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Original Article

The effects of alfacalcidol combined with calcitonin in the treatment of osteoporosis and its influence on levels of inflammation

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Abstract: Objective: To investigate the effectiveness of Alfacalcidol combined with Calcitonin in the treatment of osteoporosis and its influence on the degree of pain, bone metabolism indexes, bone mineral density and inflammatory factor levels. Methods: In this retrospective study, 110 patients with osteoporosis treated in The Second Affiliated Hospital of Shandong First Medical University from January 2019 to June 2021 were selected as the study subjects. According to different treatment methods, these patients were divided into an observation group and a control group with 55 cases in each group. Patients from the control group were treated with the alfacalcidol capsules alone, while those from the observation group were treated with the alfacalcidol capsules combined with intramuscular calcitonin injection. Patients in both groups were treated for 6 months continuously. The treatment effect, visual analogue scale (VAS) score and Oswestry disability index (ODI), bone mineral density (BMD), serum markers levels such as calcium (Ca), phosphorus (P), alkaline phosphatase (ALP), tartrate-resistant acid phosphatase-5b (TRACP-5b), insulin-like growth factor (IGF-1), type I procollagen amino terminal propeptide (PINP) and β-collagen special sequence (β-Crosslaps), the levels of inflammatory factor including interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α), quality Life Questionnaire Core 30 (QLQ-C30) scores and incidences of adverse reactions were evaluated and compared between the two groups. Results: The effective rate of patients in the observation group was 90.91%, which was significantly higher than 74.54% in the control group ($P<0.05$). There was no significant difference in the term of VAS score, ODI score, serum markers levels, bone mineral density, inflammatory levels, QLQ-C30 before treatment between the two groups. Compared with the control group, the post-treatment VAS score, ODI score, the levels of IL-6, TNF-α, TRACP-5b, PINP and β-Crosslaps in the observation group were obviously lower, while the post-treatment QLQ-C30, bone mineral density, Ca, P, ALP, IGF-1 levels were significantly higher (all $P<0.05$). No statistical differences were found in the incidences of adverse reactions between the two groups ($P>0.05$). Conclusion: The combination of Alfacalcidol combined with Calcitonin is effective in the treatment of osteoporosis patients, which can effectively improve the levels of bone metabolism indexes and bone mineral density, alleviate the symptoms, enhance the life quality and reduce the levels of inflammation. Therefore, it is worth promoting.

Keywords: Osteoporosis, alfacalcidol, calcitonin, curative effects, inflammatory factors

Introduction

Osteoporosis is considered as a systemic skeletal disease, which is characterized by low bone mass, the exacerbation of the bone tissue microarchitecture, an increase in bone fragility and fractures [1]. Senile osteoporosis is associated with a loss of trabecular and cortical bone due to the aging. Osteoporosis has been recognized as a major global public health problem, with high morbidity caused by osteoporotic fractures in the aged population [2]. According to epidemiological survey, osteoporosis may result in more than 8.9 million fractures every year, causing an osteoporotic fracture every 3 s [3]. It was found that 22 million women

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and 5.5 million men from the European Union had osteoporosis in 2010, referring to the diagnostic criteria used by the WHO [4]. With the changes of population demography, the annual number of fragility fractures is expected to rise from 3.5 million in 2010 to 4.5 million in 2025 [5]. In China, osteoporotic fractures is expected to explosively increase because of its large elderly population [6]. Many studies have reported that the increase in the application of anti-osteoporosis medication has greatly contributed to the reduction of the incidence of osteoporotic fracture [7]. The National Osteoporosis Foundation guidelines in the United States recommend that the medications should be given following vertebral or hip fractures in people aged 50 and above [8]. Other studies have showed that anti-osteoporosis drugs such as basic supplements of bone health, inhibitors of bone resorption and stimulants of bone formation, had various degrees of drug-related adverse reactions including gastrointestinal adverse reactions, renal toxicity and so on. For older people with osteoporosis, they are more prone to drug associated sides effects due to body or organ function decline, which limit the efficacy and long-term application of these drugs [9]. Moreover, at present, there is no clear guidelines of the best medication pattern for osteoporosis patients. Therefore, selection of appropriate anti-osteoporosis agents for patients with osteoporosis is an important factor in life quality and long-term prognosis.

Recently, numerous drug treatment methods for osteoporosis have emerged. Alfacalcidol, as an active vitamin D analog, has been demonstrated to prevent fractures in patients with osteoporosis [10]. However, the application of Alfacalcidol alone has no significant anti-osteoporosis effect and presents poor efficacy [11]. In order to achieve optimal therapeutic effects, high dose drugs are usually given in clinical practice, which increases the risk of adverse reactions in patients, leading to a decrease in treatment compliance and affecting therapy effectiveness. Calcitonin is an approved drug for the therapy of osteoporosis. It can be synthesized or obtained naturally from salmon. Some studies have revealed that the anti-osteoporosis mechanism of calcitonin reversibly inhibit the resorption of bone and block the function of osteoclasts with longer duration [7, 12]. Many studies have showed that calcitonin can enhance the bone mineral density of trochanter, total hip, lumbar spine and femoral neck, and decrease the risk of vertebral fractures [13]. Another study found that calcitonin was beneficial to patients with chronic back pain or acute pain caused by vertebral osteoporotic fractures [14]. It is speculated that the combination of alfacalcidol and calcitonin in the treatment of osteoporosis could effectively overcome the limitations of alfacalcidol alone. So far, there still remains no effective clinical evidence on this topic [15, 16]. Moreover, there are few studies on the comparison of therapeutic effect between the combination of medicines and a single drug in the treatment of osteoporosis. Based on this context, the aim of study was to compare the difference in the efficacy between the combination of drugs and alfacalcidol alone in patients with osteoporosis in terms of total effective rate, bone mineral density, cytokine levels, life quality, and adverse reactions etc. This study may provide references for the prevention and treatment of osteoporosis in the elderly population in China.

Material and methods

Subjects

Patients admitted in the Orthopedics Department of the Second Affiliated Hospital of Shandong First Medical University from January 2019 to June 2021 were enrolled in this research. This study was approved by the Ethics Committee of the Second Affiliated Hospital of Shandong First Medical University (Approval number: No. 2018-177).

Inclusion criteria: (1) patients aged more than 65 years and those who met the diagnostic criteria for osteoporosis [17, 18]; (2) patients who had not undergone any treatment for osteoporosis before; (3) patients who had not received sex hormones or drugs affecting bone metabolism within three months; (4) patients who were not allergic to the drugs used in this study; (5) patients who were in the non-fractured phase and the conditions were stable; (6) patients with complete clinical data.

Exclusion criteria: (1) patients who were accompanied with endocrine or connective tissue diseases that affect bone metabolism; (2) patients who were accompanied with the kidney and

gastrointestinal diseases affecting the absorption and regulation of vitamin D, calcium, and phosphorus, as well as malignant diseases such as multiple myeloma; (3) patients who had received anti-osteoporosis treatment before; (4) patients who had an advanced stage of deformity and with disability, loss of labor force, or critical illness; (5) patients with cognitive impairment or poor compliance that affect the determination of therapeutic effects; (6) patients who had used Alfacalcidol and Calcitonin before.

According to the inclusion criteria and exclusion criteria, 110 patients with osteoporosis were recruited in this study, and the clinical data were retrospectively analyzed. Based on the treatment methods, these patients were divided into a control group and an observation group with 55 patients in each group. Patients in the control group were treated with the alfacalcidol capsules alone, while patients in the observation group were treated with the alfacalcidol capsules combined with calcitonin injection intramuscularly.

Treatment methods

All the included patients underwent routine basic treatment, such as supplements of calcium and vitamin D, reasonable diet, and developing good lifestyle habits etc. Besides, patients in the control group received alfacalcidol capsules (Chongqing YaoPharma Co., Ltd., lot number: H10950135) once a day on an empty stomach at an oral dose of 0.5 μg. Patients were required to be fasting and horizontal within 30 minutes after taking this medicine. Patients in the observation group were given additional carbocalcitonin (Shandong Luye Pharma Group, lot number: H20040338). The injection dose of carbocalcitonin was 10 U twice a week for 4 weeks, then the dose was changed to be once a week. The treatment lasted for six months in both groups.

Observed indexes

Treatment efficacy: The treatment effects of patients in the two groups were evaluated. The judgement standard was as follows [19]: significant effective: clinical symptoms such as lumbago and back pain basically disappeared or were significantly alleviated. Moreover, the bone mineral density increased by more than 2% compared to before treatment. Effective: clinical symptoms and signs were improved after treatment, with an increase in bone mineral density less than 2%; Ineffective: after treatment, the conditions of patients including lumbago and back pain and bone mineral density were not improved, and even aggravated. The total effective rate = 1 - number of patients with no effect/total number of patients × 100%.

Bone mineral density: A dual energy X-ray absorptiometry instrument was used to measure the bone mineral density of different parts before and after treatment [20]. The parts included the femoral neck and the 2-4th lumbar spine (L2-L4). Each part was detected twice and the average value was calculated.

Pain degree and low back pain dysfunction: Visual analogue scale (VAS) was used to evaluated the pain degree of patients [21]. The scale ranges from 1 to 10 points. The VAS score was determined based on the perceived pain of patients. The higher scores indicated that the pain was more severe. The Oswestry Disability Index (ODI) was used to evaluate the low back pain dysfunction [22]. It includes 10 items, and the 6-level scoring system with 0-5 points was performed. The total scores were 50 points. The higher score indicated that the low back pain dysfunction was more severe.

Inflammatory factors: The levels of inflammatory factors including interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α) were detected in patients before and after treatment [23]. ELISA Kits of IL-6 (Lot number: KHC0061, Invitrogen, USA) and TNF-α (Lot number: A35601, Invitrogen, USA) were used to examine the levels of these cytokines. The assays were conducted strictly following the operating instructions on the Kits.

Serum markers: Serum markers were compared between the two groups [24]. Before and after treatment, 4 ml of fasting venous blood was collected, and the serum was isolated through centrifugation. The serum levels of calcium (Ca), phosphorus (P), alkaline phosphatase (ALP) and tartrate-resistant acid phosphatase-5b (TRACP-5b), insulin-like growth factor (IGF-1) and type I procollagen amino terminal propeptide (PINP) and β-collagen special sequence (β-Crosslaps). Ca, P, ALP and TRACP-5b were examined by fully automatic biochemical analyser (Type AU5800, Beckman Coulter, Inc.,

Table 1. Comparison of general information between the two groups

Group	Control group (n = 55)	Observation group (n = 55)	t/χ^2	P
Male/Female (n)	30/25	32/23	0.148	0.701
Age (years)	76.21±6.37	75.82±6.18	0.326	0.745
BMI (kg/m^2)	20.35±1.04	20.27±0.93	0.425	0.672
Course of disease (months)	6.12±2.05	5.97±1.36	0.452	0.652
Diabetes (n)	6	8	0.327	0.567
Hypertension (n)	8	7	0.077	0.781
Hyperlipidemia (n)	7	9	0.293	0.589
Severty of illness			0.215	0.898
Mild	16	14		
Moderate	32	33		
Severe	7	8		

Note: BMI: Body mass index.

USA). IGF-1 was measured by enzyme-linked immunosorbent assay (ELISA). These test kits were purchased from Wuhan EIAab Technology Co., Ltd. The test was conducted according to the kit instructions. PINP and β-Crosslaps were detected by Automatic electrochemical luminescence immunoanalyzer (Type: cobas e411, Roche (Shanghai) Pharmaceuticals Trading Co., Ltd.).

Quality life questionnaire core 30 (QLQ-C30) scores: The QLQ-C30 scale was used to evaluate life quality of patients in both groups before and after treatment [15]. There are 30 questions in QLQ-C30 scale including five items regarding physiological function, cognitive function, role function, social function and emotional function. A lower score suggests lower life quality.

Adverse reactions: The incidences of adverse reactions were compared between two groups [25]. The adverse reactions included gastrointestinal reaction, weakness, xerostomia and palm flush. The overall rate of adverse reactions was evaluated and compared.

Statistical analysis

The collected data were processed with SPSS software (IBM, USA), version 22.0. Measurement data were presented as Mean ± standard deviation (SD). The comparisons between the two groups were performed through independent samples t-tests, while the comparisons before and after treatment were performed through paired t-tests. Enumeration data were presented in the form of case/percentage [n (%)]. The comparisons between the two groups were performed through Chi square tests. P<0.05 indicated statistically significant differences.

Results

Comparison of general information

Table 1 shows that there were no significant differences regarding sex, age, body mass index, course of disease, severity of illness and underlying diseases between the control group and observation group (all P>0.05), indicating the two groups were comparable.

Comparison of treatment effect

After treatment, the total effective rate of treatment in the control group was 74.54% (41/55), with 21 significantly effective cases and 20 effective cases, while the total effective rate of therapy in the observation group was 90.9%1 (50/55), with 26 significantly effective cases and 24 effective cases. The difference was significant between the two groups, as shown in **Table 2**.

Comparison of bone mineral density

As shown in **Table 3**, there were no statistical differences for bone mineral density in femoral neck, L2, L3 and L4 between the control group and observation group before treatment (all P>0.05). The bone mineral density of different parts in both groups were significantly higher than those before treatment (all P<0.05). In addition, the bone mineral density of different parts in the observation group was significantly higher than those in control group (all P<0.05).

Comparison of VAS and ODI scores

As shown in **Figure 1**, before treatment, there was no significant difference in the term of VAS scores and ODI scores between the observation group and control group. VAS scores after treatment in both groups were significantly

Table 2. Comparison of treatment efficacy between the two groups

Group	Significantly effective (cases)	Effective (cases)	Ineffective (cases)	Total effective rate (%)
Control group (n = 55)	21 (38.18%)	20 (36.36%)	14 (25.45%)	74.54
Observation group (n = 55)	26 (47.27%)	24 (43.64%)	5 (9.09%)	90.91
χ^2				5.153
P				0.023

Table 3. Comparison of bone mineral density between the control group and observation group

Positions		Control group	Observation group	T	P
Femoral neck	Before treatment	0.68±0.17	0.66±0.14	0.674	0.502
	After treatment	0.89±0.13	0.95±0.11	2.613	0.010
L2	Before treatment	0.69±0.15	0.70±0.16	0.338	0.736
	After treatment	0.85±0.17	0.93±0.18	2.396	0.018
L3	Before treatment	0.70±0.19	0.67±0.18	0.850	0.397
	After treatment	0.83±0.12	0.94±0.15	4.247	<0.001
L4	Before treatment	0.72±0.20	0.75±0.22	0.748	0.456
	After treatment	0.87±0.19	0.96±0.18	2.550	0.012

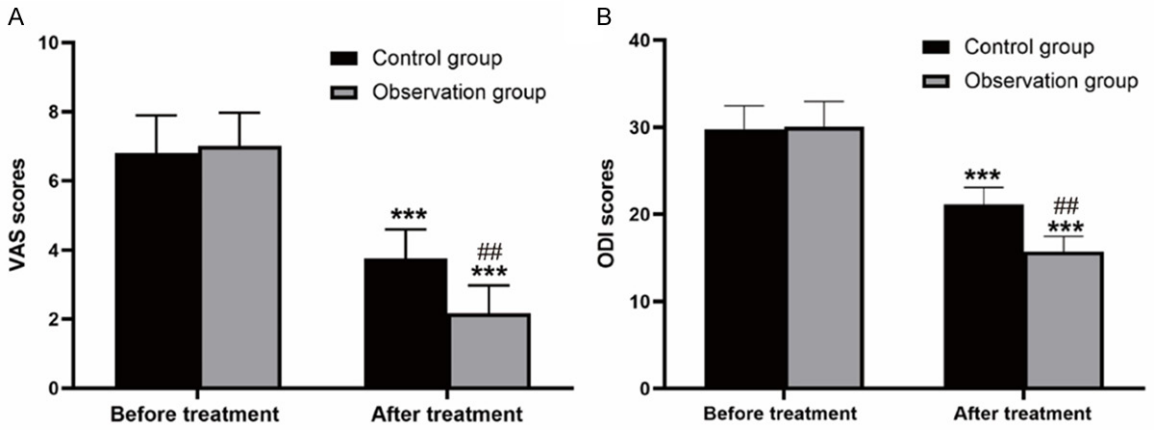

Figure 1. Comparison of VAS and ODI scores between the two groups. A: VAS scores. B: ODI scores. Compared with before treatment, ***P<0.001; Compared with the control group after treatment, ##P<0.01. VAS: visual analogue scale. ODI: Oswestry disability index.

reduced in contrast to before treatment (all P<0.05). ODI scores after treatment in both of groups were significantly decreased in contrast to before treatment. After treatment, the VAS score in the observation group was obviously lower than that in the control group (3.74± 0.85 vs 2.17±0.80, P<0.001), while ODI score in the observation group was remarkably lower than that in the control group (21.14±1.95 vs 15.69±1.77, P<0.001).

Comparison of TNF-α and IL-6 levels

As shown in **Figure 2**, there were no significant differences in the serum levels of TNF-α and IL-6 between the control group and observation group before treatment (P>0.05). The TNF-α, and IL-6 levels after treatment in both groups were significantly decreased than those before treatment (all P<0.001). In addition, the TNF-α and IL-6 levels after treatment in the observation group were significantly lower than those in control group (all P<0.01).

Comparison of serum markers levels

As shown in **Figure 3**, there were no significant differences in the serum markers levels including Ca, P, ALP, TRACP-5b, IGF-1, PINP and β-Crosslaps between the control group and

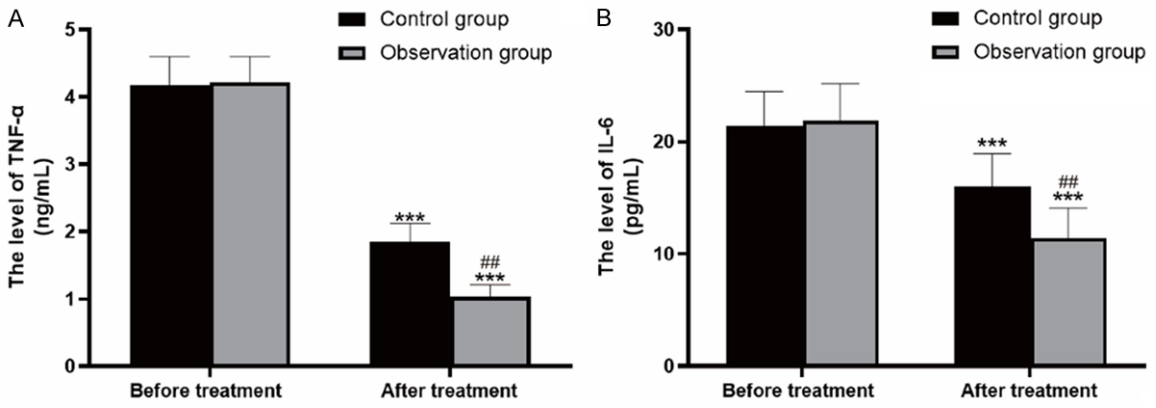

Figure 2. Comparison of TNF-α and IL-6 levels between the two groups. A: The level of TNF-α. B: The level of IL-6. Compared with before treatment, ***P<0.001; Compared with the control group after treatment, ##P<0.01. IL-6: Interleukin-6. TNF-α: Tumor necrosis factor-α.

observation group before treatment (P>0.05). The Ca, P, ALP and IGF-1 levels after treatment in both groups were significantly elevated compared to those before treatment, while the levels of TRACP-5b, PINP and β-Crosslaps were obviously decreased (all P<0.05). In addition, the Ca, P, ALP and IGF-1 levels after treatment in the observation group was markedly higher than those in the control group, while the TRACP-5b, PINP and β-Crosslaps levels were obviously lower than those in the control group (all P<0.05).

Comparison of QLQ-C30 scores

Before treatment, QLQ-C30 scores differed insignificantly between the control group and observation group (57.91±5.18 vs 58.22±5.69, P>0.05). After treatment, the scores in both groups were significantly improved than those before treatment (all P<0.001), and the post-treatment QLQ-C30 score in the observation group was significantly higher than that in control group (71.95±6.32 vs 83.26±6.74, t = 11.082, P<0.001), as shown in **Figure 4**.

Comparison of adverse reactions

As shown in **Table 4**, in the control group, there were three cases with gastrointestinal reaction, two cases with weakness, one case with xerostomia and palm flush, while there were 5 patients with gastrointestinal reaction, two patients with weakness, two patients with xerostomia and palm flush. No statistical differences were observed between the two groups.

Discussion

With the aging of population, osteoporosis has become a major global health problem. Osteoporotic fractures can lead to increased risk of further fractures, increased morbidity and mortality, and severe temporary or permanent impairment of independence and quality of life in patients. The pathogenesis of senile osteoporosis is not yet fully understood. So far, it is generally believed to be caused by the multifactors such as hormonal regulation, inorganic salt metabolism disorders, age, race, genetics, nutrition, and lack of physical activity [26]. Increasing evidence found that the drug therapy could alleviate pain, and consequently improve bone mineral density in patients with osteoporosis [27]. It is confirmed that anti-osteoporotic treatment is related with improved clinical outcomes [28]. Currently, the first choice of anti-osteoporotic agents is still under investigation.

Conventional anti-osteoporotic treatment usually involves the application of Alfacalcidol, the function of which is similar to that of synthetic material of parathyroid hormone. The mechanism of action for Alfacalcidol is to enhance the levels of 1,25-dihydroxyvitamin D3 in the blood circulation, increase the absorption of calcium and phosphorus in the intestine and renal tubules, elevate the levels of blood calcium and phosphorus, and promote osteogenesis [29]. In addition, some studies have indicated that Alfacalcidol could reduce the plasma parathyroid hormone levels, and inhibit the

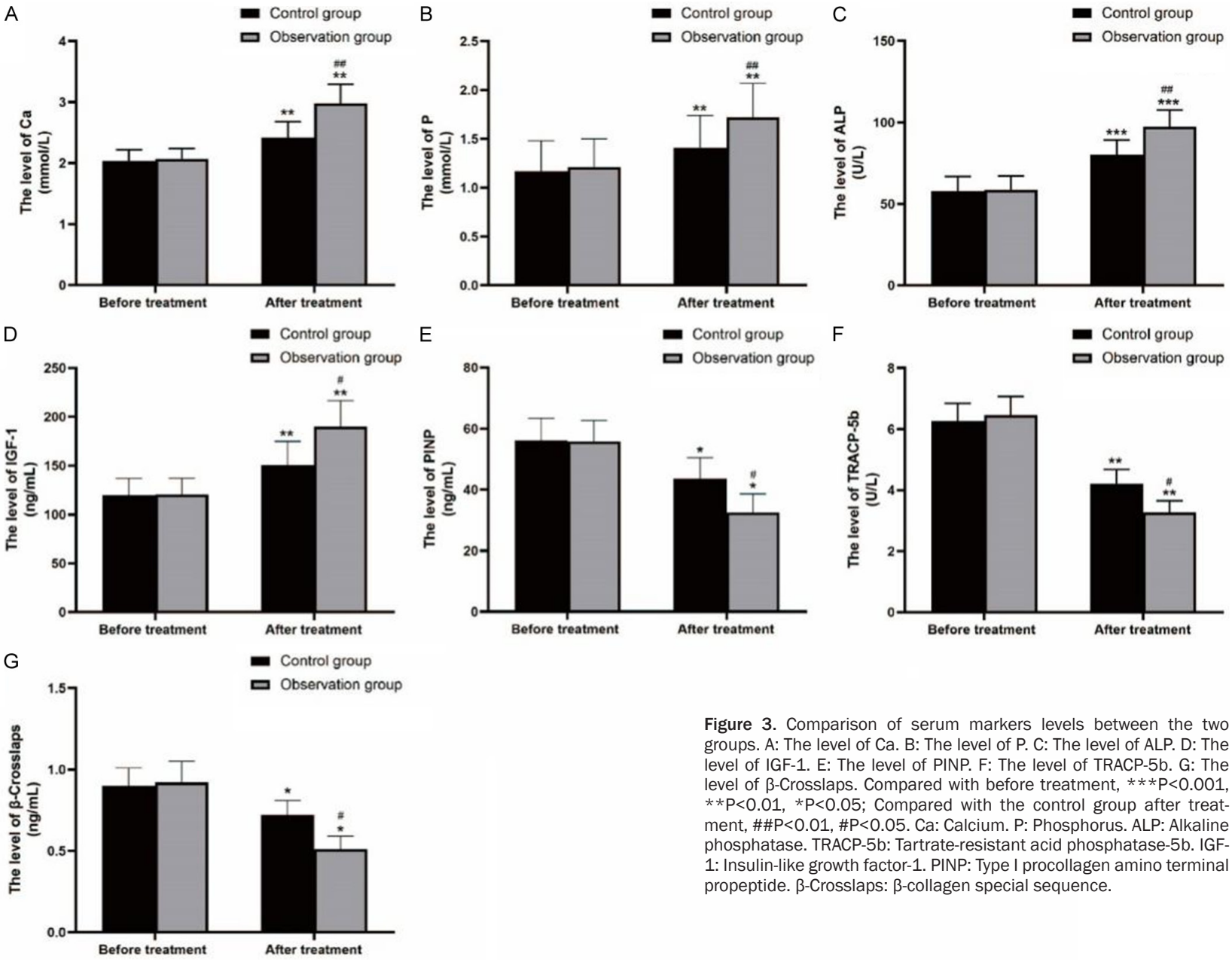

Figure 3. Comparison of serum markers levels between the two groups. A: The level of Ca. B: The level of P. C: The level of ALP. D: The level of IGF-1. E: The level of PINP. F: The level of TRACP-5b. G: The level of β-Crosslaps. Compared with before treatment, ***P<0.001, **P<0.01, *P<0.05; Compared with the control group after treatment, ##P<0.01, #P<0.05. Ca: Calcium. P: Phosphorus. ALP: Alkaline phosphatase. TRACP-5b: Tartrate-resistant acid phosphatase-5b. IGF-1: Insulin-like growth factor-1. PINP: Type I procollagen amino terminal propeptide. β-Crosslaps: β-collagen special sequence.

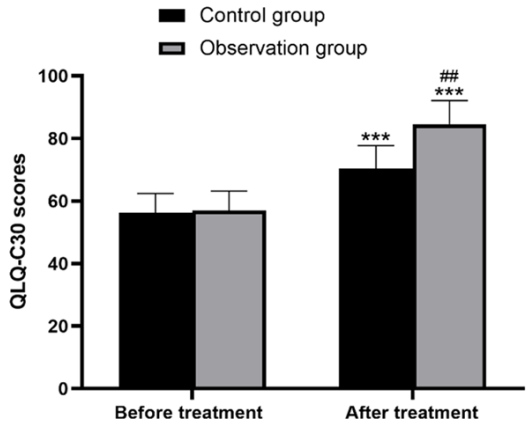

Figure 4. Comparison of QLQ-C30 scores between the two groups. Compared with before treatment, ***P<0.001; Compared with control group after treatment, ##P<0.01. QLQ-30: Quality Life Questionnaire Core 30.

bone resorption, thus improving the symptoms of osteoporosis [30]. Other studies reported Alfacalcidol could decrease the frequency of vertebral fractures and increase the level of calcium [10]. Our results showed that the total effective rate of Alfacalcidol in treatment of osteoporosis was 74.54% and the total incidence of adverse reactions was about 10.91%. The above results were similar with previous studies [11]. Alfacalcidol could obviously improve and BMD and the life quality of patients, which was basically in accordance with results reported by Itoi et al [31]. In addition, other studies reported that Alfacalcidol could improve the bone turnover markers in patients with osteoporosis [32]. This study also reported that compared with those prior to treatment, alfacalcidol therapy decreased the levels of serum TNF-α and IL-6. These results were similar with previous studies [33]. Compared with before treatment, alfacalcidol could obviously improve VAS and ODI scores, which was basically in accordance with results reported by Ni et al [34].

Conventional therapy of alfacalcidol can increase calcium absorption and urinary calcium excretion, and inhibit the bone resorption. However, it is difficult to achieve ideal therapeutic effects solely. In order to find a better curative effect, the combined use of drugs was applied. So far, no statistical conclusion has been drawn on the effects of combination use of alfacalcidol and Calcitonin in patients with osteoporosis in contrast to alfacalcidol alone. Calcitonin, as an inhibitory agent of bone resorption, is a synthetic drug and can decrease the rate of bone turnover and maintain the integrity of the trabecular architecture, resulting in the preservation of bone strength and quality in osteoporotic patients [35]. Some studies have showed that Calcitonin can not only restrain osteoclasts, but also improve the absorption of bone in patients [36]. Other studies demonstrated that calcitonin can alleviate pain caused by osteoporosis in patients, and also decrease the incidence of adverse reactions [37]. Another study showed that calcitonin could obviously improve the level of blood calcium and has a better effect on alkaline phosphatase in contrast to conventional treatment [38]. In this study, the results showed that the combination of alfacalcidol and calcitonin was more effective than alfacalcidol alone in patients with osteoporosis. In addition, in contrast to the control group, the QLQ-C30 scores, ODI scores, BMD and total therapeutic effective rate in the observation group were obviously increased and VAS scores were remarkably decreased. The combined use of afacalciferol and calcitonin can comprehensively regulate Ca levels and bone synthesis. The former can promote the absorption of Ca and reduce excretion, providing sufficient raw materials for bone synthesis; the latter can antagonize the former's actions of high blood calcium, enhance the absorption and utilization of Ca in the body and promote the osteogenesis. These two drugs complement each other and achieve significant therapeutic effects. In term of adverse reactions, the results of this study showed that the incidence of adverse reactions in the observation group was slightly higher than that in the control group, but without statistical differences. This may be associated with the sample size and it is similar to the results reported by Soen et al [39]. In terms of inflammation, TNF-α, as a bone resorption stimulating factor could exert biological overlapping effects, effectively inhibit bone cell formation, and play an important role in the formation of bone cells in patients, further improving the speed of bone resorption. IL-6 can regulate bone cell formation through paracrine and autocrine pathways. It was found that there was a significant increase in IL-6 levels in patients with osteoporosis. The enhancement of IL-6 activity played a certain promoting role

Table 4. Comparison of adverse reactions between the control group and observation group (Cases)

Groups	Gastrointestinal reaction	Weakness	Xerostomia and palm flush	Total incidence rate (%)
Control group (N = 55)	3	2	1	10.91
Observation group (N = 55)	5	2	2	16.36
χ^2				0.695
P				0.405

in the secretion and formation of osteoclast precursors, which could enhance bone resorption, and ultimately leading to osteoporosis in patients. The results of this study showed that the combined treatment showed significantly lower levels of serum TNF-α and IL-6 compared to afacalciferol alone. This is similar with the results reported by Liang et al [39].

ALP is an important protein involved in bone metabolism. Some studies revealed that the downregulation of ALP levels was closely associated with the disease of osteoporosis, serving as an indicator for evaluating bone formation and bone turnover [40]. The level of TRACP-5b is negatively correlated with bone resorption and can be used as a marker for evaluating bone resorption and osteoclast activity [41]. IGF-1 is a bone formation stimulating factor and an essential growth factor for bone growth. A decrease in IGF-1 concentration could lead to a reduction in bone density, resulting in osteoporosis [42]. P1NP and β-Crosslaps are two bone metabolism biomarkers recommended by the International Osteoporosis Foundation. P1NP is a biomarker of bone formation, and its level is positively correlated with the synthesis rate of type I collagen and bone turnover rate; β-Crosslaps is a biomarker of bone resorption and a metabolite of type I collagen. It can affect the structure of type I collagen fibers by modifying the phosphate structure at the hydroxyl end of cysteine, thereby increasing the fragility of periosteum, trabeculae and cortex, promoting bone metabolism and reducing bone density, and participating in the occurrence and development of osteoporosis. In addition, blood calcium and phosphorus are also factors associated with bone formation, which could clearly reflect bone metabolism conditions in the body. In this study, the serum levels of calcium, phosphorus, ALP, and IGF-1 in the observation group were significantly higher than those in the control group after treatment, while TRACP-5b, PINP and β-Crosslaps levels were significantly lower than those of the control group. These results indicate that the combination of afacalciferol and calcitonin could significantly improve the abnormal expression of serum bone metabolism indicators in elderly patients with osteoporosis and promote bone resorption and formation. The reasons for these effects may be that these two drugs could antagonize parathyroid hormone, directly inhibit osteoclast activity, and promote an increase in blood calcium and phosphorus levels. The pharmacological mechanisms may be related to the reduction of bone resorption and prevention of bone loss.

In conclusion, the combination use of afacalciferol and calcitonin is more effective than afacalciferol alone in the treatment for patients with osteoporosis, with better therapeutic effect, higher BMD, significant improvement in life quality and serum bone marker levels, and reduced inflammation factor. The results of this research could provide experimental basis for clinical treatment of osteoporosis. However, there are still some limitations. For example, the incidence of adverse reactions in the observation group was similar to that in the control group, which may be associated with the small sample size. This research has other limitations such as being a single-center study, lacking long-term follow-up results, and no reports of the related mechanism. In the future, a larger sample size and multicenter controlled long-term follow-up study is needed for further confirmation.

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Disclosure of conflict of interest

None.

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