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Changes in Hematobiochemical, Radiological, and Synovial Fluid Parameter in Patients of Osteoarthritis Knee with Effusion: A Prospective Observational Study

Sachin Jain[1], Sameer Gupta[1], Tarun Naugraiya[1]

Learning Point of the Article:

Osteoarthritis is not only a degenerative joint disease but there is inflammatory component also present.

Abstract

Introduction: A joint is the point of connection between two bones in our body. Inflammation of joint leads to several diseases, including osteoarthritis (OA). OA is a common condition of debilitating joint disease mainly affecting the elderly.

Case Report: In this study, we had studied correlation the cases (OA with synovial effusion) and control (OA without synovial effusion) with blood parameters, radiological and synovial fluid parameters (tumor necrosis factor-α [TNF]-α levels), and the incidence of synovial effusion in radiological staging of disease. Out of 100 patients, 50 patients with OA knee with effusion and 50 patients OA knee without effusion. We concluded that incidence of synovitis knee along with raised markers of inflammation, that is, C-reactive protein, erythrocyte sedimentation rate, and synovial fluid TNF-α levels was significantly higher in Stage II of OA knee, indicating that inflammation is significant part of early OA knee. Inflammation in early part of disease can lead to articular cartilage damage and rapid progression of osteoarthritic changes.

Conclusion: Our study concluded that OA is not only a degenerative disease but also there is significant contribution of inflammation in disease process. Targeting inflammation in synovium may delay/prevent articular cartilage damage and osteophytes formation, especially in early OA. Anti-TNF-α agents and anti-inflammatory drugs may be considered for definitive treatment of OA.

Keywords: Tumor necrosis factor-alpha, osteoarthritis, Kellgren Lawrence

Introduction

Osteoarthritis (OA) is degenerative disease of joint characterized by cartilage breakdown, formation of bony outgrowths at the joint margin (osteophytes), subchondral bone sclerosis, alteration to the joint capsule, and inflammation of synovial membrane [1,2].

The synovial membrane contains metabolically highly active cells (synoviocytes), which is physiologically important as it nourishes chondrocytes through the synovial fluid and joint space and removes metabolites and product of matrix degradation. Inflammation of the synovium that occurs in OA results in synovitis, that is, detectable by radiographically, arthroscopy, or histology. Despite this synovial inflammation, OA is usually defined as a non-inflammatory disorder, since the leukocyte count in OA synovial fluid is typically below the threshold that defines an non-inflammatory disorder (2000 cells per mm3) [3]. Synovitis, that is, directly responsible for several clinical signs and symptoms reflects the structural progression of the disease; is an important factor in OA pathophysiology because of action of several mediators and pro-inflammatory markers that lead to cartilage destruction.

Hence, treatment that specifically targets the previously

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Author's Photo Gallery


Dr. Sachin Jain


Dr. Sameer Gupta


Dr. Tarun Naugraiya

[1]Department of Orthopaedics, GRMC, Lashkar, Gwalior, Madhya Pradesh, India.

Address of Correspondence:
Dr. Tarun Naugraiya,
House Number L-13, Site-1st, City Centre (Landmark: Infront of Hero Showroom), Gwalior, Madhya Pradesh - 474 011, India.
E-mail: tarun_naugraiya@live.com

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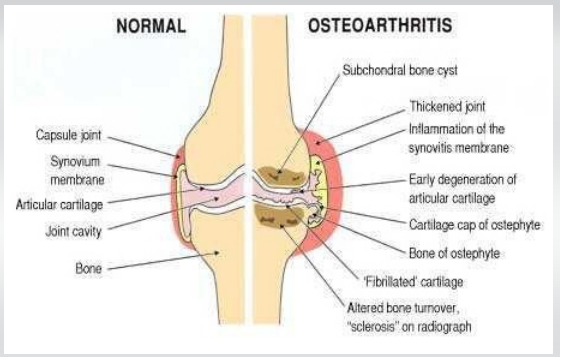

Figure 1: Schematic diagram of contrasting a normal knee versus an osteoarthritic knee. This illustrates that osteoarthritis is a multisymptomatic and complex disease.

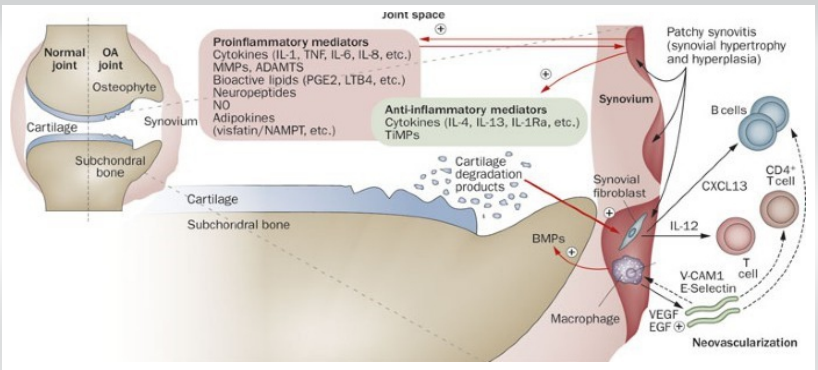

Figure 2: Involvement of the synovium in osteoarthritis pathophysiology.

neglected component of OA could be beneficial for both the symptoms and structural changes which occur in OA [4].

Case Report

This study was done prospectively in the Department of Orthopaedics and Trauma Centre in J. A. Group of Hospitals, Gwalior (M.P.). The cases were selected on random basis those having complaint of knee pain. A total number of 100 patients with 50 control (OA without effusion) and 50 cases (OA with effusion) patients were selected on O.P.D. basis. Patients included in our study – patients with complete clinical records, age – 30–85 years, capability to give informed consent for participating in study, no known metastatic disease, and no clinical evidence of inflammatory joint disease other than OA. Patients excluded – refusal to consent, age group <30 and >85, and clinical evidence of inflammatory joint disease other than OA, that is, history of recurrent episode of knee synovitis, multiple joint pain, involvement of synovitis in early ages, history of psoriatic arthropathy, uric acid arthropathy, Crohn's and ulcerative colitis, ankylosing spondylitis, and X-ray suggestive of rheumatoid arthritis.

Methods

The present study is a descriptive cross-sectional study of data obtained through a database. The reference values used in the present study were determined by the hematological laboratory and tumor necrosis factor-α (TNF-α) testing was done by ELISA method in synovial fluid.

Observation

In our study, the age of the patients ranged from 30 to 80 years with the most common in the age group of 41 to 60 years.

There were 60 (60%) male and 40 (40%) females in the study showing male preponderance in patients presenting to ortho OPD with complaint of knee pain. The male:female ratio was 1.5:1.

In our study, there were four patients found positive with TNF-α in OA without effusion, 46 cases found negative with TNF-α in OA without effusion whereas 28 cases found positive with TNF-α in OA with effusion and 22 cases found negative with TNF-α in OA with effusion.

Pearson's Chi-square test applied, $P < 0.05$ was taken as statistically significant. The correlation was found statistically significant ($P = 0.001$) showing higher incidence of TNF-α

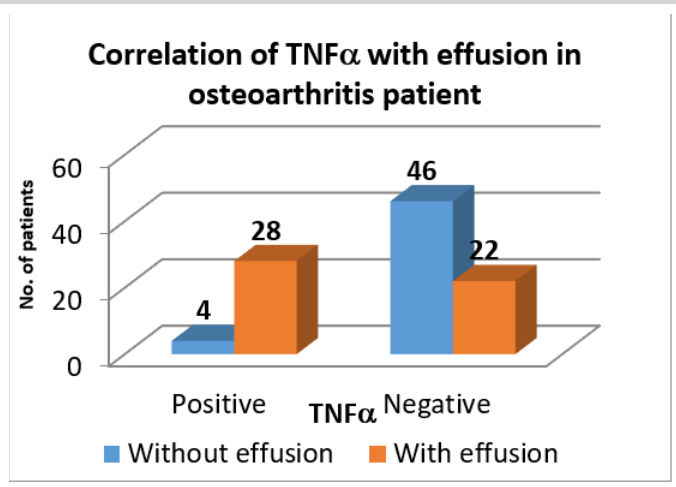

Figure 3: Correlation of tumor necrosis factor-α with effusion in osteoarthritis patient

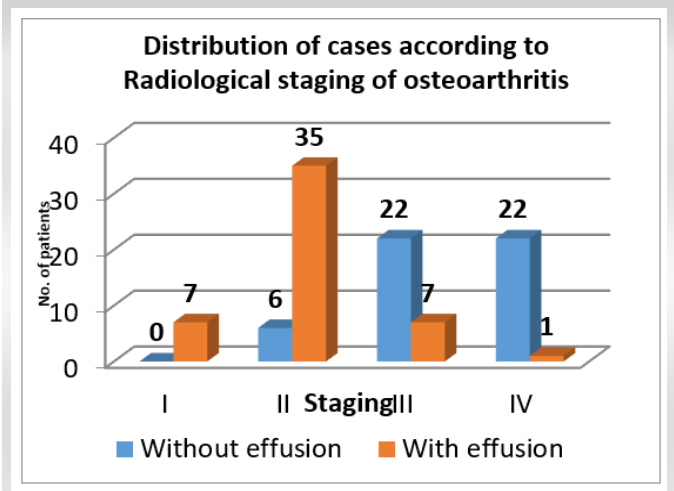

Figure 4: Distribution of cases according to radiological staging of osteoarthritis.

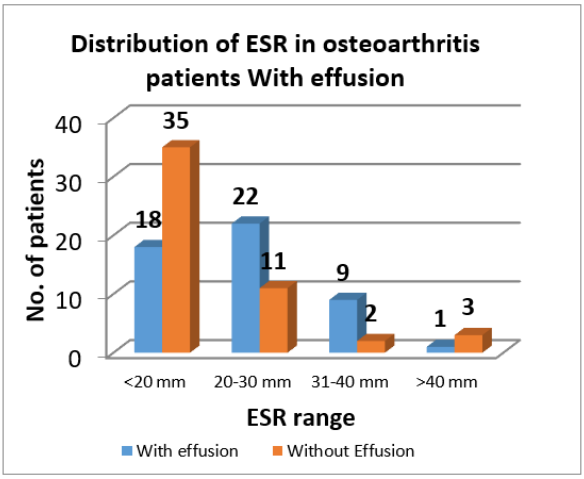

Figure 5: Distribution of erythrocyte sedimentation rate in osteoarthritis patients with effusion.

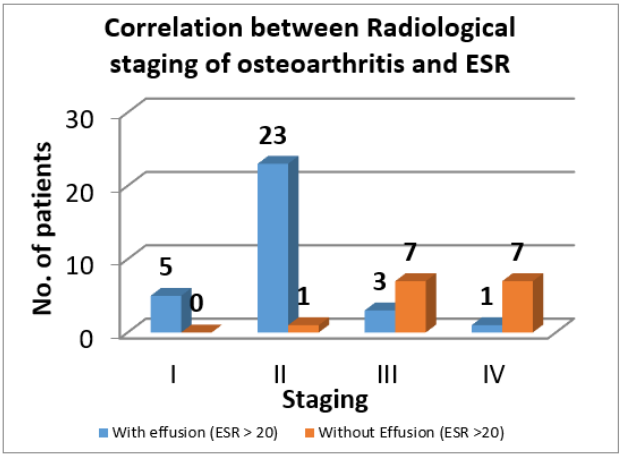

Figure 4: Correlation between radiological staging of osteoarthritis and erythrocyte sedimentation rate.

positivity in OA knee with effusion patients.

There was a positive correlation of TNF-α levels in OA knee with effusion patients.

In our study, there were 0 cases in Kellgren Lawrence (KL) Grade I, 6 cases in KL Grade II, 22 cases in KL Grade III, and 22 cases in KL Grade IV in OA without effusion patients whereas 7 cases in KL Grade I, 35 cases in KL Grade II, 7 cases in KL Grade III, and 1 case in KL Grade IV in OA with effusion patients.

The correlation was found to be statistically significant (P = 0.001) and showing that incidence of effusion is highest in KL Grade II OA. As the severity of OA increased, there was a decrease in incidence of effusion because there is less synovial inflammation with increase in grading of OA knee with effusion patients.

In our study, there were 18 cases with erythrocyte sedimentation rate (ESR) <20 mm/h, 22 cases with ESR between 20 and 30 mm/h, 9 cases with ESR between 31 and 40 mm/h, and 1 case with ESR >40 mm/h in OA with effusion patients whereas there were 35 cases with ESR <20 mm/h, 11 cases with ESR between 20 and 30 mm/h, 2 cases with ESR between 31 and 40 mm/h, and 3 cases with ESR >40 mm/h in OA without effusion patients.

The correlation was found statistically significant (P = 0.012) showing a positive correlation of raised ESR value in OA with effusion patients.

In our study, there were 5 cases in KL Grade I, 23 cases in KL Grade II, 3 cases in KL Grade III, and 1 case in KL Grade IV with ESR >20 mm/h in OA with effusion patients whereas 0 case in KL Grade I, 1 case in KL Grade II, 7 cases in KL Grade III, and 7 cases in KL Grade IV with ESR >20 in OA without effusion patients.

The correlation was found statistically significant (P = 0.032) showing that there was increased incidence of raised ESR in Stage II OA and that the risk in ESR above 20 mm at the end of 1st h is significantly more common in patients with OA knee with effusion.

In our study, 30 cases had positive C-reactive protein (CRP) and 20 cases had negative CRP in OA with effusion patients whereas there were 14 cases who had positive CRP and 36 cases had negative CRP in OA without effusion patients.

The difference was found statistically significant (P = 0.04) showing a positive correlation of CRP with OA knee with effusion patients.

Discussion

The present study gives an idea of prevalence of OA knee in study but it is not indicative of actual prevalence because in our view, males younger than 60 years are predominant bread earners and they are socially mobile as compared to females. Females in our population are mostly housewives and are not coming to hospital in early stage of disease. Males present more frequently with knee pain because of decreased earning capacity due to pain and inability to work.

CRP, ESR, and synovial fluid TNF-α are inflammatory markers evaluated in the present study. These inflammatory markers were significantly increased in OA knee with effusion patients. It also leads to synovial inflammation resulting in production of inflammatory markers which may be contributing to pathogenesis of OA. Inflamed synovium leads to increased destruction of articular cartilage, leading to progression of OA. This rate of effusion is significantly higher in KL Grade II patients and is associated with higher levels of serum CRP, ESR, and synovial fluid TNF-α levels.

As the destruction of articular cartilage in KL Grade II disease progresses to Grade III and then to KL Grade IV, the incidence of synovial effusion decreases significantly.

This may indicate that there can be inflammatory process contributing to the destruction of articular cartilage. The

highest incidence of this inflammation is during KL Grade II of OA knee, which is probably triggered by early degenerative process which results into active synovitis. This gradually results in increased cellular infiltration and over expression of mediators of inflammation. As the disease progresses, the inflammation may be decreasing gradually so that in KL Grade IV OA knee, there is a much lower incidence of inflammation.

Targeting inflammation in synovium should delay or prevent articular cartilage damage and osteophyte formation, thus helping in reducing the progression of OA. Hence, in our opinion, the patient with early stage of OA with effusion should be treated with anti–TNF-α and anti-inflammatory drugs.

In our study, we found that there was no correlation of hemoglobin level in blood, serum uric acid level, and serum calcium level with radiological staging of OA knee in OA patients.

Conclusion

The incidence of synovitis knee along with raised markers of inflammation, that is, CRP, ESR, and synovial fluid TNF-α levels was significantly higher in Stage II of OA knee, indicating that inflammation is significant part of early OA knee. Inflammation in early part of disease can lead to articular cartilage damage and rapid progression of osteoarthritic changes. Our study concluded that OA is not only a degenerative disease but also there is significant contribution of inflammation in disease process. Targeting inflammation in synovium may delay/prevent articular cartilage damage and osteophytes formation, especially in early OA. Anti-TNF-α agents and anti-inflammatory drugs may be considered for definitive treatment of OA.

Clinical Message

OA is not only a degenerative disease but also there is significant contribution of inflammation in disease process. Anti-TNF-α agents and anti-inflammatory drugs may be considered for definitive treatment of OA.

Declaration of patient consent : The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient's parents have given their consent for patient images and other clinical information to be reported in the journal. The patient's parents understand that his names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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