Efficacy of the combination of VitD₃, Ca, and Zn in application of infantile rickets

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ABSTRACT

Objective: To explore the clinical efficacy of the combination of VitD₃, Ca, and Zn in application of infantile rickets. Methods: A total of 70 infants with rickets who were admitted in our hospital from January, 2015 to January, 2016 were included in the study and randomized into the study group and the control group. The patients in the control group were given VitD₃ injection, 300 000 IU, IM, 1 time/month, in the first month, and were given VitAD, 1 granule/time, 1 time/d, and D-Cal, 1 bag/time, 1 time/d, in the second month. On this basis, the patients in the study group were given zinc gluconate oral liquid, 10-20 mL/d. Three-month treatment was regarded as one course. The peripheral blood before and after treatment was collected. The full automatic biochemical analyzer was used to detect Ca, P, Zn, and BALP. ELISA was used to detect 25-(OH)D₃. The single photon absorptiometer was used to determine the bone mineral density of radius and ulna. The efficacy was estimated. Results: After treatment, Zn, Ca, P, and 25-(OH)D₃ in the two groups were significantly elevated, but BALP was significantly reduced when compared with before treatment. The improvement of various biochemical indicators in the study group was significantly superior to that in the control group. After treatment, the bone mineral density of radius and ulna in the two groups was significantly elevated when compared with before treatment. The elevated degree of bone mineral density in the study group was significantly superior to that in the control group. The total effective rate in the study group (94.3%) was significantly higher than that in the control group (71.4%). Conclusions: The combination of VitD₃, Ca, and Zn in the treatment of infantile rickets can balance the microelement level, synergize to promote the bone formation, and enhance the bone mineral density, with a safe and reliable efficacy; therefore, it deserves to be widely recommended in the clinic.

1. Introduction

Vitamin D deficiency rickets (rickets) is a systemic chronic nutritional disease characterized by bone lesions with Ca and P metabolic disorders caused by VitD deficiency in infants[1]. Rickets is characterized by bone lesions caused by abnormal calcification of metaphysis cartilage plate in growing, and meanwhile the nerve, muscle, immunity, and biochemical changes will also be produced, which can cause multi-system growth and development retardation with no timely treatment[2]. It is found by deep study on rickets that the various microelements are associated with the pathogenesis of rickets[3]. It is reported that Zn deficiency can cause abnormal bone growth and rickets change. In children with rickets, the serum Zn level is significantly lower than that in the normal children[4]. The study is aimed to explore the clinical efficacy of the combination of VitD₃, Ca, and Zn in application of infantile rickets.
2. Materials and methods

2.1. General materials

A total of 70 infants with rickets who were admitted in our hospital from January, 2015 to January, 2016 were included in the study. Inclusion criteria: (1) those who were in accordance with the diagnostic criteria of rickets[5], manifesting in night sweats in different degrees, night terror, pillow bald, and skeletal deformity; (2) those whose laboratory examinations showed that the serum Ca and P levels were reduced, while BALP was elevated; (3) those whose X-ray showing wrist joint changes in different degrees; (4) those who had normal gastrointestinal function, liver and renal function. Those who were premature infants were excluded from the study. The patients were randomized into the study group and the control group. In the study group, there were 35 cases, among which 21 were male, and 14 were female; aged from 3 months to 2 years old, with an average age of (12.6±3.7) months. In the control group, there were 35 cases, among which 20 were male, and 15 were female; aged from 3 months to 2 years old, with an average age of (11.8±4.1) months. The comparison of the general materials between the two groups was not statistically significant (P>0.05).

2.2. Methods

The patients in the control group were given VitD3 injection (produced by Jiangsu Wuzhong Pharmaceutical Co. Ltd. Approval No. H32021405), 300 000 IU, IM, 1 time/month, in the first month, and were given VitAD (produced by Shandong Dayin Marine Organism Pharmaceutical Co. Ltd., Approval No. H37022973), 1 granule/time, 1 time/d, and D-Cal (calcium carbonate D3 granules, produced by Anshi Pharmaceutical Co. Ltd., Approval No. J20120144), 1 bag/time, 1 time/d, in the second month. On this basis, the patients in the study group were given zinc gluconate oral liquid (produced by Sanjing Pharmaceutical Co. Ltd., Approval No. D3940000624), 10-20 mL/d. Three-month treatment was regarded as one course.

2.3. Observation indicators

The peripheral blood before and after treatment was collected. The full automatic biochemical analyzer was used to detect Ca, P, Zn, and BALP. ELISA was used to detect 25-(OH)D3. The single photon absorption meter was used to determine the bone mineral density of radius and ulna. Efficacy estimation: excellent: the clinical symptoms were disappeared, and the serum biochemical indicators were recovered to normal; effective: the clinical symptoms were significantly alleviated, and the serum biochemical indicators were near to normal; invalid: the clinical symptoms were not improved.

2.4. Statistical analysis

SPSS 19.0 software was used for the statistical analysis. Chi-square test was used for the enumeration data. The measurement data were expressed as mean ± SD, and t test was used. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the serum biochemical indicators before and after treatment

After treatment, Zn, Ca, P, and 25-(OH)D3 in the two groups were significantly elevated, but BALP was significantly reduced when compared with before treatment (P<0.05). The improvement of various biochemical indicators in the study group was significantly superior to that in the control group (P<0.05) (Table 1).

3.2. Comparison of the bone mineral density before and after treatment

After treatment, the bone mineral density of radius and ulna in the two groups was significantly elevated when compared with before treatment (P<0.05). The elevated degree of bone mineral density in the study group was significantly superior to that in the control group (P<0.05) (Table 2).

3.3. Comparison of the clinical efficacy

After treatment, in the study group, 25 (71.4%) were excellent, 8 (22.9%) were effective, 2 (5.7%) were invalid, and the total effective rate was 94.3%. In the control group, 13 (37.1%) were excellent, 12 (34.3%) were effective, 10 (28.6%) were invalid, and the total effective rate was 71.4%. The comparison between the two groups was statistically significant (P<0.05).

4. Discussion

The rickets is mainly associated with insufficient VitD intake, insufficient VitD reserve during the perinatal period, excessively rapid growth, lack of sunshine, and medications[6]. VitD deficiency can reduce the absorption of Ca and P by the intestine, and thus hypocalcemia occurs, resulting in an increased secretion of parathyroid hormone and the release of bone calcium in order to maintain the serum Ca level normal or near normal. When the infants
human elements and vitamins and inadequate bioavailability of microelements caused by insufficient intake of osteogenesis related mineralization due to metabolic disorders of Ca, P, and other minerals.

The rickets is a kind of chronic metabolic disease with poor clinical manifestations of rickets development retardation, and slow growth, which can aggravate the growth hormones, resulting in delayed bone calcification, skeletal development retardation, and slow growth, which can aggravate the clinical manifestations of rickets[7]. Some researchers demonstrate that the bone tissue pathological change of rickets caused by Zn insufficiency is similar to that caused by VitD insufficiency. Zn deficiency can reduce the secretion of growth hormones, resulting in delayed bone calcification, skeletal development retardation, and slow growth, which can aggravate the clinical manifestations of rickets[10]. It is reported that Zn deficiency can inhibit the activation of osteoblasts, resulting in weakened bone calcification, and affecting the growth, development, and physiological function of bones in infants; therefore, appropriate Zn supplement when lack of Ca can improve the immunological function and function metabolism to promote the recovery of rickets; moreover, appropriate Zn supplement will not interfere the absorption of Ca[4,11]. BALP is a non-collagen protein synthetized by the osteoblasts, is a marker of the activation of cartilage growth plate, and can reflect the osteoblast function change and VitD requirement. BALP level in the peripheral blood is earlier elevated than the bone signs and image change, whose elevated level is a marker of weakened bone mineralization and remaining in the osteoblast stage.

The greater the increasing range is, the more serious the condition is[12,13]. 25-(OH)D3 is a metabolite with the highest concentration in the serum, and is the most objective indicator to reflect VitD requirement of infantile rickets can balance the microelement level, synergize to promote the bone formation, and enhance the bone mineral density, with a safe and reliable efficacy; therefore, it deserves to be widely recommended in the clinic.

Zn plays an important role in the bone development process, and can maintain the dynamic balance of osteoclasts and osteoblasts. The serum Zn in a low level can cause the reduction of bone mass, bone space structure disorder, poor bone remodeling, and cartilage apoptosis, can also affect the cell renewing and saliva phosphatase activity, resulting in anorexia, and reduce the exogenous intake of VitD, Ca, and P[15,16]; therefore, Ca and Zn can mutually promote and synergize in the functional efficacy. It is reported by Yu et al[8] that adoption of the combination of Zn, VitD, and Ca in the treatment of infantile rickets showed that after 12-week medication, the improvement of serum Zn, serum Ca, NBAP, and the bone density of radius and ulna was significantly superior to that by the conventional combination of VitD and Ca. The results in the study showed that after treatment, Zn, Ca, P, and 25-(OH)D3 in the two groups were significantly elevated, but BALP was significantly reduced when compared with before treatment (P<0.05); the improvement of various biochemical indicators in the study group was significantly superior to that in the control group (P<0.05); after treatment, the bone mineral density of radius and ulna in the two groups was significantly elevated when compared with before treatment (P<0.05); the elevated degree of bone mineral density in the study group was significantly superior to that in the control group (P<0.05); the total effective rate in the study group (94.3%) was significantly higher than that in the control group (71.4%) (P<0.05), suggesting that the combination of VitD3, Ca, and Zn in the treatment of infantile rickets has a significant efficacy.

In conclusion, the combination of VitD3, Ca, and Zn in the treatment of infantile rickets can balance the microelement level, synergize to promote the bone formation, and enhance the bone mineral density, with a safe and reliable efficacy; therefore, it deserves to be widely recommended in the clinic.

References

interpretation of vitamin deficiency and vitamin D deficiency rickets. 


