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Original Research Article

Frequency of low BMD and associated risk factors in patients with inflammatory bowel disease

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ABSTRACT

Background: Low bone mineral density (BMD) is a known complication of inflammatory bowel disease (IBD), with several factors contributing to its occurrence. This study aims to assess the frequency of BMD and identify associated risk factors in patients with IBD. The aim of this study was to determine the frequency of low BMD and identify associated risk factors in patients with inflammatory bowel disease (IBD).
Methods: This cross-sectional study included 90 patients with established inflammatory bowel disease (IBD) at the Department of Gastroenterology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from June 2019 to September 2020. Patients aged 18 years and older, currently on IBD medication, were enrolled. Data on BMD, disease characteristics, and demographic factors were collected and analyzed using SPSS version 23.0.
Results: Among 90 IBD patients (mean age 31.8 years, 74.4% male, 35.6% with Crohn's), 40% were smokers. BMD results showed 34.4% normal, 40% osteopenia, and 25.6% osteoporosis. Low BMD was linked to lower BMI (20.25kg/m²) and vitamin D levels (17.45ng/ml), with regression analysis confirming vitamin D deficiency as the only independent risk factor.
Conclusions: Our study underscores the high prevalence of osteopenia and osteoporosis in Bangladeshi IBD patients, highlighting the critical need for regular monitoring and intervention focused on modifiable risk factors like BMI and vitamin D to safeguard bone health.

Keywords: Inflammatory bowel disease, Low BMD, Osteopenia, Osteoporosis, Risk factors

INTRODUCTION

Inflammatory bowel diseases (IBD) are chronic idiopathic disorders causing inflammation of the gastrointestinal tract.[1] It is characterized by episodes of relapse and remission, with two recognized subtypes: ulcerative colitis (UC) and Crohn's disease (CD), which vary in their patterns of involvement. The prevalence of osteopenia and osteoporosis ranges from 22% to 77% and 17% to 41% respectively.[2] Low bone mineral density (BMD) increases the likelihood of fractures in this patient group, with individuals with inflammatory bowel disease (IBD) facing a 40% greater risk of fractures compared to the general population.[3]

Several risk factors may contribute to the increased risk of low BMD in IBD patients, including nutritional deficiency, especially calcium and vitamin D deficiency.[4] inflammatory cytokine, corticosteroid use age, gender, body weight/BMI,8 and smoking.[2,5-7,9]

Ulcerative colitis (UC) mainly targets the mucosa of the colon, with varying degrees of extent and severity. In its mildest form, it may be confined to the distal rectum, whereas in its most severe form, it can affect the entire colon. However, 80% of the patients present with disease extending from the rectum to the splenic flexure and only 20% have pancolitis.[10] It involves rectum in about 95 % cases and may extend proximally in a symmetrical, circumferential and uninterrupted pattern.[11]

Crohn's disease can affect any part of GIT but it affects ileal and ileocolic region 40%, small intestine 30 to 40%, only colon 20% and perianal region <10%.[12]

The clinical features of ulcerative colitis (UC) include diarrhoea mixed with blood and mucus, abdominal pain and tenderness, weight loss, low-grade fever and anemia.[13,14] Extraintestinal complications include iritis, arthritis, deep vein thrombosis and primary sclerosing cholangitis.[15-17] Both Crohn's disease and UC are associated with several extraintestinal complications, including arthritis and low bone mineral density.[19]

Low bone mineral density, that is, osteopenia and osteoporosis, is an important extraintestinal complication of IBD. The prevalence of osteopenia and osteoporosis ranges from 22% to 77% and 17% to 41%, respectively.[2] Low bone mineral density (BMD) increases the likelihood of fractures in these patients, with individuals suffering from inflammatory bowel disease (IBD) facing a 40% greater fracture risk compared to the general population.[3] Several risk factors may contribute to the increased risk of low BMD in IBD patients, including nutritional deficiency, especially calcium and vitamin D deficiency, inflammatory cytokines and corticosteroid use.[4,5,7]

A study by Jahnsen et al, found that bone mineral density (BMD) is decreased in patients with Crohn's disease but not in those with ulcerative colitis. However, Ezzat et al, demonstrated that BMD is reduced in both Crohn's disease and ulcerative colitis, linking vitamin D deficiency to lower BMD.[19,20]

Till now, there is no study available regarding BMD in inflammatory bowel disease patients in Bangladesh. The purpose of this study was to assess the frequency of low bone mineral density (BMD) and to identify the associated risk factors in patients with inflammatory bowel disease (IBD).

The aim of this study was to determine the frequency of low BMD and identify associated risk factors in patients with inflammatory bowel disease (IBD).

METHODS

Study place

This cross-sectional study was conducted at the Department of Gastroenterology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.

Study duration

The study duration was from June 2019 to September 2020.

Sample size

The sample size was calculated using a standard estimation formula based on previous studies, resulting in a total study population of 90 patients.

Inclusion criteria

The study included; patients aged≥18 years. Diagnosed cases of IBD (either Crohn's disease or ulcerative colitis). Patients currently taking medication for IBD. Patients willing to provide informed consent for the study.

Exclusion criteria

Patients with chronic kidney disease. Patients with chronic liver disease. Patients with diabetes mellitus. Patients with malignancies. Women who are currently pregnant or have been pregnant within the last 6 months. Postmenopausal women. Patients with other chronic diseases possibly associated with low bone mineral density (BMD), such as rheumatoid arthritis or thyroid disorders. Patients taking vitamin D supplements or hormone replacement therapy. Patients not willing to participate in the study.

Informed consent was obtained from all participants, ensuring confidentiality and voluntary participation. A thorough medical history and clinical examinations were conducted. Bone mineral density (BMD) was measured using dual-energy X-ray absorptiometry at the lumbar spine (L2–4) and femur (femoral neck), with results expressed as Z scores and T scores. Vitamin D levels were assessed, with normal values defined as greater than 30 ng/ml insufficiency and deficiency were defined as serum levels between 20–30 ng/ml and less than 20 ng/mL, respectively.

Data were collected via a pre-designed questionnaire capturing socio-demographic details, clinical variables (disease type, location and duration) and laboratory results (including vitamin D levels).

Analyses were conducted using SPSS version 23.0, presenting continuous variables as means with standard deviations and categorical variables as counts with percentages. Comparisons between normal and low BMD groups used t-tests or chi-square tests, with a significance level set at $p<0.05$.

Univariate and multivariate logistic regression models assessed associations while controlling for confounding variables. The study was approved by the institutional

review board (IRB) of BSMMU, maintaining ethical standards and patient confidentiality throughout. The primary outcome variables included the relationship between BMD and various demographic and clinical factors in patients with inflammatory bowel disease (IBD).

RESULTS

Table 1 shows the demographic profile of the study population. The average age of the study population was 31.80±5.25 years, with the mean age of Crohn's disease (CD) and ulcerative colitis (UC) patients being 30.66±5.75 years and 32.43±4.90 years, respectively. Out of 90 patients, 67 (74.4%) were male and 23 (25.6%) were female.

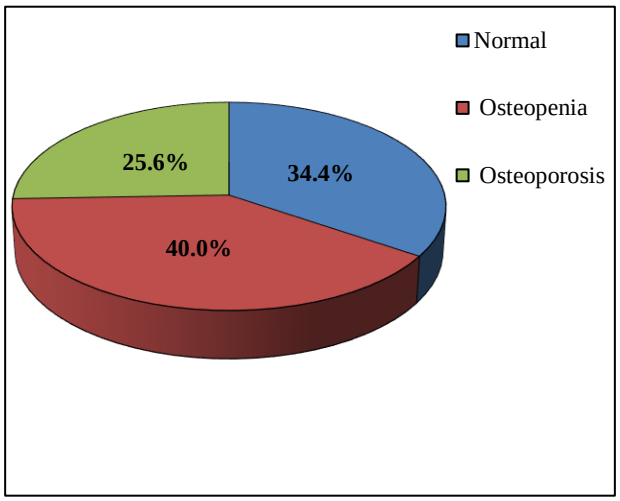

Figure 1: Frequency of low BMD among IBD patients (n=90).

Table 2 shows the baseline characteristics of the study population. Out of 90 IBD patients, 32 were diagnosed with Crohn's disease and 58 with ulcerative colitis.

A total of 36 (40.0%) were smokers; among CD patients, 17 (53.1%) were smokers and among UC patients, 19 (32.8%) were smokers. The mean BMI of CD and UC patients was 20.82±2.74 and 21.39±3.17, respectively.

20 (62.5%) of the Crohn's disease patients and 43 (74.1%) of the ulcerative colitis patients were treated with steroids. The mean disease duration for CD and UC patients was 3.37±1.77 and 3.25±1.92 years, respectively. The average serum vitamin D level for all IBD patients was 20.28±5.49. Among CD patients, the average was 18.99±4.95 and for UC patients, it was 21.00±5.69. Figure 1 shows the prevalence of low BMD among IBD patients. Among the 90 IBD patients, 31 (34.4%) had normal BMD, while 36 (40.0%) had osteopenia and 23 (25.6%) had osteoporosis. Table 3 shows the distribution of the study subjects according to age and gender. The average age of patients with normal BMD was 32.16±6.16 years, while the average age of patients with low BMD was 31.61±4.76 years (p value 0.639), indicating no significant association between age and BMD. Additionally, there was no significant difference in bone mineral density between male and female IBD patients.

Table 4 presents the effects of BMI and disease duration on bone mineral density (BMD) in IBD patients. Patients with normal BMD had a mean BMI of 22.96±2.91, while those with low BMD had a mean BMI of 20.25±2.66 (p value<0.001), indicating that lower BMI is associated with low BMD.

Additionally, the mean disease duration for patients with normal BMD was 2.28±1.14 years, compared to 3.82±1.96 years for patients with low BMD (p value<0.001). Vitamin D levels were significantly lower in patients with low BMD (17.45±4.06 ng/ml) compared to those with normal BMD (25.68±3.45 ng/ml) (p<0.001). These findings suggest that low BMI, longer disease duration and low vitamin D levels are associated with decreased bone mineral density in IBD patients.

Table 5 presents the association of disease type (Crohn's disease vs. ulcerative colitis) and steroid use with bone mineral density (BMD) in IBD patients. There was no significant association between the type of inflammatory bowel disease and BMD.

Additionally, the analysis revealed no association between steroid use and low BMD (p value=0.411), indicating that steroid use did not significantly impact BMD in the study population.

Table 6 presents the regression analysis of risk factors for low bone mineral density (BMD). The analysis indicates that among the factors examined, only vitamin D level was found to be independently associated with low BMD.

Table 1: Demographic profile of the study subjects (n=90).

Characteristics		All patients (n=90)	CD (n=32)	UC (n=58)	P value
Age (in years)	21-30	36 (40.0)	15 (46.9)	21 (36.2)	[a]0.126
	31-40	48 (53.3)	15 (46.9)	33 (56.9)	
	>40	6 (6.7)	2 (6.3)	4 (6.9)	
	Mean±SD	31.80±5.25	30.66±5.75	32.43±4.90	
Gender	Male	67 (74.4)	24 (75.0)	43 (74.1)	[b]0.928
	Female	23 (25.6)	8 (25.0)	15 (25.9)	

Table 2: Baseline characteristics of the study subjects (n=90).

Characteristics	All patients (n=90)	CD (n=32)	UC (n=58)	P value
Type of IBD				
Crohn's disease	32 (35.6%)	32 (100%)	0 (0.0%)	
Ulcerative colitis	58 (64.4%)	0 (0.0%)	58 (100%)	
Smoking status	36 (40.0%)	17 (53.1%)	19 (32.8%)	0.059
BMI (kg/m²)				
Underweight (<18.5)	23 (25.6%)	11 (34.4%)	12 (20.7%)	
Normal (18.5–22.9)	39 (43.3%)	11 (34.4%)	28 (48.3%)	0.399
Overweight (23.0–26.9)	25 (27.8%)	10 (31.3%)	15 (25.9%)	
Obese (≥27)	3 (3.3%)	0 (0.0%)	3 (5.2%)	
Mean±SD BMI	21.18±3.01	20.82±2.74	21.39±3.17	
History of steroid use	63 (70.0%)	20 (62.5%)	43 (74.1%)	0.249
Duration of disease (in years)	3.28±1.86	3.37±1.77	3.25±1.92	[a]0.771
Vitamin D	20.28±5.49	18.99±4.95	21.00±5.69	[a]0.098

Table 3: Distribution of study subjects according to age and gender (n=90).

BMD level		Low (n=59)	Normal (n=31)	P value
Age (in years)	21-30	24 (40.7)	12 (38.7)	0.639
	31-40	31 (52.5)	17 (54.8)	
	>40	4 (6.8)	2 (6.5)	
	Mean±SD	31.61±4.76	32.16±6.16	
Gender	Male	44 (74.6)	23 (74.2)	0.968
	Female	15 (25.4)	8 (25.8)	

Table 4: Association of BMI, disease duration and vitamin D with bone mineral density (n=90).

BMD level		Low (n=59)	Normal (n=31)	P value
BMI (kg/m²)	Under weight (<18.5)	20 (33.9)	3 (9.7)	<0.001
	Normal weight (18.5-22.9)	27 (45.8)	12 (38.7)	
	Over weight (23.0 – 24.9)	12 (20.3)	13 (41.9)	
	Obese (≥25)	0 (0.0)	3 (9.7)	
	Mean±SD	20.25±2.66	22.96±2.91	
Disease duration		3.82±1.96	2.28±1.14	<0.001
Vitamin D		17.45±4.06	25.68±3.45	<0.001

Table 5: Association of disease type and steroid use with bone mineral density (n=90).

BMD level		Low (n=59)	Normal (n=31)	P value
IBD	Crohn's disease (CD)	23 (39.0)	9 (29.0)	0.349
	Ulcerative colitis (UC)	36 (61.0)	22 (71.0)	
Steroid use	Yes	43 (72.9)	20 (64.5)	0.411
	No	16 (27.1)	11 (35.5)	

Table 6: Regression analysis of risk factors for low BMD (n=90).

Variable	B	SE	P value	OR	95% CI (OR)
BMI	0.129	0.15	0.389	1.138	0.848–1.526
Disease duration	0.153	0.316	0.628	1.166	0.627–2.165
Vitamin D	0.782	0.187	0	2.185	1.515–3.151

DISCUSSION

Inflammatory bowel disease (IBD) is increasingly being recognized in the Asian population. Low bone mineral density (osteopenia and osteoporosis) is a common and significant extraintestinal complication of IBD. The risk of fractures in IBD patients is 40% higher than in the general population.[3] Several factors contribute to low bone mineral density in IBD, including disease type, disease duration, inflammatory cytokines, BMI and vitamin D deficiency. This cross-sectional study was conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU) to determine the frequency of osteopenia and osteoporosis, as well as the factors associated with these conditions in our IBD patients.

We found that 65.6% of patients had low bone mineral density, with 40% having osteopenia and 25.6% having osteoporosis. This finding is similar to the study by Khadgawat et al, which found a 63% prevalence of low BMD in Indian IBD patients. Bundela et al, also reported that, among Indian UC patients, 34.5% had osteopenia and 40% had osteoporosis. Ezzat et al, found the prevalence of osteopenia to be 30% and osteoporosis to be 26.7% in Egyptian IBD patients.[20-22] A study by Even et al, in Israel reported that 63% of CD patients and 59% of UC patients had low BMD.[23] Similarly, Abraham et al, found that 40% of American IBD patients had low BMD.[24]

Although older age and female gender are considered risk factors for low bone mineral density in the general population, we found no significant association between these factors and low BMD in our IBD patients. This aligns with studies by Bundela et al, Abraham et al and Ezzat et al.[20,22,24] On the other hand, Ismail et al, reported that advancing age is associated with low BMD in IBD.[25]

Lower BMI is known to be a risk factor for low bone mineral density. In our study, lower BMI was significantly associated with low BMD in univariate analysis, but this association was not independent in multivariate analysis. Similarly, Bundela et al, Abraham et al and Ezzat et al, found no significant association between BMI and BMD in IBD patients. However, Zali et al, Ismail et al, and even et al, reported that lower BMI is associated with low BMD in IBD patients.[20,22-26] We found no significant difference in BMD between Crohn's disease and ulcerative colitis. This finding aligns with the studies by Abraham et al and Ismail et al, However, Ezzat et al, reported that low BMD is more common in Crohn's disease than in UC.[20,24,25]

In our study, prolonged disease duration was associated with low BMD in univariate analysis, but this association was not independent in multivariate analysis. Similarly, Ismail et al and Ezzat et al, found no significant association between disease duration and BMD. Conversely, Ezzat et al and Krela-Kazmierczak et al, found a significant correlation between disease duration and BMD.[20,25,27] There was no significant association between steroid use and low BMD in our study. Ismail et al and Bundela et al, similarly reported no significant association between steroid use and low BMD.[22,25] However, Krela-Kazmierczak et al, found that steroid use was significantly associated with low BMD in their studies.[27] We found that vitamin D deficiency was significantly associated with low BMD in our IBD patients. This finding aligns with studies by Abraham et al, Ezzat et al. However, Bundela et al and Even et al, did not find a significant correlation between vitamin D deficiency and low BMD.[20,22-24]

This study highlights the high prevalence of low bone mineral density among IBD patients, underscoring the need for routine screening and preventive measures. Identifying and managing modifiable risk factors, such as BMI and disease duration, could help mitigate the risk of fractures and improve long-term outcomes in these patients in our country.

The current study had the limitations that is the study involved a relatively small sample size of IBD patients. The participants were recruited from a single center, limiting the generalizability of the findings to the broader population. Recruitment from a tertiary care center may have led to a selection bias, as these patients often present with more severe disease and higher steroid exposure, potentially influencing the results related to bone mineral density (BMD).

CONCLUSION

In our study, we found a high prevalence of osteopenia and osteoporosis among patients with inflammatory bowel disease (IBD) in Bangladesh. Although no significant associations were observed between bone mineral density (BMD) and patient age, gender or disease type, factors such as lower BMI, prolonged disease duration and vitamin D deficiency were strongly linked to low BMD. Additionally, steroid use did not significantly impact BMD in this population. These findings underscore the importance of regular monitoring and early intervention to manage bone health in IBD patients, as well as the need to address vitamin D levels and other contributing factors to low BMD in this demographic.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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