Effect of compound $\alpha$-keto acid tablets on nutritional status, calcium-phosphorus metabolism and inflammatory factors in patients with maintenance hemodialysis

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ABSTRACT

Objective: To investigate the effect of compound $\alpha$-keto acid tablets on nutritional status, calcium-phosphorus metabolism and inflammatory factors in patients with maintenance hemodialysis. Methods: 84 cases with maintenance hemodialysis were collected, according to the order of treatment were randomly divided into the observation group and control group, each of 42 cases. The control group was treated with maintenance hemodialysis, on the basis of this; the observation group was treated with compound $\alpha$-keto acid tablets. The serum total protein (TP), serum albumin (ALB), hemoglobin (HB), transferrin (TRF), calcium (Ca), phosphorus (P), calcium phosphorus product (CaP), serum intact parathyroid hormone (iPTH), interleukin 6 (IL-6), tumor necrosis factor alpha (TNF-alpha) and high sensitive C reactive protein (hs-CRP) of two groups were tested before and after treatment.

Results: After treatment, the TP, ALB, HB, TRF of observation group were significantly higher than those in the control group ($P<0.05$), and blood P, blood Ca×P, serum iPTH were significantly lower than the control group ($P<0.05$), serum IL-6, TNF-alpha and hs-CRP levels were significantly lower than those of the control group ($P<0.05$). Conclusion: Compound $\alpha$-keto acid tablets can effectively improve the nutritional status of hemodialysis patients, maintain the metabolism of calcium and phosphorus balance, and can reduce the inflammatory reaction, is worth the clinical promotion and application.

1. Introduction

Maintenance hemodialysis is an effective renal replacement therapy and generally adopted so far. In recent years, with the continuous improvement of dialysis technology, the survival rate of the patients was also increased gradually, but because the loss of kidney function of end-stage renal disease patients, the long-term hemodialysis will cause malnutrition, disorders of calcium and phosphorus metabolism, chronic inflammation and other severe complications. Seriously affect the physical and mental health and the quality of life. Therefore, effectively improve the nutritional status of patients, maintain calcium and phosphorus metabolic balance, inhibit the inflammatory reaction are very important for the treatment of patients with maintenance hemodialysis. Our study shows that compound $\alpha$-keto acid tablets had obvious effect in the treatment of patients with maintenance hemodialysis, reports as follows.

2. Materials and methods

2.1. General information

Study was undertaken of 84 cases of patients receiving maintenance hemodialysis in the blood purification center in our hospital from Nov. 2012 to Nov. 2013. All patients were in...
ESRD (end-stage renal disease) patients, with male 49 cases, female 35 cases, age ranged from 25 to 78 years old, with a mean age of (46.39±7.28). The primary disease of 29 cases of chronic glomerulonephritis, 16 cases of hypertensive nephropathy, 21 cases of diabetic nephropathy, 10 cases of polycystic kidney, interstitial nephritis in 8 cases. Excluded patients with severe cardiovascular and cerebrovascular diseases, acute and chronic infectious diseases, accompanying systemic or autoimmune disease, malignant tumor or other consumptive diseases; used hormone or immunosuppressive drugs among 2 months; lactating women or pregnancy. Patients had allergic reactions to compound α-keto acid tablets and other contraindications were also excluded. Our study conforms to the requirements of Hospital Ethical Committee, all patients were informed of the research and signed the protocol of treatment. Patients were divided into two groups according to the order of treatment, each of 42 cases. Two groups had no significant difference in gender composition, average age, primary disease and the severity of illness (P>0.05).

2.2. Treatment method

All patients received hemodialysis treatment, 3 times a week, dialysis time is 4h, using the German Penny low flux polyethersulfone dialyzer, bicarbonate dialysis fluid, blood flow rate of 200-250 mL/min, dialysate flow rate of 500 mL/min, dialysate calcium concentration of 1.5 mmol/L, low molecular weight heparin anticoagulation. At the same time, giving conventional treatment like controlling blood pressure, anemia correction and improvement of calcium and phosphorus metabolism. On the basis of this, the observation group was treated with compound α-keto acid tablets, 4 tablets each time, 3 times each day. Both the two groups were continued treated for 6 months.

2.3. Observation indexes

Patients Venous blood were collected in the morning when fasting and after treatment, separate serum through centrifuge and the serum put to the icebox below zero 70 degree. Serum total protein (TP), serum albumin (ALB), hemoglobin (HB), transferrin (TRF) and blood calcium (Ca) and phosphorus (P) levels determined by automatic biochemical analyzer; serum intact parathyroid hormone (iPTH) level was detected by chemiluminescence immunoassay; interleukin-6(IL-6) and tumor necrosis factor alpha (TNF-α) levels were detected by the enzyme linked immunosorbent assay (ELISA); high sensitive C reactive protein (hs-CRP) level was measured by immunoturbidimetric method.

2.4. Statistical treatment

Dates were analyzed by statistical software SPSS17.0, measurement data showed by mean±SD, the groups were compared using t test, P<0.05 considered for the difference had statistical significance.

3. Results

3.1. The detection results of nutritional indexes

After treatment, the control group TP, ALB, HB, TRF levels had no significant difference compared with the same group before treatment (P>0.05); Those levels were significantly increased in the observation group (t=7.93, 7.48, 9.26, 6.88, P<0.05), and significantly higher than the control group (t=8.56, 7.82, 9.47, 7.68, P<0.05). See Table 1 for details.

3.2. Comparison indexes of calcium and phosphorus metabolism

After treatment, the observation group blood P, blood Ca×P and the levels of serum iPTH significantly lower than the same group before treatment (t=7.42, 6.83, 8.21, P<0.05), and those levels were significantly lower than the control group (t=7.84, 8.36, 7.25, P<0.05), but the blood Ca had no significant change before and after treatment(P >0.05); those indexes levels showed no significant change in the control group before and after treatment (P >0.05). See Table 2 for details.

3.3. Comparison level of inflammatory factor

After treatment, both two groups patients serum IL-6, TNF-α and hs-CRP level were significantly decreased than before treatment (t=7.65, 8.47, 8.39, 7.53, 8.26, 6.78, P<0.05), but the observation group decreased significantly than that of the control group, the differences had statistically significant (t=7.58, 8.24, 7.86, P<0.05). See Table 3 for details.

<table>
<thead>
<tr>
<th>Group</th>
<th>Cases</th>
<th>Time</th>
<th>TP (g/L)</th>
<th>ALB (g/L)</th>
<th>HB (g/L)</th>
<th>TRF (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>42</td>
<td>Before</td>
<td>57.2±3.81</td>
<td>28.6±2.48</td>
<td>78.6±6.82</td>
<td>1.8±0.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>treatment</td>
<td>58.1±4.92</td>
<td>29.1±2.56</td>
<td>80.2±7.15</td>
<td>1.9±0.28</td>
</tr>
<tr>
<td>Observation</td>
<td>42</td>
<td>After</td>
<td>56.9±3.76</td>
<td>28.7±2.37</td>
<td>78.3±6.70</td>
<td>1.8±0.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>treatment</td>
<td>68.5±4.52</td>
<td>32.8±3.14</td>
<td>92.4±6.89</td>
<td>2.4±0.29</td>
</tr>
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</table>

Ps: Compared with the control group at the same time, *P<0.05; Compared with before treatment, †P<0.05.
4. Discussion

Hemodialysis is effective in the treatment of chronic renal failure patients, but the long-term dialysis will cause the accumulation of toxins, metabolic and endocrine disorders. The body gradually appears malnutrition, disorders of calcium and phosphorus metabolism, micro inflammation and other complications. All of those greatly increase the incidence of cardiovascular diseases which is an important cause of death in end-stage renal disease patients[4,5].

Studied found that[6], more than 40% of maintenance hemodialysis patients with the presence of micro inflammatory state, the reason is in many aspects. After stimulated by pathogens, endotoxin, immune complexes and other chemical substances, mononuclear macrophages activated, accelerate the production and release of inflammatory cytokines such as IL-6, hs-CRP and TNF-α. Due to the kidney failure and the decreased inflammatory cytokine scavenging capacity of the patients, inflammatory factors gradually increased and maintained in the body, eventually lead to chronic systemic inflammatory response, mainly for the abnormal increase of IL-6, hs-CRP, TNF-α and other inflammatory proteins. In addition, during the long-term hemodialysis, endotoxin and its products in dialysate easily through the dialysis membrane into the blood circulation greatly increased the stimulation of the body and the diffusion inflammatory state of the patients. Micro inflammatory state without clear symptoms of infection, it has become the main reason for patients complicated with malnutrition or metabolic disorders. Therefore, we should actively inhibit the micro inflammatory state reaction. Inflammatory factor will suppress albumin, muscle protein synthesis, accelerate the skeletal muscle protein metabolism, and inhibit appetite, gastric acid secretion and intestinal peristalsis, thus affecting the intake of nutrients and lead to malnutrition. It’s a serious threat to survival quality and prognosis of patients with maintenance hemodialysis[7–9]. Besides this, calcium and phosphorus metabolism disorder has become one of the common complications of hemodialysis, it can cause renal osteodystrophy and vascular calcification, increase the incidence of cardiovascular complication and mortality rate[10–13]. Therefore, stable the metabolic balance, improve the nutritional status and depress the micro inflammatory reactions are very important in improving the quality of life and reducing the risk of death of the patients.

Our studies showed that, after using compound alpha keto acid treatment based on hemodialysis, the observation group nutritional status improved significantly, nutrition indexes like serum total protein, serum albumin, hemoglobin and transferrin were significantly higher than in the control group received only hemodialysis. This may due to the essential amino acids and keto analogues contained in compound alpha keto acid tablets, which can supply the lacking essential amino acids, increase the synthesis of high quality protein and improve the nutritional status in maintenance hemodialysis patients[14]. The observation group patients’ serum calcium, calcium products, serum intact parathyroid hormone were decreased obviously. Compound alpha keto acid, an effective compound preparation composed of essential amino acids and keto form. It can be combined with phosphorus, reduce the intestinal absorption of it. It also inhibit intracellular phosphorus release and has significant effect on improving hyperphosphatemia, reducing the long-term complications of patients with maintenance hemodialysis[15,16]. At the same time, after treated by compound alpha keto acid, patients IL-6, TNF-α and hs-CRP were significantly improved than the control group. This indicated that it can also be combined with nitrogen metabolic wastes in blood, promote its elimination, and reduce its accumulation so as to reduce patients’ gastrointestinal reaction, oxidative stress and inflammatory response.

In summary, compound alpha keto acid tablets has good effect on patients with maintenance hemodialysis. It can effectively improve the nutritional status of patients, maintain the balance of calcium and phosphorus metabolism, and reduce the inflammatory reaction. It has important clinical significance to improve the quality of life and survival rate of patients and worth promotion and application.

Table 2.
Comparison indexes of calcium and phosphorus metabolism.

<table>
<thead>
<tr>
<th>Group</th>
<th>Cases</th>
<th>Time</th>
<th>Ca (mmol/L)</th>
<th>P (mmol/L)</th>
<th>Ca×P (mg2/dL2)</th>
<th>iPTH (pg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>42</td>
<td>Before treatment</td>
<td>2.14±0.13</td>
<td>2.29±0.21</td>
<td>61.49±8.62</td>
<td>412.37±59.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>2.17±0.15</td>
<td>2.26±0.19</td>
<td>62.27±7.85</td>
<td>396.85±56.84</td>
</tr>
<tr>
<td>Observation</td>
<td>42</td>
<td>Before treatment</td>
<td>2.16±0.12</td>
<td>2.31±0.23</td>
<td>60.83±9.24</td>
<td>413.46±61.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After treatment</td>
<td>2.25±0.18</td>
<td>1.78±0.14</td>
<td>36.26±8.70</td>
<td>145.21±54.67</td>
</tr>
</tbody>
</table>

Ps: Compared with the control group at the same time, P<0.05; Compared with before treatment, P<0.05.

Table 3.
Comparison level of inflammatory factor.

<table>
<thead>
<tr>
<th>Group (n=42)</th>
<th>Time</th>
<th>IL-6 (ng/L)</th>
<th>TNF-α (ng/L)</th>
<th>hs-CRP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Before treatment</td>
<td>79.63±12.47</td>
<td>81.36±14.28</td>
<td>8.97±2.45</td>
</tr>
<tr>
<td></td>
<td>After treatment</td>
<td>65.24±11.85</td>
<td>67.52±13.40</td>
<td>7.14±1.82</td>
</tr>
<tr>
<td>Observation</td>
<td>Before treatment</td>
<td>80.16±12.64</td>
<td>82.18±14.71</td>
<td>9.02±2.38</td>
</tr>
<tr>
<td></td>
<td>After treatment</td>
<td>54.72±11.29</td>
<td>58.47±12.62</td>
<td>5.76±1.74</td>
</tr>
</tbody>
</table>

Ps: Compared with the control group at the same time, P<0.05; Compared with before treatment, P<0.05.
Conflict of interest statement

We declare that we have no conflicts of interest.

References


