

Clinical study of high viscosity bone cement in the treatment of osteoporotic vertebral compression fracture.

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Abstract

Objective: This study was aimed to explore clinical effects of high viscosity bone cement in the treatment of osteoporotic vertebral compression fracture.

Methods: A total of 90 patients with osteoporotic vertebral compression fracture were selected from our hospital as the study objects and were randomly divided to control group and observation group with 45 cases in each. All patients underwent PVP surgery in which the control group was treated with low viscosity bone cement while the observation group was given high viscosity bone cement, pain degree, vertebral parameters, and bone cement leakage rate of patients after treatment were observed and compared between two groups.

Results: The VAS score of the observation group was significantly lower than that of the control group and the Barthel score was significantly higher than that of the control group, $P<0.05$; heights of vertebral border and center of patients in the observation group were significantly higher than those in the control group and the Cobb angle was significantly less than that of the control group, $P<0.05$; bone cement leakage rate in the observation group was significantly lower than that in the control group, $P<0.05$.

Conclusion: High viscosity bone cement in the treatment of osteoporotic vertebral compression fractures can significantly alleviate waist pain and improve vertebral body for the patients, thus raising the life quality of patients of remarkable clinical significance.

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

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Introduction

Under the influence of osteoporosis, patients have low and fragile bone strength and experience a fracture threshold of decreasing trend, if effected by external force they are prone to suffer fracture, resulting in long-term bedridden of patients with intractable pain, reducing the patient's quality of life, even shortening their life span if serious and causing huge economic burdens of patients' families and society [1]. Percutaneous vertebroplasty is currently a common clinical treatment method in this regard with advantages of fewer traumas, faster pain relief and less complications. But bone cement will be applied in the treatment and its improper use will lead to seepage problems, thus affecting the treatment effect of patients [2]. To solve this, high viscosity bone cement is introduced into medical treatment, thus effectively reducing the incidence of complications like bone cement leakage. In this study based on the above background, clinical effects of high viscosity bone cement in the treatment of osteoporotic vertebral compression fracture were discussed, 90 cases of osteoporotic vertebral compression fracture were selected from our hospital as the research objects in which patients of the observation group were given high viscosity bone cement treatment and therefore

obtained better curative effects compared with the control group. The details are as follows.

Materials and Methods

General data

From March 2016 to February 2017, a total of 90 osteoporotic vertebral compression fracture patients in our hospital were selected as the objects and were randomly divided into control group and observation group with 45 cases in each group. All the patients signed informed consents [3] from clinical trials and researches before treatment. Among the control group, there were 26 males and 19 females at the age of 55~72 with an average age of 56.3 ± 2.5 while among the observation group there were 28 males and 17 females at the age of 53~70 with an average age of 54.4 ± 3.1 . There was no significant difference in the baseline data between the two groups ($P>0.05$).

Inclusion criteria

Patients were, by MRI [4] and CT [5] detection, diagnosed to have osteoporotic vertebral compression fracture with severe

pain in chest and back, which remained unimproved in the conservative treatment of 5d~30 d; MRI result showed high signals of vertebral T2W [6] and fat suppression [7] and a low signal of T1W [8] while CT test result showed that cracks from vertebral body fracture was the centrum causing the pain; patients, without mental and language barriers, can make effective communications and enable to take care of themselves in daily life.

Exclusion criteria

Patients had pathological compression fracture caused by vertebral tumor or infection; patients suffered from lung disease and kidney function injury, and patients had more than 75% in the degree of compression [9].

Treatment methods

In the surgical treatment, routine disinfection towels were placed in the bed and the patients were guided to take prone position followed by a local anesthesia. In the whole process of the surgery, the patients were monitored by medical staff through DSA [10], percutaneous needle was through transpedicular pierced into the position of 1/3 centrum and at this time the control group were treated with low viscosity bone cement which was compounded respectively from powder (g), liquid (ml), barium and powder (g) at the ratio of 15:10:3. The cement compound was injected when adjusted to a viscous state [11]; the observation group was treated with high viscosity bone cement with 27 g powder and 10 ml monomer in which the former was mainly uniformly modulated with 14.3 g polymer (including methyl methacrylate and methyl acrylate) and 12.7 g zirconium dioxide. The cement entered the phase of doughing time 150 s after the modulation when it would be injected into centrum of the patients with pressure pump. The injection of bone cement was stooped when the target centrum was fully filled or overflowing [12]. In addition, the injection amount of bone cement was recorded by the nursing staff now and the patients were treated with CT examination 3~5 d after the surgery to grasp the condition of bone cement leakage and timely make effective measures of prevention and control.

Observation index

The observation indexes include three aspects as follows: the assessment of pain and activity of daily living mainly through VAS scale [13] and Barthel scale [14], in which there is a full mark of 10 in the former with 0~3 as no pain; 4~6 evident yet tolerable pain; 7~10 unbearable pain and in the latter 100 is the full mark with the mark less than 20 signifying the loss of self-care ability, 21~40 severe disability in the need of being looked after in the daily life, 41~60 minor self-care ability yet still in the need of being taken care of and 61~100 basic self-care ability; comparison of vertebral parameters including anterior vertebral height, midline vertebral height and Cobb angle [15]; status of bone cement leakage: the bone cement leakage rate in two groups was compared.

Statistical processing

Count data were described as percentage and Measurement data mean \pm SD. Chi-square and t test were applied with statistical significance of $P < 0.05$. Statistical software: SPSS 17.0 and Microsoft office excel.

Results

Compared with the control group, the VAS score was significantly lower and Barthel score was significantly higher in the observation group, $P < 0.05$, Table 1.

Table 1. Comparison of pain and activity of daily living between the two groups.

Group	Case	VAS score	Barthel score
Observation	45	3.7 \pm 0.9	76.5 \pm 5.3
Control	45	7.3 \pm 1.2	42.4 \pm 7.1
t	-	16.10	25.81
P	-	0.02	0.01

The anterior and midline height of the vertebral border of the patients in the observation group were significantly higher than those in the control group, and the Cobb angle was significantly less than that of the control group, $P < 0.05$, as shown in Table 2.

The bone cement leakage rate of the observation group was significantly lower than that of the control group, $P < 0.05$, as shown in Table 3.

Discussion

Osteoporosis is a common whole body metabolism correlation bone disease with low bone strength and low bone mass. Patients in this regard would end up in fracture merely effected by a slight external force. Vertebral compression fracture is a common complication which is usually treated by PVP surgery in which the low viscosity bone cement is often used. However, it is proved that the cement is prone to leakage in the process of injection, thus extending the setting time of bone cement. Related research [16] has showed the leakage rate of low viscosity bone cement reached 31.9%~57.8%, seriously affecting the treatment effects. Based on this, many scholars pay attention to the characteristics that bone cement fluidity will be subject to the influence of viscosity and innovatively choose high viscosity bone cement in the operation. In this way, it is no need for medical staff to bother to judge the injection time, thus effectively extending the injection window time [17].

The results of this study showed that VAS score of the observation group was significantly lower than that of the control group and Barthel score was significantly higher than that of the control group, $P < 0.05$; The anterior and midline height of the vertebral border of the patients in the observation group were significantly higher than those in the control group,

and the Cobb angle was significantly less than that of the control group, $P < 0.05$; The bone cement leakage rate of the observation group was significantly lower than that of the control group, $P < 0.05$. The specific reasons are as follows: 1. the treatment of high viscosity bone cement helps to improve the stability of vertebral body, making the anterior height, midline height and Cobb angle of vertebral body restore to a normal state. High viscosity bone cement is improved based on traditional bone cement. With the advantages of a longer injectable time and moderately low which can before a long time and low demands on the polymerization temperature, the application of the high viscosity bone cement in the course of PVP surgical treatment enables to achieve good mechanical stability of the vertebral body so as to effectively alleviate the patient's pain. At the same time, when the patients achieved good stability in the vertebral body, their bed time would significantly decrease, thus improving their self-care ability. The study by Wu et al. [18] showed that the viscosity of bone cement directly affects its coagulative power. In the PVP surgical treatment of osteoporotic vertebral compressive fracture, the application of high viscosity bone cement enables to maintain stability of the vertebral body, avoid the pain caused by vertebral dislocation and improve the patients' self-care ability. In the study, Barthel score of the patients with the treatment of high viscosity bone cement is on average 11.2 scores higher than that of the patients with the treatment of low viscosity bone cement, consistent with the results of this study;

High viscosity bone cement is helpful to reduce the leakage rate of bone cement and improve the therapeutic effect. According to the research by Guo et al. [19], it showed that cement leakage occurred mainly in the vein, intervertebral disc and paravertebral sites. Many conditions of leakage will not affect the treatment effect, but may compress spinal cord and nerve root. Besides, if the leakage of bone cement reaches the site of vein, it will penetrate to the lungs of the patients with blood flow, reduce the patient's blood oxygen and even cause pulmonary embolism when serious, thus posing a life danger to the patients. Therefore, how to control the leakage of bone cement in the clinical treatment has become the focus of researchers. And the high viscosity bone cement has obvious instantaneous high viscosity and longer injection time, which greatly reduces the risk of bone cement leakage. Meanwhile during treatment, medical personnel can set up three reference points followed by the puncture one after one to effectively control the direction of balloon implantation, maximally avoiding potential position and reducing the incidence of the bone cement leakage.

In conclusion, high viscosity bone cement can significantly alleviate lumbar pain and improve vertebral body conditions for the patients in the treatment of osteoporotic vertebral compression fracture of striking significance in clinical practices.

Table 2. Comparison of vertebral parameters between the two groups.

Group	Case	Height of anterior vertebral border (mm)	Midline height (mm)	Cobb angle (°)
Observation	45	22.4 ± 0.8	23.4 ± 2.9	16.9 ± 1.9
Control	45	15.3 ± 1.4	17.1 ± 1.8	28.1 ± 1.7
t	-	29.53	12.38	29.46
P	-	0.032	0.017	0.025

Table 3. Comparison of bone cement leakage rate between the two groups.

Group	Case	Venous leakage	Intervertebral disc leakage	Paravertebral leakage	Leakage rate
Observation	45	1 (2.22)	3 (6.67)	2 (4.44)	6 (13.33)
Control	45	11 (24.44)	7 (15.56)	8 (17.78)	26 (57.78)
	-	-	-	-	19.397
P	-	-	-	-	0.027

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