Metacarpal Bone Mass in Systemic Lupus Erythematosus

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Summary  We report the prevalence of metacarpal cortical thinning in systemic lupus erythematosus (SLE). Fifty-eight ambulant female patients attending a lupus clinic (mean age 32.4 years), were found to have significant thinning of metacarpal cortices (p<0.05) when compared with 63 normal females (mean age 34.1 years). However, metacarpal bone mass was within the normal range. Measurements were made at 6 metacarpals of the 2 hands using a computer-aided technique (digitized radiogrammetry). Femoral cortical width and Singh index at the left femur, as well as the vertebral index at L3 were also recorded. The trabecular indices were in the range of normality, but the SLE group had more patients in the immediately pre-osteopaenic range. Metacarpal bone loss was not related to disease duration or corticosteroid therapy. The prevalence of osteopenia in SLE is probably underestimated and the pathogenesis is likely to be multifactorial.

Key words  Osteoporosis, Osteopenia, Radiogrammetry, Corticosteroid

INTRODUCTION

Osteopenia denotes a reduced bone mass while osteoporosis implies fractures due to structural bone failure. Strictly speaking, osteoporosis is diagnosed histologically. Nordin (1), who uses the terms interchangeably, separates the definition of osteopenia into simple and accelerated, depending on whether the apparent density of representative bone is normal or low, after correction for age and sex, respectively. Bone is osteopenic when its apparent density falls below the young normal lower limit. This definition is based on the objective measurement of bone mass and considers fractures to be more frequent in this group over time (2).

Until very recently (3), formal studies of bone mass in systemic lupus erythematosus (SLE) were lacking. Dubois (4) discusses osteopenia (OP) in SLE purely as a complication of therapy. He expressed the opinion that OP in SLE is rare and shows a tendency to recovery. Schur (5) states that OP occurs only in older patients and those in whom corticosteroids (CS) are administered. In 1985, Dykman et al. (6), reported the factors associated with glucocorticoid induced bone loss. Among their 123 patients with rheumatic diseases 33% had SLE; 50% of whom were under 50 years of age. They concluded that the risk for development of glucocorticoid OP was the same in all patient groups, as measured by single photon absorptiometry (SPA). Hyperparathyroidism secondary to chronic renal failure has been reported in SLE (7,8), but bone mass was not measured in those reports.

The techniques for noninvasive measurement of trabecular and cortical bone mass have been vastly improved in recent years. Metacarpal bone measurements predict risk of subsequent fracture of trabecular bone (9). Unfortunately, the newer techniques for measuring trabecular bone mass noninvasively are still largely confined to specialized research centres. When trabecular bone is considered to be radiologically osteopenic, using measures such as the Singh index (10) and Saville index (11), 30-50% of bone mass is likely to have been lost (12). Metacarpal radiogrammetry is a simple, validated, established measure of bone loss (13-15), and the technique has been recently improved (16).

Against this background, a study was designed to determine the prevalence of OP in SLE. We report our findings of radiogrammetry measurement of 6 metacarpals.

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MATERIAL AND METHODS

Sixty-seven consecutive ambulant female patients under 50 years of age with SLE were studied. They were all regularly attending an outpatient lupus clinic at Groote Schuur Hospital (GSH) between September, 1984 and April, 1985. Age under 50 years, regular menstruation, independent ambulation and disease classification according to the American Rheumatism Association (ARA) revised criteria (17) were the main bases for selection. Males and pregnant females were excluded. A protocol was designed to record age, race, sex, age at onset of disease, duration of disease and criteria for diagnosis of SLE. Age at onset was taken as the age at which the first acceptable symptoms of SLE occurred (5). A complete physical examination was carried out by a single observer (AAK), but laxity of tendons was not specifically evaluated. The records were examined to determine those patients who had taken CS in the course of their disease. All patients had standardized X-rays of both hands, the left hip and lumbar spine centred at L3. Detailed dietary, smoking and alcohol histories were also obtained. Four patients had bilateral total hip replacements for avascular necrosis of the femoral head, while 5 patients did not arrive for X-rays, leaving 58 cases suitable for analysis.

X-rays of both hands were taken at a tube distance of 100 cm. The exposure and development times were standardized for the purpose of this study. The 6 metacarpal cortical area (6MHS) and the 6 metacarpal cortical area percent (14) were calculated as previously described (14-16). The combined cortical thickness was calculated as the difference between total width (TW) and medullary width (MW) at the midshaft of the right 2nd metacarpal. The sum (Σ) of these measurements from 6 metacarpals was also calculated. The left hip was radiographed at 15° of internal rotation as suggested by Singh (10,18). This was graded by a single observer (AAK) according to the Singh index of trabecular OP (18). The cortical thickness 1 cm proximal to the lesser trochanter was measured as recommended by Fredensborg and Nilsson (19). The 3rd lumbar vertebra was graded for OP by a single observer (AAK) according to the method of Saville (11). Single photon absorptiometry (SPA) and dual photon absorptiometry (DPA) were not available at the research centre at the time of study.

Seventy-five healthy female volunteers of similar age range were used as controls for this study. Sixty-three had X-rays and they constitute the group against whom comparisons were made. The same selection criteria were applied with respect to age, gender, menstruation and pregnancy. They had the same X-rays as the patients. No volunteers were accepted for study if they had a medical disease of any kind requiring regular treatment. A dietary, smoking and alcohol history was obtained.

Measurements of inner (MW) and outer (TW) diameters at the 2nd, 3rd and 4th metacarpal midshafts of both hands were made by a single observer (AAK), using a Houston Hipad Digitizer interfaced with an IBM PC (16). Vernier calipers were not used. The validity of this method has been previously reported and the intra-observer error was <5% (16). The observer error in grading the trabecular changes was not tested. The hand radiograph was scored for erosions and joint space narrowing at the wrist, interphalangeal and metacarpophalangeal joints. The carpal length was also measured and the carpo-metacarpal ratio (CMR) was calculated as an index of radiological severity (20).

The corticosteroid (CS) treated group represents subjects who had received such therapy at any stage during the course of their disease. The same selection criteria were used, irrespective of CS therapy. In general, patients were started on 60 mg/day (1 mg/Kg/day), reducing gradually over 6 months as dictated by control of the disease. The total cumulative dose was calculated. All such patients had been on CS therapy for longer than six months and up to 6 months prior to study. Three patients were also receiving oral cyclophosphamide, but they had normal menstruation.

Renal function was measured by serum urea and creatinine. Too few patients had 24-hour urine collections for the measurement of creatinine clearance. Renal involvement (casts, protein > 0.5 G/24 hrs, renal biopsy changes) was not necessarily accompanied by renal impairment, as defined by a serum creatinine of > 100 µmoles/l. Severity of arthritis was measured by the Keitel function test (KFT), which is a global measure of disability and inflammation, with a range of 4-100 (21). The total test was arbitrarily divided according to groups of joints as previously described (22). Only the total score will be presented in this report.

Statistical methods

The mainframe computer at the SAMRC Biostatistics Institute was used for all the statistical calculations. The SAS package (23,24) and BMDP statistics software (25) were used for all conventional analyses. Analysis of variance (Anova) was used for univariate comparisons. Multivariate discriminant analysis was used to evaluate the sensitivity and specificity of the measurement of the combined cortical thickness in SLE. Stepwise multiple regression analysis was used to pre-