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# PROFILE OF METABOLIC SYNDROME AMONG PATIENTS OF KNEE OSTEOARTHRITIS: A HOSPITAL BASED CROSS-SECTIONAL, OBSERVATIONAL AND PROSPECTIVE 1 YEAR STUDY

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**ABSTRACT** **Introduction:** The prevalence of metabolic syndrome is high in India. It is frequently associated with comorbidities like diabetes mellitus, cardiovascular abnormalities and hypertension. Osteoarthritis is also commonly associated with diabetes mellitus, dyslipidemia and hypertension. **Materials and methods:** Our study was an observational single centre study done in the Department of Medicine of Government Medical College, Jammu. The study aimed to find the point prevalence of metabolic syndrome among patients of knee osteoarthritis and to study epidemiological, demographic, clinical profile of metabolic syndrome among patients of knee osteoarthritis. The study was done on outpatients who fulfilled the criteria for osteoarthritis. **Results:** A total of 129 patients were included in the study. Mean age of the patients was 64 yrs with no gender difference. There was urban preponderance in the patients. Duration of disease was less than 10 yrs in 93% patients.19% of the patients had a BMI of more than 30kg/m2. Hypertension was present in half of the patients. Diabetes Mellitus was present in 41.9% of the study population group. The point prevalence of metabolic syndrome was 57.4%(n=74) among the study population. **Conclusion:** There is high prevalence of individual components of metabolic syndrome in patients of Osteoarthritis knee.

**KEYWORDS :** Osteoarthritis, metabolic syndrome, diabetes mellitus, hypertension

## INTRODUCTION

Metabolic syndrome consists of a constellation of metabolic abnormalities that confer increased risk of cardiovascular disease and diabetes mellitus. The major features of the metabolic syndrome include central obesity, hypertriglyceridemia, low levels of high-density lipoprotein (HDL), cholesterol, hyperglycemia, and hypertension.

Worldwide prevalence of Metabolic Syndrome ranges from <10% to as high as 84%, depending on the region, composition (sex, age, race, and ethnicity) of the population studied, and the definition of the syndrome used. In general, one-quarter of the world's adult population has the Metabolic Syndrome.

In 1988 to 1994, at least one-fourth of the population had the Metabolic Syndrome by NCEP criteria. It has been estimated that 50million Americans had the Metabolic Syndrome in 1990 and 64 million had the syndrome in 2000. Two factors appear to account for this increase. One of these is obesity and second is aging of the population.

In 2000, approximately 32% of U.S. adults had the metabolic syndrome. The prevalence of the metabolic syndrome varies around the world with the highest recorded among native Americans, with nearly 60% of women and 45% of men ages 45-49**.** In East and Southeast Asian populations prevalence appears to be between 10 to 30%.

In India age-standardized prevalence rates of metabolic syndrome are 33.5% overall, 24.9 % in males and 42.3% in females [(1)]**.** As per an Indian study, prevalence according to IDF, NCEP, WHO criteria are 25.8 %, 18.3 % and 23.0% respectively [(2)]. According to another study Metabolic Syndrome was present in 41.1% in urban Asian Indian adults [(3)].

Osteoarthritis (OA) is the most common type of arthritis. Osteoarthritis is more common in women than men but the prevalence increases dramatically with age. 45% of women over the age of 65 have symptoms while radiological evidence is found in 70% of those over 65**.** Osteoarthritis is the second most common rheumatologic problem and is the most frequent joint disease with prevalence of 22 to 39% in India [(4)]**.**

Osteoarthritis is one of the diseases with the highest rate of comorbidity. Previous studies have reported comorbidity rates of 68% to 85% [(5,6,7)]. Diseases that are most frequently associated with Osteoarthritis are diabetes, hypertension, and cardiovascular disorders [(8,9)]. Diabetes, hypertension, and obesity are components of metabolic syndrome.

## MATERIALS AND METHODS

Present study is an attempt to determine the relationships between knee osteoarthritis, metabolic syndrome and metabolic syndrome parameters through a population – based study . This study was conducted from November 2020 to October 2021. This was a current prospective, cross sectional and observational study with the following objectives.

1. To study point prevalence of metabolic syndrome among patients of knee osteoarthritis.
2. To study epidemiological, demographic, clinical profile of metabolic syndrome among patients of knee osteoarthritis.

The study was conducted in the Post Graduate Department of Medicine of Government Medical College, Jammu after getting valid, informed consent from the patients and after getting permission from the institutional ethics committee. The patients were selected from the outdoor patient department of medicine. All principles of bioethics were followed in the current study.

### INCLUSION CRITERIA

1) Outdoor patients.
2) Any gender.
3) Any patient who fulfill the criteria for osteoarthritis.
4) Those who will be giving their valid, informed consent.

### EXCLUSION CRITERIA

1) Patients with critical illness.
2) Patients refusing to give consent.
3) Patients who needed hospital admission.

### CRITERIA FOR OSTEOARTHRITIS

Patients of osteoarthritis knee were diagnosed as per American College of Rheumatology Criteria (1999) [(10)].

Using history, physical and radiological findings:

- Pain in the knee and radiological osteophytes and one of the following
- Over 50 years of age
- Less than 30 minutes of morning stiffness.
- Crepitus on active motion.

Using history, physical examination and laboratory findings-

- Pain in the knee and five of the following
- Over 50 years of age
- Less than 30 minutes of morning stiffness
- Crepitus on active motion

- Bony tenderness
- Bony enlargement
- No palpable warmth of synovium
- ESR less than 40 mm at the end of one hour
- Rheumatoid factor less than 1:40
- Synovial fluid signs of osteoarthritis

Radiographic osteoarthritis was defined according to Lawrence-Kellgren grading system.

**Grade 0**: no radiographic features of OA.

**Grade 1**: doubtful joint space narrowing (JSN) and possible osteophytic lipping

**Grade 2**: definite osteophytes and possible JSN on weight-bearing radiograph

**Grade 3**: multiple osteophytes, definite JSN, sclerosis, possible bony deformity

**Grade 4**: large osteophytes, marked JSN, severe sclerosis and definite bony deformity

## CRITERIA FOR METABOLIC SYNDROME

The International Diabetes Federation, 2005 defined Metabolic Syndrome as central obesity plus any two of the following four parameters:

1. Raised triglycerides: ≥150 mg/dl (1.7 mmol/l).

2. Reduced HDL cholesterol: < 40 mg/dl (1.03 mmol/l) in males and < 50 mg/dl (1.29 mmol/l) in females.

3. Raised blood pressure: systolic BP ≥130 mm Hg or diastolic BP ≥85 mm Hg.

4. Raised FPG: ≥ 100 mg/dl or previously diagnosed type 2 DM

## STATISTICAL ANALYSIS

The socio demographic profile, clinical profile of both metabolic syndrome and osteoarthritis and metabolic profile was analyzed and correlated in a detailed subgroup analysis.

Data was entered and analyzed using SPSS version for Windows and Microsoft Excel applications. The data is presented as MeanSEM for quantitative variable and as n (%) for qualitative variable. The suitable statistical comparison test (Chi square Test or Fisher's Exact Test) was applied to establish the correlation between the two entities.

## RESULTS

The study was carried out on 129 patients who were attending outpatients of department of medicine. Each patient was subjected to detailed history, examination and appropriated investigations were made to screen the patients for metabolic syndrome.

The socio-demographic profile revealed that maximally 44.2 %(n=57) of the patients with osteoarthritis knee were in the age group of 60-69 years followed by 31.2% (n=41) in≥70 years age group and 24% (n=31) of the patients were in the 50-59 years age group. The mean age of the study population was recorded as 64.75 years.

**Table 1: Age- wise Distribution of Patients of Osteoarthritis Knee (n=129)**

| Age (years) | No. of Patients(n=129) | % |
|---|---|---|
| 50-59 | 31 | 24 |
| 60-69 | 57 | 44.2 |
| ≥70 | 41 | 31.2 |

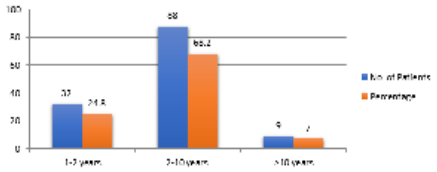
Mean 64.75 (± 8.861 S.D)
Males and females were equal in number with male to female ratio of 1:1.016.

**Table 2: Sex- wise Distribution of Patients of Osteoarthritis Knee (n=129)**

| Gender | No. of Patients(n=129) | % |
|---|---|---|
| Male | 64 | 49.6 |
| Female | 65 | 50.4 |

Male: Female 1:1.016

**Figure 1: Distribution of Patients of Osteoarthritis Knee (n=129) on the Basis of Duration of Pain.**



On the basis of duration of knee pain, patients were divided into those having pain for one to two years, two to ten years and more than ten years with maximum patients in two to ten years age group 68.2%(n=88) of total patients followed by one to two years age group constituting 24.8%(n=32) and least patients in more than ten years age group 7%(n=9).

Study showed slight urban preponderance with urban to rural ratio of 1.26:1.

On the basis of occupation our study population comprised of housewives 36.4%(n=47), retired personnel 29.5% (n=38), farmers and drivers 22.5%(n=29), salaried 10.9%(n=14) and non- salaried 0.8%.

Hypertension was present in 51.9%(n=67) of the study population group.

**Figure 2: Distribution of Patients of Osteoarthritis Knee (n=129) on the Basis of Presence of Hypertension.**

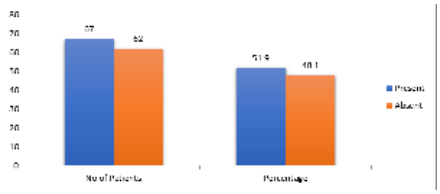
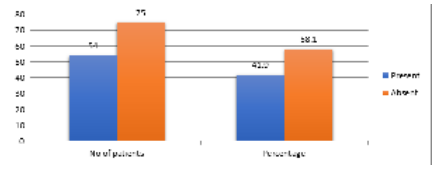


**Figure 3: Distribution of the Patients of Osteoarthritis Knee (n=129) on the Basis of Presence of Diabetes Mellitus.**



Diabetes Mellitus was present in 41.9% of the study population group. Dyslipidemia was present in 54.3% of the study population using Triglycerides as per IDF criteria. Dyslipidemia was present in 61.2% of the population using HDL as per IDF criteria.

**Figure 4: Distribution of Patients of Osteoarthritis Knee (n=129) on the Basis of BMI**

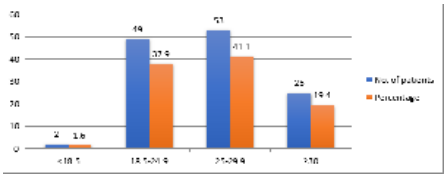
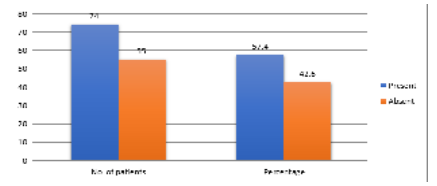


**Figure 5: Distribution of the Patients of Osteoarthritis Knee (n=129) on the Basis of Presence of Metabolic Syndrome**



Most of the patients had BMI in the 25-29.9kg/m² group with 41.4%(n=53) of total patients followed by 18.5-24.9 kg/m² group comprising 37.9% (n=49) patients followed by ≥ 30 kg/m² group

comprising 19.4%(n=25) and least patients in less than 18.5kg/m² group 1.6%(n=2)

On the basis of waist circumference, maximum number of patients were having waist circumference more than 90 cms comprising 58.13%(n=75). The point prevalence of metabolic syndrome was 57.4%(n=74) among the study population.

## DISCUSSION

Osteoarthritis is the most common type of arthritis. Its high prevalence, especially in the elderly, and the high rate of disability related to the disease make it a leading cause of disability in the elderly. The results of the current study showed that the maximum number of patients were in the age group of 60-69 years with mean of 64.75 years which is in accordance to various previous studies [11].

The mean BMI of the population study was 26.66 which is in the range of pre-obese. The prevalence of hypertension in our study population was 51.9%. Rahman MM *et al,* 2014 [12] observed the presence of hypertension in 40.2 % of the patients. A meta-analysis involving 9762 participants also showed that hypertension was associated with both radiographic and symptomatic OA (13). In the more recent study, the association was further confirmed. (14)

The concordance of diabetes mellitus with osteoarthritis in our population was 41.9 %.

Most of the patients in our study population were overweight (BMI)≥25kg/m² comprising 60.5% of patients. Out of which 19.4% were obese. Manek NJ *et al*, 2013 [15] found a strong association between high BMI and the presence of knee osteoarthritis (odds ratio 3.90 for highest versus lowest quartile of BMI; p<0.0001).

Obesity (as per criteria of BMI) was present in higher percentage of patients in knee osteoarthritis group as compared to the non-osteoarthritis group in Hongxing Li *et al*, 2016[11] study like our study.

In our study we found that most of the patients were obese using the waist circumference criteria (≥80cms for females and ≥90cms for males) comprising 67.44 % of the study group.

Dyslipidemia was present in 54.3% of the population study group (using triglycerides as criteria) and 61.2% of the study group (using HDL as criteria). Similar results were found in the Hongxing Li *et al*, 2016[11] study. Dyslipidemia was present in 64.25 of patients in osteoarthritis group as compared to37.0% in non-osteoarthritis group in their study.

The point prevalence of metabolic syndrome in our study population was 57.4 %. Similar results were found in the study of Malik S *et al*, 2015 [16]. With the aging population the prevalence of osteoarthritis and metabolic syndrome is increasing. The present study supports the notion that metabolic syndrome and its comorbidities are more common in patients with osteoarthritis.

Metabolic syndrome and osteoarthritis share many of the same pathophysiological mechanisms such as inflammatory aging, oxidative stress, lipid metabolism disorders, and vascular endothelial cell dysfunction leading to the damage of cartilage, subchondral bone, and mitochondrial DNA**.**

It has been suggested that hypertension may be associated with atherosclerotic disease, defects may be present in the sub-chondral plate in weight bearing areas, and vascularity of these defects decrease with age.

Obesity promotes increased expression of pro-inflammatory cytokines and degrading enzymes, inhibiting cartilage matrix synthesis and potentially contributing to the formation of osteoarthritis. Considering the mechanical factors, the stress and amount of force on the weight-bearing joints are increased in overweight subjects. This additional physical load could cause cartilage breakdown leading to OA**.**

It has been suggested that the damage caused by hyperglycemia is both direct and indirect via its effect on chondrocyte metabolism imbalance and sensitivity to matrix metalloproteinase promoting cartilage matrix degeneration and apoptosis**.** Hyperglycemia and OA interact at both local and systemic levels; local effects of oxidative stress and advanced glycation end-products are implicated in cartilage damage, whereas low-grade systemic inflammation results from glucose accumulation and contributes to a toxic internal environment that can exacerbate OA**.**

Many of the components of metabolic disorders are involved in self-propagating cycles resulting in both systemic and intra-articular inflammation and oxidative damage**.**

Increased blood viscosity and micro fat emboli as well as the deposition of lipids into the chondrocytes may be triggering events for osteoarthritis**.** Dyslipidemia inhibits nitric oxide synthesis allowing the local microenvironment to produce oxidative damage, along with cytokines released from the infrapatellar fat pad, resulting in inflammatory mediated osteoarthritis progression [17,18]. Metabolic syndrome and OA both share a low-grade inflammatory state, and an increasing number of studies have found correlations between metabolic syndrome and OA [19].

## LIMITATIONS OF THE STUDY-

1. Less number of patients(n=129).
2. Short time period study (1 year).
3. This was an observational study.
4. No control group i.e non osteoarthritis patients was taken in the study plan.
5. Severity of the osteoarthritis was not taken into consideration.
6. Correlation between components of metabolic syndrome and severity of osteoarthritis were not derived.
7. No subgroup analysis was done.
8. The study design selected was not meant to comment on the biological plausibility and temporal relationship.
9. Results of a single centre study could not be generalized to the other tertiary centres of India.

## FUTURE PROSPECTS

Our study has confirmed some early findings of a link between metabolic risk factors and knee osteoarthritis. In future the scope of the study should be extended to a larger population at different study centres and should also include non- osteoarthritis population to get comparative results. Future research should therefore investigate the role of early novel medical interventions in retarding the development and progression of osteoarthritis and its symptomatology or by demonstrating a reduction in metabolic syndrome after the reduction of osteoarthritis symptoms through surgery. Whether reducing the risk factors of metabolic syndrome has a preventive role in reducing the incidence or symptomatology of osteoarthritis should be the subject of future research. Further studies should also focus the temporal relationship between the components of metabolic syndrome and symptoms of osteoarthritis.

## REFERENCES


1. Prasad DS, Kabir Z, Dash AK, Das BC. Prevalence and risk factors for metabolic syndrome in Asian Indians: A community study from urban Eastern India. J Cardiovasc Dis Res 2012,3 (3):204-11
2. Deepa M, Farooq S, Datta M, Deepa R, Mohan V. Prevalence of metabolic syndrome using WHO, ATPIII and IDF definitions in Asian Indians: the Chennai Urban Rural Epidemiology Study (CURES-34). Diabtes Metab Res Rev 2007;23(2):127-34
3. Ramachandran A, Snehalatha C, Satyavani K, Sivasankari S, Vijay V. Metabolic syndrome in urban Asian Indian adults--a population study using modified ATP III criteria. Diabetes Res Clin Pract 2003;60(3):199-04
4. Mahajan A, Jasrotia DS, Manhas AS, Jamwal SS. Prevalence of Rheumatic disorder in urban population in Jammu. JK Sci 2003; 563-66
5. Sarzi-Puttini P, Cimmino MA,Caporali R, Parazzini F, Canesi B. Osteoarthritis: an overview of the disease and its treatment strategies. Semin Arthritis Rheum. 2005 Aug;35(1 Suppl 1):1-10.
6. Tuominen U, Blom M, Hirvonen J, Seitsalo S, Hietanieni K, Rissanen P, Sintonen H. The effect of co-morbidities on health-related quality of life in patients placed on the waiting list for total joint replacement. Health Qual Life Outcomes. 2007 Mar 15; 5:16.
7. van Dijk GM, Veenhof C, Schellevis F, Lankhorst GJ, Dekker J. Comorbidity, limitations in activities and pain in patients with osteoarthritis of the hip or knee. BMC Musculoskelet Disord. 2008 Jun 26; 9:95.
8. Schellevis FG, van der Velden J, van Eijk JT, van Weel C. Comorbidity of chronic diseases in general practice. J Clin Epidemiol. 1993
9. Tukker A, Visscher TL, Picavet HS. Overweight and health problems of the lower extremities: osteoarthritis, pain and disability. Public Health Nutr. 2009
10. American College of Rheumatology subcommittee on osteoarthritis guidelines. Arthritis Rheum 2000;43(9):1905-15
11. Li H, George DM, Jaarsma RL, Mao X. Metabolic syndrome and components exacerbate osteoarthritis symptoms of pain, depression and reduced knee function. Ann Transl Med. 2016 Apr;4(7):133
12. Rahman MM, Cibere J, Anis AH, Kopec JA. Risk of Type 2 Diabetes among Osteoarthritis Patients in a Prospective Longitudinal Study Int J Rheumatol 2014
13. Y.M. Zhang, J. Wang, X.G. Liu. Association between hypertension and risk of knee osteoarthritis: a meta-analysis of observational studies Medicine (Baltim), 96 (2017)
14. Y. Xie, W. Zhou, Z. Zhong, et al. Metabolic syndrome, hypertension, and hyperglycemia were positively associated with knee osteoarthritis, while dyslipidemia showed no association with knee osteoarthritis Clin Rheumatol (2020)

15. Manek NJ, Hart D, Spector TD, MacGregor AJ. The Association of Body Mass Index and Osteoarthritis of the Knee Joint: An Examination of Genetic and Environmental Influences Arthritis Rheum 2003;48 (4): 1024–29
16. Malik S, Salim B, Khaili Z, Nasim A. Association of metabolic syndrome in patients with osteoarthritis RMJ 2015; 40(4):362-65
17. Xia B, Di Chen, Zhang J, Hu S, Jin H, Tong P. Osteoarthritis pathogenesis: a review of molecular mechanisms. Calcif Tissue Int. 2014
18. Bastiaansen-Jenniskens YM, van Osch GJ. Infrapatellar fat pad of patients with end-stage osteoarthritis inhibits catabolic mediators in cartilage. Ann Rheum Dis. 2012
19. Q. Tan, A. Jiang, W. Li, C. Song, H. Leng. Metabolic syndrome and osteoarthritis: possible mechanisms and management strategies Med Novel Technol Device, 9 (2021), Article 100052