Gender, Hormonal, and Comorbidity-Related Variations in Osteoarthritis: A Comparative Observational Study

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ABSTRACT

Background: Osteoarthritis (OA) is the most common degenerative joint condition globally, especially in older adults. Factors like gender, hormones, BMI, affected joints, and other health issues can affect the onset and progression of OA. **Objectives:** This study evaluates the relationship between osteoarthritis and five factors: gender, menstrual status (menstruating vs. menopausal), Body Mass Index (BMI), affected joints, and comorbid conditions in adults. **Materials and Methods:** A cross-sectional study was conducted at a tertiary care hospital in Guntur, Andhra Pradesh with 60 osteoarthritis patients. Data was collected through patient interviews and clinical record reviews, focusing on gender, age, menstrual status in women, BMI, joint involvement, and comorbidities like diabetes, hypertension, and obesity. Statistical analysis was performed using the Chi-Square test in SPSS. **Results:** A study of 60 participants found that Osteoarthritis (OA) was more prevalent in females (63.4%) than males (36.7%), especially in postmenopausal women (76.3%). The highest incidence was in the 45 to 50 age group at 40%. Overweight individuals and those without comorbidities made up 60% of OA cases, suggesting a link between these factors and the disease. The knee joints were most affected, with a 71.6% incidence rate. However, no statistically significant differences were noted for any variables (*p*>0.05), likely due to the small sample size. **Conclusion:** Trends indicate a higher risk of Osteoarthritis (OA) in females, especially postmenopausal women and those with excess weight, but results were not statistically significant. Larger studies with longitudinal methods are needed for clearer insights.

Keywords: Osteoarthritis, Gender Differences, Menopause, Body Mass Index, Comorbidities, Joint Involvement.

INTRODUCTION

Osteoarthritis (OA) represents the most common type of arthritis worldwide and is a significant contributor to disability, especially among older adults. This condition is characterised by the deterioration of articular cartilage, alterations in the subchondral bone, and inflammation of the synovial membrane, which collectively result in symptoms such as pain, stiffness, and diminished joint functionality. While OA predominantly affects weight-bearing joints, such as the knees and hips, it may also impact the hands and spine.[1]

The incidence of OA escalates markedly with advancing age and is particularly pronounced in women, especially those who are postmenopausal.[2] This observed gender difference is largely linked to hormonal fluctuations, particularly the deficiency of estrogen, which may play a role in the deterioration of cartilage and modifications in pain perception.[3] Additionally, Body Mass Index (BMI) serves as a significant risk factor; increased body weight imposes additional mechanical strain on the joints and instigates systemic inflammation through adipokines, thereby exacerbating the loss of cartilage.[4]

Additional factors contributing to the condition include genetic susceptibility, repetitive stress on joints resulting from occupational or lifestyle choices, and chronic illnesses such as diabetes and hypertension.[5] These comorbidities may hasten the advancement of the disease and exacerbate the level of disability experienced. Notably, functional impairments, especially those related to knee involvement, considerably diminish the quality of life for those affected.[6,7]

Although the etiology of OA is recognized as multifactorial, there is a scarcity of population-specific data, especially from the Indian subcontinent. This research seeks to assess the prevalence of OA in connection with factors such as gender, menstrual status, body mass BMI, the joints involved, and associated comorbidities

within a South Indian demographic, thereby contributing to the development of clinical strategies tailored to the region.

Considering the rising prevalence of osteoarthritis among the Indian population and the limited number of comparative studies that assess the influences of gender, hormonal factors, and metabolic conditions on this disease, it is crucial to explore these elements within a well-organized clinical framework. Gaining insights into these relationships is vital for formulating preventive measures, enhancing early diagnostic capabilities, and customising treatment approaches for individual patients.

The main objective of this research is to investigate the correlation between osteoarthritis and significant demographic and clinical factors. The specific goals include: comparing the prevalence of osteoarthritis among males and females, analyzing how menstruation and menopausal status in women influence osteoarthritis, exploring the connection between Body Mass Index (BMI) and the occurrence of osteoarthritis, identifying the joints most frequently affected in patients with osteoarthritis, and assessing the influence of comorbidities such as diabetes and hypertension on the prevalence of osteoarthritis.

METHODOLOGY

This research was a cross-sectional observational study performed over six months at a tertiary care teaching hospital located in Guntur, Andhra Pradesh. It was executed through a collaboration between the Department of Pharmacy Practice and the Department of Orthopaedics, which facilitated the integration of both pharmaceutical and clinical perspectives in the processes of data collection and analysis.

The study involved a cohort of 60 patients who had been clinically diagnosed with Osteoarthritis (OA). The selection of participants was conducted through convenience sampling, adhering to specific inclusion and exclusion criteria established before the study.

A formal sample size calculation was not performed due to the exploratory nature of the study and the limited available cases during the study period.

The inclusion criteria for this study encompass individuals aged 40 years and older who have received a definitive clinical and radiological diagnosis of Osteoarthritis (OA). This includes both male and female participants, specifically accounting for menstruating and postmenopausal women. Furthermore, all patients must be prepared to give informed consent for their participation in the study. Conversely, the exclusion criteria eliminate individuals diagnosed with inflammatory arthritis, such as rheumatoid arthritis or gout, those who have experienced recent joint trauma or surgical interventions, and patients with autoimmune joint disorders. Additionally, individuals who are either unwilling to participate or unable to provide informed consent are also excluded from the study.

Data about patients were gathered through a systematic questionnaire and clinical assessments. The recorded parameters encompassed age, gender, menstrual status (for female participants), Body Mass Index (BMI), affected joints, and the existence of comorbid conditions such as diabetes and hypertension. The calculation of BMI was performed by the classification guidelines established by the World Health Organisation, utilising the participants' weight and height.

The gathered data were input into Microsoft Excel and subsequently analysed utilising SPSS version 20.0. Descriptive statistics, including frequencies and percentages, were applied to summarise both demographic and clinical variables. To investigate the relationships between osteoarthritis and the chosen variables, the Chi-square test was utilised. A *p*-value of less than 0.05 was deemed statistically significant.

RESULTS

Table 1 shows the data on gender, hormonal status, and age distribution among osteoarthritis patients. It provides a comparative view of the involvement of the knee, spine, or both regions. The study highlights a significantly higher incidence of Osteoarthritis (OA) in females, recorded at 63.3%, in contrast to 36.7% in males. This observed gender difference aligns with global epidemiological data, which indicates that women are at a greater risk for developing OA, especially after menopause, due to a combination of anatomical, hormonal, and potentially behavioural influences.[8] The role of estrogen in safeguarding joint health is well-documented, and its reduction following menopause is a critical factor in the onset of OA. This study further substantiates these findings, revealing that 76.3% of the female participants diagnosed with OA were post-menopausal, thereby corroborating existing literature that associates the decline in estrogen levels with heightened cartilage deterioration and exacerbated joint symptoms.[9]

The study reveals that a significant proportion of patients, specifically 40%, are situated in the 45-50 years age bracket, indicating a potential shift towards an earlier manifestation of Osteoarthritis (OA) symptoms. This finding diverges from certain international studies that link the highest incidence of OA with older age groups; however, it is consistent with recent observations in developing areas where lifestyle choices, mechanical stress, and insufficient preventive healthcare may play a role in the premature onset of the disease.[10]

Table 2 consolidates data on the BMI categories and various comorbid conditions seen in osteoarthritis patients. It shows their influence on the distribution of knee, spine, and combined osteoarthritis**.**

The study indicates that 60% of patients with Osteoarthritis (OA) are classified as overweight, while 13.4% are categorised into different obesity classes, underscoring the significant impact of

Table 1: Osteoarthritis Patient Distribution by Demographics and Clinical Parameters.

Parameter	Total Patients	Knee OA	Spine OA	Knee+Spine OA	% in Total OA (60)
Gender					
Male	22	17	5	0	36.7%
Female	38	26	9	3	63.3%
Menstrual Status (in Females)					
Menopausal	29	22	5	2	76.3% of females
Menstruating	9	4	4	1	23.7% of females
Age Group (in Years)					
45-50	24	14	8	2	40%
51-55	9	7	2	0	15%
56-60	14	11	3	0	23.3%
61-65	7	6	1	0	11.7%
66-70	3	2	1	0	5%
71-75	2	2	0	0	3.3%
76-80	1	1	0	0	1.7%

Table 2: BMI and Comorbidity-wise Distribution of Osteoarthritis Patients.

Parameter	Total Patients	Knee OA	Spine OA	Knee+Spine OA	% in Total OA (*n*=60)
BMI Category					
Normal	16	8	8	0	26.7%
Overweight	36	28	6	2	60%
Obese I	6	5	1	0	10%
Obese II	1	1	0	0	1.7%
Obese III	1	1	0	0	1.7%
Comorbidities					
Diabetes	1	1	0	0	1.7%
Hypertension	8	7	1	0	13.3%
Thyroid	6	3	3	0	10%
Diabetes + Hypertension	11	8	3	0	18.3%
Diabetes + Thyroid	1	0	1	0	1.7%
Hypertension + Thyroid	3	2	0	1	5%
No Comorbidity	30	22	7	1	50%

Table 3: Statistical Significance (*p*-value Analysis).

Parameter	*p*-value
Age	0.906
Gender	0.388
Menstruating Status	0.193
Comorbidities	0.199
BMI	0.380

excess weight as a modifiable risk factor. This finding is consistent with global data that suggests a higher Body Mass Index (BMI) not only results in mechanical stress on weight-bearing joints, such as the knees, but also promotes systemic inflammation via adipokines, which further aggravates joint deterioration.[11]

The analysis of comorbidities in the present research indicates that half of the Osteoarthritis (OA) population is affected by additional health issues, including hypertension, diabetes, or thyroid disorders. Notably, the combination of diabetes and hypertension emerged as the most prevalent, occurring in 18.3%

of the cases. These results align with international studies that document elevated levels of multimorbidity among OA patients, particularly highlighting cardiovascular and metabolic disorders as the most commonly linked conditions.[11]

Table 3 presents the *p*-values derived from statistical analysis between osteoarthritis occurrence and various demographic, hormonal, comorbidity, and BMI parameters. The analysis of *p*-values indicates that none of the examined variables-age (*p*=0.906), gender (*p*=0.388), menstruation status (*p*=0.193), comorbidities (*p*=0.199), or BMI (*p*=0.380)-exhibit statistically significant correlations with either the distribution or type of osteoarthritis within the studied cohort (*p*>0.05). This finding implies that the occurrence of osteoarthritis in this group may stem from a complex interaction of multiple factors, rather than being attributable to any single variable. It emphasises the necessity for larger sample sizes or longitudinal studies to better understand the intricate relationships among risk factors.

In spite of the observed trends, the statistical evaluation conducted in this study did not reveal any notable correlation (*p*>0.05) between the prevalence of Osteoarthritis (OA) and factors such as age, gender, menstruation status, Body Mass Index (BMI), or comorbid conditions. This indicates that although certain patterns can be recognised, the underlying causes of OA are likely to be multifaceted and intricate. The lack of significant associations may be due to the small sample size or the influence of confounding variables that were not accounted for in the observational framework. This finding supports the recommendations from various international reviews advocating for more extensive, longitudinal, and multi-variable controlled research to enhance the understanding of the risk factors associated with OA.[3]

Although the results suggest higher OA prevalence in postmenopausal women and overweight individuals, these findings were not statistically significant and must be interpreted cautiously.

CONCLUSION

The study adds to the expanding literature that underscores the significance of gender, hormonal influences, and metabolic factors in Osteoarthritis (OA). It stresses the necessity for early detection and management of modifiable risk factors, especially among women and those with excess weight. Subsequent investigations should aim to include more diverse populations and utilise comprehensive risk modelling to elucidate causal links and guide focused treatment strategies.

As this was a cross-sectional study, it limits our ability to draw causal inferences. Future longitudinal and interventional studies are required to establish definitive relationships.

LIMITATIONS OF THE STUDY

Potential biases, such as selection bias due to convenience sampling and recall bias from self-reported data, may affect the reliability of findings.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABRREVIATIONS

OA: Osteoarthritis; **BMI:** Body Mass Index; **SPSS:** Statistical Package for the Social Sciences; **WHO:** World Health Organisation; **DM:** Diabetes Mellitus; **HTN:** Hypertension.

ETHICAL STATEMENT

This study was approved by the Institutional Ethics Committee of Hindu College of Pharmacy and conducted per the ethical standards laid down in the Declaration of Helsinki. Written informed consent was obtained from all participants before enrolment in the study. Patient data were anonymised, and confidentiality was strictly maintained throughout the research process.

SUMMARY

This cross-sectional observational study aimed to explore gender, hormonal, and comorbidity-related variations in Osteoarthritis (OA) among 60 adult patients in South India. The study found a higher prevalence of OA among postmenopausal women and overweight individuals, with the knee joint being the most commonly affected site. Although these trends align with existing literature, no statistically significant associations were observed due to the small sample size. The study highlights the need for larger, longitudinal studies to establish causal relationships and better inform risk stratification and early intervention strategies in OA management.

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