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Abstract

Bone Mineral Density and Bone Turnover Markers in Patients with Femur Fracture Who Visited the Emergency Department

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Background: The most frequent fracture seen at the emergency department (ED) in the elderly is a femur fracture whereas they do not know the degree of osteoporosis. We analyzed the degree of osteoporosis in patients with femur fractures and compared patients with only femur fractures (FX) to patients with femur and vertebral fractures (VX) by examining the clinical features, the bone mineral density (BMD), and biochemical markers.

Methods: From January 2004 to December 2004, we enrolled prospectively 30 femur fracture patients who visited the ED. The bone mineral densities of the lumbar spine and the femur were examined. Total calcium, phosphate, alkaline phosphatase, osteocalcin, and serum C-terminal telopeptide (s-CTX) were measured. The patients with femur fractures were divided into two subgroups according to the presence of vertebral fracture.

Results: All BMDs of the FX group showed osteoporosis. The s-CTX levels were higher than normal. The patients in the FX with VX were older than those in the FX only group, and had lower BMDs. There were no significant differences in markers between the subgroups, but the incidence of trochanteric fractures was higher in FX with VX group than in the FX only group.

Conclusion: Femur fractures in the elderly were associated with osteoporosis. In our study, despite a considerable difference in BMD between patients with femur fractures and those with femur fractures combined with vertebral fractures, there was no difference in biochemical markers on bone formation nor in the those of bone resorption. We will further investigate the biochemical markers and BMD in the population of osteoporotic fractures. So those indicators should be helpful for planning treatment and for prevention of FX in the elderly.

Key Words: Femur fracture, Osteoporosis, Bone mineral density

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: 2005 9 14 , : 2005 11 4 , : 2005 11 17 , : 2005 11 24

fracture) (femur

가 (1,2). 1993

가

2004 1 2004 12

30

가 가 가

가 가 가

가 가

가 가

가 가

가 (bone remodeling)

2) (BMD: bone mineral density)

(osteocalcin: OC) 4-6

(osteoblasts) 1

(bone turnover) 4 (lumbar spine, L1-L4)

가 C-ter

1 minal telopeptide (CTx) (neck), (trachanter), (intertra chanter)

가 (dual-energy x-ray absorptiometry) QDR 4500A (Hologic, Waltham, MA, USA)

가 1994 WHO

가 BMD가 -2.5 가

, -2.5 가

(3,4).

가 가 가

3) : serum C-terminal telopeptide (s-CTx), Osteocalcin(OC)

가 (5,6). 6

가 8 -20

가 (osteocalcin: OC)

가 (RIA kit, Brahms, Berlin)

C-terminal telopeptide (s-CTx) serum CrossLaps' assay kit (Osteometer BioTech A/S, Herlev, Denmark) (ELISA)

4)

5)

±

ANOVA

t-

SPSS ver. 10.0
p value < 0.05

1.

30 4
(13.3%) 26 (86.7%)
76.6±10.1
49.4±2.2
5±2.9 13 (43.3%) (femur neck)
13 (43.3%)
(trochanter) 4 (13.4%) (shaft)

Table 1. The clinical characteristics and subtypes in femur fractures

| Factor | N*=30 mean ± SD [†] |
|--------------------------|---------------------------------|
| Sex (male/female) | 4/26 |
| Age (years) | 76.6 ± 10.1 |
| Height (cm) | 154.5 ± 9.9 |
| Weight (kg) | 54 ± 10.7 |
| Age at Menopause (years) | 49.4 ± 2.2 |
| Number of Childbirth | 5 ± 2.9 |
| Types of fracture | |
| femur neck | 13 (43.3%) |
| trochanter | 13 (43.3%) |
| shaft | 4 (13.3%) |

*N; number [†]SD; standard deviation

(Table 2). 18

8 2 2
1 3 1 6

2. (BMD: bone mineral density)

0.7 g/cm²
0.6 g/cm²
(trochanter) 0.4 g/cm² †
T-score -2.5
(Table 1).

3. : serum C-terminal telopeptide (s-CTx), osteocalcin(OC)

s-CTx 0.7 ng/mL(;
0.2~1.7 ng/mL)
0.506 ng/mL
s-CTx 0.9 ng/mL
0.332 ng/mL OC 7.9
ng/ml(; 0.9-20.1 ng/mL) (: 4~12
ng/ml) 4

(Table 2).

4.

(Table 3).

5.

Table 2. The bone turnover markers in femur fractures

| Marker | Mean ± SD | normal range |
|-------------------------|----------------------------------------|----------------|
| s-CTx* (ng/ml) | 0.7 ± 0.4 (female) 0.9 ± 0.7 (male) | 0.506 0.332 |
| OC [†] (ng/ml) | 7.9 ± 5.6 | 4-12 |
| Ca [†] (mg/dl) | 8.0 ± 0.8 | 8.2-10.8 |
| P [§] (mg/dl) | 3.6 ± 0.8 | 2.5-5.5 |
| ALP (IU/L) | 73.2 ± 19.4 | 30-140 |

*s-CTx; serum c-telopeptide, [†]OC; osteocalcin

[†]Ca; calcium, [§]P; phosphate,

ALP; total serum alkaline phosphatase,

(bone strength)가

16 (53.3%) 5 9 가 가
 2 가 가
 14 8 , 4
 , 2

20 ~ 40%

(7).

가 (p=0.026), 가

serum C-terminal telopeptide (s-CTx),
 osteocalcin (OC), calcium, phosphate, total serum
 alkaline phosphatase 가

가 C-terminal telopeptide (CTx)

(p<0.05)

가

(Table 4).

가

(intertrochanter) 가
 (p=0.013)

(Table 5).

(8,9). Karlsson (2)

가

, Margareta (10)

(microarchitectural deterioration)

가

가

Table 3. The clinical characteristics, bone turnover markers, and BMD between subtypes of femur fractures

| Types of hip fracture | femur neck (n=13) | trochanter (n=13) | shaft (n=4) | p value |
|--------------------------------------|----------------------|----------------------|----------------|---------|
| Age (years) | 76.8 ± 8.4 | 75.0 ± 11.3 | 81.25 ± 12.1 | 0.571 |
| Height (cm) | 155.5 ± 10.7 | 155.1 ± 10.1 | 149.5 ± 6.1 | 0.57 |
| Weight (kg) | 54.2 ± 10.7 | 53.0 ± 11.8 | 56.5 ± 8.5 | 0.857 |
| Age at Menopause (years) | 48.9 ± 1.8 | 49.8 ± 2.2 | 49.7 ± 3.3 | 0.639 |
| Number of Childbirth | 6.1 ± 3.4 | 4.1 ± 1.9 | 3.75 ± 2.06 | 0.197 |
| s-CTx* (ng/ml) | 0.6 ± 0.2 | 0.8 ± 0.5 | 0.8 ± 0.6 | 0.334 |
| OC [†] (ng/ml) | 6.1 ± 2.2 | 9.3 ± 6.8 | 9.0 ± 8.5 | 0.404 |
| BMD | | | | |
| lumbar spine (g/cm ²) | 0.7 ± 0.1 | 0.7 ± 0.2 | 0.6 ± 0.02 | 0.961 |
| neck (g/cm ²) | 0.5 ± 0.2 | 0.5 ± 0.1 | 0.4 ± 0.007 | 0.871 |
| trochanter (g/cm ²) | 0.4 ± 0.2 | 0.4 ± 0.1 | 0.4 ± 0.1 | 0.840 |
| intertrochanter (g/cm ²) | 0.7 ± 0.2 | 0.6 ± 0.1 | 0.7 ± 0.1 | 0.796 |
| femur (g/cm ²) | 0.6 ± 0.2 | 0.6 ± 0.1 | 0.5 ± 0.03 | 0.788 |

*s-CTx; serum c-telopeptide, [†]OC; osteocalcin

BMD : bone mineral density

Lawton (11) sernbo (12)

가 가

가

(p=0.026),
(p<0.05).
(intertrochanter)

가

(p=0.013).

가

가

Table 4. Comparison of clinical characteristics, biochemical markers and BMD in the subgroups divided by the presence of vertebral fractures

| Group Mean ± SD | FX [†] only group (n=14) | FX with VX [‡] (n=16) | p value |
|--------------------------------------|--------------------------------------|-----------------------------------|---------|
| Types of hip fracture (T/C/S*) | 4/8/2 | 9/5/2 | |
| Age (years) | 72.3 ± 5.9 | 80.4 ± 11.5 | 0.026 |
| Height (cm) | 158.2 ± 9.7 | 151.3 ± 9.2 | 0.352 |
| Weight (kg) | 55.9 ± 9.4 | 52.3 ± 11.7 | 0.053 |
| Age at Menopause (years) | 49.6 ± 2.4 | 49.2 ± 2.0 | 0.714 |
| Number of Childbirth | 5.6 ± 3.3 | 4.5 ± 2.5 | 0.339 |
| s-CTx (ng/ml) | 0.7 ± 0.4 | 0.8 ± 0.4 | 0.847 |
| OC (ng/ml) | 8.6 ± 4.9 | 7.3 ± 6.3 | 0.587 |
| Ca (mg/dl) | 8.0 ± 1.1 | 7.9 ± 0.5 | 0.927 |
| P (mg/dl) | 3.9 ± 0.9 | 3.4 ± 0.6 | 0.18 |
| ALP (IU/L) | 66.1 ± 17.5 | 79.3 ± 19.3 | 0.07 |
| BMD[§] | | | |
| lumbar spine (g/cm ²) | 0.8 ± 0.08 | 0.6 ± 0.1 | 0.02 |
| neck (g/cm ²) | 0.6 ± 0.2 | 0.4 ± 0.1 | 0.016 |
| trochanter (g/cm ²) | 0.5 ± 0.2 | 0.4 ± 0.1 | 0.03 |
| intertrochanter (g/cm ²) | 0.8 ± 0.1 | 0.6 ± 0.1 | 0.006 |
| femur (g/cm ²) | 0.7 ± 0.2 | 0.5 ± 0.1 | 0.007 |

*T/C/S; trochanteric fracture/neck fracture/shaft fracture

[†]FX; femur fracture, [‡]VX; vertebral fracture, [§]BMD; bone mineral density

Table 5. Comparison of BMD in subgroups divided by the presence of vertebral fractures of age-matched comparison

| Group Mean ± SD | FX [†] only group (n=13) | FX with VX [‡] (n=9) | p value |
|--------------------------------------|--------------------------------------|----------------------------------|---------|
| Age (years) | 72.3 ± 5.9 | 72.1 ± 10.0 | 0.432 |
| BMD[§] | | | |
| lumbar spine (g/cm ²) | 0.68 ± 0.13 | 0.62 ± 0.1 | 0.335 |
| neck (g/cm ²) | 0.60 ± 0.2 | 0.41 ± 0.1 | 0.122 |
| trochanter (g/cm ²) | 0.52 ± 0.2 | 0.36 ± 0.1 | 0.14 |
| intertrochanter (g/cm ²) | 0.76 ± 0.1 | 0.56 ± 0.1 | 0.013 |
| femur (g/cm ²) | 0.66 ± 0.1 | 0.51 ± 0.1 | 0.065 |

[†]FX; femur fracture, [‡]VX; vertebral fracture, [§]BMD; bone mineral density

Masaaki (13)
 가 가 가
 (femur neck fracture)
 (trochanteric fracture)
 Sweet (14) Fitts (15)
 가

가
 가
 가

OC
 가
 3~10
 (16,17).
 CTx
 가
 CTx
 가
 가
 가
 OC
 가
 가

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