ORIGINAL ARTICLE

Osteopenia and osteoporosis in a young Mexican population

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RESUMEN

Introducción. La osteopenia y osteoporosis forman parte de una enfermedad sistémica, metabólica y multifactorial que constituye un problema a nivel mundial, las fracturas son su principal manifestación clínica que conlleva a importantes repercusiones médicas y socioeconómicas. El estudio de esta condición en el adulto joven difiere de otros grupos y se tiene poca información disponible. **Objetivo.** Describir la frecuencia de algunos factores de riesgo para osteopenia y osteoporosis en adultos jóvenes en una población mexicana. **Material y métodos.** Estudio transversal realizado en la Fundación Clínica Médica Sur. Se analizaron características demográficas y clínicas de pacientes entre 30 y 49 años con diagnóstico de osteopenia u osteoporosis por puntaje T en densitometría de antebrazo. **Resultados.** Se incluyeron 60 mujeres y 40 hombres con puntaje T promedio de -1.8. Las características frecuentemente reportadas fueron sedentarismo (35%), tabaquismo (31%), nuliparidad (13%) y cristaluria en 12%. El 45% de los pacientes cumplió criterios para síndrome metabólico. No se encontró correlación entre el puntaje T y las variables metabólicas. **Conclusión.** El tener un alto índice de sospecha para osteopenia y osteoporosis en el adulto joven puede ayudar a identificar y tratar los factores de riesgo modificables. Son necesarios estudios prospectivos y con mayor número de pacientes que permitan evaluar el peso individual de los factores de riesgo e intervenciones.

Palabras clave. Factores de riesgo. Adultos jóvenes. Calcio. Vitamina D. Síndrome metabólico.

ABSTRACT

Introduction. *Both osteopenia and osteoporosis conforms a systemic, metabolic, and multifactorial disease considered a worldwide burden. It follows a different path in the young adult and has been poorly studied.* ***Objective.*** *To describe risk factors for osteopenia and osteoporosis in young adults, including metabolic syndrome criteria.* ***Methods.*** *We performed a descriptive, observational study at a private clinic in Mexico City. We included patients aged 30 to 49 years with osteopenia or osteoporosis, determined by forearm T-score. Results. We included 60 women and 40 men, with average age 43 years old, and average T-score -1.8. Most frequently reported risk factors were physical inactivity (35%), smoking (31%), nulliparity (13%), and urinary crystals on 12%. Almost half (45%) of patients had metabolic syndrome criteria. There was no correlation between T-score and metabolic variables.* ***Conclusion.*** *A high suspicion index for osteopenia and osteoporosis in young adults may help to identify and treat modifiable risk factors. Prospective and large-scale population studies are needed to assess the impact of each risk factor.*

Key words. *Risk factors. Young adults. Calcium. Vitamin D. Metabolic syndrome X.*

INTRODUCTION

Both osteopenia and osteoporosis are part of a systemic, metabolic, and multi-factor disease, whose clinical manifestation outcome is fracture.[1] This is the most frequent metabolic bone disease and, due to its major implications, it has been considered as a global health problem.[2] The costs of such disease are high and result from biochemical and diagnostic studies, as well as from follow-up imaging studies, the treatment, and handling of complications.[1] Mortality resulting from a femur fracture is 20% for a one-year period (which is similar to suffering a severe myocardium infarct), while that resulting from vertebral fractures is of 20% for a 5-year period.[2]

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Although there are several methods to determine the BMD, dual X-ray absorptiometry (DXA) is considered by the World Health Organization (WHO) as the best indicator of fracture risk,[3] and it is also indicated to assess the response to medical treatment. Although there are several areas of the body in which the BMD can be determined, the WHO recommends applying its diagnostic criteria only to lumbar spine, femoral neck, whole hip, and forearm densitometries. The WHO recommends to provide follow-up to the same area and preferably using the same equipment.[4] There are some disadvantages inherent to the DXA method, since it underestimates the BMD in cases of osteomalacia and overestimates it in presence of osteoarthritis or osteophytes, bone calluses from previous fracture, previous use of strontium ranelate, bone surgeries, among other situations. The results shows also implications of both too low or too high body weight.[3] The WHO recommends forearm densitometry (FD) as an alternative method for the diagnosis of osteoporosis, since it particularly predicts the risk for femur fracture in women, along with fracture risk calculators considering clinical parameters. FD is especially useful in certain cases, mainly in patients with hyperparathyroidism, with a body weight greater than 100 kg, with contraindications for densitometry in other areas and for assessing the response to the treatment.[3,4]

The prevalence and incidence of osteopenia and osteoporosis varies according to the anatomical zone in which bone mineral density is determined (BMD). In México, forearm osteopenia has been reported in 48%, while osteoporosis has been reported in 18% in open population.1 Disorders of low bone density in young people between 30 and 49 years of age are secondary to the use of drugs, alterations in calcium metabolism, or idiopathic alterations.[5] This study aims to describe the frequency of some risk factors for osteopenia and osteoporosis identified in the forearm densitometry of young adults in the Mexican population.

MATERIAL AND METHODS

A cross-sectional study was performed in the Integral Diagnosis and Treatment Center (Centro Integral de Diagnóstico y Tratamiento, CIDyT) of the Medica Sur Clinic between January 1st, 2013 and April 30th, 2015. The study enrolled 100 patients between 30 and 49 years of age with a diagnosis of osteopenia or osteoporosis based on the forearm densitometry (FD) T-score and full medical records. All patients with a mean forearm T-score of -1.8 were included. Demographic, clinical, biochemical, and imaging variables were obtained. Diagnostic criteria for metabolic syndrome were assessed based on the definition of the 2006 International Diabetes Federation (IDF).[6]

Statistical analysis

Data were summarized as mean or median and frequencies. Another Pearson correlation was then conducted

Table 1. Demographic and clinical characteristics of patients under study.

Variables	n = 100
Sex (%)	
Female	60
Age (years), mean (standard deviation, SD)	42.9 (3.9)
Body mass index (kg/m^2), mean (standard deviation, SD)	25.9 (3.6)
Fasting glucose (mg/dL), mean (standard deviation, SD)	91.6 (9.1)
Triglycerides (mg/dL), mean (standard deviation, SD)	145.3 (79.9)
High-density cholesterol HDL (mg/dL), mean (standard deviation, SD)	50.9 (12.9)
Low-density cholesterol LDL (mg/dL), mean (standard deviation, SD)	123.0 (28.9)
Ultrasensitive C-reactive protein (mg/dL), mean (standard deviation, SD)	2.4 (2.3)
Glycosylated hemoglobin (%), mean (standard deviation, SD)	5.5 (0.5)
Metabolic syndrome components	
Sex-based waist circumference (cm), %*	71
Fasting glucose ≥ 100 mg/dL, or diabetes mellitus type 2, or use of specific treatment, %	17
Triglycerides ≥ 150 mg/dL or use of specific treatment, %	38
Sex-based abnormal HDL cholesterol† or use of specific treatment, %	22
Systolic blood hypertension ≥ 130 mmHg or diastolic blood hypertension ≥ 85 mmHg or use of specific treatment, %	5
High alkaline phosphatase or alkaline phosphatase ≥ 91 U/L, %	2

SD: Standard deviation. * ≥ 90 cm in men, ≥ 80 cm in women. †< 40 mg/dL in men, < 50 mg/dL in women.

in order to determine if there was a relationship between the forearm densitometry T-score and other variables, including the body mass index (BMI), fasting glucose, triglycerides, total HDL and LDL cholesterol, ultrasensitive C-reactive protein, waist circumference, and alkaline phosphatase.

A $p < 0.05$ value was considered to be statistically significant. The statistical analysis was conducted in SPSS Statistics for Windows version 20 (IBM Corp., 2011, Armonk, NY).

RESULTS

Patients included under the osteopenia classification showed similar ratios of men and women having a BMI corresponding to overweight. 45% of patients were found to meet the diagnostic criteria for metabolic syndrome (Table 1).

Table 2 shows the findings associated to bone demineralization in the population under study. Risk factors associated with osteopenia or osteoporosis was assessed in these patients.

Concerning dietary habits, it was not possible to assess the daily intake of coffee, since only 14 subjects provided such information. In order to assess if the daily intake of calcium was insufficient, lactose intolerance was assessed (7%). Nevertheless, such feature is not equivalent to a risk factor.

Our population showed a history of urolithiasis of 85% and urine crystals other than amorphous urates in 12% of cases. However, the alteration of mineral metabolism cannot be assessed with such data.

Although the use of drugs such as serotonin uptake inhibitors (2%) and proton pump inhibitors (6%) were assessed, their causal relationship to osteoporosis is unclear.

Table 3 shows the comorbidities detected in the population that have been associated with disorders in calcium metabolism. It should be noted that 11% of the sample used calcium supplements on a daily basis.

Finally, Pearson correlation coefficients for various variables were assessed by using the forearm densitometry T-score value. However, no statistically significant association was found through such analysis (Table 4).

DISCUSSION

The study was conducted in a young population in which a forearm densitometry screening study was performed as part of a medical checkup. The known risk factors for the development of osteoporosis are being a female, age greater than 50 years, Caucasian or Asian race, low weight, family history of osteoporosis, smoking habits, physical inactivity, alcohol consumption, use of drugs associated to demineralization, and suffering from diseases associated to demineralization, such as rheumatoid arthritis and celiac disease. Such risk factors have been scarcely found in the population under study. Only 8% of the patients showed one of the risk factors typically described for the development of osteopenia or osteoporosis. The modifiable factors been

Table 2. Findings associated to bone demineralization in the population under study.

Risk factors present in the sample	Percentage
Family history of osteoporosis	7
Physical inactivity	35
Current smoking or quitting smoking < 10 years ago*	31
Consumption ≥ 3 alcohol drinks	2
Coffee (4 or more cups a day)	NA
Late menarche (after 15 years of age)	5
Early menopause (before 45 years of age)	8
Nulliparity	13
Body mass index < 18.5 kg/m^2	2
Drugs*	
Glucocorticoids	NA
Levothyroxine at supra-physiological dose	2
Daily intake of calcium less that that recommended	NA
Alterations in mineral metabolism**	NA

* Since the survey being used makes no difference between current and past smoking habits, such information should be taken with caution. ** Risk factor described for adults between 30 and 49 years of age.

Table 3. Comorbidities potentially related to less bone mineral density.

Comorbidities	Percentage
Untreated hyperthyroidism	6
Hypocalcaemia*	5
Established diagnosis of hypoparathyroidism	2
Chronic diarrhea in study	4
Adrenal incidentaloma	3
Hyperprolactinaemia	1

* Figure for total serum calcium (corrected for albumin) < 8.9 mg/dL.

Table 4. Correlation of selected variables with forearm densitometry T-score.

Variable	Pearson correlation coefficient	p value
Body mass index	-0.158	0.568
Waist circumference	0.053	0.601
Waist-Hip index	-0.161	0.109
Fasting serum glucose	0.096	0.344
Triglycerides	-0.100	0.320
High-density cholesterol, HDL	0.113	0.263
Low-density cholesterol	0.017	0.865
Ultra-sensitive C-reactive protein	0.039	0.703

found were physical inactivity and consumption of tobacco.

A forearm T-score mean of -1.8 was used to identify the group with a predominance of osteopenia. However, it is well known that the diagnosis of osteopenia and osteoporosis cannot be conducted by using only the T-score in distal radius densitometry. Nevertheless, as screening study in young individuals, it may trigger a further study to assess a higher risk for osteoporosis. Whenever osteopenia is found in young individuals, our institution recommends the patient to conduct further studies with lumbar spine and proximal femur (hip) densitometry. In case the diagnosis is confirmed, the appropriate study is conducted for deciding on therapeutic measures. A densitometry correlation analysis in the three sites may provide additional information on the bone health condition of the young population arriving at our hospital.

When analyzing the population, it was noted that individuals had a mean body mass index of 25.9 kg/m^2, which corresponded to overweight. The prevalence of metabolic syndrome in Mexico is reported to be between 13 and 56%,10 based on the type of population under study and on the diagnostic criteria being used. Our sample shows a mean of 2.3 criteria present for this diagnosis based on the IDF definition. Therefore, 45% of the patients with metabolic syndrome in the population of young adults are consistent with what has been described for the national population.[8] This sample did not allow evidencing a relationship between the forearm T-score and some components of the metabolic syndrome, such as waist circumference or ultrasensitive C-reactive protein, as described in other cases.[9] Such lack of correlation may be due to the small size of the sample and to the scarce variation between T-score values.

In a prospective cross-sectional study including 588 women with a mean age of 42 years, Gómez-García, *et al*.[7] have reported a prevalence of osteopenia of 26% for the femur and of 28% for the lumbar spine, as well as lumbar spine osteoporosis in 14% and femur osteoporosis in 2% of cases. Due to the disease prevalence for the population and based on the frequency of osteopenia found in our population, the deliberate search of risk factors for osteopenia or osteoporosis during the surveys in medical checkups may be useful so that, along with the data from the forearm densitometry, preventative recommendations are made concerning dietary habits, physical activity, and further studies required in addition to densitometry of hip and vertebrae, for an early and preventative identification of bone disease. Studies conducted in larger populations with bone densitometry of the 3 areas, along with surveys to assess risk factors for bone metabolism and metabolism syndrome, may allow deciding on the appropriate diagnosis of the bone condition and the relevant therapeutic measures.

This study is limited by its retrospective character, the small size of its sample, the selection bias consisting of a population who cares about its health, follows preventative measures, and in which risky behaviors may be reduced. It was not possible to conduct densitometry of hip and vertebrae to confirm the diagnosis of osteoporosis.

In conclusion, we found that this group of young patients under the classification of osteopenia or osteoporosis according to forearm densitometry shows a high prevalence of metabolic syndrome. We believe that, in cases of forearm densitometry with an abnormal result, risk factors should be assessed and hip and lumbar spine densitometry should be conducted to confirm the diagnosis.

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