

Effect of Osteoporotic Vertebral Compression Fracture on Adjacent Intervertebral Disc Degeneration

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Abstract: Objective: The influence of vertebral compression fracture on the degeneration of adjacent disc was analyzed. **Methods:** 88 patients with osteoporotic vertebral compression fractures admitted to the orthopedic pain department from July 2014 to July 2019 were selected as the research objects. According to the previous MRI and the improved MRI results of admission, the patients were converted into old fractures after conservative treatment. They were followed up in 3, 6 and 12 months after discharge, and the VAS score at each time point (visual acuity score) was calculated. We collected and analyzed the classification of intervertebral disc degeneration and MRI index. **Results:** The follow-up rate was 65.9% (58/88); There were 42 cases (72.4%) of degenerative disc adjacent to the diseased vertebra, and 16 cases (27.5%) of adjacent intervertebral disc did not degenerate; VAS scores were lower at 14 days, 3 months, 6 months and 12 months after admission; The number of grade 1 of disc degeneration was lower in 6 months and 12 months than that in admission ($P<0.05$), and the number of grade 2, 3 and 4 was significantly higher than that in the follow-up in December ($P<0.05$). The difference between 6 and 12 months was not statistically significant ($P>0.05$); MRI index at 6 and 12 months follow-up was lower than that at admission ($P<0.05$). **Conclusion:** Through the research and analysis, we found that osteoporotic vertebral compression fracture will have a corresponding impact on the adjacent intervertebral disc, which can make the adjacent intervertebral disc degenerate.

Keywords: Osteoporotic vertebral compression fracture; Adjacent to intervertebral disc; Degeneration; Influence

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Vertebral compression fracture is a common complication of osteoporosis in the elderly. Clinically, it is often manifested as pain at the fracture site, loss of vertebral height, instability of spine and even kyphosis after no obvious trauma history or slight trauma. With the progress of the disease, continuous pain at the fracture site, limited spinal activity, seriously affect the quality of life of patients, and even some patients need to stay in bed for a long time, resulting in death due to various complications. In this case, most patients are reluctant to accept surgical treatment, but conservative treatment will theoretically change the stress distribution of fracture vertebral body and increase the stress load near the vertebral body, resulting in the degeneration of adjacent disc and vertebral fracture. From the clinical observation, it is found that the local stress changes caused by fracture can affect the degeneration of adjacent intervertebral disc, but the relevant clinical data are rarely reported. The possible effect of OVCF on adjacent intervertebral disc degeneration and its degree were evaluated by visual analogue scale (VAS), grade of intervertebral disc degeneration and MRI index. The report is as follows.

1 Material and methods

1.1 General information

Patients with osteoporotic vertebral compression fractures admitted to the pain department of Guizhou orthopedic hospital from July 2014 to July 2019 were collected. According to the previous MRI results and the improved MRI results of admission, 68 patients with complete data were included. 42 patients were confirmed to have degeneration of intervertebral disc adjacent to the diseased vertebrae, including 8 males and 34 females. The average age was 63 years old, the age was 45-75 years old, and the course was 10 days to 12 months. The MRI results of MRI and follow-up period were collected at the time of new fracture. The patients' gender and age were unlimited. Case inclusion criteria: (1) X-ray examination showed that there was osteoporosis and the anterior height of diseased vertebrae was lost; MRI showed that the fractured vertebrae was fresh without spinal cord compression; Imaging examination excluded tumor invasion; (2) MRI examination confirmed that there was no degeneration of adjacent intervertebral disc and no old fracture and tumor invasion of adjacent vertebral body.

1.2 Treatment

Conservative treatment methods: After admission, they were given bed rest, analgesic and dehydration drugs, nerve block, physical therapy, alendronate sodium, anticoagulant and other treatment measures. The pain was relieved. They wore a belt to get out of bed properly. After discharge, they continued to stay in bed, supplemented calcium, and insisted on oral alendronate sodium. After conservative treatment, fresh fracture turned to old fracture about 3 months later.

1.3 Observation index

VAS score was performed at the time of hospitalization, 14 days after admission, 3, 6 and 12 months after discharge. MRI examination was performed at 6 and 12 months after discharge. MRI index was calculated according to the methods provided by relevant scholars; According to Pfirrmann's classification, the intervertebral disc degeneration was divided into 5 grades according to Pfirrmann's classification standard. Grade 1: The nucleus pulposus of intervertebral disc showed

uniform high signal (white), which was the same as CSF signal. The boundary between annulus fibrosus and nucleus pulposus was clear, and the height of intervertebral disc was normal; Grade 2: The nucleus pulposus of intervertebral disc showed heterogeneous high signal (white), which was the same as cerebrospinal fluid signal. There were or not horizontal signal bands in nucleus pulposus. The boundary between annulus fibrosus and nucleus pulposus was clear, and the height of intervertebral disc was normal; Grade 3: The nucleus pulposus of intervertebral disc showed uneven medium or low signal (gray), the nucleus pulposus and annulus fibrosus could not be distinguished, and the height of intervertebral disc was normal or moderately decreased; Grade 4: The nucleus pulposus of intervertebral disc showed heterogeneous medium or low signal (black), the nucleus pulposus and annulus fibrosus could not be distinguished, and the height of intervertebral disc was normal or moderately decreased; Grade 5: The nucleus pulposus of intervertebral disc showed heterogeneous low signal (black), the nucleus pulposus and annulus fibrosus could not be distinguished, and the intervertebral space was moderately narrow.

1.4 Statistical methods

The statistical software SPSS 16.0 was used for statistical analysis. The measurement data was expressed as $(\bar{x} \pm s)$. The repeated measurement analysis of variance was used. The chi square test was used for counting data. The difference was statistically significant with $P < 0.05$.

2 Results

2.1 General information

Ten patients were not followed up completely because of old age, complicated diseases and compliance. Conservative treatment patients usually wear braces after 2 weeks, and their back pain is relieved slowly. After a long time of sitting in hospital, the back pain disappeared after 3 months. At the end of the follow-up, all patients' clinical symptoms were relieved.

2.2 VAS score

After conservative treatment, the fracture patients continued to wear a belt according to the doctor's instructions, avoid bending and weight bearing and adhere to oral medication. VAS scores were compared

at 3, 6 and 12 months; The difference was statistically significant ($P < 0.05$), indicating that long-term conservative treatment can relieve pain and improve

the quality of life. But the average VAS score was about 4 points, indicating that the patients still had pain after conservative treatment. See Table 1.

Table 1. Changes of VAS score and MRI index at each time point [$n=58$, ($\bar{x} \pm s$)]

Point of time	Observation index	
	VAS score	MRI index ($\text{mm}^2 \times \text{Gy}$)
In hospital	8.62±1.23	12012.78±867.63
14 days after admission	6.59±1.07*	-
3 months after discharge	4.46±1.02	-
6 months after discharge	4.34±0.96	89320.53±1127.24
12 months after discharge	3.83±0.58	90352.61±963.82

2.3 Classification of intervertebral disc degeneration

The MRI results of 58 patients were analyzed at admission and 6 and 12 months after discharge. There

was significant difference in the grading of intervertebral disc degeneration ($P < 0.05$). See Table 2.

Table 2. Grading of disc degeneration at different time points ($n = 58$, case)

Classification of intervertebral disc degeneration	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
In hospital	51	3	2	0	2
6 months after discharge	36	5	13	2	2
12 months after discharge	29	8	14	4	3

2.4 MRI index comparison

MRI examination results showed that the follow-up results of 6-12 months after discharge showed that high signal area decreased and nucleus pulposus was irregular, and the difference was statistically significant ($P < 0.05$), as shown in Table 1, indicating the influence of OVCFs on intervertebral disc degeneration.

3 Discussion

Osteoporosis vertebral compression fracture (OVCF) is a kind of fracture caused by osteoporosis, and the elderly are high incidence groups. Because of the decrease of bone mass and bone strength and the increase of bone fragility, compression fracture is easy to occur after external force. With the increase of the elderly population in China, the incidence rate of OVCF is increasing year by year. The main clinical manifestations are waist pain, muscle spasm, convulsion, and respiratory dysfunction, which pose a serious threat to the life safety of patients. At present, conservative treatment is commonly used in clinical treatment, but the effect is not obvious, and the treatment cycle is too long. However, some patients with OVCFs are reluctant to accept surgical treatment and choose conservative treatment because of the lack of understanding of the disease and treatment methods, economic reasons, and

the degree of compression is not obvious. After conservative treatment, the patient still has the cause of back pain. The purpose of this study is to confirm that the fresh fracture is transformed into old fracture by conservative treatment, and the imaging signal changes of adjacent intervertebral disc. The cause of low back pain after fracture healing may be related to adjacent intervertebral disc degeneration. Intervertebral disc degeneration is a part of aging, which is a complex biological process affected by many factors such as age, heredity, injury and inflammation. In this study, two indexes of intervertebral disc degeneration grade and magnetic resonance index were used to detect intervertebral disc degeneration from imaging and water molecular signal level in intervertebral disc. At the follow-up of 6 months after discharge, the high signal area gradually decreased, the signal of nucleus pulposus gradually decreased, and the shape of nucleus pulposus gradually became irregular. At 12 months after discharge, the change of intervertebral disc signal was statistically significant. Normal intervertebral disc tissue can maintain spinal stability, absorb vibration, slow down impact force and divide external force. After intervertebral disc degeneration, the stiffness and hardness of nucleus pulposus and annulus fibrosus increase, which makes the buffering effect of intervertebral disc weaken. At the same

time, the loss of intervertebral disc height will also lead to the change of spinal stress. The degeneration of intervertebral disc will weaken the buffering effect of intervertebral disc, which will directly or indirectly affect the stress distribution and load transfer mode of adjacent vertebral body and even the whole spine. Therefore, it can be inferred that after vertebral compression fracture, the injury of the upper and lower endplates leads to nutritional disturbance and increased pressure in the intervertebral disc, thus accelerating the degeneration of adjacent intervertebral disc. Degeneration of the intervertebral disc can cause low back pain. This is the main problem that the author wants to elaborate. After the deformity healing of thoracolumbar fracture, the stress change of vertebral body and spine and other factors lead to intervertebral disc degeneration, which causes the pain of acid swelling in the back of patients, and the quality of life of patients is affected.

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