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

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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.

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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 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

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

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.

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.

**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

**References**

1. Samuels J, Krasnokutsky S, Abramson SB. Osteoarthritis: A tale of three tissues. Bull NYU Hosp Jt Dis 2008;66:244-50.
2. Sellam J, Herrero-Beaumont G, Berenbaum F. Osteoarthritis: Pathogenesis, clinical aspects and diagnosis. In: Bijlsma H, editor. EULAR Compendium on Rheumatic Diseases. London: BMJ Publishing Group Ltd.; 2009. p. 444-63.
3. Dougados M. Synovial fluid cell analysis. Baillieres Clin Rheumatol 1996;10:519-34.
4. Goldring MB, Goldring SR. Osteoarthritis. J Cell Physiol 2007;213:626-34.
5. Petersson IF, Boeégård T, Saxne T, Silman AJ, Svensson B. Radiographic osteoarthritis of the knee classified by the Ahlbäck and Kellgren and Lawrence systems for the tibiofemoral joint in people aged 35-54 years with chronic knee pain. Ann Rheum Dis 1997;56:493-6.
6. Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. Caspian J Intern Med 2011;2:205-12.
7. Aarons L, Salisbury R, Alam-Siddiqi M, Taylor L, Grennan DM. Plasma and synovial fluid kinetics of flurbiprofen in rheumatoid arthritis. Br J Clin Pharmacol 1986;21:155-63.
8. Jones AC, Ledingham J, McAlindon T, Regan M, Hart D, MacMillan PJ, et al. Radiographic Assessment of patellofemoral osteoarthritis. Ann Rheum Dis 1993;52:655-8.
9. Hill CL, Gale DG, Chaisson CE, Skinner K, Kazis L, Gale ME. Knee effusions, popliteal cysts, and synovial thickening: Association with knee pain in osteoarthritis. J Rheumatol 2001;28:1330-7.
10. Jones AC, Ledingham J, McAlindon T, Regan M, Hart D, MacMillan PJ, et al. Radiographic assessment of patella femoral osteoarthritis. Ann Rheum Dis 1993;52:655-8.
11. Haq SA, Davatchi F. Osteoarthritis of the knees in the COPCORD world. Int J Rheum Dis 2011;14:122-9.
12. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. Indian J Orthop 2016;50:518-22.
13. Andia I, Abate M. Platelet-rich plasma: Underlying biology and clinical correlates. Regen Med 2013;8:645-58.
14. Chhajer B. Anatomy of Knee, Knee Pain, Fusion Books; 2016. p. 10-1.
15. Rytt B, Egund N, Jensen LK, Bonde JP. Occupational kneeling and radiographic tibiofemoral and patellofemoral osteoarthritis. J Occup Med Toxicol 2009;4:19.
16. Gill TJ, van de Velde SK, Wing DW, Oh LS, Hosseini A, Li G. Tibiofemoral and patellofemoral kinematics after reconstruction of an isolated posterior cruciate ligament injury: In vivo analysis during lunge. Am J Sports Med 2009;37:2377-85.
17. Bucholz RW. Rockwood and Green’s Fractures in Adults. 7th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2012. p. 1862-3.
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