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Association of Body Mass Index and Comorbidities with Osteoarthritis Severity: A Prospective Observational Study

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ABSTRACT:
Background:-Osteoarthritis (OA) is a common degenerative joint disorder. Obesity and comorbid conditions are important factors influencing disease progression and severity.Objective:-To evaluate the association between BMI, comorbidities, and osteoarthritis severity among patients attending a tertiary care hospital.Methods:- Prospective observational study conducted among 270 osteoarthritis patients. Demographic characteristics:- BMI, comorbidities, and OA severity were recorded. Statistical analysis was performed using Two-Way ANOVA.ResultsAmong 270 patients, 73.7% were female and 52.6% belonged to the 40–59-year age group. Overweight and obese patients constituted 57.04% of the study population. Comorbidities were present in 25.19% of patients, with hypertension being the most common. BMI showed significant association with OA severity (p=0.0091), while comorbidity burden was significantly associated with OA severity (p=0.0003).ConclusionObesity and comorbid conditions significantly contribute to osteoarthritis severity. Early identification and management of these factors may improve clinical outcomes.

KEYWORDS: Osteoarthritis; Body Mass Index; Obesity; Comorbidity; Disease Severity; Knee Osteoarthritis.

I. INTRODUCTION

Osteoarthritis (OA) is the most common chronic degenerative joint disorder and a leading cause of pain, disability, and reduced quality of life worldwide. It affects more than 500 million individuals globally and represents a substantial public health burden, particularly among older adults.[1,2]

The pathogenesis of osteoarthritis involves progressive degeneration of articular cartilage, subchondral bone remodeling, osteophyte formation, and low-grade synovial inflammation. Recent evidence suggests that osteoarthritis should be considered a whole-joint disease involving complex interactions between mechanical, metabolic, and inflammatory pathways.[3,4]

Obesity is recognized as one of the most important modifiable risk factors for osteoarthritis. Increased body mass index (BMI) contributes to excessive mechanical loading of weight-bearing joints, particularly the knee, and promotes chronic inflammation through adipokines and pro-inflammatory cytokines.[5,6] Several studies have demonstrated a positive association between elevated BMI and both the incidence and severity of osteoarthritis.[7–10]

Osteoarthritis frequently coexists with chronic medical conditions including hypertension, diabetes mellitus, cardiovascular diseases, and metabolic syndrome. These comorbidities share common inflammatory and metabolic mechanisms that may contribute to disease progression and increased severity.[11–15]

The burden of osteoarthritis is further increased by advancing age, obesity, and the presence of multiple comorbidities, all of which adversely affect physical function and quality of life.[16–18] Current clinical guidelines emphasize the importance of weight management, lifestyle modification, and multidisciplinary care in reducing disease progression and improving outcomes among osteoarthritis patients.[19,20]

However, limited data are available regarding the combined influence of body mass index and comorbidity burden on osteoarthritis severity in Indian tertiary care settings. Therefore, the present study was conducted to evaluate the association between BMI, comorbidities, and osteoarthritis severity among patients attending a tertiary care hospital.

II. OBJECTIVES

Primary Objective

To evaluate the association between Body Mass Index (BMI) and osteoarthritis severity among patients diagnosed with osteoarthritis attending a tertiary care hospital.

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Secondary Objectives

1. To determine the prevalence and pattern of comorbidities among osteoarthritis patients.
2. To assess the association between comorbidities and osteoarthritis severity.
3. To evaluate the demographic characteristics of osteoarthritis patients with respect to age, gender, and BMI distribution.
4. To determine the distribution of osteoarthritis according to affected joints and disease severity.
5. To identify factors associated with progression from early-stage to advanced-stage osteoarthritis.
6. To provide evidence for the importance of weight management and comorbidity control in osteoarthritis management.

IV. Materials and Methods

Use the following headings:

4.1 Study Design

Prospective observational study.

4.2 Study Site

Department of Orthopedics, Ashmi Superspeciality Hospital, Borsad, Gujarat, India.

4.3 Study Duration

Six months.

4.4 Ethical Approval

Include IEC approval details.

4.5 Study Population

270 osteoarthritis patients.

4.6 Inclusion Criteria

- Patients aged ≥18 years.
- Diagnosed osteoarthritis patients.
- Willing to participate.
- Complete medical records available.

4.7 Exclusion Criteria

- Rheumatoid arthritis patients.
- Post-traumatic arthritis.
- Incomplete records.
- Pregnant women.

4.8 Data Collection

- Age
- Gender
- BMI
- Comorbidities
- Joint involvement
- OA severity (Early/Advanced)
- Clinical characteristics

4.9 Statistical Analysis

- Descriptive statistics.
- Frequency and percentage.
- Two-Way ANOVA.
- Tukey's multiple comparison test.
- $p < 0.05$ considered statistically significant.

V. RESULTS

3.1Demographic Characteristics

A total of 270 patients diagnosed with osteoarthritis were included in the study. Females constituted the majority of the study population, accounting for 199 (73.7%) patients, while males represented 71 (26.3%) patients. The highest proportion of patients belonged to the 40–59 years age group (52.6%), followed by patients aged 60 years and above (34.44%). Patients aged 18–39 years accounted for 12.96% of the study population.

Assessment of body mass index revealed that 116 (42.96%) patients had normal BMI, while 84 (31.11%) were overweight. Obesity was observed in 64 patients (23.71%), including 43 (15.93%) with Class I obesity, 16 (5.93%) with Class II obesity, and 5 (1.85%) with Class III obesity. Only 6 (2.22%) patients were underweight.

Table 1. Demographic Characteristics of Study Population

Characteristic	Number (n)	Percentage (%)
Male	71	26.3
Female	199	73.7
18–39 years	35	12.96
40–59 years	142	52.6
≥60 years	93	34.44
Underweight	6	2.22
Normal BMI	116	42.96
Overweight	84	31.11
Obese Class I	43	15.93
Obese Class II	16	5.93
Obese Class III	5	1.85

3.2 Comorbidity Profile of Osteoarthritis Patients

Among the 270 osteoarthritis patients included in the study, 68 (25.19%) patients had one or more comorbid conditions, whereas 202 (74.81%) patients had no documented comorbidity. Hypertension was the most prevalent comorbid condition, affecting 25 (36.23%) patients, followed by type II diabetes mellitus in 12 (17.38%) patients and hypothyroidism in 5 (7.25%) patients. Other less frequently reported comorbidities included asthma, rheumatoid arthritis,

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chronic obstructive pulmonary disease (COPD), cerebrovascular stroke, and spondylosis.

Multiple comorbid conditions were observed in 19 patients. The most common combination was hypertension with type II diabetes mellitus, affecting 11 (17.39%) patients. Other combinations included type II diabetes mellitus with rheumatoid arthritis, type II diabetes mellitus with hypothyroidism, hypertension with rheumatoid arthritis, hypertension with ischemic heart disease, hypertension with hypothyroidism, and hypertension with Parkinson's disease.

These findings indicate that cardiometabolic disorders constitute a substantial proportion of comorbid conditions among osteoarthritis patients and may contribute to disease progression and increased clinical burden.

Table 2. Distribution of Comorbidities among Osteoarthritis Patients

Comorbidity	Number (n)	Percentage (%)
Hypertension	25	36.23
Type II Diabetes Mellitus	12	17.38
Hypothyroidism	5	7.25
Asthma	2	2.90
Rheumatoid Arthritis	2	2.90
COPD	1	1.45
Cerebrovascular Stroke	1	1.45
Spondylosis	1	1.45

Multiple Comorbidities

Combination	Number (n)	Percentage (%)
Hypertension + Type II Diabetes Mellitus	11	17.39
Type II Diabetes Mellitus + Rheumatoid Arthritis	3	4.35
Type II Diabetes Mellitus + Hypothyroidism	1	1.45
Hypertension + Rheumatoid Arthritis	1	1.45
Hypertension + Type II Diabetes Mellitus + Ischemic Heart Disease	1	1.45
Hypertension + Hypothyroidism	1	1.45
Hypertension + Parkinson's Disease	1	1.45

3.3 Joint Involvement and Disease Severity

Analysis of joint involvement demonstrated that weight-bearing joints were predominantly affected among osteoarthritis patients. The knee joint was the most commonly involved site, accounting for 243 (90.73%) cases. Among these, 126 (47.40%) patients were classified as having early-stage knee osteoarthritis, while 117 (43.33%) patients had advanced-stage disease.

Other affected joints included the hip in 9 (3.33%) patients and the shoulder in 6 (2.23%) patients. Less frequently involved joints were the ankle and wrist, each affecting 3 (1.11%) patients, followed by the foot, hand, and elbow, each accounting for 2 (0.74%) cases.

The predominance of knee involvement highlights the substantial impact of mechanical loading and weight-bearing stress on osteoarthritis development and progression. Furthermore, the nearly equal distribution of early-stage and advanced-stage knee osteoarthritis provided an opportunity to evaluate factors associated with disease severity.

Table 3. Distribution of Joint Involvement and Disease Severity

Affected Joint	Number (n)	Percentage (%)
Knee OA (Early Stage)	126	47.40
Knee OA (Advanced Stage)	117	43.33
Hip OA	9	3.33
Shoulder OA	6	2.23
Ankle OA	3	1.11
Wrist OA	3	1.11
Foot OA	2	0.74
Hand OA	2	0.74
Elbow OA	2	0.74
Total	270	100

3.4 Association Between Body Mass Index and Osteoarthritis Severity

To determine the influence of body mass index on disease severity, a two-way analysis of variance (ANOVA) was performed between BMI categories and stages of knee osteoarthritis. The analysis demonstrated a statistically significant association between BMI and osteoarthritis severity ($p = 0.0091$).

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Patients classified as overweight and obese were more frequently represented among advanced-stage osteoarthritis cases compared with individuals having normal BMI. Post-hoc Tukey's multiple comparison analysis further revealed significant differences between overweight and obese Class II patients (p = 0.0138) and between overweight and obese Class III patients (p = 0.0091).

These findings suggest that increasing BMI is associated with greater osteoarthritis severity and support the role of obesity as an important modifiable risk factor in disease progression.

Table 4. Association Between BMI Categories and Osteoarthritis Severity

Statistical Test	Result
Test Applied	Two-Way ANOVA
Variable 1	BMI Categories
Variable 2	Knee OA Severity
p-value	0.0091
Statistical Significance	Significant
Post-hoc Test	Tukey Multiple Comparison
Significant Comparison	Overweight vs Obese Class II (p=0.0138)
Significant Comparison	Overweight vs Obese Class III (p=0.0091)

3.5 Association Between Comorbidities and Osteoarthritis Severity

To evaluate the relationship between comorbidity burden and osteoarthritis severity, a two-way analysis of variance (ANOVA) was performed between comorbidity categories and stages of knee osteoarthritis. The analysis demonstrated a statistically significant association between comorbidities and osteoarthritis severity (p = 0.0003).

Patients with one or more comorbid conditions were more frequently represented among advanced-stage osteoarthritis cases compared with patients without comorbidities. Hypertension and type II diabetes mellitus were the most frequently observed comorbidities and constituted the predominant disease combinations among patients with severe osteoarthritis.

Although no statistically significant difference was observed among individual comorbidity categories themselves (p = 0.1412), the severity of osteoarthritis varied significantly according to disease stage, indicating that the overall comorbidity burden may contribute to disease progression.

The findings suggest that systemic disorders such as hypertension, diabetes mellitus, and other chronic conditions may influence osteoarthritis severity through shared inflammatory, metabolic, and vascular mechanisms. These results emphasize the importance of comprehensive management strategies targeting both joint disease and associated comorbid conditions.

Table 5. Association Between Comorbidities and Osteoarthritis Severity

Statistical Test	Result
Test Applied	Two-Way ANOVA
Variable 1	Comorbidity Categories
Variable 2	Knee OA Severity
p-value	0.0003
Statistical Significance	Significant
Difference Among Comorbidities	p = 0.1412 (Not Significant)
Difference Among OA Stages	Significant
Interpretation	Comorbidity burden associated with increased OA severity

Key Findings

Among 270 osteoarthritis patients, females constituted the majority of the study population and the highest disease burden was observed in middle-aged individuals. More than half of the patients were either overweight or obese. Hypertension and type II diabetes mellitus were the most prevalent comorbid conditions. Knee osteoarthritis represented the predominant joint involvement.

Statistical analysis demonstrated a significant association between BMI and osteoarthritis severity (p = 0.0091) as well as between comorbidity burden and disease severity (p = 0.0003). These findings indicate that obesity and chronic comorbid conditions are important contributors to osteoarthritis progression and should be considered during patient management and risk stratification.

LIMITATIONS

The present study has certain limitations that should be considered while interpreting the findings. First, the study was conducted at a single tertiary care center, which may limit the generalizability of the results to other healthcare settings and populations. Second, although the sample size of 270 patients was adequate for statistical analysis,

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larger multicenter studies would provide more representative findings and improve external validity.

Third, the study duration was limited to six months, restricting the assessment of long-term disease progression and outcomes. Fourth, the observational study design does not allow establishment of causal relationships between body mass index, comorbidities, and osteoarthritis severity. Fifth, important lifestyle factors such as dietary habits, physical activity levels, smoking status, occupational stress, and socioeconomic determinants were not systematically evaluated and may have influenced disease severity.

Additionally, biochemical markers of inflammation and metabolic dysfunction were not assessed, which could have provided further insight into the mechanisms linking obesity, comorbidities, and osteoarthritis progression. Finally, radiological progression and long-term functional outcomes could not be evaluated due to the absence of extended follow-up.

Despite these limitations, the study provides valuable evidence regarding the association between body mass index, comorbidity burden, and osteoarthritis severity in a tertiary care population and highlights important areas for future research.

VI. CONCLUSION

This prospective observational study evaluated the association between body mass index (BMI), comorbidities, and osteoarthritis severity among 270 patients attending a tertiary care hospital. The findings revealed a clear female predominance, with females accounting for 73.7% of the study population, and demonstrated that osteoarthritis was most frequently observed among individuals aged 40–59 years. Knee osteoarthritis was the predominant clinical presentation, highlighting the substantial burden of disease in weight-bearing joints.

A considerable proportion of patients were either overweight or obese, accounting for 57.04% of the study population. Statistical analysis demonstrated a significant association between BMI and osteoarthritis severity ($p = 0.0091$), indicating that increasing body weight contributes substantially to disease progression. These findings support existing evidence that obesity acts through both mechanical loading and metabolic-inflammatory pathways to accelerate joint degeneration.

Comorbidity analysis revealed that hypertension and type II diabetes mellitus were the most prevalent associated conditions. Furthermore, a significant association was observed between comorbidity burden and osteoarthritis severity ($p = 0.0003$), suggesting that chronic systemic diseases may play an important role in worsening disease outcomes. The coexistence of multiple comorbidities may further increase functional impairment and disease burden among osteoarthritis patients.

The study emphasizes that osteoarthritis should not be considered solely a localized joint disorder but rather a multifactorial condition influenced by metabolic, cardiovascular, and lifestyle-related factors. Early identification of obesity and associated comorbidities, coupled with appropriate lifestyle modification, weight reduction strategies, and effective management of chronic diseases, may help reduce disease progression and improve patient outcomes.

In conclusion, increased BMI and comorbidity burden are significant determinants of osteoarthritis severity. A multidisciplinary approach focusing on both joint health and systemic risk factor management is essential for optimizing treatment outcomes, reducing disability, and improving the quality of life of patients with osteoarthritis.

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