

Original Research article

Association of osteoarthritis with metabolic syndrome: A hospital based study

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Received: 10.9.2020

Revised: 21.9.2020

Accepted: 7.11.2020

Abstract

Background: Osteoarthritis (OA) is a common degenerative joint disorder characterized by progressive cartilage degradation and joint pain. Metabolic syndrome (MetS), a cluster of various clinical and biochemical parameters, is a significant predictor of the associated risk for cardiovascular events and has been implicated in various chronic diseases.

Aim: This hospital-based study aimed to assess the prevalence of MetS in patients of OA and to explore any potential association between the two.

Methods: A cross-sectional analysis was conducted over a period of one year on a cohort of 500 patients diagnosed with OA and an equal number of age and sex matched controls. Clinical and metabolic parameters including blood pressure, waist circumference, fasting blood glucose and lipid profile were assessed. Disease severity was evaluated using established clinical scoring systems. Statistical analyses were performed to determine prevalence rates of MetS and explore any associations between MetS and OA.

Results: Knee OA was the most common type seen in 61% patients; followed by cervical spine, shoulder, hip and small joints of hands/feet. Disease duration in cases ranged from 8 months to 40 years with a mean disease duration of 12.23 years. Grade 1 OA was seen in 3.4% patients, grade 2 in 34%, grade 3 in 48.4% and grade 4 in 14.2% patients. Metabolic syndrome was significantly more common in OA patients (44.8%) than in controls (17.8%) ($p < 0.05$). Occurrence of MetS showed an increasing trend with the duration of the disease ($p < 0.01$). Knee OA was significantly associated with MetS ($p < 0.01$). However, MetS was not related to severity of OA ($p = 0.19$).

Conclusion: The findings suggest a significant correlation between metabolic syndrome and osteoarthritis, highlighting the need for multidisciplinary interventions to manage both conditions concurrently.

Keywords: Inflammatory states, metabolic syndrome, osteoarthritis, cardiovascular risk

Introduction

Osteoarthritis (OA) is a prevalent musculoskeletal disorder characterized by the gradual deterioration of articular cartilage and associated joint pain, stiffness, and functional impairment. Metabolic syndrome (MetS) is a constellation of cardiovascular risk factors including obesity, hypertension, dyslipidemia and insulin resistance. Epidemiological research has shown that hypertension, heart failure and diabetes are significantly more common in patients with psoriasis than in controls and an increased mortality from cardiovascular disease in patients with severe psoriasis has been documented.[1]

OA is mostly considered not a simple cartilage degradation, but a whole joint disorder, with all the joint components involved, such as subchondral bone, synovium and adhesive ligaments/muscles. Moreover, metabolic syndrome (MetS) and OA are both share a low-grade inflammatory state suggesting that systemic metabolic disturbances may contribute to the pathogenesis of OA. The link between osteoarthritis and metabolic syndrome has previously been demonstrated in different studies.[2-4] It has been suggested that the core of both is a chronic low-grade systemic inflammation. This has led some authors to consider osteoarthritis to be part of a greater inflammatory metabolic syndrome.[5-8]

Material and Methods

This was a hospital-based prospective case-control study carried out over a period of one year (2019 to 2020) at Norther Railway Divisional Hospital, Ambala. A total of 500 patients of osteoarthritis and equal number of age and sex matched controls were included in the study after obtaining written informed consent. Inclusion criteria for patients were:

1. Age more than 18 years
2. Disease duration of at least 6 months

Exclusion criteria were:

1. Patients with other types of arthritis, e.g. Rheumatoid arthritis, Gouty arthritis, Psoriatic arthritis
2. Patients with arthritis secondary to trauma
3. Patients with congenital malformation of limbs, e.g. congenital dislocation of hips, CTEV, Hemimelia, etc.
4. Patients who are already a known case of hypertension, diabetes, dyslipidemia or coronary artery disease.
5. Patients who refused to give consent for the study

The control group comprised of healthy controls of similar age and sex chosen from the general population including colleagues, hospital staff and relatives or attendants of patients, who are not a known case of hypertension, diabetes, dyslipidemia or coronary artery disease. The source population for cases and controls was the same.

After taking an informed written consent, the study groups were evaluated and the demographic profile and clinical characteristics were recorded on a predesigned proforma. Demographic data included age, gender, height, weight, smoking and alcohol consumption habits. Body mass index (BMI) was calculated as weight in kilograms/height² in meters.

Data regarding disease characteristics including joints involved, mode of onset, duration of disease, severity were collected. The diagnosis of OA was made clinically by an Orthopedic surgeon and later confirmed radiologically. The grading of severity of OA was done according to classification system proposed by Kellgren and Lawrence, as:

Grade 0 (none): definite absence of X-ray changes of OA
Grade 1 (doubtful): doubtful joint space narrowing and possible osteophytic lipping
Grade 2 (minimal): definite osteophytes and possible joint space narrowing
Grade 3 (moderate): moderate multiple osteophytes, definite narrowing of joint space and some sclerosis and possible deformity of bone ends
Grade 4 (severe): large osteophytes, marked narrowing of joint space, severe sclerosis and definite deformity of bone ends. [9]

For MetS, following parameters were assessed: waist circumference, triglyceride level, high density lipoprotein (HDL) cholesterol level, blood pressure and fasting glucose. The diagnosis of metabolic syndrome was made based on the presence of ≥ 3 criteria of the National Cholesterol Education Program's Adult Treatment Panel III (NCEP/ATP III criteria):[13] waist circumference >102 cm in men or >88 cm in women, hypertriglyceridemia ≥ 150 mg/dL, high-density lipoprotein (HDL) cholesterol <40 mg/dL in men or <50 mg/dL in women, blood pressure $\geq 130/85$ mmHg and fasting plasma glucose ≥ 100 mg/dL.

To determine the waist circumference, measuring tape was placed around the abdomen at the level of uppermost part of the pelvic bone, while ensuring that the tape measure remained horizontal and was snug without causing compression on the skin. Blood pressure was recorded as the average of two measurements after subjects have been sitting for five minutes. A venous blood sample was taken in all patients and controls, after overnight fasting (at least 8 h) to estimate the fasting blood sugar (enzymatic method) and fasting lipid profile (enzymatic method).

All the data was properly coded and entered in Microsoft Excel and analyzed using SPSS software. Appropriate tests of significance were applied wherever required.

Results

A total of 500 cases of OA and 500 controls were included in the study. The demographic profile of cases and controls are presented in Table.1 below:

Characteristic	Cases	Controls
Age in years (mean)	32-89 (51.53)	30-80 (50.43)
Female/male ratio	2:1	2.24:1
BMI (mean \pm SD)	28.09 \pm 4.22	26.94 \pm 5.3
Smoker, <i>n</i> (%)	66 (13.2)	71 (14.2)
Alcoholic, <i>n</i> (%)	26 (5.2)	17 (3.4)

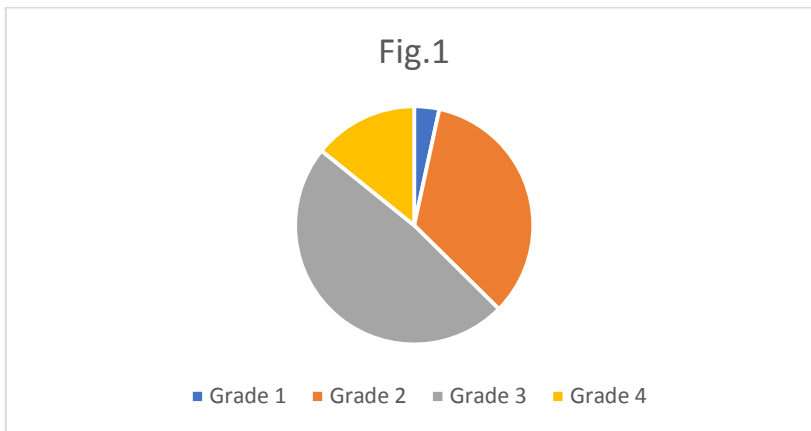
The mean age of cases was 51.53 years (± 12.14), with age ranging from 32 to 89 years. Of the 500 cases, 330 were females and 170 were males. There was no statistically significant difference in age, sex or BMI between the cases and controls.

Disease characteristics

Type of OA: Knee OA was the most common type seen in 305 (61%) patients; followed by cervical spine (24%), shoulder (7%), hip (6.4%) and small joints of hands/feet (4%).

Duration of OA: Disease duration in cases ranged from 8 months to 40 years with a mean disease duration of 12.23 years. 6 patients had disease duration less than 1 year, 10 had disease duration of 1-3 years; and in 14 patients, the duration of psoriasis was more than 3 years. OA patients with metabolic syndrome had mean disease duration of 10.62 ± 12.78 years against 1.48 ± 8.90 years in those without metabolic syndrome. The difference was statistically highly significant ($p < 0.001$)

Severity: Grade 1 OA was seen in 17 (3.4%) patients, grade 2 was seen in 170 (34%) patients, grade 3 was present in 242 (48.4%) patients and 71 (14.2%) patients had grade 4 OA (fig.1).

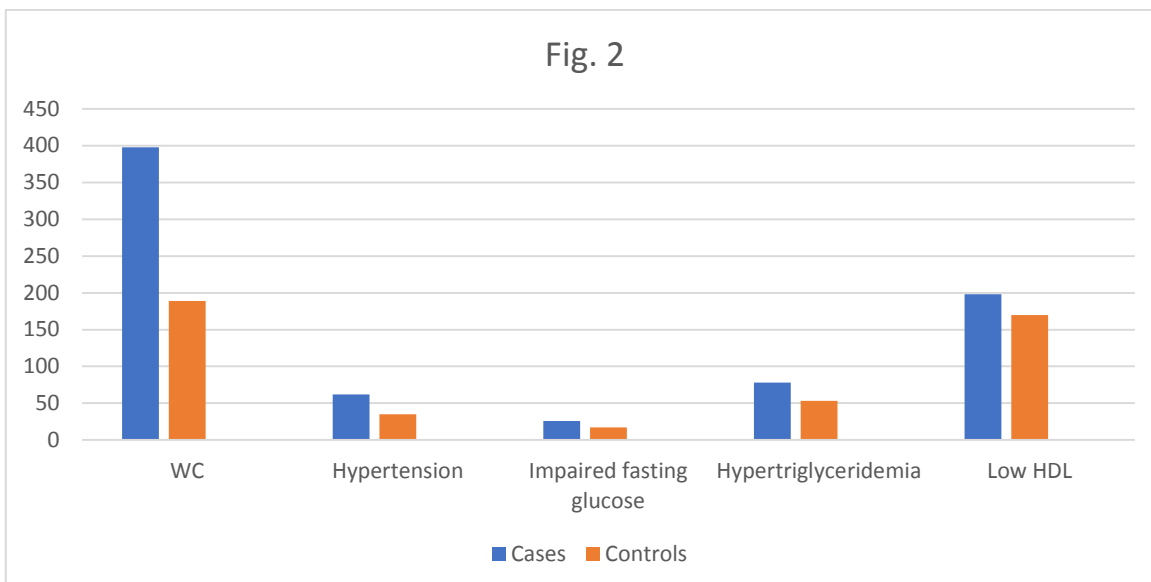


Osteoarthritis and metabolic syndrome

According to the above tabulations by applying the NCEP ATP III criteria, metabolic syndrome was present in 224 out of the 500 patients (44.8%). In the control group, only 89 (17.8%) met the NCEP ATP III. This difference was statistically highly significant ($p < 0.05$)

Individual components of metabolic syndrome

The prevalence of individual components of MetS among cases and controls are depicted in fig.2



Correlation

Correlation of duration of the disease and MetS: Of the 224 patients with metabolic syndrome 89.84% of the patients had a duration of > 5 years; thus occurrence of metabolic syndrome showed an increasing trend with the duration of the disease. This was statistically significant ($p < 0.01$).

Correlation of MetS and type of arthritis: Out of 224 patients with MetS, 175 (78.1%) had knee OA; 26 (11.6%) had OA of cervical spine, 17 (7.5%) had OA involving hip joint and 6 (2.6%) had OA involving shoulder joint. Thus, knee OA was significantly associated with MetS ($p < 0.01$)

Correlation of MetS with severity of OA: Out of the total 224 patients with metabolic syndrome, grade 1 OA was seen in 53 (23.7%) patients, grade 2 OA was present in 62 (27.7%) patients, grade 3 OA was seen in 58 (25.9%) patients and grade 4 OA was present in 51 (22.8%) patients. This difference was statistically not significant ($p=0.19$).

Discussion

While obesity is a well-recognized risk factor for OA in weight-bearing knee joints, the association of OA with the metabolic syndrome is not completely explained by an obesity-induced increased biomechanical load.[10][11] Overweight and obese persons also have an increased risk for OA in hands, which are not weight-bearing, implicating systemic factors in the obesity-OA connection.[12][13] Likely, the systemic connection between OA and the metabolic syndrome revolves around altered metabolism and inflammation. The pathogenesis of OA and the metabolic syndrome each involve abnormalities in common metabolic intermediates including glucose, hormones, several growth factors, transcription factors, nitric oxide and reactive oxygen species.[14] Further, over the last several decades, both OA and the metabolic syndrome have been increasingly recognized as low-grade inflammatory conditions with elevations in systemic inflammatory markers such as hsCRP.[15][16] For both entities, there are clear pathogenic roles for inflammatory mediators such as IL1 β and TNF α . [14] Additionally, leptin, a pro-inflammatory hormone produced by macrophages in adipose tissue and a key mediator of the metabolic dysregulation associated with obesity, has been linked to OA pathogenesis.[14] Leptin is best known for regulating energy intake as an appetite suppressant, but also plays a role in osteoclast and chondrocyte proliferation and collagen synthesis.[14]

Conclusion:

This study underscores the importance of assessing MetS in patients of OA. The observed correlations between MetS components and disease duration highlight the need for comprehensive patient care and initiating tailored approaches to prevent the cardiovascular risk and metabolic aspects. Multidisciplinary interventions that target both joint health and metabolic health may provide a more comprehensive approach to managing these conditions and improving patient outcomes. Further research, including longitudinal studies, can provide deeper insights into the complex interplay between various pathways driving the interrelationship between both disorders, potentially guiding more effective therapeutic interventions.

Limitations: (i) Cross-sectional design does not take into account the directionality of the association to be set. (ii) Limited generalizability due to the specific population studied.

Acknowledgments:

The authors would like to express their gratitude to the participants and the hospital staff for their contributions to this study.

Conflict of interest: None to declare

Source of funding: Nil

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