Evaluation of Osteoporosis Frequency in Patients With Recurrent Kidney Stones

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Abstract- Osteoporosis is defined as a reduction in bone density up to 2.5 standard deviations less than the maximum mean bone density in humans. It is estimated that 50% to 80% of the differences in the bone mass of the individuals are related to their genetic and heredity. The prevalence of osteoporosis is 6% in Iran, in which it is more than Japanese and less than in the United States. In this cross-sectional descriptive-analytical study, patients with a history of recurrent kidney stones (those who had referred to the stone clinic more than one time) undergoing bone density measurement using the DEXA method to determine the presence or absence of osteoporosis (Reduction of bone density up to 2.5 standard deviations less than the maximum mean bone density) were enrolled. Exclusion criteria were patients with metabolic diseases, corticosteroid intake, renal failure, hyperparathyroidism, and age >60 years. According to the results of this study, there were 61 patients with a history of recurrent kidney stones, which 34 of them (55.74%) were male and 27 (44.26%) were female; the mean age was 42.41±9.8 years (ranging from 18 to 60 years). Evaluation of frequency distribution of patients showed that 18% of patients had osteoporosis. In this study, 52.5% of patients were without osteoporosis and osteopenia. It should be noted that 29.5% of patients had only osteopenia. The frequency distribution of osteoporosis in patients with a history of recurrent kidney stones by gender showed that four males (36.4%) and seven females (63.6%) had osteoporosis. There was no significant relationship between gender and osteoporosis in patients with a history of recurrent kidney stones (*P*=0.153). There was also no significant relationship between gender and osteopenia in these patients (*P*=0.380). There was no significant relationship between age and osteoporosis in patients with a history of recurrent kidney stones (*P*=0.203). There was no significant relationship between BMI and osteoporosis in patients with a history of recurrent kidney stones (*P*=0.344). There was no significant relationship between osteoporosis with age and BMI in patients with a history of recurrent kidney stones, and the highest percentage of osteoporosis was in the spine region, which consisted of 8.2% of all patients. There was no significant relationship between osteopenia with gender and BMI in patients with a history of recurrent kidney stones, but there was a significant relationship between age and osteopenia in patients with recurrent kidney stones.

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Keywords: Recurrent kidney stones; Osteoporosis; Osteopenia

Introduction

Osteoporosis is now defined as a disease that is characterized by reduced bone density and loss of bone microstructure quality, which itself leads to an increase in bone fragility and fracture risk (1). The World Health Organization (WHO) has defined osteoporosis as a reduction in bone density up to 2.5 standard deviations less than the maximum mean bone density in the community (2,3). Osteopenia is defined as a reduction in bone density between -2.5 and - 1 standard deviation less than the mean maximum bone density (-1 ≤T-score

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≤-2.5) in young people. People with a T score≥ of -1 are considered as a normal person. It is estimated that 50-80% of differences in bone mass in individuals are related to genetic and heredity (4). Other factors that contribute to this issue include environmental factors, physical activity, nutrition, and puberty. Some studies have identified intrauterine growth as one of the effective factors in this regard, as there is a correlation between birth weight, the growth rate in childhood, and maximum bone density (5-7).

Menopause and loss of sexual steroids can lead to high bone turnover and low bone density, as well as is a very important factor in the incidence of osteoporosis in women; steroids are also important in men (8). The prevalence of osteoporosis in women over the age of 50 is ranging from 16% in Canada and Mexico to 6% in Iran. In 2001, a comprehensive study on prevention, diagnosis, and treatment of osteoporosis showed that osteoporosis in Iranians was higher than in Japanese and lower than the Americans (9). The prevalence of pelvic fracture is higher in white people than in non-white individuals. People in the Scandinavian region, from North American to Oceania, are more likely to develop pelvic fractures (10,11). The use of glucocorticoids and vitamin D deficiency is a major risk factor for osteoporosis and pathologic fracture (12-16). The high consumption of coffee, equivalent to more than 4 lbs per day in men and women, has been significantly associated with an increased risk of osteoporosis, but no such effect has been observed in tea consumption (17).

According to various studies, osteoporosis is associated with recurrent kidney stones, and urinary stones are a common urological complaint, affecting about 10% of the world's population. Calcium stones are the most common type of kidney stones; calcium oxalate stones are the most common (18,19). Iran is one of the countries located in the kidney stone belt. The prevalence of stones in Iran is 2-3% (20,21). As the age increases, the incidence of kidney stones increases, so that men are likely to have more than women (1.15 to 1) in Iran (22). Recurrence of kidney stones is common in the world, and it is estimated that 50% of the stones will recurrence within ten years (23,24). In Iran, the mean of recurrence was 16% after one year, 33% after five years, and 53% after ten years (25). It has been shown in various studies that 90% of the patients with calcium stones have a metabolic disorder affecting bone metabolism and reducing bone density and osteoporosis (26,27). Several studies have shown that over 60% of patients with idiopathic calcium stones have hypercalciuria (28-31). Decreased bone mineral density was seen, even in patients with normal levels of calcium, which indicates other factors involving in this process (32). Many studies have shown that dietary calcium restriction not only reduces gastric uptake but also alleviates calcium balance and bone loss (33,34). Recurrence is often associated with calcium and phosphate metabolism abnormalities (35-37). For this reason, the evaluation of bone mineral content in this group needs more attention. In this study, we tried to examine the status of patients with a history of kidney stones that referred to the Urology Clinic for the presence of osteoporosis and its correlation with effective factors.

Materials and Methods

In this cross-sectional study, sixty-one patients referred to the Urology Stone Clinic in 2018 were required to record the necessary data for study purposes, and patients with a history of recurrent kidney stones (those who had referred to the stone clinic more than one time) were examined to see their bone density using DEXA method to determine the presence or absence of osteoporosis (bone density decreased by 2.5 standard deviations less than the maximum mean bone density). The data were analyzed by a cross-sectional descriptive-analytic approach. Exclusion criteria were patients with metabolic diseases, corticosteroid intake, renal failure, hyperparathyroidism, and age over 60 years. The data needed to assess the relationship between osteoporosis and recurrent kidney stone formation and to measure the specific goals of the study were collected using a pre-prepared checklist. This study was approved by the ethic committee of Urmia University of Medical Sciences (#IR.UMSU.REC.1396.138)

Statistical analysis

The data were analyzed using SPSS 20 software. For descriptive purposes, frequency, mean, and standard deviation were calculated. A *Chi*-square test was used to measure the analytical objectives of qualitative variables, and an independent t-test was used for quantitative variables. A *P* less than 0.05 was considered significant for decision making about research hypotheses.

Ethical issues

To obtain data from the university's research and technology department, permission was obtained from Urmia University of Medical Sciences. At all stages of data collection, logging into the computer and

performing data analysis, the confidentiality of the data has been considered, and the results have been published without the name. Also, the patients were satisfied with written consent for measuring their bone density.

Results

In this descriptive-analytical study, 34 patients (55.7%) were male, and 27 (44.3%) were female among 61 patients with a history of recurrent kidney stones, which had a mean age of 42.49±9.8 years (ranging from 18 to 60 years). Frequency distribution of patients according to osteoporosis in patients with a history of recurrent kidney stones showed that 82% of patients did not have osteoporosis. Five patients (8.2%) had osteoporosis in the spine region, 3 of them (4.9%) had hip osteoporosis, 1 (1.6%) had forearm osteoporosis, 1 had radius and hip osteoporosis, and 1 of them (1.6%) had both hip and spinal region osteoporosis. Frequency distribution of patients according to osteopenia in patients with a history of recurrent kidney stones showed that 29.5% of patients had osteopenia; 13 patients (21.31%) had hip osteopenia, 2 (3.27%) had spine osteopenia, and 3 (4.91%) had hip and spine osteopenia (Table 1).

Table 1. Frequency distribution for osteoporosis in patients with a history of repeated

Variable			Frequency	Percent
Osteoporosis status	**No**		50	82
	Yes	Spine Osteoporosis	5	8.2
		Hip Osteoporosis	3	5
		Radius Osteoporosis	1	1.6
		Radius & Femur Osteoporosis	1	1.6
		Hip & Spine Osteoporosis	1	1.6
Osteopenia status	**No**		43	70.4
	Yes	Hip Osteopenia	13	21.3
		Spine Osteopenia	2	3.2
		Hip & Spine Osteopenia	3	4.9

Frequency distribution of osteoporosis in patients with a history of recurrent kidney stones showed that 45.5% of patients with osteoporosis were less than 45 years of age, and 54.5% of them were between 45 and 60 years of age. Frequency distribution of osteoporosis in patients with a history of recurrent kidney stones in their gender disorder indicates that four males (36.4%) and seven females (63.6%) had osteoporosis, which did not show a significant relationship between osteoporosis and gender (P=0.153). The frequency distribution of osteoporosis in patients with a history of recurrent kidney stones showed that 45.5% of patients with osteoporosis have normal BMI, and 45.5% of them were overweight, and 9.1% were obese. There was no significant relationship between gender and osteoporosis in patients with a history of recurrent kidney stones (P=0.153). There was no significant relationship between gender and osteopenia in patients with a history of recurrent kidney stones (P=0.380). There was no significant relationship between age and osteoporosis in patients with a history of recurrent kidney stones (P=0.203). There was a significant relationship between age and osteopenia in patients with a history of recurrent kidney stones (P=0.016). There was no significant relationship between BMI and osteoporosis in patients with a history of recurrent kidney stones (P=0.555). However, there was no significant correlation between BMI and osteopenia in patients with a history of recurrent kidney stones (P=0.103) (Tables 2 and 3).

Table 2. Relationship between BMI, age and osteoporosis type

Variable		Osteoporosis		Statistic
		Yes	No	
Gender	**Male**	4	30	P=0.153
	Female	7	20	X^2=2.042
Age	**<45**	5	33	P=0.203
	45-60	6	17	X^2=10.162
BMI	**18.5-24.99**	6	12	P=0.103
	25-29.99	7	23	X^2=4.545
	>30	5	8	

Table 3. Relationship between BMI, age and osteopenia type in patients with a history of repeated

Variable		Osteopenia		Statistic
		Yes	No	
Gender	**Male**	9	25	*P*=0.380
	Female	9	18	X^2=0.341
Age	**<45**	7	31	*P*=0.016
	45-60	11	12	X^2=5.956
BMI	**18.5-24.99**	5	13	*P*=0.55
	25-29.99	5	25	X^2=1.178
	>30	1	12	

Discussion

Osteoporosis is a bone disease that decreases bone strength and increases the risk of fractures. There are some pieces of evidence for accompanying recurrent kidney stones and osteoporosis (37). Based on the results of this study, 61 patients with osteoporosis and a history of recurrent kidney stones entered the study; most of them were young adult men. The frequency of osteopenia in patients with a history of recurrent kidney stones after BMI evaluation revealed that 33.3% of subjects with osteopenia had normal BMI, and 38.9% of them were overweight, and 27.8% were obese. In the study of the frequency of osteopenia by age group, 38.9% of patients with osteopenia were less than 45 years of age, and 61.1% of them were between 45 and 60 years of age, and also in the study of their osteopenia by gender, 9 (50%) of males and 9 (50%) of females had osteopenia. Frequency distribution of patients according to osteoporosis in patients with a history of recurrent kidney stones reveals that 82% of patients were without osteoporosis. Five patients (8.2%) had spinal region osteoporosis, 3 of them (4.9%) had hip osteoporosis, one patient (1.6%) had forearm osteoporosis, and 1 (1.6%) of them had both radius, femoral and one patient with both the spine and hip osteoporosis. The results of Mobini *et al*., in 2017 showed that bone density in the waist region was 851.0±0.17 gr/m^2 in the kidney stone group and 0.946±0.13 gr/m^2 in a group without kidney stone (*P*=0.001). However, the results of this study showed that 59% of patients did not have osteopenia (38).

Frequency distribution of patients according to osteoporosis in patients with a history of recurrent kidney stones showed that 18% of patients had osteoporosis. In this study, 52.5 % of the patients were healthy and normal. It should be noted that 29.5% of patients had only osteopenia. But in a study done conducted by Yarmohammadi *et al*., according to the results of densitometry of the neck, femur, and waist, osteopenia and osteoporosis have been reported more in postmenopausal women that were not consistent with our study (39). The study of Bazrafshan *et al*., in 2011 (40) showed a statistically significant relationship between age and bone mineral density of the lumbar spine and femur area. The relationship between body mass index and bone mineral density in the lumbar region was statistically significant, which was inconsistent with the present study, but this relationship was not significant in the femur area. Evaluation of the frequency distribution of osteoporosis in patients with a history of renal stones with their age groups shows that 45.5% of subjects with osteoporosis were less than 45 years of age, and 45.5% of them were between 45 and 60-year-old. There was no significant relationship between age and osteoporosis in patients with a history of recurrent renal stones. There was a significant relationship between age and osteopenia in patients with a history of recurrent renal stones. Frequency distribution of osteoporosis in patients with a history of recurrent renal stones, with BMI, shows that 45.5% of subjects with osteoporosis have normal BMI, and 45.5% of them were overweight, and 9.1% were obese. There was no significant relationship between BMI and osteoporosis in patients with a history of renal stones. In a study conducted by Hosseinnezhad *et al*., (41) in 2003, women with kidney stone had a high prevalence of osteopenia and osteoporosis (53.3% and 16.7%, respectively) and women without kidney stone had osteopenia and osteoporosis (35.7% and 11.2%, respectively). Frequency distribution of osteoporosis in patients with a history of repeated by gender showed that four males (36.4%) and seven females (63.6%) had osteoporosis. There was no significant relationship between gender and osteoporosis in patients with a history of recurrent renal stones. There was not a significant relationship between gender and osteopenia in patients with a history of recurrent renal stones. In a study by Fouladi *et al*., in 2012 (42), the mean BMI was 25.80±3.8. There was no significant relationship

between the type of stone and occupation of patients, place of residence, history of previous disease, BMI of patients, and history of drug use, which was consistent with the present study. Sometimes, imaging triggers the differential diagnosis of osteoporosis (43). Radius, hip and spine bones can be selected to assess the osteoporosis using imaging (44).

There was no significant relationship between osteoporosis with age and BMI in patients with a history of recurrent renal stones, and the highest percentage of osteoporosis was in the spine region, accounting for 8.2% of all patients. There was no significant relationship between osteopenia with gender and body mass index, but there was a significant relationship between age and osteopenia in patients with recurrent renal stones

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