ORIGINAL ARTICLE

The Prevalence and Risk Factors of Osteoporosis and Osteopenia in Patients Aged more than 50 Years, and Adherence to Osteoporosis Treatment Guideline in a Governmental Hospital in Al-Kharj, Saudi Arabia

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Abstract

Aim: Osteoporosis and osteopenia are common in Saudi Arabia and the burden of management in an aging population will increase in the coming decades. The study aimed to describe the prevalence of osteoporosis and osteopenia among patients more than 50 years old, and identify the risk factors of these conditions, as well as the adherence to the guideline for treating osteoporosis in a government hospital in Al-Kharj, Saudi Arabia. **Methods**: This is a retrospective and case–control study performed at an orthopedic clinic in King Khaled hospital from January 2020 to February 2021. Data were collected retrospectively from the electronic medical records. **Results**: During the study period, 752 patients visited the orthopedic clinic with a mean age of 69.05 (±13.575). About 13.6% of them were diagnosed with osteoporosis and 15.7% of them were diagnosed with osteopenia. The risk factors of having osteoporosis among the study population include being female (Odds Radio = 3.107, $P = 0.001$), having Vitamin D deficiency (OR = 21.447, $P = 0.001$), and having osteoarthritis (OR = 0.459, $P = 0.006$). The risk factors of having osteopenia among the study population include being female (OR = 2.003, $P = 0.82$), having Vitamin D deficiency (OR = 32.657, $P = 0.001$), and having osteoarthritis (OR = 6.185, $P = 0.001$). In the present study, 97.1% of the patients used an appropriate drug that is recommended by the reference guideline. **Conclusions**: Osteoporosis and osteopenia are quite prevalent among the study population. As an early intervention, screening for osteoporosis and Vitamin D levels may be proposed among Saudi individuals aged more than 50 years.

Key words: Bone disorders, osteopenia, osteoporosis, prevalence, risk factors

INTRODUCTION

Osteoporosis is the most prevalent metabolic bone disease.[1] It is a global public health concern; its most notable feature is decreased bone density, which increases the risk of fractures in the affected person.[1] The World Health Organization defines osteoporosis as a mineral density evaluation that is 2.5 standard deviations or more (a T-score of <2.5 SD) below the average value for young and healthy women.[2] There are two types of osteoporosis: Primary and secondary osteoporosis. Primary osteoporosis occurs due to aging while secondary osteoporosis is brought on by idiopathic, medical, or other conditions.[3]

Over 200 million people are thought to be affected by osteoporosis worldwide. With a growing geriatric population, osteoporosis is becoming more and more common.[4] In Saudi Arabia, osteoporosis is a widespread condition; as the population ages, the burden of managing it will rise.[5] The prevalence of osteoporosis and osteopenia in Saudi Arabia is reported to be 37.8% and 28.2%, respectively, in men and

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women over 50, and Vitamin D insufficiency continues to be the predominant risk factor for the disease in the nation.[6]

Risk factors for osteoporosis are separated into two categories modifiable and non-modifiable.[7] The modifiable risk factors include weight, smoking, alcohol use, inactivity, dietary calcium inadequacy, and long-term glucocorticoid use.[8] The non-modifiable risk factors include gender, age, race, and genetics.[7] Other risk factors for osteoporosis in women include premature menopause and loss of ovarian function before menopause.[8] Pouresmaeili *et al*. reported that modifiable risk factors include the lack of physical activity, inadequate nutritional absorption, alcohol consumption, weight loss, cigarette smoking, stress, and air pollution.[9] On the other hand, non-modifiable risk factors include a history of falls, older age, gender, white ethnic background, prior fracture, and family history of osteoporosis.[9] In addition to that, there are secondary causes of osteoporosis such as chronic use of certain medications, hyperparathyroidism, hypogonadism, chronic liver disease, Vitamin D deficiency, inflammatory diseases, diabetes mellitus, renal diseases, dementia, and cardiovascular diseases.[9]

Physicians generally do not follow guidelines for evaluating fracture risk, doing osteoporosis screenings, and treating the condition, including managing it generally in long-term care, according to reports from Greenspan *et al*. and Wall *et al*.[10,11] Furthermore, Iki *et al*. noted that although physician adherence to recommendations for treating glucocorticoid-induced osteoporosis in Japan has improved over the past few years, it is still far from optimal.[12] It is essential to ensure that osteoporosis patients get the proper care as recommended by the guidelines because adherence to osteoporosis treatment is associated with an increase in bone mineral density and a decrease in the risk of fracture.[13] Wiedenmayer *et al*. claim that adhering to established treatment protocols can help to provide diagnoses and treatments that are more trustworthy and accurate, as well as help to avoid improper medication use and any potential negative health effects.[14]

The study aimed to describe the prevalence and risk factors of osteoporosis and osteopenia among patients aged more than 50 years. The study also evaluated adherence to the guideline for treating osteoporosis in a governmental hospital in Al-Kharj.

METHODOLOGY

Study design and setting

The present study was a retrospective study that include reviewing of the medical records to collect data about the prevalence of osteoporosis and osteopenia, the risk factors of osteoporosis and osteopenia, and the medications that were used to manage osteoporosis. The study was conducted in King Khalid Hospital in Al Kharj.

Sample size

The estimated sample size is 216 patients as calculated by using the Steven K. Thompson equation (n = 500, $Z = 1.96$, $d = 0.05$, and $P = 50\%$).[15]

Inclusion and exclusion criteria

The study population will include patients more than 50 years old, both male and female patients from all nationalities, who visited the orthopedic clinic in King Khalid Hospital from January 2020 to February 2021. Patients who have other bone diseases (such as Paget's Disease and Osteomalacia) and patients who have any type of cancer will be excluded from the study. The cases group included the patients who had osteoporosis or osteopenia while the control group included the patients who visited the orthopedic clinic but did not have osteoporosis or osteopenia.

Outcome definition

The prevalence was calculated by dividing the number of patients who had osteopenia or osteoporosis by the total number of patients who visited the orthopedic clinic and after that multiplying the results by 100%. The risk factors were determined by finding the differences between the osteoporosis or osteopenia groups and the control group using Chi-square Independence Test. The factors that differ significantly between the groups were tested by binary logistic regression. The adherence is determined by comparing the prescribed medications for treating osteoporosis in a governmental hospital in Al-Kharj with the 2015 guideline for treating osteoporosis in Saudi Arabia and the American College of Endocrinology Guidelines for the Diagnosis and Treatment of Postmenopausal Osteoporosis-2020. A level of more than or equal to 20 ng/ml of Vitamin D is considered normal. A level of 12 ng/ml to <20 ng/ml was considered insufficient level and a level of fewer than 12 ng/ml indicates Vitamin D deficiency.

Data analysis

Data were analyzed using SPSS version 27.0. The adherence of prescribers to the guideline and the prevalence of osteoporosis and osteopenia were analyzed descriptively and the results were represented as numbers and percentages. The binary logistic regression was used to predict the relationship between the potential risk factors and the occurrence of osteoporosis and osteopenia.

Ethical approval

The protocol was approved by the Ministry of Health Saudi Arabia with an IRB approval number H1RE-28-Dec21-02.

RESULTS

About 752 patients aged more than 50 years visited the orthopedic clinic. More than 13% (n = 102) of them had osteoporosis and about 15% (n = 118) had osteopenia. About 76.5% of the patients who had osteoporosis and 72.0% of the patients who had osteopenia were females (P = 0.000). More than 44% of the patients who had osteoporosis and about 66.9% of the patients who had osteopenia had Vitamin D deficiency (P = 0.000). The present study showed also that 58.8% of the patients who had osteoporosis and 77.1% of the patients who had osteopenia used at least three different drugs. Furthermore, about 41.2% of the patients in the osteoporosis group (P = 0.004) and 78% of the patients in the osteopenia group (P = 0.000) had osteoarthritis [Table 1].

The binary logistic regression showed that female gender, osteoarthritis, and low Vitamin D level were statistically significant independent factors associated with osteoporosis [Table 2].

The binary logistic regression showed also that having osteoarthritis (P < 0.001, OR = 6.185, 95% Confidence Intervals [CI]: 2.805–13.639) and low Vitamin D level (P < 0.001, OR = 32.657, 95% CI: 10.342–103.124) were significantly associated with the development of osteopenia [Table 3].

The guidelines recommended the use of bisphosphonates such as alendronate, risedronate, ibandronate, and zoledronic acid as a first line. The guidelines also recommended the use ofDenosumab and Teriparatide as alternative agents.

Table 1: The prevalence of osteoporosis among patients aged more than 50 years

Demographic characteristics	Osteoporosis case (n = 102)	Osteopenia case (n = 118)	Control (n = 120)	*P*-value
Age, mean±S.D. (years)	64.80±10.90	62.07±9.295	79.40±12.861	0.000 (osteoporosis) and 0.000 (osteopenia)
Gender				
Male	24 (23.5%)	33 (28.0%)	64 (53.3%)	0.000 (osteoporosis) and 0.000 (osteopenia)
Female	78 (76.5%)	85 (72.0%)	56 (46.7)	
Vitamin D level				
Deficiency	45 (44.1%)	79 (66.9%)	4 (3.3%)	0.000 (osteoporosis) and 0.000 (osteopenia)
Normal	57 (55.9%)	39 (33.1%)	116 (96.7%)	
Number of medications				
< 3 drug	42 (41.2%)	27 (22.9%)	89 (74.2%)	0.000 (osteoporosis) and 0.000 (osteopenia)
3 drugs and more	60 (58.8%)	91 (77.1%)	31 (25.8%)	
Concurrent Diseases				
Hypertension				
Yes	13 (12.7%)	0 (0.0%)	18 (15.0%)	0.629 (osteoporosis) and 0.000 (osteopenia)
No	89 (87.3%)	118 (100.0%)	102 (85.0%)	
Diabetes				
Yes	14 (13.7%)	2 (1.7%)	3 (2.5%)	0.002 (osteoporosis) and 0.665 (osteopenia)
No	88 (86.3%)	116 (98.3%)	117 (97.5%)	
Dyslipidemia				
Yes	6 (5.9%)	0 (0.0%)	7 (5.8%)	0.988 (osteoporosis) and 0.008 (osteopenia)
No	96 (94.1%)	118 (100.0%)	113 (94.2%)	
Asthma				
Yes	9 (8.8%)	0 (0.0%)	3 (2.5%)	0.038 (osteoporosis) and 0.084 (osteopenia)
No	93 (91.2%)	118 (100.0%)	117 (97.5%)	
Osteoarthritis				
Yes	42 (41.2%)	92 (78.0%)	28 (23.3%)	0.004 (osteoporosis) and 0.000 (osteopenia)
No	60 (58.8%)	26 (22.0%)	92 (76.7%)	
Other comorbidities				
Yes	14 (13.7%)	3 (2.5%)	0 (0.0%)	0.002 (osteoporosis) and 0.084 (osteopenia)
No	88 (86.3%)	117 (97.5%)	118 (100.0%)	

More than 54% of the osteoporosis patients received denosumab and about 38.24% of them received alendronate. Most of the physicians prescribed a drug that is recommended by the guideline (97.06%). Only 2.94% of them prescribed calcitonin, which is not recommended by the guidelines. Table 5 shows the adherence of the physician to the recommendations of the guidelines.

DISCUSSION

In the present study, the prevalence of osteoporosis in patients aged more than 50 years is 13.56%. Similarly, the National Health and Nutrition Examination Survey, osteoporosis affected 12.6% of persons aged 50 and older and was more common in women (19.6%) than in males (4.4%) at the femur neck, the lumbar spine, or both.[16] Moreover, Yeap *et al*. reported that 14.0% of urban Malaysians in good health had osteoporosis.[17] Moreover, Yang *et al*. reported that in Taiwanese individuals over 50, osteoporosis is prevalent in 1.6% of men and 11.4% of women.[18] On the other hand, several studies showed a higher prevalence of osteoporosis. Hemalata *et al*. reported that osteoporosis (50%) was significantly prevalent among those over 50 who were presented with a variety of musculoskeletal pain disorders.[19] Tariq *et al*. reported that 27.2% of Saudi women between the ages of 20 and 80 had osteoporosis.[20] National Plan for Osteoporosis Prevention and Management in Saudi Arabia reported that the prevalence of osteoporosis in Saudi Arabia is 37.8% in men and women above the age of 50 years.[21]

Table 2: The risk factors of osteoporosis

Variables	OR	95% CI	*P*-value
Female gender	3.107	1.546–6.248	0.001
Vitamin D level	21.447	6.802–67.619	0.000
Osteoarthritis	0.459	0.198–1.061	0.006
Number of medications	1.284	0.613–2.689	0.507
Diabetes	4.490	0.968–20.821	0.055
Asthma	0.353	0.067–1.863	0.22

Table 3: The risk factors of osteopenia

Variables	OR	95% CI	*P*-value
Female gender	2.003	0.915–4.383	0.82
Vitamin D level	32.657	10.342–103.124	0.000
Osteoarthritis	6.185	2.805–13.639	0.000
Number of medications	1.909	0.854–4.271	0.115

For osteopenia, our study reported a prevalence of 15.69% among patients aged more than 50 years. The osteopenia rates in numerous previous studies were higher than the osteopenia rate in the present study. Yeap *et al*. reported that 40.9% of urban Malaysians in good health had osteopenia.[17] Hemalata *et al*. reported that osteopenia (36%) was significantly prevalent among those over 50 who were presented with a variety of musculoskeletal pain disorders.[19] Tariq *et al*. reported that 29.8% of Saudi women between the ages of 20 and 80 had osteopenia.[20] Moreover, the National Plan for Osteoporosis Prevention and Management in Saudi Arabia reported that the prevalence of osteopenia in Saudi Arabia is 28.2% in men and women above the age of 50 years.[6] Therefore, the occurrence of osteopenia in the present study is lower than the global rates.

The present study showed also that female gender and low Vitamin D levels were statistically significant independent factors associated with osteoporosis. The study also showed that low Vitamin D levels were significantly associated with the development of osteopenia. The previous studies showed that the female sex is a risk factor related to osteoporosis and is associated with a lower BMD.[21-24] Osteoporosis has a significant hormonal influence, particularly in postmenopausal women, where reduced estrogen levels have a negative effect on the formation of the bone by increasing the sensitivity to the bone resorption effect of parathyroid hormone. This can cause rapid bone loss as compared to bone formation leading to osteoporosis.

The major risk factor for osteoporosis among the Saudi Arabia population is Vitamin D deficiency.[6] Vitamin D plays a crucial role in blood calcium and phosphate homeostasis supporting the body's metabolic functions, neuromuscular transmission, and bone mineralization.[25] Vitamin D shortage and insufficiency are mostly brought on by decreased renal hydroxylation of Vitamin D, poor nutrition, insufficient exposure to sunlight, and a drop in Vitamin D production in the skin.[26] Old age is an independent risk factor for Vitamin D deficiency.[25] Low calcium and Vitamin D intake are linked to osteoporotic fracture and associated with osteoporosis as well as fragility fractures and increased risk of falls.[27,28] The results of recent studies showed that Vitamin D deficiency could increase the risk of low bone mineral density or osteoporosis, falls, muscle disorders, and fractures due to osteoporosis and falls.[29] The consequences of Vitamin D deficiency are secondary hyperparathyroidism and bone loss, mineralization defects, osteoporosis and fractures, and muscle weakness.[30]

The present study showed also that having osteoarthritis was a statistically significant independent factor associated

Table 4: The recommended drugs in the guidelines

The recommended drugs in the guidelines for treating osteoporosis		
Bisphosphonates such as alendronate, risedronate, ibandronate, and zoledronic acid	Denosumab (human monoclonal antibody)	Teriparatide (parathyroid hormone analog)

Table 5: The medications that were used to treat osteoporosis

Medication	Number of patients	Percentage
Denosumab	56	54.90
Alendronate	39	38.24
Calcitonin	3	2.94
Teriparatide	4	3.92

with osteoporosis and with the development of osteopenia. Low bone mass can occur in children with rheumatological illnesses 38.7–70% of the time, according to Pereira *et al*.[31] Maruotti *et al*. also noted that osteoporosis and fragility fractures are symptoms of several rheumatic illnesses.[32] Im and Kim reported that the bone mass density of the appendicular skeleton in osteoarthritis-affected joints may decrease, particularly in the upper extremities.[33] Horikawa *et al*. assumed that the osteoarthritis of the knee with sudden onset was due to the collapse of subchondral bone with loss of bone mineral density.[34]

The 2015 guideline for treating osteoporosis in Saudi Arabia and the American College of Endocrinology Guidelines for the Diagnosis and Treatment of Postmenopausal Osteoporosis-2020 recommend the use of alendronate, denosumab, zoledronate, and risedronate as initial therapy for most osteoporosis patients with high fracture risk. [Table 4]. The guidelines also informed that several agents such as abaloparatide, romosozumab, and teriparatide should be considered for patients unable to use oral therapy and as initial therapy for patients at very high fracture risk.[35,36] On the other hand, nasal and subcutaneous calcitonin should not be used to treat osteoporosis. The guidelines recommend the use of bone mineral density measurement to monitor the response to therapy.[35,36] The dose of alendronate is 70 mg weekly and must be taken after a prolonged fast and swallowed with a full glass of water. The dose of denosumab is 60 mg by subcutaneous injection every 6 months. Teriparatide is given at 20 µg daily and the dose of calcitonin is 200 IU intranasally daily.[35,36]

In the present study, all of the prescribers gave the proper dosage instructions and appropriate osteoporosis medicine to more than 97% of their patients. On the other hand, Greenspan *et al*. reported a lower adherence rate to the guideline recommendations. They reported that the adherence to osteoporosis treatment recommendations was 88% and increased to 96% after the implementation of a clinician performance initiative.[10] In addition, Iki *et al*. reported that although physician adherence to guidelines for treating glucocorticoid-induced osteoporosis has increased in Japan over the past few years, it is still far from ideal.[12] Non-adherence to guidelines includes incorrect drug selection, improper dose, improper duration, improper frequency, and improper route.

As adherence to osteoporosis treatment is correlated with an increase in bone mineral density and a decrease in the risk of fracture, it is crucial to make sure that osteoporosis patients receive the right care as advised by the guidelines.[13] According to Wiedenmayer *et al*., following established treatment protocols can contribute to more reliable and accurate diagnoses and treatments and prevent the inappropriate use of medications and the potentially harmful health effects that can arise.[14]

CONCLUSION

Osteoporosis and osteopenia are quite prevalent among the study population. Vitamin D deficiency was one of the risk factors for developing osteoporosis and osteopenia; therefore, screening of Vitamin D levels may be proposed among Saudi individuals aged more than 50 years. The adherence of health-care providers to the treatment guideline was good.

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