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Incidence of Osteoporosis in COPD Patients in Iraqi Patients and its Relation to Various Risk Factors

Dr. Abbas Mustafa Hassan[1], Dr. Husam Mohammed Ali Salih[2] and Dr. Ayad Hameed Tailan[3]

[1]M.B.Ch.B., D.M. (Respiratory Medicine), Ministry of Health, Al-Russafa Health Directorate, Al-Numan General Hospital, Baghdad, Iraq

[2]M.B.Ch.B., D.M. (Respiratory Medicine) ,Ministry of Health, Karbala Health Directorate, Imam Hussein Medical City, Karbala, Iraq

[3]M.B.Ch.B., C.A.B.M.S. (Nephro) & C.A.B.M.S. (Medicine), Iraqi Ministry of Health, Thi-Qar Health Office, Al-Nasiryah Teaching Hospital, Thi-Qar, Iraq

Abstract: Background: Chronic obstructive pulmonary disease (COPD) is a syndrome of progressive airflow limitation caused by the abnormal inflammatory reaction of the airway and lung parenchyma. Osteoporosis is one of the major extrapulmonary manifestations of COPD. The prevalence of osteoporosis in COPD patients in the Iraqi population is unknown. **Objectives:** To study the incidence of osteoporosis among COPD patients and its relation to various risk factors. **Materials and Methods:** The study was done in different hospitals in Iraq. All the diagnosed cases of 70 COPD patients, according to the GOLD guidelines, were included in this study. The present study was a cross-sectional study during the period of August 2021 - October 2022. A brief history of the patients was taken, especially regarding the duration of illness, number of exacerbations in the past three years, smoking in pack years, and history of steroid use (both systemic and inhaled steroids), after which cumulative dose of steroids was calculated. Spirometry was done in all these patients to stage the severity of COPD according to GOLD criteria. A DEXA scan of the lumbar spine was done using a bone densitometer to determine osteoporosis. (WHO) The criterion for the definition of osteoporosis was applied, and patients with a T-score of below −2.5 standard deviation (SD) were diagnosed to have osteoporosis, −1 SD to −2.5 SD were diagnosed to have osteopenia, and more than −1 SD as normal. **Results:** A total of 70 COPD patients were included in this study; among these, 36 patients (51.4%) had osteoporosis, and 23 patients (32.8%) had osteopenia. Majority (94.4%) of the patients who had osteoporosis had stage III and stage IV COPD disease. It was observed that as the severity grade of COPD increased, the risk of osteoporosis also increased. The bone mineral density (BMD) showed a significant difference among different stages of COPD. It was also observed that patients with lower body mass index (BMI) had a higher prevalence of osteoporosis (91.7%) as compared to overweight patients. On univariate analysis, it was observed that risk factors for osteoporosis were female sex, higher number of exacerbations, BMI, and severity of COPD. After using multivariate analysis, stage IV COPD, number of acute exacerbations >3 in the previous three years, and steroid cumulative dose >1000 mg were observed to be significant risk factors for osteoporosis in COPD patients. **Conclusions**: In the present study, osteoporosis was a high incidence, more than 50 %, and for osteopenia was less incidence (32.8%). As the severity of COPD increased, the risk of osteoporosis increased. Low BMI, use of systemic steroids, and repeated number of exacerbations were found to be significant risk factors for osteoporosis in COPD patients.

Keywords: Osteoporosis, COPD, BMI .

INTRODUCTION

Osteoporosis is a condition characterised by reduced bone density and an increased risk of fractures. It is a growing concern for patients with chronic obstructive pulmonary disease (COPD). (Murray, C. J. *et al*., 1997). COPD, a chronic respiratory disease affecting millions worldwide, not only impairs lung function but also has a profound impact on the skeletal system. As researchers delve deeper into understanding the relationship between COPD and osteoporosis, evidence is emerging that suggests a strong link between the two conditions. (Hogg, J. C. *et al*., 2009)

The aim of this study is to provide a clear understanding of the relationship between COPD and osteoporosis, as well as explaining technical terms when first used. This article aims to explore the occurrence of osteoporosis in patients with COPD, highlighting the risk factors, underlying mechanisms, and potential implications for clinical management. In addition, the article adheres to conventional structures with factual titles, clear, objective language, and grammatical correctness, avoiding biased language and ambiguity. (Burrows, B. *et al*., 1977).

Finally, it follows a formal register, adhering to British English conventions and providing precise word choice. By considering this frequently neglected comorbidity, healthcare professionals can enhance the care provided to COPD patients and perhaps prevent the catastrophic outcomes of osteoporotic fractures (4).

Risk factors for osteoporosis in COPD patients include low body mass index (BMI), increased COPD severity, use of oral corticosteroids, and high-sensitivity C-reactive protein (hs-CRP)

***Corresponding Author:** Dr. Abbas Mustafa Hassan

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(Abbasi 2016, Rittayamai 2012, Chen 2019). For clarity, abbreviations of technical terms are explained the first time they are used. Significantly, BMI and hs-CRP are linked to osteoporosis (Krall, E. A. *et al*., 1991; Fabbri, L. M. *et al*., 2008)

The papers suggest that the presence of COPD increases the likelihood of having osteoporosis and fractures.

In the present study found that oral corticosteroids increased bone resorption and decreased bone formation, while inhaled corticosteroids increased bone loss and fracture risk. Meanwhile, identified deleterious effects of inhaled corticosteroids on bone mineral density and markers in patients with COPD research (Rabe, K. F. *et al*., 2007) inhaled corticosteroid therapy has no significant effect on bone mineral density when compared with placebo. Lehouck, (2011) recommends that the early prevention and treatment of osteoporosis in COPD is of paramount importance and should be based on integrated risk assessment tools. (Gan, W. Q. *et al*., 2004)

MATERIALS AND METHODS

Study Design, Setting, and Timing:

The present study was conducted in the different hospitals in Iraq during the period from August 2021 to October 2022. This was a cross-sectional study that include both the admitted as well as outpatients of varying grades of COPD.

Inclusion Criteria

All the patients diagnosed as a case of COPD, based on GOLD guidelines [6], were included in the study. The diagnosis of COPD was done based on clinical history and pulmonary function testing and staging were done as per GOLD criteria.

Exclusion Criteria

Bronchogenic carcinoma, untreated thyroid dysfunction, rheumatic diseases, diseases affecting bone or calcium homeostasis, primary or secondary hyperparathyroidism, Cushing's syndrome, and patients taking treatment with calcium as previously diagnosed as osteoporosis.

Sampling and Patients

Data Collection

The selected patients were briefed about the study, and written informed consent was obtained after taking permission and agreement from these patients. The study was designed as a prospective study, and the enrolled patients were given a questionnaire concerning age, gender, present and previous medications, cigarette smoking in pack years, daily exercise, daily diet and duration of respiratory disease, and number of exacerbations in the past three years. The cumulative dose of corticosteroids was calculated by taking into account the total dose of parental steroids for the previous three years, and an equivalent dose of prednisolone was calculated.

RESULTS

Baseline Characteristics

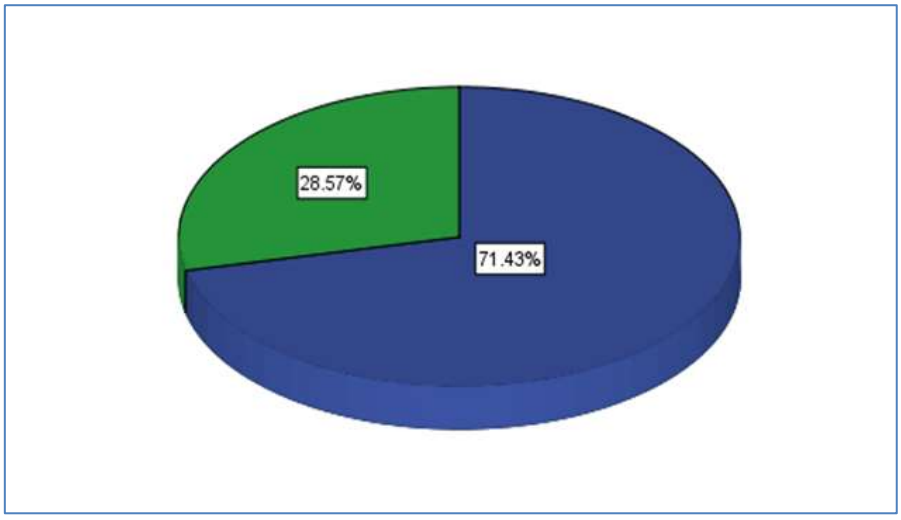

Figure 1: Distribution of gender of the patient among the study sample

A total of 70 patients were included in the study. There were 50 male patients (71.4%) and 20 female patients (28.6%) (Figure 1).

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Table 2: Baseline demographic characteristics of the patients'

variables	No.	Percentage (%)
Age group (years)		
<40	6	8.6
40–49	13	18.6
50–59	30	42.9
60-69	17	24.3
>70	4	5.7
Sex		
Male	50	71.4
Female	20	28.6
Body mass index (BMI)		
Underweight	**24**	3**4.3**
Normal	**16**	**22.9**
Overweight	1**0**	**14.3**
Obese	**20**	**28**.6
Duration of illness per (years)		
1–5	27	38.6
6–10	33	47.1
11–15	8	11.4
>15	2	2.9
Number of exacerbations in the past three years		
<3	**32**	**45.7**
3-5	2**4**	3**4.3**
>5	**14**	**20**
Duration of smocking per (years)		
5-10	5	7.1
10-15	18	25.7
More than 15	47	67.1

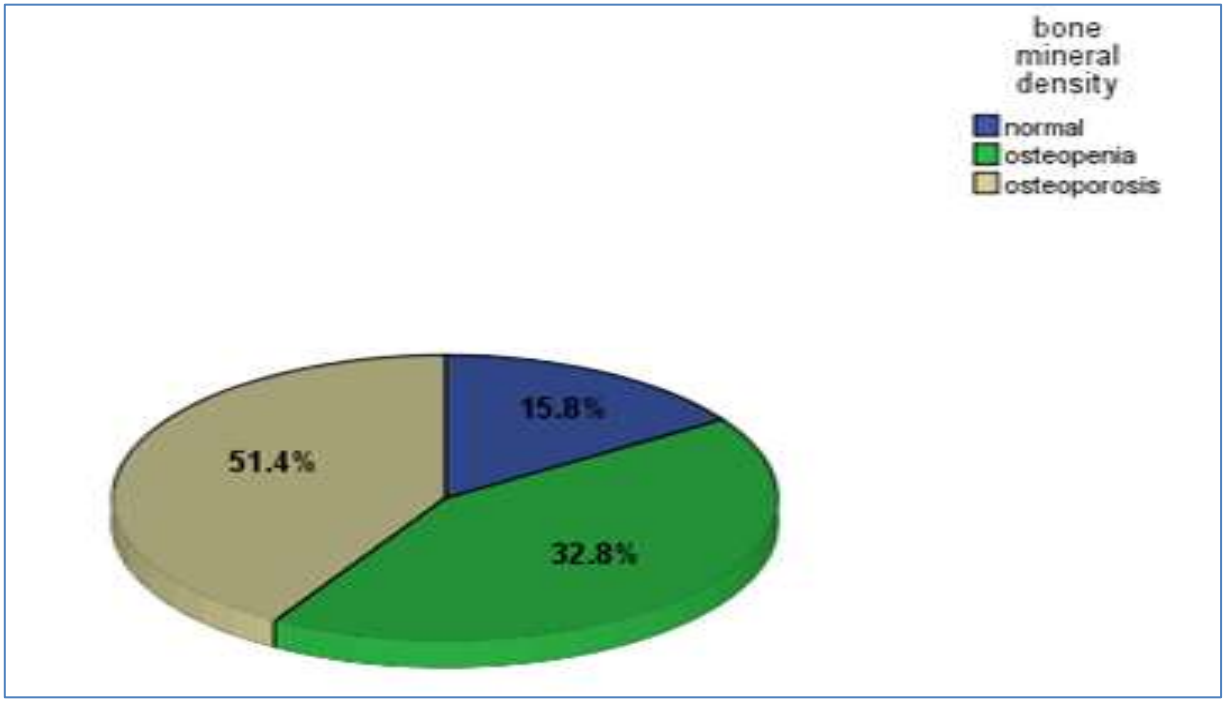

Figure 2: Distribution of bone mineral density among a sample

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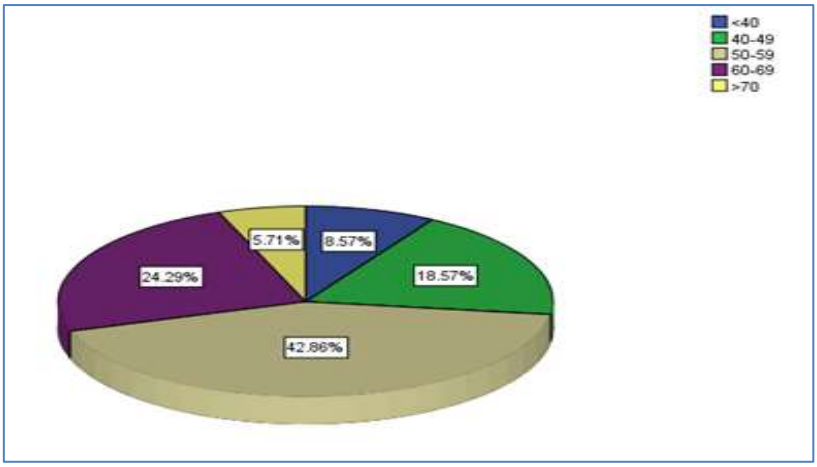

Figure 3: Age group distribution of the study sample

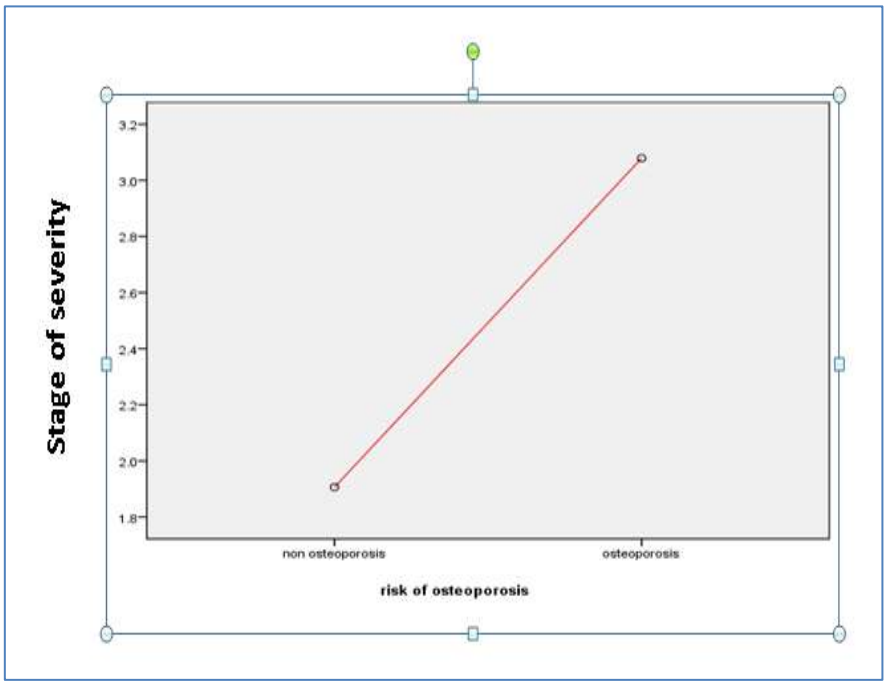

Figure 4: Correlation of stage of COPD and risk of developing osteoporosis

Table 3: Bone mineral density and severity of COPD

COPD severity	Normal (BMD) (kg/m2)	Osteopenia (BMD) (kg/m2)	Osteoporosis (BMD) (kg/m2)	Mean ± SD	P-value
Stage I	1.149	1.171	0.781	1.21 ± 0.30	***P***
Stage II	1.136	1.029	0.925	0.97 ± 0.21	**0.0001**
Stage III	1.387	0.86	0.94	0.65 ± 0.42	
Stage IV	0	0.73	0.953	0.61 ± 0.24	
Mean ± SD	1.21 ± 0.14	1.03 ± 0.12	0.73 ± 0.11		

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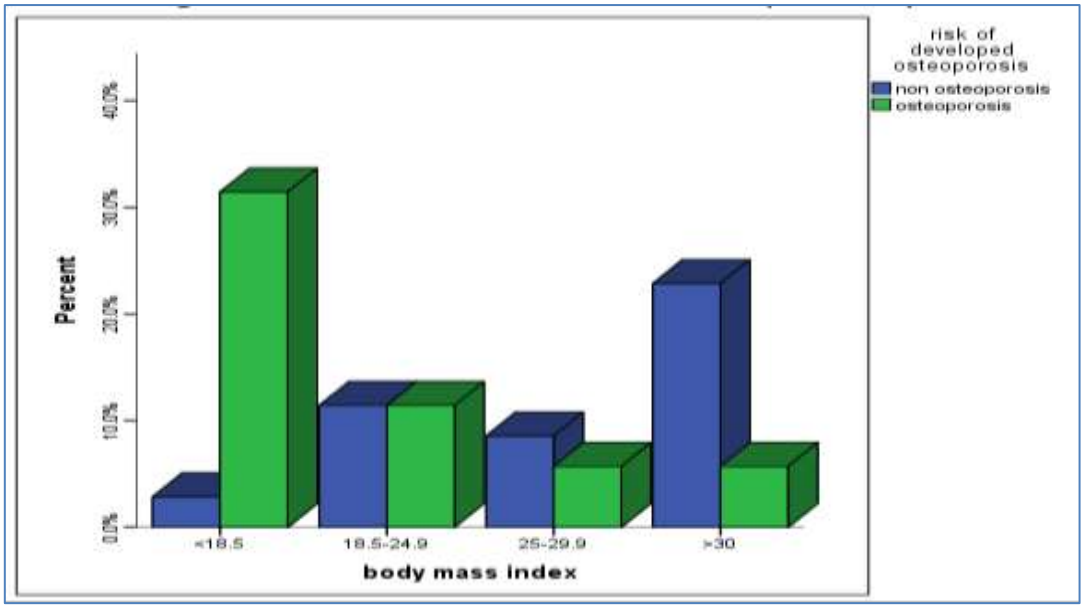

Figure 5: Correlation of BMI and risk of developing osteoporosis

Table 4: correlation between body mass index and risk of osteoporosis (P-value<.0001)

			Risk of osteoporosis		Total
			non osteoporosis	osteoporosis	
body mass index	<18.5	Count (No.)	2	22	24
		% within body mass index	8.3%	91.7%	
		% within risk	5.9%	61.1%	34.3%
	18.5-24.9	Count	9	7	16
		% within body mass index	56.3%	43.8%	
		% within risk	26.5%	19.4%	22.9%
	25-29.9	Count	6	4	10
		% within body mass index	60.0%	40.0%	
		% within risk	17.6%	11.1%	14.3%
	>30	Count	17	3	20
		% within body mass index	85.0%	15.0%	
		% within risk	50.0%	8.3%	28.6%
Total		Count	34	36	70
		% within body mass index	48.6%	51.4%	
		% within risk	100.0%	100.0%	

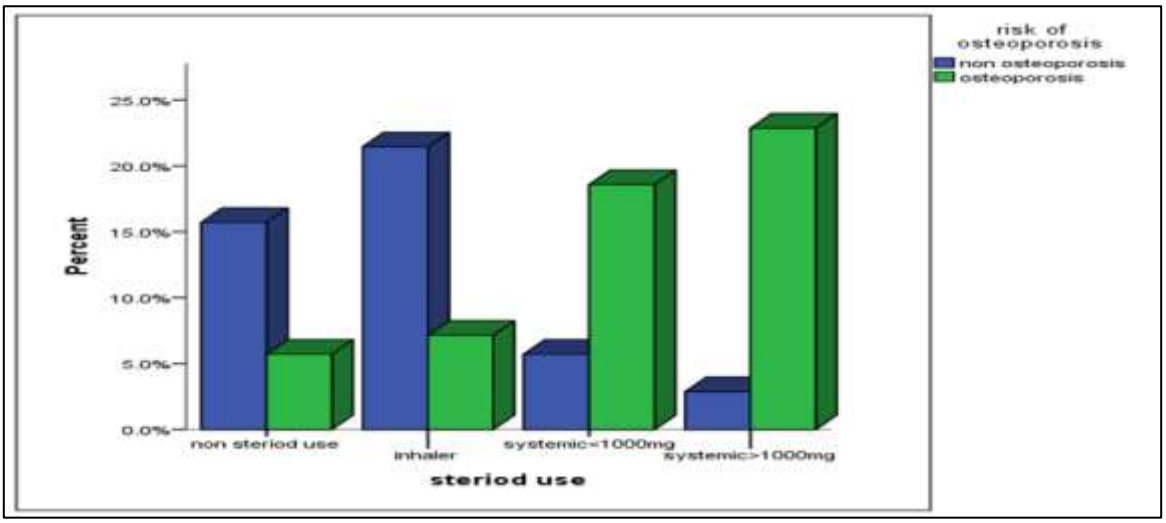

Figure 6: Correlation of steroid use and risk of developing osteoporosis

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DISCUSSION

Osteoporosis is more prevalent among COPD patients than among healthy subjects. (Graat-Verboom, L. *et al*., 2010) Thus, it is important to recognize the risk factors and strategies to manage osteoporosis in COPD patients in order to avoid osteoporotic fractures that deteriorate the quality of life and prognosis. There is no Iraqi study that has studied the occurrence of osteoporosis in COPD patients by using a standard DEXA scan. In our study, the prevalence of osteoporosis observed was 51.4% and of, osteopenia was 32.8 %, and the normal BMD was 15.7%. Various studies done in different parts of the world showed the prevalence of osteoporosis to be 9–69%, and the prevalence of osteopenia was 27-67% in COPD patients, while 0-13% for healthy subjects (13). Katsura and Kida have observed the prevalence of osteoporosis in patients with COPD to be 50%, and The prevalence of osteoporosis was reported to be 24% among postmenopausal women in Japan. (De Vries, F. *et al*., 2005).

The TORCH trial (Mazess, R. B. *et al*., 1990) found that the prevalence of osteoporosis was 41% and that for osteopenia 65%, respectively. And this study demonstrated a higher prevalence of osteoporosis and osteopenia at baseline in patients with spirometically confirmed COPD patient, but there was no association between FEV1 impairment and BMD when adjusted by age and gender. The lack of association between the severity of COPD and osteoporosis in this study could be due to a smaller number of patients with mild stages of COPD.

In line with other studies, we show that although glucocorticoid treatment is a major risk factor for osteoporosis in chronically treated COPD patients, other risk factors independent of corticosteroids but related to the disease exist. This is evident, as we did not find any difference in the prevalence of glucocorticoid treatment in the osteoporotic group versus the group having normal bone mass.

In the present study, a higher prevalence of osteoporosis was observed in female COPD patients ($P < 0.005$), as females are at increased risk for the development of osteoporosis due to the effect of estrogen as compared to the male sex. There is a definite relation between the severity of COPD disease and the risk of development of osteoporosis. In the present study, the majority of patients who had osteoporosis had grade III and IV COPD (94.4%). Also, BMD reduced as the severity of the disease progressed ($P < 0.0001$).

In a study by Stevenson, *et al*., (Daniell, H. W. *et al*., 1976), it was observed that there was an increased incidence of osteopenia and osteoporosis with the advancing COPD stage. They observed that 68% had either low bone mass (osteopenia or osteoporosis) or a previously undiagnosed vertebral fracture, with 25% of the included patients having a vertebral fracture. Consistent with the above studies, another study by de Vries, *et al*., (Engelen, M. P. *et al*., 2000) had similar findings of a higher prevalence of osteoporosis in stage III and stage IV COPD disease as compared to stage I and stage II COPD and observed that the risk of osteoporotic fracture increased in patients with COPD OR 1.61; (95% CI (confidence interval) 1.52-1.71). It was also observed that patients with more severe airway obstruction in COPD had increased risks of osteoporosis and bone fractures as compared with patients without a history of obstructive airway disease.

A correlation of BMI to the development of osteoporosis was also done in the study. It was observed that patients with lower BMI had a higher prevalence of osteoporosis (91.7%) as compared to overweight patients, and this association was statistically significant ($P < 0.0001$). Many patients with end-stage COPD lose weight as the disease progresses due to decreased intake and increased energy requirements. (Ferguson, G. T. *et al*., 2009) Furthermore, low bone mass was correlated with low-fat free mass (FFM) in stage IV patients, and FFM could thus be used as a determinant of bone loss in this population. These findings were supported by a case-control study (Slemenda, C. W. *et al*., 1989) in which patients with COPD were found to have lower bone mass than controls, and decreasing BMD was found with increasing GOLD stage. Iqbal, *et al*., (Cooper, C. *et al*., 1988) reported that the lowest BMD was seen in a group of patients with BMI below the normal median and reported an independent correlation between BMI and BMD ($r = 0.34$; $P < 0.05$). Another recent study (Johnston, C. C. *et al*., 1989) of osteoporosis in COPD found that BMI was the strongest predictor of osteoporosis, with a BMI ≤ 22 having an odds ratio of 4.18 (95% CI: 1.19–14.71, $P < 0.026$).

We hypothesized that corticosteroid, smoking, physical inactivity, low body weight, and/or malnutrition can explain the lower BMD and

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higher rates of osteoporosis in patients with COPD. Patients with moderate to severe COPD have an advanced nature of the disease, which predisposes them to osteoporosis. Another potential mechanism could be due to hypercapnia, which has been associated with increased bone resorption. (45) Dimai, *et al*., (46) showed that lower arterial pH and higher arterial carbon dioxide levels were correlated with lower BMD in COPD patients. Finally, hormonal levels may be another mechanism. Hormone replacement therapy and increased circulating estrogen levels had a protective effect on pulmonary function in pre-and postmenopausal women.

CONCLUSION

1-The incidence of osteoporosis in COPD patients is high. While the incidence of osteopenia is less than osteoporosis, and the normal BMD is very low.

2-As the severity of COPD increases, the incidence of osteoporosis also increases.

3- The risk of osteoporosis increases in low BMI and decreases in high BMI.

4- The occurance of osteoporosis in COPD patients increases relatively with increasing in the duration of illness and the duration of smoking per pack years.

5-The risk factors for osteoporosis in COPD patients were female gender, a higher number of acute exacerbations, low BMI, severity of COPD, and systemic use of steroids (accumulative dose more than 1000mg).

REFERENCES

1. Murray, C. J. & Lopez, A. D. "Global mortality, disability and the contribution of risk factors: Global Burden of Disease Study." *The Lancet*, 349 (1997): 1436-1442.
2. Hogg, J. C. & Timens, W. "The pathology of chronic obstructive pulmonary disease." *Annual Review of Pathology: Mechanisms of Disease*, 4 (2009): 435-459.
3. Burrows, B., Knudson, R. J. and Cline, M. G, *et al*. "Quantitative relationships between cigarette smoking and ventilator function." *American Review of Respiratory Disease*, 115 (1977): 195-205.
4. "Davidson's Principles & Practice of Medicine." ,"The Epidemiology of Chronic Obstructive Pulmonary Disease" 22nd ed. (2014): 673-674.
5. Krall, E. A. & Dawson-Hughes, B. "Smoking and bone loss among postmenopausal women." *Journal of Bone and Mineral Research*, 6 (1991): 331-338.
6. Fabbri, L. M., Luppi, F., Beghé, B. & Rabe, K. F. "Complex chronic comorbidities of COPD." *European Respiratory Journal*, 31 (2008): 204-212.
7. Rabe, K. F., Hurd, Anzueto, A., Barnes, P. J., Buist, S. A., Calverley, P., *et al*. "Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. GOLD executive summary." *American Journal of Respiratory and Critical Care Medicine*, 176 (2007): 532-555.
8. "Harrison's Pulmonary and Critical Care Medicine." Joseph Loscalzo; Global Initiative of COPD; New York; 17th edition; (2008): 184-185.
9. Gan, W. Q., Man, S. F., Senthil Selvan, A. & Sin, D. D. "Association between chronic obstructive pulmonary disease and systemic inflammation: A systematic review and a meta-analysis." *Thorax*, 59(7) (2004): 574-580.
10. Graat-Verboom, L., Spruit, M. A., van den Borne, B. E., Smeenk, F. W. & Wouters, E. F. "Whole-Body versus local DEXA-Scan for the Diagnosis of Osteoporosis in COPD Patients." *Journal of Osteoporosis*, 10 (2010): 640878.
11. De Vries, F., van Staa, T. P., Bracke, M. S., Cooper, C., Leufkens, H. G. & Lammers, J. W. "Severity of obstructive airway disease and risk of osteoporotic fracture." *European Respiratory Journal*, 25 (2005): 879-884.
12. Mazess, R. B., Barden, H. S., Drinka, P. J., Bauwens, S. F., Orwoll, E. S. & Bell, N. H. "Influence of age and body weight on spine and femur bone mineral density in US white men." *Journal of Bone and Mineral Research*, 5 (1990): 645-652.
13. Daniell, H. W. "Osteoporosis of the slender smoker: Vertebral compression fractures and loss of metacarpal cortex in relation to postmenopausal cigarette smoking and lack of obesity." *Archives of Internal Medicine*, 136 (1976): 298-304.
14. Engelen, M. P., Schols, A. M., Does, J. D. & Wouters, E. F. "Skeletal muscle weakness is associated with wasting of extremity fat-free mass but not with airflow obstruction in patients with chronic obstructive pulmonary disease." *American Journal of Clinical Nutrition*, 71 (2000): 733-738.

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15. Ferguson, G. T., Calverley, P. M., Anderson, J. A., Jenkins, C. R., Jones, P. W. and Willits, L. R, *et al*. "Prevalence and progression of osteoporosis in patients with COPD: Results from the towards a revolution in COPD Health Study." *Chest*, 136 (2009): 1456-1465.
16. Slemenda, C. W., Hui, S. L., Longcope, C. & Johnston, C. C. Jr. "Cigarette smoking, obesity, and bone mass." *Journal of Bone and Mineral Research*, 4 (1989): 737-741.
17. Cooper, C., Barker, D. J. & Wickham, C. "Physical activity, muscle strength, and calcium intake in fracture of the proximal femur in Britain." *BMJ*, 297 (1988): 1443-1446.
18. Johnston, C. C., Melton, L. J. & Lindsay, R. "National Osteoporosis Foundation. Clinical indications for bone mass measurements." *Journal of Bone and Mineral Research*, (1989): 1-28.

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