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Assessment of incidence of osteoporosis among smokers

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Abstract
Background: An imbalance in bone remodeling, which results in decreased bone mineral density (BMD), degeneration of the microarchitecture of the bone, and an elevated risk of fracture, is the hallmark of osteoporosis, a complicated heterogeneous condition. The present retrospective cohort study was conducted to access the incidence of osteoporosis among smokers.
Materials and Methods: 240 smokers with smoking history of > 10 cigarettes per day for past 5 years were included. Smokers were put in group I and 240 normal controls (non-smokers) in group II. Clinical data of all the patients were obtained. Detailed medical and personal history of all the subjects was also recorded.
Results: Group I had 164 males and 76 females and group II had 130 males and 110 females. Age group <30 years had 56 males and 70 females, age group 30-45 years had 64 males and 65 females and age group >45 years had 120 males and 105 females. . Osteoporosis was seen in 38 in group I and 12 in group II. The incidence of osteoporosis among smokers was 15.83%. The incidence of osteoporosis among non-smokers was 5%. The relative risk was 3.166. The p value 0.01. Difference was significant ($p< 0.05$).
Conclusion: Smoking is a significant risk factor for osteoporosis. The incidence of osteoporosis was higher among smokers as compared to non- smokers.

Keywords: Smoking, Osteoporosis, risk factors, bone mineral density

Introduction
An imbalance in bone remodelling, which results in decreased bone mineral density (BMD), degeneration of the microarchitecture of the bone, and an elevated risk of fracture, is the hallmark of osteoporosis, a complicated heterogeneous condition [1]. It significantly affects both health and the economy. Risk factors for osteoporotic fractures include higher rates of morbidity and death. There is a lot of data to support the independent risk factor for poor BMD that smoking poses [2].
Smoking has a well-documented negative impact on bone health, contributing significantly to the development and progression of osteoporosis. Osteoporosis is a condition characterized by weakened bones and an increased risk of fractures [3]. Chemicals in tobacco smoke, such as nicotine and cadmium, are toxic to bone cells. Smoking affects hormone levels, particularly reducing estrogen levels in women, which is critical for maintaining bone density. Lower estrogen levels accelerate bone loss [4]. Smoking impairs calcium absorption from the diet, which is essential for bone strength and structure. Smoking inhibits the function of osteoblasts, the cells responsible for bone formation, leading to decreased bone formation and increased bone resorption. Smoking generates free radicals, leading to oxidative stress, which damages bone cells and decreases their function [5]. Chronic inflammation caused by smoking further contributes to bone loss. For smokers, smoking is a primary cause of cadmium exposure; for non-smokers, diet or work-related exposure are the main sources of exposure. Osteoporosis and fracture have long been linked to cadmium exposure, particularly at high levels [6]. The present study was conducted to asses incidence of osteoporosis among smokers.

Materials and Methods
The present study was conducted on 240 smokers with smoking history of > 10 cigarettes per day for past 5 years were included. All were informed regarding the study and their written consent was obtained.

The diagnosis of osteoporosis is made when patients meet any of the following criteria

1. Fragility fracture.
2. T-score ≤−2.5 at the lumbar spine, femoral neck, total hip or distal 1/3 radius on DEXA exam.
3. T-score between −1.0 and −2.5 with elevated fracture risk as determined by country-specific thresholds using the online Fracture Risk Assessment Tool (FRAX).

Data such as name, age, gender etc. was recorded. Smokers were put in group I and 240 normal controls (non-smokers) in group II. Clinical data of all the patients was obtained. Detailed medical and personal history of all the subjects was also recorded. Thorough clinical and oral examination was performed. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table I: Distribution of patients

Group	Males	Females
Group I	164	76
Group II	130	110

Table 1 shows that group I had 164 males and 76 females and group II had 130 males and 76 females.

Table 2: Age wise distribution

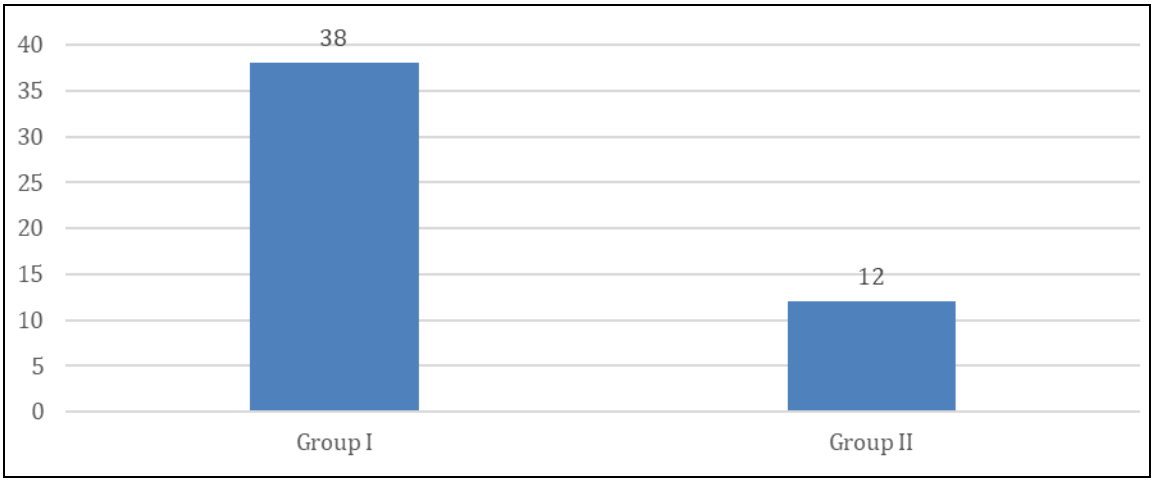
Age group (years)	Male	Female	Total participants
<30	56	70	126
30-45	64	65	129
>45	120	105	225

Table 2 shows that age group <30 years had 56 males and 70 females, age group 30-45 years had 64 males and 65 females and age group >45 years had 120 males and 105 females.

Table 3: Incidence of osteoporosis

	Osteoporosis	No osteoporosis	Relative risk
Group1 (Smokers)	38	202	3.166
Group 2 (Non-smokers)	12	228	

Table 3, graph I shows that osteoporosis was seen in 38 in group I and 12 in group II. The incidence of osteoporosis among smokers was 15.83%. The incidence of osteoporosis among non-smokers was 5%. The relative risk was 3.166. The p value 0.01. Difference was significant (p< 0.05).



Graph 1: Incidence of osteoporosis

Discussion

Smoking affects blood circulation, reducing the blood supply to bones. Adequate blood flow is essential for bone health as it delivers necessary nutrients and oxygen [7, 8]. Smoking elevates cortisol levels, a stress hormone that can lead to bone loss by promoting bone resorption and inhibiting bone formation [9, 10]. Numerous studies have shown that smokers have lower bone mineral density compared to non-smokers, increasing the risk of osteoporosis and fractures. There is a dose-response relationship between smoking and bone loss, with higher smoking intensity and longer duration correlating with greater bone density reduction [11, 12]. Smokers are at a significantly higher risk of fractures, particularly hip, spine, and wrist fractures, compared to non-smokers. Smoking also impairs the healing process of fractures, leading to longer recovery times and increased risk of complications [13, 14]. The present study was conducted to asses incidence of osteoporosis among smokers.

Lohiya *et al*. [15] assessed the incidence of osteoporosis among smokers. Overall incidence of osteoporosis among smokers and non-smokers was 31.6 percent and 4.2 percent respectively. Incidence of osteoporosis was significantly higher in smokers in comparison to non-smokers. In the smoker's group, 50.63 percent of the patients with osteoporosis belonged to the age group of more than 45 years while 34.81 percent of the patients belonged to the age group of 30 to 45 years. In the non-smokers group, 47.62 percent of the patients with osteoporosis belonged to the age group of more than 45 years while 38.09 percent of the patients belonged to the age group of 30 to 45 years. In the smokers and non-smokers group, 66.46 percent and 61.91 percent of the patients with osteoporosis were females.

Anwar *et al*. [16]. Found out incidences of osteoporosis among adult smokers. Total 480 adult smokers were included in this study. Bone mineral density of every person was done with the help of portable ultrasound machine at calcaneum. Total numbers of adult smokers were 500 with median age of 41 years (range 31-59 years). Out of these, 496 were male (94.2%) and 4 were female (0.08%). Osteoporosis was diagnosed in 128 smokers (29.4%) out of 500 (p = 0.00). Osteopenia was diagnosed in 297 smokers (59.4%). Rest of smokers had normal bone mineral density. Incidence of osteoporosis among the healthy adults calculated in study was 29.4%, which is highly significant. Factors affecting the outcome were age of smoker, no of cigarettes smoked per day, and duration of smoking.

In our study, we found that in group 1(participants with history

of smoking) 38 participants had osteoporosis, 202 participants did not. In group 2 (participants without history of smoking) 12 participants had osteoporosis. 228 participants did not have osteoporosis. The incidence of osteoporosis among smokers was 15.83%. The incidence of osteoporosis among non-smokers was 5%. The relative risk was 3.166. The p value 0.01. Difference was significant ($p< 0.05$).
The shortcoming of the study is small sample size.

Conclusion
Authors found that smoking is a significant risk factor for osteoporosis. The incidence of osteoporosis was higher among smokers as compared to non- smokers.

Conflict of Interest
Not available

Financial Support
Not available

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