Effect of ossotide injection on the bone metabolism and bone mineral density in patients with femoral intertrochanteric fracture

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ABSTRACT

Objective: To explore the effect of ossotide injection on the bone metabolism and bone mineral density (BMD) in patients with femoral intertrochanteric fracture. Methods: A total of 80 elderly patients with femoral intertrochanteric fracture who were admitted in our hospital from May, 2015 to May, 2016 for PFNA internal fixation were included in the study, served as the fracture group, and randomized into the observation group and the control group with 40 cases in each group. Moreover, 40 healthy individuals who came for physical examinations were served as the healthy group. The fracture patients were performed with PFNA internal fixation of closed reduction under epidural or general anesthesia, and were given anti-infection, anti-coagulation, and functional exercise after operation. On this basis, the patients in the observation group were given ossotide injection (20 mL) + normal saline (250 mL), ivdrip, 1 time/d, for 4 weeks. The morning fasting venous blood before and after treatment in the fracture group and the day in the healthy group was extracted. The full automatic electrochemiluminescence immunity analyzer was used to detect CTX, PINP, and BGP. The full automatic biochemical analyzer was used to detect Ca and P. Colorimetry was used to detect the serum AKP. X-ray bone density apparatus was used to detect BMD. Results: The serum PINP and CTX levels in the fracture group were significantly higher than those in the healthy group, while BGP level was significantly lower than that in the healthy group. The serum PINP and CTX levels after treatment in the two groups were significantly reduced when compared with before treatment, while BGP level was significantly elevated, and those in the observation group were significantly superior to those in the control group. After treatment, Ca, P, AKP, and BMD in the control group were not significantly different from those before treatment, Ca, P, and BMD in the observation group were significantly elevated, while AKP was significantly reduced, significantly superior to those in the control group. Conclusions: Ossotide injection can preferably regulate the serum bone metabolism in patients with femoral intertrochanteric fracture, increase BMD, improve the functional status, and effectively promote the fracture healing.

1. Introduction

Femoral intertrochanteric fracture is the fracture from the basilar part of femoral neck to the lesser trochanter, and belongs to the extracapsular fracture[1]. Osteoporosis is the main cause for developing femoral intertrochanteric fracture. Due to the negative balance of bone transformation in elderly patients, bone absorption is greater than bone formation, and the calcium in the bone tissues is missing, resulting in the alteration of bone structure and morphology, which can cause osteoporosis, with brisk bones and small bearing range of exterior stress; therefore, fracture is easy to be caused under the direct effect of external force[2]. Bone metabolism indicators can sensitively, timely, and accurately reflect the short-term bone metabolism, and indirectly assess the bone mass and bone turnover[3]. Some researches demonstrate that ossotide
injection, including various bioactive peptides of bone metabolism, can stimulate the proliferation of osteoblasts, regulate Ca and P metabolism, promote the new bone formation, and is applied in the clinic to prevent the osteoporosis and repair the fracture[4]. The study is aimed to explore the effect of ossotide injection on the bone metabolism and bone mineral density (BMD) in patients with femoral intertrochanteric fracture.

2. Materials and methods

2.1. General materials

A total of 80 elderly patients with femoral intertrochanteric fracture who were admitted in our hospital from May, 2015 to May, 2016 for PFNA internal fixation were included in the study and served as the fracture group. All the patients were in accordance with the diagnostic criteria of femoral intertrochanteric fracture in the Diagnostic Efficacy Criteria of Chinese Medical Disease[5]. Informed consents were obtained from the patients. Exclusion criteria: (1) those who had coagulation disorders; (2) those who were taking coagulants; (3) those who had previous deep venous thrombosis; (4) those who had thrombus before operation; (5) those who were merged with other fractures. In the fracture group, 38 were male, and 32 were female; aged from 63 to 82 years old, with an average age of (74.8±2.8) years old, and the patients were randomized into the observation group and the control group with 40 cases in each group. Moreover, 40 healthy individuals who came for physical examinations were served as the healthy group, among which 25 were male, and 15 were female; aged from 62 to 81 years old, with an average age of (73.7±2.4) years old. The comparison of age and gender among each group was not statistically significant (P>0.05).

2.2. Methods

The fracture patients were performed with PFNA internal fixation of closed reduction under epidural or general anesthesia, and were given anti-infection, anti-coagulation, and functional exercise after operation. On this basis, the patients in the observation group were given ossotide injection (produced by Hubei Visa Biological Pharmaceutical Co. Ltd., Approval No. H20003061, 20 mL) + normal saline (250 mL), ivdrip, 1 time/d, for 4 weeks.

2.3. Observation indicators

The morning fasting venous blood before and after treatment in the fracture group and the day in the healthy group was extracted. The full automatic electrochemiluminescence immunity analyzer was used to detect CTX, PINP, and BGP. The full automatic biochemical analyzer was used to detect Ca and P. Colorimetry was used to detect the serum AKP. X-ray bone density apparatus was used to detect BMD.

2.4. Statistical analysis

SPSS 18.0 software was used for the statistical analysis. The measurement data were expressed as mean ± SD, and t test was used. Chi-square test was used for the enumeration data. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of PⅠNP, CTX, and BGP between the fracture group and the healthy group

The serum PINP and CTX levels in the fracture group were significantly higher than those in the healthy group, while BGP level was significantly lower than that in the healthy group (P<0.05) (Table 1).

Table 1. Comparison of PⅠNP, CTX, and BGP between the fracture group and the healthy group.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>PⅠNP (ng/mL)</th>
<th>CTX (pg/mL)</th>
<th>BGP (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>80</td>
<td>66.24±34.23</td>
<td>655.34±305.49</td>
<td>2.11±0.67</td>
</tr>
<tr>
<td>Healthy</td>
<td>40</td>
<td>33.45±11.75</td>
<td>268.54±178.49</td>
<td>6.12±0.47</td>
</tr>
</tbody>
</table>

P<0.05, when compared with the healthy group.

3.2. Comparison of PⅠNP, CTX, and BGP before and after treatment in the fracture group

The serum PINP and CTX levels after treatment in the two groups were significantly reduced when compared with before treatment, while BGP level was significantly elevated (P<0.05), and those in the observation group were significantly superior to those in the control group (P<0.05) (Table 2).

Table 2. Comparison of PⅠNP, CTX, and BGP before and after treatment in the fracture group.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>PⅠNP (ng/mL)</th>
<th>CTX (pg/mL)</th>
<th>BGP (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>40</td>
<td>Before treatment</td>
<td>65.52±27.15</td>
<td>657.12±287.43</td>
<td>2.19±0.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>37.65±18.36*</td>
<td>322.44±175.34*</td>
<td>5.68±0.34*</td>
</tr>
<tr>
<td>Control</td>
<td>40</td>
<td>Before treatment</td>
<td>65.83±26.52</td>
<td>656.31±276.98</td>
<td>2.21±0.87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>49.82±22.15</td>
<td>517.56±185.47</td>
<td>3.67±0.68</td>
</tr>
</tbody>
</table>

P<0.05, when compared with the control group.
diagnosis and treatment effect of osteoporosis. The dual-energy bone absorption and bone formation. Previously, BMD is used to monitor the bone mass, increased fragility, and decreased intensity, and can cause fracture in the daily life or by mild violence[6]. The femoral intertrochanteric fracture is a common disease in the aged, mostly caused fracture in the daily life or by mild violence[6]. The femoral intertrochanteric fracture is a common disease in the aged, mostly accompanied by osteoporosis, whose morbidity can account for 50% of hip fracture. Due to the weak constitution in the elderly patients, the bed rest time is long for the conservative treatment, which can cause various complications, with a higher morbidity[7]. With the development of minimally invasive surgery, PFNA internal fixation is widely applied in the clinic, with advantages of small trauma, early postoperative out-of-bed activity, and preferable prognosis, and is preferred for the treatment of femoral intertrochanteric fracture[8]. Fracture can cause a series of pathophysiological changes. Besides, the trauma caused by operation can change the nerves, endocrine secretions, metabolism, and stress reaction. During the healing process, under the regulation of bone growth factors and on the basis of better reduction fixation, appropriate drugs can effectively promote the repairing of soft tissue injury and enhance the fracture healing speed[9]. Ossotide injection, including a large amount of bone growth factors and trace elements, can induce the synthesis of bone growth factors, stimulate the proliferation, differentiation, and chemotaxis of bone cells, and accelerate the fracture healing[10]. Some researches demonstrate that ossotide injection can significantly improve the blood micro-circulation of the tissues adjacent to the fracture, guarantee the adequate nutrition supply, play the effects of damage repairing, anti-inflammation, and analgesia, and effectively enhance the fracture healing speed[11].

Osteoporosis is the result of the imbalance of bone absorption and bone formation. Previously, BMD is used to monitor the diagnosis and treatment effect of osteoporosis. The dual-energy X-ray absorption analyzer was used to measure BMD to evaluate the risk of hip fracture. However, BMD is unable to timely reflect the short-term bone metabolism, can play its effect only when the bone mass loss reaches a certain degree, especially for the femoral intertrochanteric fracture, BMD has a certain limitation to assess the bone turnover during the perioperative period[12]. Bone metabolism is the process of bone absorption and bone formation, whose biochemical indicators are characterized by high sensitivity, strong specificity, and timely response, can reflect the short-term bone metabolism and earlier bone turnover level, but BMD maintains constant in a relatively long time, and can reflect the bone metabolism morphological result; therefore, bone metabolism in combined with BMD should be adopted for monitoring during the perioperative period in elderly patients with femoral intertrochanteric fracture to more accurately assess the fracture healing[13].

PⅠNP is associated with the osteoblast activity and bone formation, most abundant in the bone tissues, and can reflect the synthesis speed of type I collagen. When the osteoblast synthesis is reduced, the serum PⅠNP will be reduced; therefore, determination of serum PⅠNP can reflect the osteocytes and bone formation. CTX is originated from the degradation products of type I collagen, whose degradation activity will be increased when the osteoclast activity is strengthened, and is the most valuable indicator to evaluate the osteoclast activity and bone turnover[14]. Some researches demonstrate that[15] PⅠNP and CTX are significantly elevated in the early stage of bone fracture, then CTX is gradually reduced, while PⅠNP maintains a high level within 1 year, showing that in the early stage of bone fracture, bone resorption is earlier than osteogenesis, fracture healing is mainly of bone resorption, and born formation is active in the early stage of fracture healing. The results in the study showed that the serum PⅠNP and CTX levels in the fracture group were significantly higher than those in the healthy group, indicating that after ossotide injection, those levels in the fracture patients with osteoporosis are higher than those in the control group, showing that ossotide injection is beneficial to the fracture healing. BGP is synthetized during the advanced differentiation of osteoblasts, is a kind of non-collagen protein, can combine with the bone matrix, part of which is released into the blood, is served as the bone formation indicator in the clinic to evaluate the bone metabolism, and is a specific index to reflect the bone formation speed, whose elevated level shows the favorable fracture growth[16]. The results in the study showed that BGP level in the fracture groups was significantly lower than that in the healthy group, and was significantly elevated after

### 3.3. Comparison of Ca, P, AKP, and BMD before and after treatment

After treatment, Ca, P, AKP, and BMD in the control group were not significantly different from those before treatment (P>0.05), Ca, P, and BMD in the observation group were significantly elevated, while AKP was significantly reduced, significantly superior to those in the control group (P<0.05) (Table 3).

### 4. Discussion

Osteoporosis is a common metabolic bone disease in older people, with manifestations of degenerative bone micro-structure, reduced bone mass, increased fragility, and decreased intensity, and can cause fracture in the daily life or by mild violence[6]. The femoral intertrochanteric fracture is a common disease in the aged, mostly accompanied by osteoporosis, whose morbidity can account for 50% of hip fracture. Due to the weak constitution in the elderly patients, the bed rest time is long for the conservative treatment, which can cause various complications, with a higher morbidity[7]. With the development of minimally invasive surgery, PFNA internal fixation is widely applied in the clinic, with advantages of small trauma, early postoperative out-of-bed activity, and preferable prognosis, and is preferred for the treatment of femoral intertrochanteric fracture[8]. Fracture can cause a series of pathophysiological changes. Besides, the trauma caused by operation can change the nerves, endocrine secretions, metabolism, and stress reaction. During the healing process, under the regulation of bone growth factors and on the basis of better reduction fixation, appropriate drugs can effectively promote the repairing of soft tissue injury and enhance the fracture healing speed[9]. Ossotide injection, including a large amount of bone growth factors and trace elements, can induce the synthesis of bone growth factors, stimulate the proliferation, differentiation, and chemotaxis of bone cells, and accelerate the fracture healing[10]. Some researches demonstrate that ossotide injection can significantly improve the blood micro-circulation of the tissues adjacent to the fracture, guarantee the adequate nutrition supply, play the effects of damage repairing, anti-inflammation, and analgesia, and effectively enhance the fracture healing speed[11].

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>Time</th>
<th>Ca (mmol/L)</th>
<th>P (mmol/L)</th>
<th>AKP (IU/L)</th>
<th>BMD (g/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>40</td>
<td>Before treatment</td>
<td>2.15±0.51</td>
<td>1.52±0.51</td>
<td>172.35±17.51</td>
<td>0.62±0.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>2.89±0.83</td>
<td>1.93±0.54</td>
<td>93.57±12.41</td>
<td>0.88±0.42</td>
</tr>
<tr>
<td>Control</td>
<td>40</td>
<td>Before treatment</td>
<td>2.16±0.48</td>
<td>1.51±0.54</td>
<td>173.47±14.87</td>
<td>0.63±0.36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>2.21±0.32</td>
<td>1.58±0.46</td>
<td>168.55±15.36</td>
<td>0.65±0.41</td>
</tr>
</tbody>
</table>

*p<0.05, when compared with the control group.*
ossotide injection, indicating that the fracture healing is better in the observation group.

AKP exists in the skeleton, liver, and kidney. The normal serum AKP is produced by the osteocytes, whose high level predicts the skeletal diseases, probably associated with the fracture healing stage, osteomalacia, and osteocyte carcinoma[17]. The weakened bone strength due to BMD reduction in elderly patients is a risk factor for developing osteoporotic fracture, and fracture is easy to be induced under the effect of external force; therefore, detection of BMD in the clinic can predict the risk of hip fracture[18]. The results in the study showed that after treatment, Ca, P, AKP, and BMD in the control group were not significantly different from those before treatment (P>0.05), Ca, P, and BMD in the observation group were significantly elevated, while AKP was significantly reduced, significantly superior to those in the control group (P<0.05), suggesting that ossotide injection can effectively promote the fracture healing.

In conclusion, ossotide injection can preferably regulate the serum bone metabolism in patients with femoral intertrochanteric fracture, increase BMD, improve the functional status, and effectively promote the fracture healing.

References