ORIGINAL RESEARCH ARTICLE

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Comparison of the Osteoporosis between Male Smokers with and without Chronic Obstructive Pulmonary Disease

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ABSTRACT

***Background**: Osteoporosis is the most common metabolic bone disease that represents an increasingly serious problem, particularly as the population ages. It occurs because loss of bone mineral content. Osteoporosis, thus, causes significant morbidity, especially in elderly, due to recurrent pathologic fractures. It has been suggested that Chronic Obstructive Pulmonary Disease (COPD) is a risk factor for osteoporosis. We intended to investigate the relationship between COPD and osteoporosis in our patient population.*

***Materials and Methods**: Setting: Pulmonary diseases division of Hazrate Rasool-e-Akram hospital. Design: It is a case- control study. Target: One hundred volunteer men with history of at least 20 pack year cigarette smoking were sequentially assigned into two groups: 50 patients with COPD (according to the result of spirometry) and a control group of 50 individuals of matching age. Interventions: All individuals were underwent Bone Mass Densitometry (BMD) by Dual-Energy X-Ray Absorptiometry (DEXA), and Pulmonary Function Testing (PFT). Statistical Analysis: The data was processed using descriptive statistical analysis and t-test and χ^2 test.*

***Results**: The frequency of osteoporosis in our patient and control groups were 52% (26 patients) and 8% (4 persons), respectively. The mean T-score value of spinal bone density in patient and control groups were -1.15 and +0.62 respectively ($p<0.0001$). The mean T-score value of femoral bone density was -2.58 in patient group and -0.49 in controls ($p<0.0001$). There was a statistically significant correlation between the presence of osteoporosis with both the severity and duration of COPD ($p <0.0001$). However, BMD was not correlated with the body mass index (BMI), age or the amount of cigarette smoking. Patients with COPD are 12.5 times more likely than their controls to develop osteoporosis (OR: 12.46, CI 95% = 3.9 – 39.85).*

Conclusion**: Our study confirms that COPD is a risk factor for osteoporosis. There may be many contributing factors such as immobility, chronic respiratory acidosis and the use of gluccocorticoids. Therefore, prevention of osteoporosis should be a part of medical care for COPD patients. **(Tanaffos 2004; 3(9): 13-18)

***Key words**: Osteoporosis, Chronic obstructive pulmonary disease (COPD), Systemic steroid, Smoking.*

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INTRODUCTION

Osteoporosis is the most common metabolic bone disease and represents an increasingly serious problem, particularly as the population ages. Elderly white women are the most affected group by osteoporosis. However, osteoporosis is commonly seen in both sexes, all races and all age groups.

T-score is a value that compares the patient's bone mass density to the individuals at their peak bone mineral density. Osteoporosis is defined by the World Health Organization as a T-score of <-2.5. Also, osteopenia defined as a $-2.5 \leq$ T - score ≤ -1 (1).

Osteoporosis can result in devastating psychosocial, physical, and economic consequences. Despite its great importance, osteoporosis often remains overlooked and undertreated, mainly because it is a clinically silent disease until it manifests in the form of a pathologic fracture (2). It is important to define causes and risk factors of osteoporosis. Some of these causes are determined, including female sex, advanced age, hormonal disturbances, alcohol, smoking, genetic factors, and low calcium intake (1).

There are other conditions that have been suggested to be risk factors for osteoporosis, although their definitive role has not been proven. Among those, COPD is one of the most common debilitating diseases that have been linked to the development of osteoporosis (3,4,5).

Karadag F et al. in there study on 28 male patients with COPD and 20 normal volunteer men observed that osteoporosis is not more common in the patients group (6).

Furthermore, Johnell et al. showed that treatment with inhaled corticosteroid did not increase the risk of osteoporosis in patients with COPD (7).

New the question is, must patients with COPD, at least those with moderate to severe disease, be screened for osteoporosis? To answer this question and debate the controversies in this regard, we investigated the relationship between chronic obstructive pulmonary disease and osteoporosis in our studied population.

MATERIALS AND METHODS

The study was conducted in pulmonary and gastrointestinal diseases divisions of Hazrate Rasool-e-Akram Hospital, affiliated to Iran University of Medical Sciences. Volunteer men with the history of at least 20 packed year smoking cigarette status were chosen. Patients with history of using systemic steroid (at least for 4 month during the recent year), severe medical co-morbidities; including liver cirrhosis, thyroid dysfunction and rheumatologic disorders, malignancies, chronic renal disease (Creat >2.0 mg/dl) and patients treated with bisphosphonate, erygocalciferol, levothyroxin, lithium, calcium and vitamin D preparations were excluded.

Eventually, by using a sequential method, 100 volunteers were assigned into two groups: patients group (50 people with COPD) and the control group (50 people without COPD according to the spirometry).

The study was conducted in a case- control design. The following parameters were obtained for both patient and control groups: age, body mass index (BMI), amount of smoking (pack/ year), FEV1 (percentage of predicted value), the presence of COPD (FEV1/FVC<70% and non-responding to bronchodilator) and the presence of osteoporosis (a T-score of <-2.5) according to the result of bone mineral densitometry (BMD).

A thorough history was taken and the spirometry values were obtained by using CHESTAC-55V spirometer. A Norland XAi46 DEXA scanner was used to calculate the bone mass density. The data was analyzed by SPSS 11.50 package and using descriptive statistical analysis and t-test and χ^2 test.

Based on the amount of smoking, both patient and

control groups were divided into three subgroups: 20-29 pack/year, 30-39 pack/year, and ≥ 40 pack/year.

Meanwhile, the patient (COPD) group was assigned into 3 subgroups based on the duration of disease: ≤ 10 years (44 patients = 88%), 11-20 years (3 patients = 6%) and >20 years (3 patients = 6%). Likewise, patients were classified to 3 subclasses classes with respect to the severity of disease, based on the results of spirometry (according to ATS criteria): mild (FEV1 61-80%), moderate (FEV1 41-60%) and severe (FEV1 ≤ 40%) respectively, there were 12, 16 and 22 patients in each subgroup.

RESULTS

According to spinal densitometry, the frequency of osteopenia in COPD and control groups were 36% (18 patients) and 14% (7 controls), respectively. However, osteoporosis was detected in 13 (26%) patients and 2(4%) controls.

Using femoral neck densitometry results, the frequency of osteopenia in COPD and control groups were 24% (12 patients) and 20% (10 subjects) respectively. Moreover, our data showed that 52% (26 patients) of COPD group and 8% (4 subjects) of control group suffer from osteoporosis.

Adding up the results of spinal and femoral neck densitometry, the cumulative frequency of osteoporosis in COPD and control groups were 52% (26 patients), and 8% (4 persons) respectively. (Figure 1).

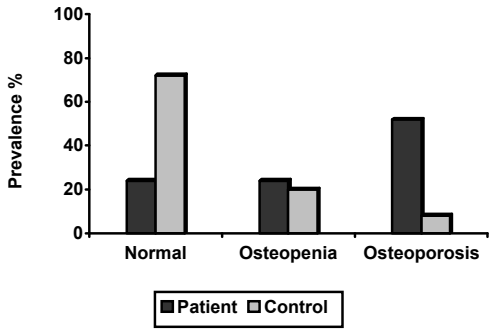

Figure 1. Distribution of cases and controls according to osteoporosis and osteopenia.

Table 1 demonstrates the baseline characteristics of both COPD and control groups. As noted the mean (±SD) age of the patients and controls were 69.34 ± 9.47 and 70.5±7.79 years, respectively.

Table 1. Baseline characteristics of 50 patients with COPD and 50 control subjects *

	Patient group (n=50)	Control subjects (n=50)	p-value
Age (year)	69.34 ± 9.49 (50-92) †	70.50 ± 7.79 (56-85)	NS
Duration of COPD (year)	6.69 ± 6.38 (1-30)	-----	
Smoking (p/y)	34.76 ± 18.32 (20-130)	29.62 ± 7.01 (20-45)	NS
T-score of spine	- 1.15 ± 1.60 [(-3.4)-(+2.72)]	0.62 ± 1.51 [(-2.86)- (+3.19)]	< 0.0001
T-score of femur	- 2.58 ± 1.68 [(-5.13)- (+1.00)]	-0.49 ± 1.42 [(-4.10)-(+2.14)]	< 0.0001
FEV1 (%)	44.78 ± 15.84 (20-74)	89.08 ± 8.56 (78-110)	
BMI (kg/m2)	23.15 ± 3.93 (12.70 – 32.45)	23.27 ± 3.81 (14.88-33.91)	NS

* Values are presented in mean ± standard deviation.

† Figure in the parenthesis reflect the lower and upper limits.

FEV 1: Forced expiratory volume in 1 second, BMI: Body mass index,

p/y: pack/ year, NS: Not significant

T-test and χ^2 test showed no significant statistical difference between the mean values of the age and the body mass index (BMI) in two groups ($p > 0.05$). Moreover, using the same statistical analysis, our data showed that there was no significant correlation between the amount of smoking (p/y) and prevalence of osteoporosis ($p>0.05$). Data analysis confirmed that there was a significant statistical correlation between both the duration of COPD and the prevalence of osteoporosis ($t =7.4$, $df = 49$, $p <0.001$). Moreover, there was a significant statistical correlation between the severity of COPD and the prevalence of osteoporosis ($t = -17.39$, $df = 75.4$, $p <0.0001$).

Finally the study showed that:

- There was significant statistical correlation between COPD and osteoporosis with Spinal densitometry ($\chi^2=20.98$, $df=2$, $p<0.0001$).
- There was significant statistical correlation between COPD and osteoporosis with Femoral neck densitometry ($\chi^2=28.32$, $df=2$, $p<0.0001$).
- The risk of osteoporosis in patients with COPD is almost 12.5 fold more than the control group (OR: 12.46, CI 95% = 3.9-39.85).

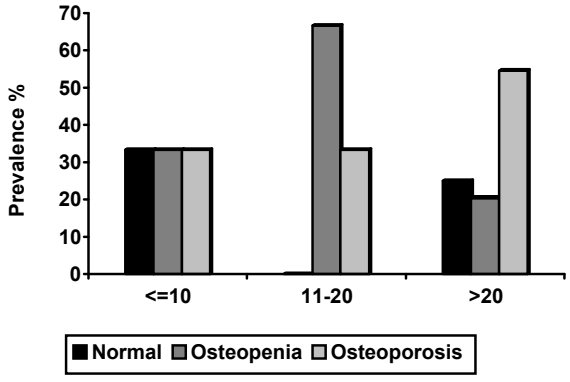

Figure 2. Prevalence of Normal Densitometry, Osteopenia and Osteoporosis According to duration of COPD

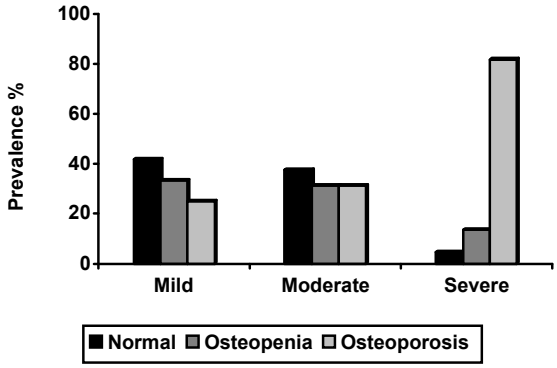

Figure 3. Prevalence of normal densitometry, Osteopenia and Osteoporosis according to severity of COPD

DISCUSSION

Our results revealed that the frequency of osteoporosis, defined as T-score<--2.5, in patients with COPD is much more than their controls. Indeed, COPD patients are 12.5 times more likely to develop osteoporosis. Age, BMI and amount of smoking did not prove to play as a risk factors for developing osteoporosis.

Furthermore, we have noticed a significant association between osteoporosis and COPD duration and severity.

Katsura and Kida have reported osteoporosis is 50% of their studied group that is in agreement with our findings (5). Regarding the T-score of the spine and femoral neck region, we have found significant difference between the COPD patients and their controls, whereas, Karadag et al. failed to find such differences. We noted a mean T-score of –1.15 and +0.62 in patients and controls, spine region respectively. Related figures in Karadag et al. study was +0.87 and +0.85 ($p<0.9$ vs. $p< 0.0001$ in our study).

Similarly, the mean T-score value of femoral bone density in our patients and controls were -2.58 and -0.49, respectively, whereas in Karadag et al. study

these values were +0.79 and +0.79 ($p<0.68$ vs. $p<0.0001$ in our study)(6).

Of course, it is worth stating that, to our knowledge, Karadag et al. study was the only one which has not detected a significant association between COPD and osteoporosis; however, they have noted relationship between bone mass density and severity of airway obstruction in COPD subjects. However, Karadag et al. performed their study in patients that were clinically stable and perfectly cured, thus, this choosing may be affecting.

CONCLUSION

According to our results and majority of the similar studies, COPD is a risk factor for osteoporosis. It is necessary for pulmonologist to accentuate for preventive and cure strategies to reduce morbidity of osteoporosis in these patients.

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