

## **Effect of high viscosity bone cement on treatment of osteoporotic vertebral compression fracture.**

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### **Abstract**

**Objective:**To study the clinical effect of high viscosity bone cement on the treatment of osteoporotic vertebral compression fracture.

**Methods:**From March 2016 to February 2017, 90 cases of osteoporotic vertebral compression fracture in our hospital were selected as the objects, which were divided into control group and observation group in 45 cases with random table extraction. All patients underwent PVP surgical treatment, in which the control group was given low viscosity bone cement, the observation group was given high viscosity cement, and the pain situation, vertebral body parameters and the leakage rate of bone cement were observed and compared between the two groups.

**Results:** The VAS score in the observation group was significantly lower than that in the control group, and the Barthel score was significantly higher than the control group. The frontal height and midline height of the patients in the observation group were significantly higher than those in the control group, and the Cobb angle was significantly lower than the control group. The leakage rate of bone cement in the observation group was significantly lower than that in control group.

**Conclusion:**The treatment of osteoporotic vertebral compression fracture patients with high viscosity bone cement can obviously relieve the waist pain and improve the patient's vertebral body condition to promote their quality of life, clinical significance. It has a significant clinical significance.

**Keywords:** High viscosity bone cement, Osteoporosis, Vertebral compression fracture, Clinical research.

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### **Introduction**

Affected by osteoporosis, the patient's bone strength is low and very fragile, so that the fracture threshold of patients shows a significant downward trend. Fracture problems can be easily caused by external forces, resulting in prolonged bed-ridden and intractable pain, which reduces the quality of life of patients and even shortens their life expectancy, posing huge financial burden to the patient's family and society [1].

At present, more common clinical treatment methods are percutaneous vertebroplasty, which has the advantages of quicker pain relief with minor trauma and mild complication. The Bone cement will be used in specific treatment, whose improper use may produce the Infiltration, thus affects the curative effect [2].

To reduce the risk of complications such as bone cement leakage, the medical profession has introduced high viscosity cement. Based on above background, the clinical effect of high viscosity bone cement in the treatment of osteoporotic vertebral compression fracture was discussed, and 90 cases of osteoporotic vertebral compression fracture were selected in our hospital, among which the patients with high viscosity bone cement treatment were treated with ideal effect. The details are as follows.

### **Materials and Methods**

#### **General information**

From March 2016 to February 2017, 90 cases of osteoporotic vertebral compression fracture were selected in our hospital,

which were divided into control group and observation Group in 45 cases by random table method. Before receiving treatment, all patients signed the "Investigation and research Informed consent" [3] with our hospital, the control group between men and women 26:19, age 55~72, average  $56.3 \pm 2.5$  y old; the observation Group of men and women ratio of 28:17, age 53~70, average ( $54.4 \pm 3.1$  y old). They are comparable with no significant difference in baseline data between the two groups.

**Inclusion criteria:** 1. The osteoporotic vertebral compression fracture detected by MRI [4], CT [5], the patient's waist back and chest had severe pain, whose symptom was not improved after the conservative treatment of 5~30 d. 2. MRI results showed that vertebral body T2W [6] and fat inhibition [7] showed high signal, while T1W [8] was low signal, and the results of CT examination showed that vertebral fracture was a painful vertebral body. 3. With no mental and language barrier, the patient could communicate effectively and could take care of their daily life.

**Exclusion criteria:** Excluding the pathological compression fracture due to vertebral body tumor or infection, the patient should not suffer from pulmonary heart disease and liver or kidney function injury, and the compression degree more than 75% were excluded [9].

### Treatment methods

In the surgical treatment, the nursing staff placed the routine disinfection towel on the bed, and guided the patient to take the prone position, to operate local anesthesia for the patient. During surgery, under DSA's [10] monitoring, the paramedics strike the bone puncture needle through the patient's vertebral arch into the vertebral body 1/3 position.

The observation group was given high viscosity cement, in which the powder used for 27 g, the monomer was set to 10 ml, whose former mainly including polymers (including methyl methacrylate and acrylic acid methyl ester) 14.3 g, Zirconia 12.7 g. After the 150 s of modulation is the dough period, during which the medical staff use the pressure pump to inject the patient's vertebral body. When the target vertebral body filled, or bone cement has obvious overflow, stop the injection of bone cement [11,12].

In addition, the nursing staff will record the amount of bone cement injection, and begin CT scan after 3~5 d of operation for patients, to grasp the patient's bone cement leakage to make timely and effective prevention and control measures.

### Observation indexes

The specific observation indicators include the following three aspects: 1. The pain situation and the daily life ability appraisal, mainly chooses the VAS scale [13] and the Barthel scale [14,15], wherein the former is full divides into 10 points, 0~3 points expresses no pain; 4~6 points indicate pain is obvious but tolerable; The 7~10 points indicate that pain is unbearable; The latter is divided into 100 points, ~20 points is

no life self-care ability, 21~40 points of severe disability, the patient's life depends on others care, 41~60 patients have a slight self-care ability, but the life still needs others to care, 61~100 points can be divided into patients basic self-care; 2. The vertebral parameter comparison mainly includes the vertebral leading edge height, the vertebral midline height and the Cobb angle three-phase index; 3. The leakage of bone cement was compared with that of the two groups.

### Statistical analysis

The statistical software SPSS17.0 [16] is used to analyse and process the data, in which the counting data is indicated by the example number (rate), the Chi-square test, the measurement data are indicated by the mean  $\pm$  standard deviation, and t-test.  $P < 0.05$  suggests that the difference is statistically significant.

### Results

The VAS score in the observation group was significantly lower than the control group ( $t=4.240$ ,  $P=0.013$ ), and the Barthel score was significantly higher than the control group ( $t=6.746$ ,  $P=0.003$ ), as shown in Table 1.

**Table 1.** Comparison of pain and daily life ability in two groups.

Group	n	VAS score	Barthel score
Observation group	45	$3.7 \pm 0.9$	$76.5 \pm 5.3$
Control group	45	$7.3 \pm 1.2$	$42.4 \pm 7.1$
t	-	4.24	6.74
P	-	0.013	0.003

The frontal height and midline height of the patients in the observation group were significantly higher than those in the control group ( $t=7.799$ ,  $p=0.001$ ;  $t=3.444$ ,  $P=0.026$ ), and the Cobb angle was significantly smaller than the control group ( $t=10.883$ ,  $P=0.002$ ), as shown in Table 2.

**Table 2.** Comparison of vertebral body parameters in two groups.

Group	n	Anterior vertebral height (mm)	Midline vertebral height (mm)	Cobb angle (degree)
Observation Group	45	$22.4 \pm 0.8$	$23.4 \pm 2.9$	$16.9 \pm 1.9$
Control group	45	$15.3 \pm 1.4$	$17.1 \pm 1.8$	$28.1 \pm 1.7$
t	-	7.79	3.44	10.88
P	-	0.001	0.026	0.002

The leakage rate of bone cement in the observation group was significantly lower than that in control group ( $\chi^2=19.397$ ,  $P=0.015$ ), as shown in Table 3.

**Table 3.** Comparison of bone cement leakage rate in two groups.

Group	n	Venous leakage	Intervertebral leakage	Vertebral leakage	Leakage rate
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Observation Group	45	1 (2.22%)	3 (6.67%)	2 (4.44%)	6 (13.33%)
Control group	45	11 (24.44%)	7 (15.56%)	8 (17.78%)	26 (57.78%)
$\chi^2$	-	-	-	-	19.39
P	-	-	-	-	0.015

## Discussions

Osteoporosis is a more common systemic metabolic bone disease, with low bone strength and less bone mass. The patient easy to appear fracture subjected to slight external force, in which the vertebral compression fracture is a common clinical complication. In clinical practice, PVP surgery is usually adopted, in which the low viscosity cement is often used in the treatment, but in the injection process leakage is very easy to appear, which increase the coagulation time of bone cement. Related research [17] shows low viscosity cement leakage can reach 31.9%~57.8%, seriously affected the treatment effect of the patient. Based on this, many scholars have noticed that the fluidity of bone cement will be influenced by its viscosity, and creatively select the high viscosity cement in the operation, then the medical staffs need not take the initiative to judge the injection time, to prolong the injection window period effectively [18].

The results showed that the VAS score in the observation group was significantly lower than that in the control group, and the Barthel score was significantly higher than that of the control group. The frontal height and midline height of the patients in the observation group were significantly higher than those in the control group, and the Cobb angle was significantly lower than the control group,  $P < 0.05$ ; the leakage rate of bone cement in the observation group was significantly lower than that in control group,  $P < 0.05$ . The specific causes of the analysis are as follows: 1. The treatment of high viscosity bone cement benefit improving the stability of vertebral body, which restores the vertebral body leading edge height, midline height and Cobb angle to normal condition. High viscosity cement is improved based on traditional bone cement, which has the advantages of long injection time and low polymerization temperature. It can be used in the process of PVP surgery to achieve good mechanical stability of the vertebral body, thus effectively alleviating the pain of patients. At the same time, when the patient's vertebral body has achieved good stability, then the bed time is significantly reduced, thus enhancing the self-care ability. Wu et al. [19] research shows that the viscosity of bone cement directly affects its cohesion. Application of high viscosity bone cement in the treatment of osteoporotic vertebral compression fracture in patients with PVP can guarantee the stability of vertebral body, thus avoid the pain caused by dislocation of vertebral body, and improve the self-care ability of patients. Among which the Barthel score of high viscosity bone cement treatment given by the patients was 11.2 points higher than that of the low viscosity bone cement, which was consistent with the results of the study. High viscosity bone cement is beneficial to reduce the leakage

rate of bone cement and improve the therapeutic effect of the patients. According to Guo et al. [20] research shows that the leakage of bone cement mainly occurs in the veins, intervertebral discs and vertebrae. While lots of leakage will not affect the treatment effect, but will cause the compression for the spinal cord and nerve root, thus occurs nerve compression symptom. But if the bone cement seeps to the vein place, it will penetrate to the patient's lungs as the blood flow, thus reduces the patient's blood oxygen, when serious case even may cause the pulmonary embolism, and causes bring the life danger to the patient. Therefore, how to control the leakage of bone cement in clinical treatment is becoming the focus of researchers, while the high viscosity cement has obvious instantaneous high viscosity, and its injection time is longer, which greatly reduces the risk of cement leakage. At the same time in the treatment process, the medical staff can set up three reference points, so that one by one puncture, then effectively control the direction of the balloon implantation, to avoid the leakage of the most prone position and reduces the occurrence of bone cement leakage probability.

In summary, the treatment of osteoporosis vertebral compression fracture patients with high viscosity bone cement can significantly relieve the waist pain; improve the patient's vertebral body.

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