

The prevalence of radiographic vertebral fractures in Mexican men

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Abstract

Summary The prevalence of radiographically ascertained vertebral fractures in a random sample of 413 in Mexican men is 9.7% (95% CI 6.85–12.55). Increase of vertebral fracture rises with age from 2.0% in the youngest group (50–59 years) to 21.4% in the oldest group (80 years and over). **Introduction** This is the first population-based study of vertebral fractures in Mexican men using a standardized methodology reported in other studies.

Methods The presence of radiographic vertebral fractures increases with age. This same pattern was found in Mexican women with steady age increments, but the higher prevalence of fractures in women starts at age 70, whereas in men, the higher prevalence starts a decade later (80 years and over).

Results The standardized prevalence per 1,000 men 50 years and over in the Mexican population for the year 2005 is 65.8 (95% CI 29.9–105.5), and it is 68.6 (95% CI 32.2–108.7) in the US population for the year 2000.

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Introduction

In the last decade, osteoporosis and fragility fractures in men received more attention than previously because of new awareness of those conditions on the health system. They account for one-third of all fractures in individuals 50 years and over and for one-fourth of the total costs associated with fractures [1]. It has also been documented that fragility fractures in men lead to higher morbidity and mortality than women [2, 3]. Vertebral fractures in men have been associated with reduced function, increased dependency, and poor quality of life. Men with symptomatic vertebral fractures commonly complain of back pain, loss of height, and kyphosis; they also have significantly less energy, poor sleep patterns, more emotional problems, and impaired mobility when compared with age-matched control subjects. About 20% of asymptomatic vertebral fractures that get clinical attention occur in men [4].

It has been suggested that race and geography might play a role in the different figures of fragility fractures in

men. Whites have a higher rate than African-Americans, and Asians have a lower likelihood of having hip fractures.

In Mexico, one out of 20 Mexican men and one out of 12 Mexican women older than 50 years of age will sustain a hip fracture [5]. The rate of radiographically defined vertebral fractures in Mexican women is high [6] (overall rate of 19.2%), but no data regarding the epidemiology of vertebral fractures in men have been published. The aim of the present study was to determine the prevalence of radiographically defined vertebral fractures by age in a random sample of Mexican men over 50 years and to identify potential conventional risk factors associated with vertebral fractures in this group.

Methods

Study design

A radiographical survey was designed for this study; 413 Mexican men were included from a population-based random sample in the city of Puebla. The random probability sample was generated with the advice of the National Institute of Geography and Statistics (INEGI) in Mexico. We used the last census available to build a stratified sample of 100 men for the following age groupings: 50–59, 60–69, 70–79, and ≥ 80 . We used the demographic information available from every district and group of households blocks within the city and we used the maps and cartography provided by INEGI during the survey.

Before the study began, a training workshop was held with the interviewers to review the questionnaire and survey methods.

Eligible men participated in a face-to-face interview in their homes; after the interview, they were asked to have lateral X-rays of the thoracic and lumbar spine taken. If a man was unable or unwilling to participate, he was replaced by the first man available of the same age stratum, making home visits to houses from right to left of the first assigned house in the same block of households until a man who fulfilled the criteria was found.

The protocol was submitted to and approved by the Institutional Review Board, and a written consent of all participants was obtained before the interview.

Questionnaire

The questionnaire used was originally designed for Latin American Vertebral Osteoporosis Study (LAVOS) [6]. All questions were developed based on the questionnaires of two large studies, the European Prospective Osteoporosis Study (EPOS) and the Study of Osteoporotic Fractures

(SOF) [7, 8], and collected self-reported data on demographics, lifestyle factors, and conventional risk factors for osteoporosis [9]. To assess dietary calcium, we included a semi-quantitative food questionnaire validated in Spanish for the Mexican population [10]. The Sistema de Nutrientes (SNUT) program was used to compute dietary calcium in milligram per day. Commercial calcium supplement intake was calculated according to names and daily doses reported by participants. Alcohol intake was calculated in grams per day (gr/day) using the SNUT program and categorized accordingly to the World Health Organization Audit Program [11] as: never for the subject who did not report alcohol intake, mild from 1–10 gr/day, moderate from 11–40 gr/day, and severe for more than 40 gr/day. The questions assessed the frequency and type of alcoholic beverage during the last year. Physical activity was assessed in minutes per day in accordance to time spent in various activities, including walking, dancing, and cycling among others, and computed for 1 week in the previous year during these activities. Height (cm) was determined by a stadiometer to the nearest 0.1 cm; weight (kg) was assessed using a regularly calibrated scale to the nearest 0.1 kg; and the body mass index (BMI) was computed as weight (kg) divided by the square of the height (m^2), usually defined as a BMI of 19–24.9, overweight 25–29.9, and obese >30 . All other risk factors were self-reported. The questionnaire was originally used for the LAVOS study, terms were for clarification, and the instrument was standardized. We found a 16.5% nonrespondent rate during the survey.

Radiology

Lateral thoracic and lumbar spine radiographs were taken with a 40" tube-to-film distance according to a standard protocol that included details concerning positioning of subjects and radiographic technique. Radiographs were taken with the subject in the left lateral position. The breathing technique was used for the thoracic films. The thoracic film was centered at T7 and the lumbar film at L2. All radiographic studies were done in the same department and collected in our morphometry center in Mexicali. A sample of radiographs was sent to the same center early in the study to verify quality assessment and compliance with the protocol.

All study radiographs were digitized using an AccuTab[®] table, and vertebral dimensions were measured by placement of six points defining the margins of each vertebral body using a cursor with a peripheral device that enters the value of vertebral height in software specially designed to create a database. Six points were marked on each vertebral body from T4 to L4 to define vertebral shape and to describe three vertebral heights—Ha (anterior), Hm (medial), and Hp (posterior)—using the same criteria as SOF [12, 13].

The central reader was trained at the San Francisco Coordinating Center to ensure that the positioning of points was similar to that used in the Study of Osteoporotic Fractures and the Beijing Osteoporosis Project [14]. To test the comparability of the method, a random sample of 10% of Mexican radiographies were sent to San Francisco for morphometric measurements. A good degree of agreement ($\kappa=0.77$, 95%CI 0.64–0.90) was found between readers at the San Francisco Coordinating Center at San Francisco and the Mexican Morphometry Center regarding the identification of normal and abnormal vertebrae.

Definition of vertebral deformity

We used the modified Eastell criteria to define vertebral fracture, and we used the same criteria used in SOF to place the six points in each vertebra [15, 16]. This method starts by deriving normal values of vertebral dimensions from the study population using the statistical trimming method described by Black [12]. The reference normal values for the Latin American countries participating in this study were derived by a biostatistician (L.P.) at the San Francisco Coordinating Center.

A fracture was diagnosed in a vertebral body based on measurements of vertebral heights. A fracture was defined if there was a reduction of three SDs or more from the normal mean for the vertebral level of anterior-to-posterior or middle-to-posterior heights ratios. In addition, a vertebral body was defined as fracture if both the ratio of posterior-to-adjacent posterior and the anterior heights-to-adjacent anterior were reduced by three SDs or more from normal values.

Analysis

The prevalence of asymptomatic vertebral fractures was calculated for each age stratum with a 95% confidence interval. A man with at least one vertebral deformity was considered a case of vertebral fracture. The prevalence of the different risk factors was also estimated in this group. We use a bivariate analysis to estimate the odds ratio and 95% confidence interval; this was followed by a multivariate method—Cox regression model as suggested by Barros AJ and Hirakata [17] to adjust for the different risk factors and the prevalence ratio with 95% confidence interval was estimated. Additionally, we estimated the odds ratios using a logistic regression model (full model and stepwise) as both methods are widely used to report this type of findings. Finally, the prevalence of vertebral fractures was age-standardized with the direct method against Mexican and US populations for comparison [18, 19]. Statistical analyses were performed using Statistical Package for the Social Sciences (12th edition).

Table 1 Prevalence of vertebral fractures per age strata

Age	Total <i>N</i> (num. of fx)	PV 95% IC
50–59	101 (2)	1.9 (0–4.7)
60–69	103 (8)	7.6 (2.4–12.8)
70–79	106 (8)	7.6 (2.5–12.6)
80>	103 (22)	21.4 (13.3–29.4)

Results

The present analysis is based on a total sample of 413 men who had morphometric measurements of their spine radiographs. Table 1 shows the prevalence of vertebral fractures by age strata. As expected, the prevalence of vertebral fracture steadily increased from ages 50–59 years to over 80 years, with a prevalence of 2% (95% CI –0.74–4.70) among those 50–59 years to 21.4% (13.45–29.27) in those 80 years and over ($p=0.0001$).

The prevalence of potential risk factors for fracture is shown in Table 2. It is important to note the high

Table 2 Characteristics of participants

Variable	Mexican men <i>n</i> =413
Age (mean \pm sd)	68.99 \pm 11.64
Height (mean \pm sd)	159.77 \pm 6.69
Weight (mean \pm sd)	69.39 \pm 12.05
Maternal history of Fx	2.4%
Personal history of Fx	13.3%
Body mass index	
Underweight	1.2%
Normal	27.4%
Overweight	49.4%
Obese	22.0%
Height loss	42.4%
Calcium \geq 800 mg	17.9%
Use of steroids	1.0%
Smoking	
Current smoking	22.8%
Ever smokers	40.4%
Never smokers	36.8%
Alcohol intake	
Never	46.0%
1–10 gr/day	48.9%
10–40 gr/day	0.5%
>40 gr/day	4.6%
Physical activity	
\geq 30 min/day	48.2%

prevalence in some of these factors: a little over 40% of the sample had height loss and the proportion of men who were overweight and obese was very high (49.4 and 22.0%, respectively); almost half the sample (48.2%) met the minimal recommendations of physical activity (≥ 30 min/day). Less than one-fourth (22.8%) were active smokers, and only 17.9% of the sample included ≥ 800 mg of calcium in their diets. The multivariate analysis shows a tendency for height loss, but there are no significant differences in any of the risk factors evaluated between the fracture and nonfracture groups (see Table 3). The standardized prevalence per 1,000 men 50 years and over in the Mexican population for the year 2005 are 65.8 (95% CI 29.9–105.5), and they are 68.6 (95% CI 32.2–108.7) in the US population for the year 2000.

Discussion

This is the first study that reports the prevalence of vertebral fractures in Mexican men in which there was an overall prevalence of 9.7% (95% CI 6.85–12.55). The prevalence of vertebral fractures in men is half the prevalence estimated for women (19.2% 95% CI 15.3–33.0) recently published in the LAVOS study using the same methodology [6]. The presence of vertebral fractures rises with age from 2.0% in the youngest group (50–59 years) to 21.4% in the oldest group (80 years and over). This same pattern were found in Mexican women with steady age increments, but the higher prevalence in women starts at age 70, whereas in men, the higher prevalence starts a decade later (80 and over). Different

Table 3 Risk factors for vertebral fracture in Mexican men

Variable ^a	N 413 ^b	%	Bivariate OR (IC 95%)	<i>p</i> value	Multivariate OR (IC 95%)	<i>p</i> value
Maternal history of fractures						
No	39/403	9.7	1		1	
Yes	1/10	10.0	1.04 (0.02–7.84)	0.97	1.37 (0.15–12.64)	0.77
History of fracture						
No	32/358	8.9	1		1	
Yes	8/55	14.5	1.73 (0.69–4.23)	0.28	1.57 (0.612–4.03)	0.34
Body mass index						
Underweight	0/5	0				
Normal	12/113	10.6	1		1	
Overweight	19/204	9.3	0.86 (0.38–1.98)	0.85	1.09 (0.47–2.50)	0.82
Obese	9/91	9.9	0.92 (0.34–2.50)	0.95	1.65 (0.59–4.58)	0.33
Height loss						
No	11/198	5.6	1		1	
Yes	26/175	14.9	2.97 (1.35–6.63)	0.068	2.08 (0.94–4.61)	0.06
Calcium dietary						
<800 mgs	34/339	10.0	1		1	
≥ 800 mgs	6/74	8.1	1.26 (0.48–3.50)	0.77	0.66 (0.25–1.74)	0.40
Smoking						
Never	12/152	7.9	1		1	
Ever	19/167	11.4	1.50 (0.66–3.42)	0.37	1.45 (0.64–3.29)	0.37
Current	9/94	9.6	1.24 (0.46–3.13)	0.37	1.56 (0.58–4.21)	0.37
Alcohol intake gr/d						
Never	23/190	12.1	1		1	
1–10	16/202	7.9	0.67 (0.30–1.28)	0.44	0.74 (0.35–1.58)	0.40
11–40	0/2	0				
>40	1/19	5.3	0.40 (0.01–2.82)	0.48	0.46 (0.05–3.89)	0.48
Physical activity						
0–29 min/day	16/117	13.7	1		1	
≥ 30 min/day	13/199	6.5	0.49 (0.21–1.20)	0.19	0.56 (0.24–1.32)	0.19

^a Multivariable analysis adjusted by age

^b Number of positive observations/total observations for each factor

patterns have been reported in different regions and countries. The European Vertebral Osteoporosis Study [7] found an overall similar frequency of vertebral deformities in their study in 19 European countries, but their sample did not include subjects older than 75 years of age, whereas the substantial increments of vertebral fractures are found in other studies. A higher incidence of vertebral fracture in men was reported in the Rotterdam study, and the incidence increased with age [20]. Similar results were found in the EPOS study where the rate of incidence of morphometric fracture was 9.9 in 1,000 women aged 50–79 per year, with a rate approximately one-half which is 5.7 in 1,000 men per year [21]. Differences in the prevalence between genders have also been reported in the United States (14% in men and 19% in women [22]) In Asia, the prevalence in women 65 years and over was 20% (18–22%) and in men, 12.5% (11–14%) [23]. We conclude that vertebral fractures are more frequent in older age Mexican men, and these figures have to be taken into consideration by Mexican health authorities as they plan future programs oriented to prevent and treat fragility fractures in men.

Included in our questionnaire were several clinical risk factors known to be associated with osteoporosis and fractures, but we were not able to demonstrate differences between the fracture and nonfracture group. The fracture group had a higher frequency of self-reported height loss, however, only a tendency of this was shown in the bivariate and multivariate analysis.

This study has several strengths. The results were based on a random community sample and there was a high rate of participation. This study followed the standardized approaches for recruiting participants, obtaining X-rays, and assessing potential risk factors, and all of the films were assessed centrally using the same methods that have been employed in international studies and in the LAVOS study [6].

Our study also had limitations. It was not specifically designed to characterize the risk factors for vertebral fracture in men; therefore, the sample size was not large enough to find significant association with the risk. As it was a cross-sectional study, we could not assess the association of pain or symptoms with vertebral fractures.

In conclusion, vertebral fractures in Mexican men over 50 years are frequent, it increases with age, and the rise stops after the age of 70 years. Compared with Mexican women, the prevalence of men with vertebral fractures is half that reported for Mexican women using the same methodology (9.7 vs. 19.2, respectively). This pattern of presentation is similar to that reported for other countries.

These figures should alert clinicians and health authorities to this health problem in older Mexican men. Mexico

should implement measures to identify vertebral fractures so as to allocate resources for the treatment and prevention of this condition because, with the growing number of the elderly and the future increments in life expectancy in this country, vertebral fractures could rise to epidemic proportions.

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Conflicts of interest None

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