—Report on Experiments and Clinical Cases—

Multiple Fish Vertebra Deformity in Child with Systemic Lupus Erythematosus

A Case Report

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Abstract

We report an 11-year-old female patient with multiple fish vertebra deformity, which occurred in the course of treatment with corticosteroids for systemic lupus erythematosus (SLE). She was treated for SLE with predonisolone (30 mg per day) from April 2, 1996, and presented at our outpatient clinic for an osteoporosis check-up on April 27. She was 132 cm tall with − 1.7 standard deviation of the average height, and X-ray examination revealed no evidence of osteoporosis in the spine. Bone mineral density (BMD) was 74.7% of the average BMD. Subsequently, she grew to 136 cm in September. However she began to have low back pain (LBP) from November, and received alfacalcidol. LBP deteriorated after pulse therapy with methylpredonisolone. In June 1997, X-ray examination revealed multiple fish vertebra deformity with 58.3% of the average BMD. Moreover her height had decreased to 131 cm. She underwent combination therapy with elcatonin and alfacalcidol. In September 1999, she had no LBP nor progression of fish vertebra deformity. However she had no growth in height. Corticoseroids and SLE have multiple effects on bone metabolism, making the treatment of porosis complicated and difficult. (J Nippon Med Sch 2000; 67: 271—274)

Key words: systemic lupus erythematosus, fish vertebra deformity, child

Introduction

We report a child patient with multiple fish vertebra deformity which occurred in the course of treatment for systemic lupus erythematosus (SLE).

Case Report

An 11-year-old female visited the dermatology department of our hospital complaining of erythema on the face, hands and feets in March 1996. She was diagnosed as having SLE, and was treated with predonisolone (30 mg per day) from April 2. She presented at our outpatient clinic for an osteoporosis check-up on April 27. She was 132 cm tall with − 1.7 standard deviation (SD) from average height, and weighed 25 kg with − 1.6 SD from average weight. X-ray examination revealed normal density and shape of vertebral bodies in the lumbar and thoracic spine with no evidence

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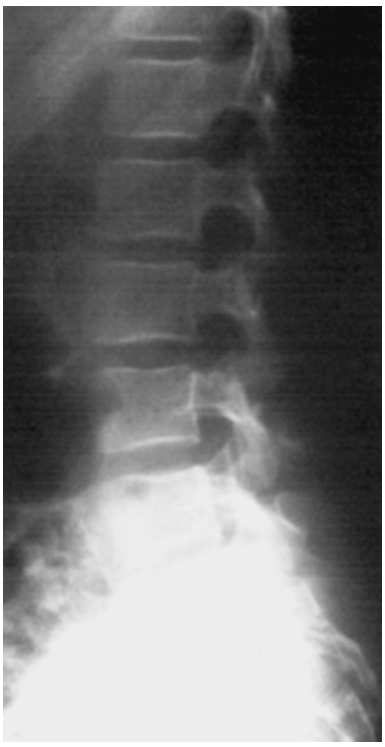

Fig. 1 X-ray examination at first visit to our clinic (April 1996). X-ray examination revealed normal density and shape of vertebral bodies in the lumbar and thoracic spine with no evidence of osteoporosis.

Table 1 Blood examination (April, 1996)

WBC	3,700 /μl ↓	ZTT	18.9 K.U. ↑
ALP	283 IU/l	TTT	17.5 K.U. ↑
GOT	57 IU/l ↑	CRP	(−)
GPT	78 IU/l ↑	IgG	2,439 mg/dl ↑
LDH	471 IU/l	IgA	456 mg/dl ↑
BUN	12.4 mg/dl	IgM	299 mg/dl ↑
Cre	0.6 mg/dl	C3c	48.8 mg/dl
Na	137 μEq/l	C4	9.5 mg/dl ↓
K	4.0 μEq/l	CH50	27.4 U. ↓

of osteoporosis (**Fig. 1**). Bone mineral density (BMD) in the heel bone measured by single energy x-ray absorptiometry (SXA) was 0.268 g/cm^2 with 74.7% of the average BMD[1]. Blood examinations showed a decrease in C 4 and CH 50, an increase in IgG, IgA and IgM, and a mild liver dysfunction (**Table 1**).

Subsequently, she grew to 136 cm in September. However she began to have low back pain (LBP) from November, and received alfacalcidol (0.25 μg). In December, she had pulse therapy with methylpredonisolone (500 mg) for central nervus system lupus. LBP

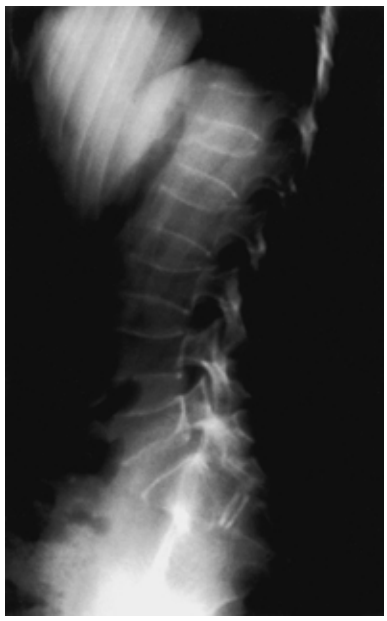

Fig. 2 X-ray examination 1 year and 3 months after treatment with steroids (June 1997). X-ray examination revealed multiple fish vertebra deformity in the lumber and thoracic spines.

deteriorated after pulse therapy, and she became unable to stand in June 1997. X-ray examination revealed multiple fish vertebra deformity in the lumber and thoracic spines (**Fig. 2**). SXA showed BMD of 0.271 g/cm^2 in the heel bone with 58.3% of the average[1] BMD. When compared with the results of BMD in May 1996, no increase in BMD associated with growth was observed. Moreover her height had declired to 131 cm. She underwent combination therapy with elcatonin (20 I.U.) and alfacalcidol (0.5 μg).

X-ray examination on September 25, 1997 revealed a round back with on compression fractures of the lower thoracic spine (**Fig. 3**). Subsequently, however, LBP improved with time. Examination of bone turnover markers in September 1998 showed serum osteocalcin level, and urine pyrisinoline and deoxypyrisinoline levels of 1.9 ng/ml, 23 pmol/μmol Cr and 3.0 pmol/μmol Cr respectively, suggesting low turnover osteoporosis. Dual energy x-ray absorptiometry (DEXA) showed BMD of 0.381 g/cm^2 in radius with 82.8% of the average BMD (−2.7 SD). She had no LBP or progression of fish vertebra deformity in September 1999 (**Fig. 4**). However, she had no growth in height.

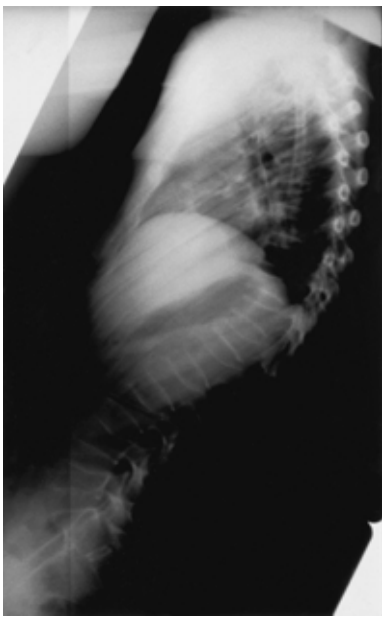

Fig. 3 X-ray examination 1 year and 6 months after therapy with steroids (September 1997). X-ray examination revealed a round back with compression fractures of the lower thoracic spine.

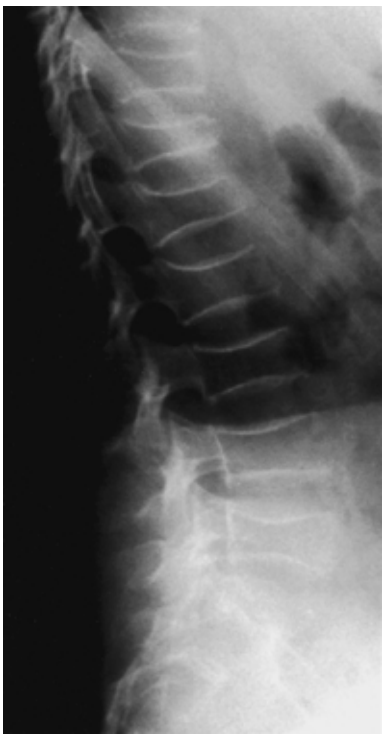

Fig. 4 X-ray examination 3 years and 6 months after therapy with steroids (September 1999). She had no pain or progression of fish vertebra deformity.

Discussion

Fish vertebra deformity is a severe form of osteoporosis which frequently occurs in menopausal patients with SLE, but rarely in child patients. In the present case, osteoporosis may have been caused by both SLE and corticosteroid therapy.

Juvenile osteoporosis has been classified into idiopathic osteoporosis and secondary osteoporosis caused by various diseases or corticosteroids. Fitzpatric[2] postulated several mechanisms of steroid-induced osteoporosis: inhibition of intestinal calcium absorption, suppression of bone formation and acceleration of bone absorption by direct effect on osteoblasts and osteoclasts, inhibitory effects on hormonal functions, and hyperparathyroidism secondary to minus calcium balance.

Also, corticosteroids have been reported to cause growth failure by inhibition of growth hormone (GH) secretion[3] and IGF-1 activity. Mizuno et al[4] reported that the dosage and administration period of corticosteroids was related to BMD. If corticosteroids are administered at a dose of 3.4 mg/m^2/day (m^2: the surface area of the body), an increase in BMD associated with bone growth may not occur. Our case was continuously given predonisolone at more than 10.3 mg/m^2/day (total dose: 12890 mg) through the study period, which may be a sufficient dose to impair bone growth.

Kalla et al[5] reported that SLE may decrease BMD unassociated with steroid therapy, and stated that bone loss in SLE may be partly explained by inflammation. Suzuki et al[6] stated causative factors of osteoporosis in SLE as follows: a decrease in serum level of 25-hydroxyl vitamin D, associated chronic renal failure (Lupus nephritis) and avoidance of sun exposure.

In bone growth, 70% of the bone mass development depends on hormonal and nutritional factors, and the remaining 30% is influenced by daily activity. In SLE children, restrictions of daily activity or sun exposure may contribute to bone growth failure.

Bone turnover has been evaluated by various markers for bone formation and absorption. In normal[7] females aged 11 to 15 years, serum osteocalcin level as a marker of bone formation is 17～25 ng/m*l*, and urine pyrisinoline and deoxy-pyrisinoline levels as markers of bone absorption are 75～150 pmo*l*/μmo*l* Cr and 10

～20 pmol/μmol Cr, respectively. Generally, it has been reported that corticosteroids induce high turnover osteoporosis. However, in our case, these 3 markers were remarkably lower than normal, suggesting low turnover osteoporosis characterized by both suppression of bone formation and absorption. Yanagawa et al[8] stated that from the results of low serum osteocalcin level, SLE patients treated with steroids tend to have low turnover osteoporosis.

As for treatment of osteoporosis and bone growth failure in SLE children, in general, treatment regimens include administrations of calcium, vitamin D, vitamin K and Calcitonin. Unterman et al[3] noted that corticosteroids appear to antagonize GH action, apart from potential alternation in GH secretion. Itiki et al[9] reported in a clinical trial of GH that SLE children on corticosteroid therapy showed improvements in growth rate and osteoporosis by administration of GH.

Increased urinary excretion of calcium is one of the causative factors for steroid-induced osteoporosis. Thiazides diuretics are effective in reducing urinary calcium excretion. Yamada[10] noted that combination therapy with 1 α-hydroxyvitamin D, calcium and thiazides is effective in the prevention of steroid-induced osteoporosis. In contrast, Katayama[11] stated that in patients with pulse therapy with corticosteroids, thiazides failed to prevent loss of trabecular bone which is susceptible to steroids.

In conclusion corticoseroids and SLE have multiple effects on bone metabolism, making the treatment of porosis complicated and difficult. Further research is needed to establish treatment regimens for steroid-induced osteoporosis in child SLE to prevent loss of bone mass and spine deformities.

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