Characteristics of patients with low-trauma vertebral fractures in the United Arab Emirates: a descriptive multi-center analysis

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Abstract. Vertebral fracture is the most common type of osteoporotic fracture. However, the prevalence of osteoporosis and osteoporotic vertebral fractures were not explored previously in the United Arab Emirates (UAE). This study aims to describe for the first time the demographic and morphological characteristics of patients with fragility vertebral fractures in the UAE through a retrospective review of the medical records of patients with low-trauma vertebral fractures who visited two tertiary centers during 2011–2016. The sex, age at the time of fracture, nationality, body mass index (BMI), and anatomical fracture location were recorded for each patient. Overall, 143 subjects were diagnosed with low-trauma vertebral fractures in the Emirate of Abu Dhabi during 2011–2016. Of these, 98 were women (68.5%) and 45 were men (31.5%). The overall mean patient age at diagnosis was 62.5 years, and almost half were younger than 65 years. Approximately 60% of the patients were UAE nationals. Fifty-one patients (36.7%) were obese (mean BMI: 35.3 kg/m²), and women with vertebral fractures had a significantly higher mean BMI compared with men ($p = 0.041$). Nearly 40% of men had a normal BMI, compared with 20% of women. Most fractures were compression fractures (77.6%) in the thoracolumbar transition region. In conclusion, patients with fragility vertebral fractures were predominantly female and tended to be overweight or obese, although male patients tended to have a lower BMI than female patients.

Key words: Low-trauma, Osteoporosis, Vertebral fracture, Body mass index, Fragility fracture

OSTEOPOROTIC vertebral fractures are the most common type of osteoporotic fracture and most frequently occur at the thoracolumbar junction [1-3]. These fractures cause significant morbidity, such as debilitating back pain, which leads to a decreased functional capacity and deconditioning [4-7]. Such fractures are also associated with mortality [8] and predict the risk of subsequent vertebral fracture [9, 10]. However, osteoporotic vertebral fractures are underdiagnosed [11, 12].

Still, many factors known to associate with sustaining fragility vertebral fractures have been identified, including age, ethnicity, post-menopausal status, body mass

index (BMI), and lifestyle practices [13-18].

Osteoporosis is a global health problem. In the Middle East region, osteoporosis and related fractures are considered an emerging health problem because of population aging and the widespread adoption of unhealthy lifestyles, high BMI levels, high rates of vitamin D deficiency, and other risk factors for osteoporosis [19]. Although no official epidemiological data on the burden of osteoporosis in the United Arab Emirates (UAE) have been gathered, regional demographic similarities suggest that the prevalence is likely similar to the rates of 30.5–49.6% reported in Saudi Arabia [20]. Currently, there is a dearth of research that has addressed the burden of osteoporotic vertebral fractures in the UAE. This study aims to describe for the first time the demographic and morphological characteristics of patients with fragility vertebral fractures in the UAE.

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Abbreviations: UAE, United Arab Emirates; BMI, body mass index; CT, computed topography; BMD, bone mineral density.

Materials and Methods

Study settings and participants

This was a retrospective review of the medical records of patients with low-trauma vertebral fractures who visited two tertiary centers in the Emirate of Abu Dhabi during 2011–2016. The relevant ICD-10 codes for vertebral fracture diagnoses were used to search and identify patients with vertebral fractures in the electronic medical records. All diagnoses of vertebral fracture were made by a certified radiologist. Vertebral fractures were confirmed using either plain spinal-view X-rays or vertebral computed tomography (CT) scans and the Denis scale.

All patients older than 17 years who had been diagnosed with vertebral fragility fractures within the study period were identified. The initial search identified 1,134 patients, of whom 1,129 and 47 had available X-ray and CT scan data, respectively (these groups overlapped), to confirm the vertebral fractures. However, confirmatory images were not available for five patients, and these cases were excluded from the study. After reviewing the records of the remaining 1,129 patients, an additional 986 were excluded because they had traumatic vertebral fractures due to motor vehicle crashes and falls from a height (>2 m). Patients with secondary causes of osteoporosis, such as rheumatological diseases, glucocorticoid use, and malignancy, were also excluded from the study. Finally, one case of incidental fracture was excluded because the date of fracture was unknown. The final number of patients included in this study was 143. This study was approved by the ethical review board of this institution (REC-15.06.2015 [RS-371]) and was conducted in accordance with the Declaration of Helsinki.

Study variables

Information about each patient's sex, age at the time of fracture, nationality, BMI within approximately 6 months of the fracture event, and the anatomical fracture location were extracted from the medical records. Age was categorized into three groups: <40, 40–64, and ≥65 years. Ethnicity was classified as UAE National, Arab, Asian, African, and Caucasian. BMI (kg/m^2) was calculated as the weight (kg)/height (m)² and categorized as follows: underweight (<20 kg/m^2), normal (20 to <25 kg/m^2), overweight (25 to <30 kg/m^2), and obese (≥30 kg/m^2). The exact anatomical locations of the vertebral fractures and the reported type (compression, wedge, and burst) were extracted. The fracture burden was calculated as the number of involved vertebrae per patient.

Statistical analysis

Categorical data are expressed as numbers and percentages. Continuous data are reported as means and stand-

ard deviations. The chi-squared or Fisher's test was used to determine the statistical significance of differences between proportions, and Student's *t*-test was used to compare differences in mean values. Stata 15 (StataCorp. 2017. Stata Statistical Software: Release 15. StataCorp LLC, College Station, TX, USA) was used to perform the analysis. The significance level of the statistical tests was set at 5%.

Results

A total of 1,129 subjects were diagnosed with vertebral fractures in the two participating tertiary centers in the Emirate of Abu Dhabi during 2011–2016. Of these, 143 were diagnosed with low-trauma vertebral fractures. Table 1 presents the general and fracture characteristics of the low-trauma vertebral fractures patients. 98 patients were female (68.5%) and 45 were male (31.5%). The overall mean age at diagnosis was 62.5 years. There were no statistically significant differences in mean age between women and men ($p = 0.207$). In contrast, women with vertebral fractures had a statistically significant higher mean BMI than their male counterparts ($p = 0.041$), although there were no significant differences in the proportions of BMI categories between women and men ($p = 0.174$). Approximately 60% of the patients were UAE Nationals. Most of the fractures were compression fractures (77.6%) followed by wedge fractures (18.2%). There were no statistically significant differences in fracture types or numbers between women and men ($p = 0.718$ and 0.785 , respectively).

A total of 189 vertebrae were affected by fracture among the 143 patients. Of these, 126 and 63 were observed in women and men, respectively. Fig. 1 describes the proportions of the fractured vertebrae. In women, approximately 64% of the fractures affected the T12 (20.6%), L1 (28.6%), and L2 (14.3%) vertebrae (Fig. 1). In men, approximately 60% of the fractures affected the T12 (28.6%), L1 (17.5%), and L2 (14.3%) vertebrae.

Valid BMI measurements were available for only 139 of 143 patients. The patients' characteristics are presented according to BMI category in Table 2. Approximately 37% of patients ($n = 51$) were obese; these patients had a mean BMI of 35.3 kg/m^2 and a mean age of 63.3 years. Overweight and obese patients were more frequent within each age group. However, there were no statistically significant differences in the frequencies of BMI categories between age groups or between different nationalities, fracture types, or burden types.

Table 1 General characteristics of 143 patients diagnosed with low-trauma vertebral fractures at two tertiary centers in the Emirate of Abu Dhabi during 2011–2016

	All patients	Women	Men	<i>p</i> -value
Number (%)	143 (100)	98 (68.5)	45 (31.5)	
Age (mean (SD))	62.5 (18.4)	63.3 (17.2)	60.6 (20.8)	0.207
Age groups				0.133
<40 years	20 (14.0)	11 (11.2)	9 (20.0)	
40–64 years	50 (35.0)	39 (39.8)	11 (24.4)	
≥65 years	73 (51.0)	48 (49.0)	25 (55.6)	
BMI (kg/m ²)* (mean (SD))	28.7 (7.1)	29.4 (7.8)	27.1 (5.1)	0.041
BMI groups*				0.174
Normal (20 to <25 kg/m ²)	45 (32.4)	26 (27.4)	19 (43.2)	
Overweight (25 to <30 kg/m ²)	43 (30.9)	31 (32.6)	12 (27.3)	
Obese (≥30 kg/m ²)	51 (36.7)	28 (40.0)	13 (29.5)	
Nationality/Ethnicity				0.852
UAE	85 (59.4)	59 (60.2)	26 (57.8)	
Arabs	36 (25.2)	24 (24.5)	12 (26.7)	
Asians	12 (8.4)	8 (8.2)	4 (8.9)	
Africans	6 (4.2)	5 (5.1)	1 (2.2)	
Caucasians	4 (2.8)	2 (2.0)	2 (4.4)	
Fracture type				0.718
Compression	111 (77.6)	75 (76.5)	36 (80.0)	
Wedge	26 (18.2)	18 (18.4)	8 (18.8)	
Burst	6 (4.2)	5 (5.1)	1 (2.2)	
Fracture burden (<i>number of fractures per patient</i>)				0.785
1	116 (81.1)	82 (83.7)	34 (75.6)	
2	18 (12.6)	11 (11.2)	7 (15.6)	
3	4 (2.8)	2 (2.0)	2 (4.4)	
4	2 (1.4)	1 (1.0)	1 (2.2)	
5	2 (1.4)	1 (1.0)	1 (2.2)	
6	0	0	0	
7	1 (0.7)	1 (1.0)	0 (0.0)	

All values are presented as numbers (%) unless indicated otherwise.

**n* = 139

BMI, body mass index; SD, standard deviation; UAE, United Arab Emirates

Discussion

This was the first study to explore the characteristics of patients with low-trauma vertebral fractures in the UAE. Our results demonstrate that most patients with fragility vertebral fractures were obese women with a mean age of 63 years. Compression fractures were the most frequently diagnosed type.

Older age was previously reported to be associated with an increased risk of both osteoporosis and osteoporotic fracture. The mean age of the patients with fracture in this study was younger than the ages reported in other parts of the world [5]. This could be explained by the

younger population that resides in the UAE. The majority of UAE residents are younger than 65 years, and almost half of the patients in this study were also younger than 65 years. The high prevalence of overweight, obesity, and vitamin D deficiency [21, 22] in this young population would likely have contributed to a higher prevalence of low BMD and related fractures. The age structure of the UAE is expected to change over time consequent to steady increases in life expectancy and a decline in the fertility rate [23, 24]. These demographic changes are expected to lead to changes in lifestyle practices such as the more widespread adoption of an unhealthy lifestyle and further increases in the BMI, rate of

Fig. 1 Proportions of fractured vertebrae by sex in patients with fragility vertebral fractures diagnosed at two tertiary centers in the Emirate of Abu Dhabi during 2011–2016.

vitamin D3 deficiency, and other potential risk factors. These changes will likely increase the burden of osteoporosis and, subsequently, the number and burden of the associated fractures. We further note that the percentage of fragility fractures affecting patients younger than 40 years was 14%, which is non-negligible and certainly concerning, particularly as those patients did not have any of the previously mentioned secondary causes of osteoporosis. Certainly, genetic and dietary factors would be interesting subjects of future studies.

Similar to previous reports [25], most of the patients with vertebral osteoporotic fractures in this study were female. Interestingly, most of our patients with vertebral fractures were also overweight or obese, and women had significantly higher mean BMI levels than men, with a normal BMI recorded for nearly 40% of men relative to 20% of women. The high BMI among women supports earlier findings by Pirro *et al.*, who reported a higher BMI level (26.5 kg/m²) in women with fractures relative to those without fractures [10]. However, a European study observed a negative relationship between BMI and vertebral fractures [26], and a Moroccan study found that vertebral fractures were less prevalent in obese women [27].

Strengths and limitations

The main strength of this study was the rigorous retrospective chart review design. Moreover, as this study is the first to describe the demographic and morphological characteristics of patients with fragility (*i.e.*, low-trauma) vertebral fractures in the UAE, the results will provide a benchmark for future studies not only in the UAE but also elsewhere in the Middle East, as the populations share similar ethnic backgrounds and lifestyle practices. However, this study was also limited by the small number of included patients and characteristics, the lack of a comparison group, and a lack of BMD measurements. We further note that diabetes mellitus and COPD may also affect bone health, and the inclusion of the true incidence of each condition could have affected the statistical differences between the BMI categories.

Conclusions

Patients with vertebral fractures in our study were predominantly female, and nearly half were younger than 65 years. Overweight and obesity were highly prevalent among fracture patients, and particularly female patients, who had a higher BMI than their male counterparts.

Table 2 Characteristics of 139* patients diagnosed with low-trauma vertebral fractures at two tertiary centers in the Emirate of Abu Dhabi during 2011–2016 according to BMI category

	Underweight (<20 kg/m ²)	Normal (20 – <25 kg/m ²)	Overweight (25 – <30 kg/m ²)	Obese (≥ 30 kg/m ²)	<i>p</i> -value
Number	9	36	43	51	
BMI, kg/m ² (mean (SD))	18.0 (1.4)	23.4 (1.3)	27.5 (1.4)	35.3 (7.1)	
Sex					0.134
Women	7 (7.4)	19 (20.0)	31 (32.6)	38 (40.0)	
Men	2 (4.6)	17 (38.6)	12 (27.3)	13 (29.4)	
Age, years (mean (SD))	48.3 (23.2)	66.1 (19.7)	61.9 (17.1)	63.3 (16.1)	0.068
Age groups					0.169
<40 years	4 (21.1)	5 (26.3)	4 (21.1)	6 (31.6)	
40–64 years	3 (6.1)	11 (22.5)	17 (34.7)	18 (36.7)	
≥ 65 years	2 (2.8)	20 (28.2)	22 (31.0)	27 (38.0)	
Nationality/Ethnicity					0.061
UAE	8 (9.6)	21 (25.3)	24 (28.9)	30 (36.1)	
Arabs	1 (2.9)	6 (17.1)	10 (28.6)	18 (51.4)	
Asians	0 (0.0)	5 (45.5)	6 (54.5)	0 (0.0)	
Africans	0 (0.0)	1 (16.7)	3 (50.0)	2 (33.3)	
Caucasians	0 (0.0)	3 (75.0)	0 (0.0)	1 (25.0)	
Fracture type					0.842
Compression	8 (7.3)	29 (26.6)	32 (29.4)	40 (36.7)	
Wedge	1 (4.0)	6 (24.0)	8 (32.0)	10 (40.0)	
Burst	0 (0.0)	1 (20.0)	3 (60.0)	1 (20.0)	
Fracture burden (<i>number of fractures per patient</i>)					0.070
1	7 (6.3)	26 (23.2)	37 (33.0)	42 (37.5)	
2	1 (5.6)	6 (33.3)	4 (22.2)	7 (38.9)	
3	0 (0.0)	3 (75.0)	0 (0.0)	1 (25.0)	
4	0 (0.0)	0 (0.0)	1 (50.0)	1 (50.0)	
5	0 (0.0)	1 (50.0)	1 (50.0)	0 (0.0)	
6		0	0	0	
7	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	

* A total of 139 of 143 patients with vertebral fracture had a valid BMI.

All values are shown as numbers (%) unless indicated otherwise.

BMI, body mass index; SD, standard deviation; UAE, United Arab Emirates

Acknowledgments

Not applicable.

Data Availability

As the database included in this study is de-identified, it is not available in an open-access repository.

Supporting data can be requested by emailing the corresponding author.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Research Ethics Committee at both centers. Consent to participate is not applicable.

Consent for publication

Not applicable.

Competing interests

Eiman Alseddeeqi, Nihal Bashir, Khaled Al-Ali, and Luai A. Ahmed declare that they have no competing

interests.

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Authors' contributions

All authors (EA, LA, NB, and KA) contributed to the study design. NB and EA accomplished data collection. LA analyzed the material. EA, LA, and KA drafted different parts of the manuscript, and all approved the final version.

Disclosure

This article does not contain any studies with human or animal subjects performed by any of the authors.

Disclosure summary

Eiman Alseddeeqi, Nihal Bashir, Khaled F. AlAli and Luai A. Ahmed declare that they have no conflicts of interest.

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