Effect of long-term aerobic exercise on estrogen level and bone composition in female osteoporosis patients

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Objective: To investigate the effect of long-term aerobic exercise on estrogen level and bone composition in female patients with osteoporosis. Methods: A total of 120 women with osteoporosis were selected from January 2017 to July 2018. They were randomly divided into three groups, the experimental group, the conventional treatment group and the pure exercise group, each of 40 cases. The routine group was treated with calcium supplement and vitamin D3. The experimental group was treated with aerobic exercise plus routine therapy. The simple exercise group was treated with aerobic exercise. The estrogen level and bone mineral density of the three groups were compared before and after treatment. Results: There was no significant difference in estradiol levels among the three groups before treatment, and there was significant difference in estradiol levels between the three groups at 3 and 6 months after treatment. The bone mineral density of the experimental group, the routine group and the simple exercise group at 3 months and 6 months after treatment was higher than that before treatment, the difference was statistically significant. The levels of estradiol in the experimental group, the routine group and the simple exercise group at 3 and 6 months after treatment were higher than those before treatment, and the differences among the three groups were statistically significant. Conclusion: Long-term exercise can effectively improve the estrogen level and bone mineral density of female patients with osteoporosis, and has obvious effect on preventing osteoporosis.

1. Introduction

Osteoporosis, a group of bone metabolic diseases, is common in menopausal women and elderly men. It is often accompanied by joint pain, spinal deformity or compression fractures, and fragile fractures of heavy bones, involving the whole body. The patient's imaging examination showed that the bone mass was reduced, the bone trabeculae and other fine tissues were destroyed and honeycombed. The change of the bearing axis of the bone weakened the bone strength, and the fracture was easy to occur under the condition of slight external force, which seriously reduced the quality of life of the elderly[1-2]. Studies have shown that estrogen reduction is one of the important causes of the disease, the treatment of hormone replacement therapy, exercise therapy, etc[3]. In this study, long-term aerobic exercise guidance was given to female patients with osteoporosis, hormone levels and bone mineral density were evaluated before and after treatment to determine its therapeutic effect and clinical value.

2. Objects and methods

2.1. Object of study

From January 2017 to July 2018, 120 female patients with osteoporosis were selected as the observation objects. Inclusive criteria: The standard deviation of bone loss in bone density test was improved, and the T value of at least one part was less than -2.5SD. Exclusive criteria: hormones and calcium preparations were taken within the past six months; no other endocrine diseases affecting bone metabolism,
such as hyperparathyroidism, hyperthyroidism, etc., and no severe cardiopulmonary dysfunction and other motor restriction disorders. Methods: 120 cases were randomly divided into three groups, 40 cases in the experimental group, the conventional treatment group and the pure exercise group. The age range of the experimental group was 36-68 years, with an average age of (41±6) years, a body weight of 53-72 kg and an average weight of (60.2±4.7) kg. The age range of the conventional group was 35-69 years, with an average age of (46±8) years, a body weight of 55-73 kg and an average weight of (63.2±5.2) kg. The average age was (44±6) years old, weighing between 52 and 70 kg, and the average weight was (60±6) kg. There was no significant difference in age and weight among the three groups (P>0.05).

2.2. Method

A total of 120 subjects were given diet control, mainly low sugar, low fat and high protein diet. The routine group was given calcium supplement and vitamin D3, the experimental group was given aerobic exercise therapy plus routine treatment, and the simple exercise group was given aerobic exercise therapy. Aerobic exercise therapy includes walking, fitness running, social dance, swimming, bicycle, taijiquan, yoga, aerobics and other ways, follow the principle of moderate, aerobic, at least 12 times a month, each time more than 30 min, heart rate variability control within 30%.

2.3. Observation indicators

A total of 120 subjects completed the general condition assessment and estrogen (estradiol), bone mineral density measurement before enrollment. There was no contraindication of aerobic exercise. The estrogen (estradiol) and bone mineral density (BMD) were measured again after 3 months and 6 months of treatment, and the therapeutic effects of the three groups were compared. Bone mineral density (BMD) was measured by dual-energy X-ray absorptiometry (DEXA) in the hip, spine and femoral neck.

2.4. Statistical processing

The data obtained in this study were analyzed by SPSS 20.0 statistical software. The measurement data were analyzed by F test and the counting data by \(X^2\) test. \(P<0.05\) showed statistical significance.

3. Results

3.1. Comparison of estradiol levels in three groups of subjects at different times

Table 1. Comparison of estradiol levels in three groups of subjects at different times.

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Before treatment</th>
<th>Three month after treatment</th>
<th>Six month after treatment</th>
<th>(F)</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG</td>
<td>40</td>
<td>55.7±12.9</td>
<td>121.3±15.6</td>
<td>169.0±18.1</td>
<td>526.609</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CG</td>
<td>40</td>
<td>56.5±12.1</td>
<td>82.7±14.9*</td>
<td>106.5±16.5*</td>
<td>117.155</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PEG</td>
<td>40</td>
<td>55.5±10.7</td>
<td>87.9±15.2*</td>
<td>137.2±15.6*</td>
<td>344.891</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

notes: \(\alpha<0.05\), vs. EG; \(\alpha<0.05\), vs. CG.

different times

There was no significant difference in estradiol levels among the three groups before treatment (\(F=0.0786, P=0.924\), and there was significant difference in estradiol levels between the three groups at 3 months and 6 months after treatment (\(F=75.604, 138.991, P<0.001\)). The levels of estradiol in the experimental group, the routine group and the simple exercise group at 3 months and 6 months after treatment were significantly higher than those before treatment (\(P<0.05\) (see Table 1).

3.2 Comparison of bone mineral density in three groups of subjects at different times

Bone mineral density of the experimental group, the routine group and the simple exercise group at 3 months and 6 months after treatment was higher than that before treatment, and there were significant differences among the three groups (\(P<0.05\)) (see Table 2).

4. Discussion

Studies have shown that female osteoporosis is closely related to estrogen reduction: when women enter menopause, estrogen secretion in the female gonads, especially estradiol secretion significantly reduced, the corresponding bone metabolism absorption is greater than the formation; with age, calcium and vitamin absorption and transformation decreased, ultimately leading to osteoporosis[4,5] occurred. For postmenopausal women and elderly men with osteoporosis, they are prone to fracture, joint pain and other symptoms, seriously reducing their quality of life, so early intervention should be given early treatment[6,7]. Aerobic exercise refers to all kinds of light and moderate intensity exercises that people take under the condition of normal breathing and oxygen supply. Common aerobic exercises include walking, swimming, cycling, gymnastics, square dance, yoga, jogging, mountain climbing and so on. A large number of studies have found that aerobic exercise can promote to a certain extent. Osteogenesis increases bone mineral density, so aerobic exercise therapy has therapeutic significance for patients already suffering from osteoporosis[8,9].

The key to achieving aerobic exercise is the time and frequency of exercise and the increase of heart rate after exercise. The criteria for judging aerobic exercise are: (1) the heart rate (target heart rate) reaches 170 during exercise - the age of the exerciser[10]; (2) the heart rate index (heart rate after exercise divided by pre-exercise heart rate) ranges from 1.3 to 1.5; (3) 60 steps per minute and lasts more than 10 minutes,
effective in the third month, which indicated that long-term exercise was more mineral density. Bone mineral density in June was higher than that density of patients, but exercise therapy has a better effect on the bone that both routine and exercise therapy can improve the bone mineral density, thereby promoting estrogen levels in women. In this study, the bone content of central beta-endofibrin and improve ovarian function, showed that aerobic exercise may be a good stimulus to increase the level of estradiol in patients. The study of Shingu Y[15,16] showed that aerobic exercise may be a good stimulus to increase the content of central beta-endofibrin and improve ovarian function, thereby promoting estrogen levels in women. In this study, the bone mineral density levels of the experimental group, the routine group and the simple exercise group at 3 and 6 months after treatment were higher than those before treatment (P<0.05). These results suggest that the level of estradiol is significantly increased after routine therapy and exercise therapy, indicating that aerobic exercise can increase the level of estradiol in patients[13,14]. The study of Shingu Y[15,16] and the corresponding aerobic pedometer has been successfully developed[11,12]. The estradiol levels of the three groups were the same before treatment, but the estradiol levels of the three groups were significantly higher at 3 months and 6 months after treatment (P<0.001). The levels of estradiol in the experimental group, the routine group and the simple exercise group at 3 and 6 months after treatment were higher than those before treatment (P<0.05). To sum up, long-term exercise can effectively improve the estrogen level of women with osteoporosis, improve the bone mineral density of patients, osteoporosis prevention has a significant role.

Reference


