Clinical efficacy of different surgical treatments for diseased vertebrae combined with adjacent vertebral cement augmented Pedicle screw technology in the treatment of severe OVCF

Accepted 23rd May, 2022

ABSTRACT

The study is done to compare the clinical efficacy of different surgical treatments for diseased vertebrae combined with adjacent vertebral cement augmented pedicle screw technology in the treatment of severe osteoporosis vertebra compressed fractures (OVCF) providing a reference for the clinical reasonable selection of surgical methods. The study retrospectively analyzed the clinical data of severe OVCF patients who were admitted to our hospital and followed up regularly. Select 90 of them as research objects according to the inclusion criteria, and divide them into cement augmented pedicle screw group (group A), vertebroplasty group (group B) and pedicle screw group (group C) according to the different surgical treatments of diseased vertebrae, the adjacent vertebrae were fixed with cement augmented pedicle screw. Comparing the visual analogue scale (VAS), Oswestry Disability Index (ODI) changes in the vertebral anterior margin compression rate and kyphosis angle of the diseased vertebra of the three surgical treatments at different time points (preoperative, postoperative 1 day, 1 month, 3 months, 6 months, and 12 months), duration of surgery, hospitalization days, hospitalization costs, complications. All patients recovered well after surgery. VAS, there was no significant difference in three groups at preoperative and postoperative 1 month and 3 months (P>0.05); groups A and B were significantly lower than group C at postoperative 1 day (P<0.05), there was no significant difference in groups A and B (P>0.05), groups A and C were significantly lower than group B at postoperative 12 months. 24 months (P<0.05), there was no significant difference in groups A and C (P>0.05), ODI groups A and B were significantly lower than group C at postoperative 1 day and 1 month (P<0.05); there was no significant difference in three groups at preoperative, postoperative 3 months, 12 months and 24 months (P>0.05). Compression rate of the vertebral anterior margin, angle of kyphosis of the diseased vertebral, there was no significant difference in three groups at preoperative, postoperative 1 day, 1 month, and 3 months (P>0.05), groups A and C were significantly lower than group B at postoperative 12 months and 24 months (P < 0.05), there are no significant differences between groups A and C (P<0.05). Average of hospitalization days, cost of hospitalization, duration of surgery, group B was significantly lower than group A and C (P<0.05). It was concluded that different surgical treatments can obtain satisfactory efficacy in treating the diseased vertebrae, but there are differences in VAS, ODI, kyphotic deformity correction, and hospitalization costs at different times after surgery. The surgical treatment should be reasonably selected according to the specific conditions in clinical practice.

Key words: Surgical treatment, cement augmented pedicle screw, severe, OVCF.

INTRODUCTION

With the deepening of the aging of China's population, the incidence of Osteoporosis is increasing yearly, and the most serious complication of osteoporosis fracture (Yuanzheng et al., 2019). The most common site of fractures caused by Osteoporosis is the thoracolumbar segment. Osteoporotic fractures of the vertebral can reduce the life expectancy of patients. The fatality rate of long-term bedridden patients can up to 20% and the permanent disability rate can up to
50%. It need prompt treatment. Active surgical intervention can effectively relieve pain, correct kyphosis, reconstruct spinal stability, and improve the quality of life of patients on the basis of drug anti-osteoporosis treatment (Liu and Hu, 2017). Although the academic community generally recognizes the positive significance of bone cement-enhanced pedicle screw technology in the treatment of severe osteoporosis (Leng et al., 2019; Wang et al., 2014; Girardo et al., 2018), there are many clinical options for the treatment of diseased vertebrae with surgical methods and internal fixation methods. Which one can better correct kyphosis, restore vertebral body height, and reduce postoperative pain is still controversial. The author conducted a comparative study on the data of 90 patients with severe OVCF in the thoracic and lumbar spine who received bone cement-enhanced pedicle screw technology in our hospital from January 2015 to January 2020, in order to explore the advantages and disadvantages of three surgical methods for the clinical effect.

INFORMATION AND METHODS

General information

Inclusion criteria

1. Patients who received bone cement-enhanced pedicle screw technology in our hospital.
2. The latest A0 type A1 fracture.
3. The new T10-L2 fracture;
4. Bone mineral density T value <-2.5SD;
5. Kyphosis angle >15°or anterior column compression >40%;
6. Follow-up time of more than 2 year.

Exclusion criteria

1. 2 or more vertebral body fractures
2. Combined nerve injury.
3. Vertebral tumors or infection.

4. Patients lost to follow-up.

All patients were divided into three groups according to different surgical methods for treating the diseased vertebrae. Group A (30 cases): bone cement-enhanced pedicle screw fixation; group B (30 cases): vertebroplasty fixation; group C (30 cases): pedicle screw fixation was performed, and bone cement enhanced pedicle screw fixation was performed on the adjacent vertebrae. There is no clear standard for the selection indications of different surgical methods, and it is mainly determined according to the experience of the chief surgeon (Table 1).

Surgical methods

All operations were performed by the same experienced spine surgeon, and the same cannulated screws and bone cement were used in all three groups of operations.

Group A: After anesthesia, the patient was placed in a prone position, and the pelvis and shoulders were elevated to slightly extend the thoracolumbar. The pedicle of the affected vertebra and adjacent vertebrae was marked on the body surface. After routine disinfection, make 6 incisions about 1.5 cm long at the marked place. Under the monitoring of the C-arm X-ray machine, the puncture needles were placed along the bilateral positioning points. After reaching the designated depth, the threads were tapped under the protection of the cannula, and the cannulated screws were screwed in along the guide wire. Fluoroscopy showed that the 6 pedicle screws were in good position. Select the appropriate length of the connecting rod, properly pre-bend, and properly open the reduction, and see that the fracture is well reduced by fluoroscopy. Polymethyl methacrylate, PMMA), closely observe the injection of bone cement, see that the filling of bone cement is satisfactory, put the pre-bent connecting rod, tighten each nut, remove the nail tail and suture the wound in sequence, and the operation is completed.

Group B: After fixation of the upper and lower vertebrae of
the diseased vertebra by the method of group A, proper opening and reduction, after the fracture was well reduced, the connecting rods were pulled out and the cannulated screws and the diseased vertebrae were injected with "drawing" stage bone cement under C-arm fluoroscopy. Closely observe the injection of bone cement, put in the pre-bent connecting rod after the filling of bone cement is satisfactory, tighten each nut, remove the nail tail and suture the wound in sequence, and the operation is completed.

**Group C:** 4 cannulated screws were placed percutaneously, 2 ordinary screws were placed in the diseased vertebra, appropriate length of connecting rod was selected, appropriate pre-bending, bilateral connecting rods were installed percutaneously, and appropriate distraction reduction was performed. After pulling out the connecting rod, inject the "drawing" stage bone cement into the cannulated screws above and below the diseased vertebra. After the bone cement is fully filled, put the pre-bent connecting rod, tighten the nuts, remove the screw tail, and suture the wound in sequence. The operation is completed.

**Postoperative management**

Intraoperative and postoperative antibiotics were used to prevent infection, and the waist circumference was worn on the 1st postoperative day for ambulation protection until 3 months after operation.

**Postoperative regular anti-osteoporosis treatment**

**Observe the indicator**

Clinical observation indexes include operation time, hospitalization days, hospitalization expenses, VAS score before and after operation, and ODI index; imaging observation indexes include preoperative, 1 day, 1 month, 3 months, 12 months, and 24 months after operation. The compression rate of the anterior edge of the vertebral body (the ratio of the upper and lower heights of the most obvious compressed vertebral to the posterior height of the same vertebral body), the kyphosis angle of the diseased vertebra (the upper endplate line of the upper vertebral of the injured vertebra body and the lower endplate of the lower vertebral body of the injured vertebra body angle of intersection of vertical lines).

**Statistical processing**

SPSS26.0 software was used for statistical analysis in this study. All data were in line with normal distribution. Measurement data were expressed as mean±standard deviation (x±s). ANOVA was used for comparison of measurement data among the three groups, and comparison between count data using χ² test, test level (α=0.05, P<0.05), the difference is statistically significant, if the difference is statistically significant, the SNK-q test was used for pairwise comparison between groups, the difference is statistically significant (P<0.05).

**RESULTS**

VAS, there was no significant difference in three groups at preoperative and postoperative 1 month and 3 months (P>0.05); groups A and B were significantly lower than group C at postoperative 1 day (P<0.05), there was no significant difference in groups A and B (P>0.05); groups A and C were below group B at postoperative 12 months, 24 months (P<0.05), there was no significant difference in groups A and C (P>0.05). ODI, groups A and B were significantly lower than group C at postoperative 1 day and 1 month (P<0.05); there was no significant difference in three groups at preoperative, postoperative 3 months, 12 months and 24 months (P>0.05). Compression rate of the vertebral anterior margin, angle of kyphosis of the diseased vertebra, there was no significantly difference in three groups at preoperative, postoperative 1 day and 1 month (P<0.05); there are no significant differences between groups A and C (P>0.05). Average of hospitalization days, cost of hospitalization, duration of surgery, group B was significantly lower than group A and C (P<0.05) (Table 2).

### Table 2: Comparison of three sets of different point-of-phase VAS scores (x±s) (n=30)

<table>
<thead>
<tr>
<th>Group</th>
<th>Preoperative</th>
<th>Postoperative 1d</th>
<th>Postoperative 1 month</th>
<th>Postoperative 3 months</th>
<th>Postoperative 12 months</th>
<th>Postoperative 24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.77±1.01</td>
<td>2.07±0.94</td>
<td>1.87±0.68</td>
<td>1.47±0.51</td>
<td>1.37±0.49</td>
<td>1.23±0.43</td>
</tr>
<tr>
<td>B</td>
<td>7.80±0.85</td>
<td>2.17±0.79</td>
<td>2.00±0.79</td>
<td>1.50±0.68</td>
<td>1.20±0.41</td>
<td>1.83±0.65 *</td>
</tr>
<tr>
<td>C</td>
<td>7.70±0.95</td>
<td>3.60±0.93 * #</td>
<td>2.27±0.69</td>
<td>1.53±0.51</td>
<td>1.23±0.43</td>
<td>1.27±0.45 #</td>
</tr>
<tr>
<td>F</td>
<td>0.088</td>
<td>27.743</td>
<td>2.388</td>
<td>1.02</td>
<td>1.185</td>
<td>12.682</td>
</tr>
<tr>
<td>P</td>
<td>0.915</td>
<td>0.000</td>
<td>0.098</td>
<td>0.903</td>
<td>0.311</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Note:** Compared with group A, *P<0.05;** Compared with group B, #P<0.05 (SNK-q test)
Table 3: Comparison of three sets of different point-of-phase ODI scores (x±s) (n=30)

<table>
<thead>
<tr>
<th>Group</th>
<th>Preoperative</th>
<th>Postoperative 1d</th>
<th>Postoperative 1 month</th>
<th>Postoperative 3 months</th>
<th>Postoperative 12 months</th>
<th>Postoperative 24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>72.07±2.32</td>
<td>58.07±2.32</td>
<td>48.43±2.85</td>
<td>30.43±1.91</td>
<td>28.43±1.91</td>
<td>21.53±1.46</td>
</tr>
<tr>
<td>B</td>
<td>71.37±2.66</td>
<td>57.37±2.66</td>
<td>47.93±1.89</td>
<td>29.70±1.74</td>
<td>27.33±1.70</td>
<td>21.30±1.53</td>
</tr>
<tr>
<td>C</td>
<td>71.03±2.71</td>
<td>61.03±2.71</td>
<td>50.67±2.07</td>
<td>29.73±1.57</td>
<td>27.73±1.58</td>
<td>21.70±1.12</td>
</tr>
<tr>
<td>F</td>
<td>1.265</td>
<td>17.236</td>
<td>11.917</td>
<td>1.686</td>
<td>1.633</td>
<td>0.634</td>
</tr>
<tr>
<td>P</td>
<td>0.287</td>
<td>0.000</td>
<td>0.191</td>
<td>0.201</td>
<td>0.053</td>
<td>0.053</td>
</tr>
</tbody>
</table>

Note: Compared with group A, *P<0.05; Compared with group B, #P<0.05 (SNK—q test)

Table 4: Comparison of three sets of different point-of-phase Kyphosis angles (x±s) (n=30)

<table>
<thead>
<tr>
<th>Group</th>
<th>Preoperative</th>
<th>Postoperative 1d</th>
<th>Postoperative 1 month</th>
<th>Postoperative 3 months</th>
<th>Postoperative 12 months</th>
<th>Postoperative 24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>17.45±2.07</td>
<td>3.91±0.88</td>
<td>3.89±0.88</td>
<td>3.87±0.86</td>
<td>3.86±0.86</td>
<td>3.86±0.86</td>
</tr>
<tr>
<td>B</td>
<td>17.22±1.63</td>
<td>4.15±0.73</td>
<td>4.13±0.72</td>
<td>4.12±0.73</td>
<td>4.76±0.89</td>
<td>4.76±0.90</td>
</tr>
<tr>
<td>C</td>
<td>17.45±1.93</td>
<td>4.38±0.67</td>
<td>4.25±0.68</td>
<td>4.04±0.68</td>
<td>4.03±0.68</td>
<td>4.03±0.67</td>
</tr>
<tr>
<td>F</td>
<td>0.153</td>
<td>2.818</td>
<td>1.699</td>
<td>0.824</td>
<td>10.135</td>
<td>10.251</td>
</tr>
<tr>
<td>P</td>
<td>0.858</td>
<td>0.065</td>
<td>0.442</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: Compared with group A, *P<0.05; Compared with group B, #P<0.05 (SNK—q test)

Table 5: Comparison of three sets of different point-of-phase Vertebral compression ratio (x±s) (n=30)

<table>
<thead>
<tr>
<th>Group</th>
<th>Preoperative</th>
<th>Postoperative 1d</th>
<th>Postoperative 1 month</th>
<th>Postoperative 3 months</th>
<th>Postoperative 12 months</th>
<th>Postoperative 24 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>39.80±3.50</td>
<td>5.13±1.25</td>
<td>4.76±1.19</td>
<td>4.67±1.18</td>
<td>4.65±1.18</td>
<td>4.64±1.17</td>
</tr>
<tr>
<td>B</td>
<td>39.77±3.08</td>
<td>5.37±1.50</td>
<td>4.87±1.38</td>
<td>4.76±1.34</td>
<td>5.69±1.72</td>
<td>5.67±1.74</td>
</tr>
<tr>
<td>C</td>
<td>40.01±3.35</td>
<td>5.21±1.42</td>
<td>4.73±1.37</td>
<td>4.51±1.39</td>
<td>4.50±1.40</td>
<td>4.48±1.39</td>
</tr>
<tr>
<td>F</td>
<td>0.045</td>
<td>0.269</td>
<td>0.091</td>
<td>0.271</td>
<td>6.024</td>
<td>5.880</td>
</tr>
<tr>
<td>P</td>
<td>0.956</td>
<td>0.765</td>
<td>0.913</td>
<td>0.763</td>
<td>0.004</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Note: Compared with group A, *P<0.05; Compared with group B, #P<0.05 (SNK—q test)

Table 6: Comparison of three sets of hospitalization (x±s) (n=30)

<table>
<thead>
<tr>
<th>Group</th>
<th>Operation</th>
<th>Length of hospital days</th>
<th>Hospitalization costs</th>
<th>Complication</th>
<th>Group</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>104.03±5.29</td>
<td>8.87±1.04</td>
<td>6.22±0.21</td>
<td>0</td>
<td>A</td>
<td>104.03±5.29</td>
</tr>
<tr>
<td>B</td>
<td>97.23±4.83</td>
<td>7.70±1.09</td>
<td>4.82±0.16</td>
<td>2</td>
<td>B</td>
<td>97.23±4.83</td>
</tr>
<tr>
<td>C</td>
<td>100.70±5.70</td>
<td>9.93±1.55</td>
<td>5.65±0.21</td>
<td>0</td>
<td>C</td>
<td>100.70±5.70</td>
</tr>
</tbody>
</table>

Note: Compared with group A, *P<0.05; Compared with group B, #P<0.05 (SNK—q test)

All patients successfully completed the operation. Bone cement leakage occurred in 2 patients in group B during operation without special treatment, no venous leakage and pulmonary embolism, without clinical symptoms after operation. During the follow-up period, the screw rods were not loosened, broken or fallen off in the three groups, nor were there any cases of nerve root injury or delayed neurological dysfunction, and there was no recurrence of adjacent vertebral body fractures. Preoperative low back pain symptoms, anterior vertebral compression rate, and kyphosis angle of the diseased vertebra were significantly improved. Postoperative residual low back pain included 2
patients in group A, 5 patients in group B, and 1 patient in group C.

DISCUSSION

Vertebroplasty and pedicle screw fixation have been widely used in spine surgery (Jindal et al., 2012; Min et al., 2013). The mechanical strength and durability provided by pedicle screw fixation depend on the holding force of the screw-bone interface. However, in patients with osteoporosis, due to the thinning of trabecular bone and the destruction of bone tissue, the holding force of the pedicle screw on the bone tissue around the vertebral body decreases, and the strength of the bone-screw interface decreases, which will lead to the loosening of the pedicle screw and the loss of bone tissue, pull-out, false joint formation, etc, which eventually lead to the failure of the operation. Some studies have found that the rate of pedicle screw loosening in severe osteoporotic vertebral bodies is as high as 60% through postoperative follow-up of osteoporosis patients (Galbusera et al., 2015). Percutaneous vertebroplasty (PVP) and percutaneous kyphoplasty (PKP) are suitable for osteoporotic stable vertebral fractures with an intact posterior wall of the spinal canal and no neurological symptoms. However, there are certain defects in the simple use of the two surgical methods for severe vertebral body collapse (Liu and Hu, 2017). OVCF patients with significantly reduced spinal stability after PKP are prone to correction loss and poor long-term prognosis. However, PVP cannot effectively correct the spinal alignment, and some patients with severe vertebral body collapse continue to lose vertebral body height after surgery, resulting in poor deformity correction and maintenance (Kim and Ju, 2017). For patients with severe osteoporotic vertebral compression fractures and severe kyphosis, how to increase screw holding force, reduce vertebral height loss, and
improve long-term prognosis has become the focus and hot issue of spine surgery. The bone cement-enhanced pedicle screw technology emerged as the times require, which can significantly enhance the axial pull-out force and fatigue resistance of the screw, and provide strong and durable internal fixation for severe osteoporotic vertebral bodies.

It can effectively restore the mechanical strength of the vertebral body, reduce the loss of vertebral body height, and reduce the incidence of screw loosening, and obtain a good clinical effect (Coniglio et al., 2021; Hu et al., 2019). Schnake et al. (2017) used different types of pedicle screws, different types of pedicle screws, and different surgical methods to insert pedicle screws at different times after the injection of bone cement to draw conclusions. The bone cement-reinforced pedicle screw can effectively restore the stability of the vertebral body and improve the anti-pullout force of the screw. The advantages and disadvantages of the three surgical methods for the treatment of the diseased vertebra are as follows: The advantages of bone cement-enhanced pedicle screw technology in diseased vertebrae are similar to those of ordinary pedicle screws in improving the quality of life of patients, but have obvious advantages in maintaining spine height, preventing screw prolapse, and improving long-term stability (Chandra et al., 2017). Zheng et al. (2019) used the finite element analysis of normal and osteoporotic vertebral bodies to evaluate the holding force of PMMA cement-reinforced pedicle screws on the vertebral body, and found that the axial pull-out force of the screws was significantly enhanced through biomechanical testing. Liu et al. (2011) found that the PMMA cement-reinforced pedicle screw technique not only improved the axial pull-out force of the screw, but also enhanced its fatigue resistance. After the severe osteoporotic vertebral body was fixed with PMMA bone cement reinforced pedicle screw technique, the X-ray film showed that PMMA bone cement existed between the screw and the bone tissue, forming a spindle-like structure in the vertebral body, and the local bone tissue density increased.

It can be seen that PMMA bone cement can increase the adhesion of bone and screw, form screw-bone cement and bone cement-bone interface, make the anchoring of screw and vertebral body firmer, and significantly improve pedicle screw fixation stability (Choma et al., 2012). There are two mechanisms for PMMA bone cement to strengthen the pedicle screw. One is that the PMMA bone cement injected through the screw channel spreads in the vertebral body. The contact area with the bone is increased, and the interface between screw-bone cement and bone cement-bone is formed. The bone cement acts as an intermediate medium and forms a stable complex between the surrounding bone and the screw. Second, the bone cement of the inserted screw diffuses in the vertebral body. After solidification, the bone density around the screw increases, and the combination of bone cement, screw and vertebral body will be tighter, thereby improving the holding strength of the screw. Because of the cytotoxicity of bone cement, it can not only effectively relieve postoperative pain, but also quickly relieve the clinical symptoms of patients. The stability of the screw rod system can also restore the height of the diseased vertebra, improve the kyphosis angle of the diseased vertebra, and reduce the incidence of long-term recompression of the diseased vertebra due to osteoporosis (Pan et al., 2017). The postoperative recovery time is short and the complication rate is reduced. The disadvantage is that the cost is higher than that of the other two groups of surgical methods. Complications caused by intraoperative and postoperative leakage of bone cement, such as leakage through the intervertebral foramen and epidural, may cause nerve compression, and reflux through the venous plexus may cause symptoms such as thrombosis and pulmonary embolism.

The advantage of vertebroplasty in the diseased vertebra is that the bone cement can continuously release heat under the action of cytotoxicity, which not only promotes the increase of the stability of the vertebral body, but also reduces the stimulation of nerve endings. In addition, it can destroy the nerve endings of the diseased vertebra, thereby alleviating the pain symptoms of the patient, and the patients can exercise in the early stage after the operation, so as to reduce the postoperative complications of the patients. The disadvantage is that due to the "empty window" effect formed after fracture reduction (Liang et al., 2016; Fan et al., 2020), the parallelogram effect of the screw-rod system. For patients with osteoporosis, the strength of bone is lower than that of bone cement, which often leads to the loss of vertebral body height after the operation of the diseased vertebrae, and the possible complications of bone cement leakage in patients with residual low back pain in the long-term after operation. The advantages of pedicle screw fixation in the diseased vertebra. Some studies have shown (Pan et al., 2017) whether the diseased vertebra is screwed or not, the fractures of the diseased vertebra are completely healed. Compared with the traditional surgical modalities, pedicle screws in the diseased vertebra can effectively increase the internal fixation strength (Wu et al., 2019; Norton et al., 2014). Reducing the possibility of long-term height loss of the diseased vertebrae helps in reducing the incidence of long-term residual low back pain. The disadvantage is that the clinical symptoms of patients cannot be quickly relieved in the early postoperative period, the postoperative recovery time is long, and the complications caused by long-term bed rest (Yuanzheng et al., 2019). Due to the poor holding force of the screw-bone interface in patients with osteoporosis, the long-term postoperative vertebral screw loosening, the possibility of falling off or even breaking.

In recent years, the widespread use of cement-enhanced pedicle screw technology has brought about dramatic changes in the treatment of OVCF patients. It can directly and effectively maintain the stability of the spine, restore the height of the spine, improve clinical symptoms, improve the quality of life of patients, shorten the length of hospital
stay, and significantly improve and maintain the correction effect of kyphosis. The role of PMMA bone cement to strengthen the pedicle screw has been fully affirmed in clinical application. It has some long-term complications, such as degeneration of adjacent vertebral bodies (Cho et al., 2015). A large number of literatures have confirmed that bone cement-enhanced pedicle screws can effectively improve clinical symptoms in patients with OVCF, but there are few literature reports on the choice of treatment methods for diseased vertebrae and whether there are differences in the efficacy of different methods of internal fixation. We observed the postoperative VAS score, ODI index, correction effect of local kyphosis and long-term loss angle of three groups of patients. It was found that both the conical bone cement-enhanced group and the vertebroplasty group could effectively relieve the clinical symptoms and correct the kyphosis of the patients in the early stage. But the bone cement-enhanced group had better deformity correction effect than the vertebroplasty group, and no long-term loss of angle was found during follow-up. There was no significant difference between the mid- and long-term bone cement reinforcement group and the pedicle screw group in correcting deformity and long-term loss of angle. The reasons may be as follows:

a. The internal fixation of the pedicle screw reinforced with bone cement runs through the three columns of the spine, which has good stability and stronger correction.

b. After the pedicle screw is reinforced with bone cement, the anti-removal force of the pedicle screw is increased, and the incidence of lost angle and re-fracture due to screw loosening, prolapse or even fracture in the long-term is reduced.

CONCLUSION

In conclusion, the bone cement-enhanced pedicle screw technology has been gradually promoted in the treatment of osteoporotic spinal diseases. Compared with conventional pedicle screw internal fixation and conventional PVP and PKP techniques, it has better performance in fixation strength, vertebral body recovery height and distance. It has obvious advantages in terms of long-term stability. However, there are still some shortcomings in this technology that need to be solved urgently. One is the timing of intraoperative injection of bone cement, and the other is how to avoid the leakage of bone cement. These problems still need to be further studied in clinical practice.

ACKNOWLEDGMENTS

Zhangjiakou High-level Innovation Team Construction Project in 2018 (20180-4), Medical Research Project of Hebei Provincial Hygiene and Health Commission in 2021 (20210570); Training Program for Outstanding Clinical Medical Talents funded by provincial Government (2022); Hebei County-level public hospital suitable health technology promotion (2022).

REFERENCES


