treated with vertebroplasty/kyphoplasty or open surgery. Open surgery was performed as the following. The patient was in prone position and under general anesthesia. The injured vertebra and the adjacent vertebrae were exposed through posterior median approach. Pedicle screw channel was made and 1.5 ml bone cement was injected into it. Before bone cement hardened, pedicle screw placement, connecting rod installation and reduction were performed. For the patients with neurological symptoms, lamina resection decompression was performed. Then posterolateral bone graft fusion was done.

2.5. Evaluation methods and follow-up

Back and lower back pain were evaluated by VAS score [9]. Curative effect was evaluated by ODI score. Complications were observed and recorded. All patients were followed up 1, 3, 6, 9 and 12 months postoperatively. One year after the surgery, the patients were followed up every 6 months. VAS score and ODI score were recorded. Clinical examination, X-ray films, CT or MRI assessment were performed to assess fracture healing and vertebral height loss.

2.6. Statistical analysis

All measurement data were presented as mean ± SD. The data were analyzed by *t*-test using SPSS 17.0. *P* < 0.05 was considered as statistical difference.

3. Results

X-ray and CT results showed that there were vertebral wedge compression in 151 cases and vertebral burst fracture in 132 cases with the characteristics of anterior vertebral column crack and posterior vertebral bone fracture. As for the injured vertebral segment, there were 78 cases with T11 injure, 110 cases with T12 injure, 116 cases with L1 injure and 77 cases with L2 injure (Figs. 1–3). Two hundred and fifty-two cases had two vertebrae injure. One hundred and twenty-nine cases had three vertebrae injure or more.

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