The effectiveness of anti-osteoporotic therapy with alendronate in geriatric hip fracture patients

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Summary

Objective: To evaluate the difference of bone mineral density and serum concentration of osteocalcin, CTX in geriatric hip fracture patients after 12 months of anti-osteoporotic therapy with alendronate. *Subject and method:* 60 patients ≥ 60 years old in 108 Military Central Hospital and 103 Military Hospital, were divided in two groups: 30 hip fracture patients with osteoporosis, treated with alendronate in 12 consecutive months, and 30 non-hip fracture people as control group. Patients were evaluated by bone mineral density (BMD) measurement (DEXA technique, Hologic machine) and concentration of serum osteocalcin, CTX, before and after 12 months of alendronate treatment. *Result:* After 12 months of alendronate (Fosamax) treatment, the lumbar mean BMD increased (∆) 0.060 ± 0.040 (g/cm2) and there were 30% (9) patients with BMD improvement, $p<0.05$, the hip mean BMD also increased (∆) 0.080 ± 0.061 (g/cm2) and there were 33.3% (10) patients with BMD improvement, $p<0.01$. The decreases in serum concentration of osteocalcin, CTX, and patient rates were 1.47 ± 8.13ng/ml, 20% (6 pts) ($p>0.05$), 0.16 ± 0.2ng/ml, 33.3% (10 patients) ($p<0.05$), respectively. *Conclusion:* The geriatric hip fracture patients with osteoporosis had good outcome in term of bone mineral density and CTX serum concentration after 12 month treatment with alendronate.

Keywords: Hip fracture, bone mineral density, osteocalcin, CTX, alendronate.

1. Background

Hip fracture is the top three common complications of osteoporosis, leading to disability and mortality. In Vietnam, osteoporosis, especially in adults is not concerned properly. It is not sufficient in non-surgical treatment. Therefore, this study aims to evaluate the bone mineral density (BMD) and serum concentration of osteocalcin, CTX in geriatric patients with osteoporotic hip fracture before and after 1 year of biphosphonate treatment.

2. Subject and method

2.1. Subject

Thirty individuals ≥ 60 years old who suffered from osteoporotic hip fracture were enrolled. All patients were examined and treated with alendronate for 12 months at 108 Military Central Hospital and 103 Military Hospital from January 2013 to August 2015.

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Pathologic fractures, traffic accident causes, and serious comorbidities were ruled out.

2.2. Method

The subjects were examnined according to the chart form: Age, gender, BMI, comorbidity, risk factors. Two follow-up time points were before treatment (T0) and after 12 months of alendronate treatment (Fosamax) (T1). The treatment regimen was as follow: Alendronate (fosamax) 70mg/week, calcium 1000mg/day and vitamin D 800IU/day in consecutive 12 months. BMDs were performed at lumbar spine (L1-L4) and femoral head by DEXA method, Hologic machine at the T0 and T1. The serum concentrations of osteocalcin and CTX were also mesured at two time points by sandwich principle, Elecsys machine 2010. The BMI classification of South-East Asian diabetes association was selected. The confirmation of hip fracture accorded to Linton criteria. The osteoporosis diagnosed by WHO 1994 criteria with cut-off 2.5.

Data analysis: SPSS 19.0 software. The qualitative variables were described by proportion (Chi-square test). The quantitative variables were showed by $\bar{X}$ ± SD (t-test) or minimum and maximum median (Mann-Whitney test). The correlation was r. The statistical significance was defined when $p<0.05$.

3. Result

Table 1. General characteristics

Characteristics		Case group (n = 30)
Age (years) Median		70 (60 - 90)
Gender (n, %)	Male	7 (23.3%)
	Female	23 (76.7%)
BMI (kg/m^2) ($\bar{X}$± SD)		21.1 ± 2.8
Location (n, %)	Intertrochanteric	9 (30.0%)
	Cervical	14 (46.7%)
	Others	7 (23.3%)
Comorbidities (n,%)	Hypertension	11 (37.9%)
	Diabetes mellitus	4 (13.8%)

The average age of case group was 70 years old, with female dominant. The most common location of fracture was at cervical site. Hypertension was the most common comorbidity.

Table 2. The serum concentration of bone turnover markers before alendronate treatment

Serum concentration of markers	Case group (n = 30)
Osteocalcin ($\bar{X}$ ± SD) (ng/ml)	18.0 ± 7.45
CTX ($\bar{X}$ ± SD) (ng/ml)	0.69 ± 0.18

The average serum concentrations of osteocalcin and CTX were 18.0 ± 7.45 and 0.69 ± 0.18, respectively.

Table 3. The lumbar and neck bone mineral densities before and after 12 months of alendronate treatment

BMD at the treated group	Time point		p
	Before treatment (T0)	After 12 months (T1)	
Lumbar BMD			
Bone mineral density ($\bar{X}$ ± SD) (g/cm^2)	0.599 ± 0.133	0.660 ± 0.064	
Difference T1- T0 (g/cm^2)		0.060 ± 0.040	<0.05
Patient proportion (%)		30.0%	

Neck BMD			
Bone mineral density ($\bar{X}$ ± SD) (g/cm^2)	0.602 ± 0.120	0.682 ± 0.131	
Difference T1 - T0 (g/cm^2)		0.080 ± 0.061	<0.01
Patient proportion (%)		33.3%	

After alendronate treatment, the lumbar and femoral BMDs were significantly increased, with p<0.05.

Table 4. The serum concentrations of osteocalcin and CTX before and after 12 months of alendronate treatment

The concentration of boneturn over markers		Time point		p
		Before treatment (T0)	After 12 months (T1)	
Osteocalcin	($\bar{X}$ ± SD) (ng/ml)	17.17 ± 9.32	15.70 ± 6.07	
	Difference T1 - T0 (ng/ml)		1.47 ± 8.13	>0.05
	Patient proportion (%)		20.0%	
CTX	($\bar{X}$ ± SD) (ng/ml)	0.83 ± 0.34	0,67 ± 0.31	
	Difference T1 - T0 (ng/ml)		0.16 ± 0.2	<0.05
	Patient proportion (%)		33.3%	

After treament, the CTX serum concentration was significantly decreased, with p<0.05.

4. Discussion

4.1. General characteristics

From 60 individuals in the research, female was more dominant than male. There was no difference in gender distribution (p>0.05). The BMI in hip fracture group 21.1kg/m^2 and equal to control group 22.1kg/m^2. The cervical fracture was the most common accounted for 46.7%. The comorbidity rates were hypertension 37.9%, diabetes mellitus 13.8%, this results was similar to Hoang Thi Kieu Hoa's results [2]. These were also the high risk factors for fracture and required prevention in geriatric patients.

4.2. The difference of BMD after 12 months of treatment with alendronate

There were 30 patients who were consecutively received alendronate treatment in 12 months. A large number of researches showed the effectiveness of alendronate in osteoporosis patients. The multicentral clinical research of Libemann M in 1994 osteoporosis females in three years, the control group showed the improvement of BMD after alendronate treatment (lumbar spine increased 8.8%, femoral neck increased 5.9%, and the whole body increased 2.5%) [6]. The case-control study FIT of Dennis MB (2027 osteoporosis females with fracture) proved the increase of lumbar and femoral BMD in comparison with control group 6.2%, 4.1%, respectively, and 50% decrease of spine and non-spine fracture [5].

In this study, the lumbar and femoral BMDs were improved after 12 months of treatment. In detail, lumbar spine mean BMD increased from 0.599 ± 0.133 (g/cm^2) before treatment to 0.66 ± 0.064 (g/cm^2) after treatment, with the increment of 0.060 ± 0.040 (g/cm^2), and 30.0% showed improvement, p<0.05. Femoral neck mean BMD also increased from 0.602 ± 0.120 (g/cm^2) pre-treatment to 0.682 ± 0.131 (g/cm^2) post-treatment, with the increment of 0.080 ± 0.061 (g/cm^2), and 33.3% showed improvement, p<0.01.

In the mechanism, the BMD change is slower than the biometabolism change in bone, because the bone turnover takes place in at least 6 months.

4.3. The difference in osteocalcin and CTX serum concentrations after 12 months of alendronate treatment

Serum osteocalcin concentration

In this thesis, the osteocalcin concentration of the hip fracture group treated by alendronate (Fosamax) decreased from 17.17 ± 9.32ng/ml (before treatment) to 15.70 ± 6.07ng/ml (after treatment), with the decrement of 1.47 ± 8.13ng/ml, and the patient proportion was 20.0%, p>0.05. This results was also similar to others authors. Do Thi My Anh showed that osteocalcin concentration before treatment was 19.56 ± 5.86ng/ml, after 1 month it reduced to 16.0 ± 4.02ng/ml (18.2%) and after 3 months it was down to 15.30 ± 4.34ng/ml (26.1%) [1]. Vanita R [1] showed the result after 3 months treatment of alendronate 70mg/week, the osteocalcin concentration reduced from 25.18 ± 4.97ng/ml to 14.64 ± 4.48ng/ml. Ravn P's research of 1202 menopausal woman with alendronate treatment, proved the reduction of 29% in osteocalcin concentration after 6 months [7].

Serum CTX concentration

According to many researches, the bone resorption marker, such as CTX, was of value in following up and outcome assessment of biphosphonates treatment. In this study, the hip fracture group treated by alendronate (Fosamax) resulted in the reduction of CTX concentration from 0.83 ± 0.34ng/ml (before treatment) down to 0.67 ± 0.31ng/ml (after 12 months of treatment), with 0.16 ± 0.2ng/ml of decrement, and 33.3% patient porpotion, p<0.05. According to Do Thi My Anh (2012) research, the serum CTX concentration before, after 1 month, 3 months was 0.60 ± 0.34ng/ml, 0.53 ± 0.29ng/ml (10.7%), and 0.52 ± 0.29ng/ml (12.3%), respectively [1]. Dennis MB after treating osteoporosis by alendronate showed the CTX concentration decreased 50% after 1 month and maintained in the next months [4]. Christgau S with alendronate research showed the decrease 56% of serum CTX concentration after 1 month treatment, and 64.8% after 6 months [1]. In the zoledronic research by Reid IR [8], lumbar BMD increased 4.5%, and serum CTX and NTX concentration reduced 50 - 65% after 12 months. In another study by Gonnelli S, serum CTX concentration reduced 60% in the next 6 months, and fracture risk decreased 3 times in the next years [5].

5. Conclusion

The lumbar and femoral bone mineral densities were significantly improved after 12 months of alendronate treatment. The concentration of serum CTX significantly decreased after biphosphonate treatment.

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