

Bone mineral density of Brazilian girls with juvenile dermatomyositis

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Abstract

We measured bone mineral density (BMD) in girls with juvenile dermatomyositis (JDM) considering multiple factors in order to determine if it could be used as a predictor of reduction in bone mass. A cross-sectional study of lumbar spine BMD (L2-L4) was conducted on 10 girls aged 7-16 years with JDM. A group of 20 age-matched healthy girls was used as control. Lumbar spine BMD was measured by dual-energy X-ray absorptiometry. Weight, height and pubertal Tanner stage were determined in all patients and controls. Duration of disease and mean daily and cumulative steroid doses were calculated for all patients on the basis of their medical charts. JDM activity was determined on the basis of the presence of muscle weakness, cutaneous vasculitis and/or elevation of serum concentration of one or more skeletal muscle enzymes. Seven patients demonstrated osteopenia or osteoporosis. Lumbar BMD was significantly lower in the JDM patients than the age-matched healthy control girls (0.712 vs 0.878, respectively; Student *t*-test, *P* = 0.041). No significant correlation between BMD and age, height, Tanner stage, disease duration, corticosteroid use, or disease activity was observed in JDM girls, but a correlation was observed between BMD and weight (Pearson's correlation coefficient, *r* = 0.802). Patients with JDM may be at risk for a significant reduction in BMD that might contribute to further skeletal fragility. Our results suggest that reduced bone mass in JDM may be related to other intrinsic mechanisms in addition to steroid treatment and some aspects of the disease itself may contribute to this condition.

Key words

- Dermatomyositis
- Adolescent girls
- Bone mineral density
- Osteoporosis
- Corticosteroids

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Introduction

Osteoporosis is a disorder characterized by loss of matrix and bone mineral content and microarchitectural deterioration of bone tissue (1). It used to be primarily an age-related disorder occurring in postmenopausal women and in the elderly, but more recently

it has been observed to be associated with diseases such as asthma, rheumatoid arthritis, dermatomyositis, and systemic lupus erythematosus (SLE) (2-6). Previous studies have assessed multiple factors as possible contributors to the reduction in bone mineral density (BMD) in patients with these diseases. However, few studies on BMD have

been conducted on the pediatric population (7-12). Low BMD in patients with juvenile dermatomyositis (JDM) has been associated with a combination of factors such as disease activity, high doses of corticosteroids, low intake of calcium, delayed pubertal stage, low sunlight exposure, and prolonged immobility. An early diagnosis of patients at risk for bone loss is important for the attenuation and management of this condition, which may lead to a poor outcome of JDM when not adequately treated (1).

Material and Methods

Patients

We followed the clinical course of 10 female patients with JDM aged 7 to 16 years. All subjects fulfilled the diagnostic criteria for JDM established by Bohan and Peter in 1975 (13). The findings were compared to those obtained for 20 aged-matched healthy girls selected from the community.

The Ethics Committee of Universidade Federal de São Paulo approved the study protocol and informed consent was obtained from persons responsible for the participants.

Weight (kg) and height (cm) were measured in patients and controls using an anthropometric balance. An experienced pediatrician determined the Tanner stage. Patients were classified into two groups: girls within the G1-G2 Tanner range (group 1) and G3-G5 girls (group 2). This division was due to the fact that G3 to G5 patients present higher bone mass (14). Duration of disease in months was considered as the period of time from the first clinical manifestations to the evaluation by bone densitometry. Mean daily steroid dose ($\text{mg prednisone kg}^{-1} \text{ day}^{-1}$) and mean cumulative steroid dose (g) were calculated from the medical records.

The medical history of JDM patients was reviewed and disease activity was defined on the basis of the presence of at least one of the following four criteria: 1) muscle weak-

ness of the neck flexors and extensors, shoulder abductors, elbow flexors and extensors, hip flexors, extensors, and abductors, and knee flexors and extensors; 2) skin vasculitis (heliotrope discoloration of the upper eyelids, Gottron's papules, and abnormalities of the periungual skin); 3) degree of impairment in ambulation, and 4) elevation of one or more serum concentrations of the skeletal muscle enzymes (aspartate aminotransferase, creatine kinase, aldolase, and lactic dehydrogenase). The presence of calcinosis was reviewed, particularly in the lumbar spine.

Dual-energy X-ray absorptiometry

BMD at the lumbar spine level (L2-L4) was measured in all subjects by dual-energy X-ray absorptiometry using a LUNAR DPX densitometer (Lunar Radiation Corporation, Madison, WI, USA). This site was chosen because of its pathophysiologic importance for vertebral compression fractures and because a high-quality age-related normative database is available for the pediatric population. Z scores were calculated from the BMD data for comparison with published normative data. The densitometer used in our Unit has a coefficient of variation of 2.0% at the lumbar spine in children.

Lumbar spine radiography was carried out to exclude calcinosis.

Statistical analysis

The Student *t*-test was used to compare BMD of patients and controls. The chi-square test was used to compare BMD of controls and JDM patients with Tanner stage. In the JDM group, Pearson's correlation coefficient was used to detect potential associations between BMD and anthropometric measures, time of disease, and mean daily and cumulative steroid doses. The Student *t*-test was also used to compare the BMD of patients with Tanner stage and disease activ-

ity. All statistical analyses were performed using the SPSS software version 8.0. A P value of <0.05 was considered to be statistically significant.

Results

The demographic, anthropometric and clinical characteristics of the 10 patients and 20 controls are shown in Table 1. No patient showed calcinosis. Seven patients had disease activity and 3 did not. Mean duration of disease was 3.6 ± 1.6 years. Mean daily steroid dose was 0.32 ± 0.21 mg kg⁻¹ day⁻¹ and mean cumulative steroid dose was 15.3 ± 8.9 g. All patients with JDM were treated with oral or intravenous corticosteroids and at the time of evaluation all patients were taking this medication except one. The two groups were similar in terms of age, weight and height, with no statistically significant difference between them. In the JDM group, 4 patients were in stage G1-G2 and 6 were in stage G3-G5. In the control group, 8 individuals were in stage G1-G2 and 12 were in stage G3-G5. Pubertal development did not show a statistically significant difference between the two groups.

Seven patients had osteopenia or osteoporosis.

Patients with JDM had significantly reduced BMD in the lumbar spine compared to controls ($P = 0.041$). In the JDM group, we did not observe a significant correlation between BMD and age, height, disease duration, or corticosteroid use, although, a statistically significant correlation was observed between BMD and weight ($r = 0.802$). There were no significant differences in BMD between JDM patients in stages G1-G2 and in stages G3-G5 (0.645 vs 0.757 g/cm²), or between patients with and without disease activity (0.758 vs 0.645 g/cm²). No patients had clinical or vertebral fractures (15).

Statistical analysis only allowed the use of simple tests and multiple regression was not performed.

Discussion

An important determinant of osteoporosis is the peak bone mass achieved during the second decade of life. Thus, osteopenia and osteoporosis originate in childhood and adolescence (16). Children with rheumatic diseases such as juvenile SLE and JDM develop a diminished bone mass both because of the inflammatory nature of the disease and of the use of steroids to treat the active manifestations of the diseases (10). Because many of these patients are diagnosed and treated during the late prepubertal and early pubertal periods when bone formation is more intense, bone loss might lead to osteopenia and to the risk of osteoporosis during adulthood (10). Few reports are available about BMD in patients with JDM (10). Our results demonstrate that children with JDM present a reduced bone mass at the lumbar spine level compared with healthy children.

Steroids are a mainstay drug therapy in JDM and are a well-recognized cause of osteoporosis in other rheumatic diseases (17-23). Differently from other reports, our study showed that in children with JDM there is no significant correlation between bone mass and steroid use, a fact possibly due to the small number of patients included in our study.

Table 1. Demographic, anthropometric, clinical characteristics, and bone mineral density of patients with juvenile dermatomyositis and controls.

	JDM patients	Controls
Number of subjects	10	20
Age (years)	11.8 ± 3.2	12.0 ± 2.8
Weight (kg)	38.9 ± 19.4	41.2 ± 11.6
Height (cm)	137.5 ± 17.2	148.5 ± 14.4
Tanner stage G1-G2/G3-G5	4/6	8/12
Time of disease (years)	3.6 ± 1.6	-
Daily steroid doses (mg kg ⁻¹ day ⁻¹)	0.32 ± 0.21	-
Cumulative steroid doses (g)	15.3 ± 8.9	-
Spine bone mineral density (g/cm ²)	$0.712 \pm 0.239^*$	0.878 ± 0.179

Data are reported as means \pm SD. JDM = juvenile dermatomyositis.

* $P < 0.05$ compared to controls (Student *t*-test).

Perez et al. (10) showed a significant bone loss associated with decreased calcium absorption in 12 JDM patients receiving steroid therapy. Falcini et al. (1) observed a reduction in both lumbar spine BMD and calcaneal ultrasound measurements in 53 patients with juvenile rheumatoid arthritis (N = 29), juvenile SLE (N = 13) and JDM (N = 11) compared with a control group. All JDM patients were taking corticosteroids.

Our results show that weight was statistically correlated with bone mass in JDM patients. This finding agrees with others showing that weight is the best predictor of bone mass in healthy children (24,25).

The most important increase in lumbar spine BMD was found in pubertal stage 4 for both sexes (14). It is during this stage of puberty that the deceleration of the growth spur occurs and adult levels of sex steroids can be attained (14). In our study, we did not find a significant correlation between bone loss and pubertal stage. However, JDM patients who were in stages G1-G2 presented lower BMD than patients in stages G3-G5. Our results indicate some increment in bone mass as a function of pubertal development even in patients with an important reduction in bone density.

All children with osteopenia or osteoporosis were being treated with calcium and vitamin D.

There are many disease-related variables, like reduced serum osteocalcin levels or elevated serum cytokines, that could play a role in determining the BMD of patients with JDM (26-28). Secondary mechanisms resulting in increased susceptibility to bone loss include female sex, immobility due to muscle weakness and constitutional symptoms like anorexia, the deliberate avoidance of sunlight exposure, gastrointestinal vasculitis impairing calcium and vitamin D absorption, and ovarian failure associated with the disease itself or secondary to cytotoxic therapy (29,30). None of these factors were evaluated in our study and perhaps could explain the reduced bone mass in JDM children. Disease activity and steroid treatment did not correlate with BMD in these patients. The present results suggest that the reduced bone mass observed in these children represents a multifactorial process and some aspects of JDM itself may contribute to this condition.

It is important to emphasize that the small sample size of the present study limited our ability to generalize our findings.

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