European Journal of Clinical Pharmacy
Print ISSN: 2385-409X, **Online ISSN**: 3105-0409
Website: https://farmclin.com/

Biochemical Markers and Pharmacological Management of Osteoarthritis: Correlation of Inflammatory Biomarkers with Clinical Outcomes in Orthopedic Patients

Article History:

Name of Author:
Dr. Swati Narayanrao Pullewar[1],Dr. Sharwari Yashwant Narawade[2*], Dr. Anshu Shekhar [3]

Affiliation: *[1]Associate Professor, Department of Pharmacology, Santosh Medical College & Hospital, India*
[2]Department of Biochemistry, Raipur Institute of Medical Sciences, Raipur, India
[3]Department of Orthopaedics, Shri Balaji Institute of Medical Sciences, Raipur, India.

Corresponding Author:
Dr. Sharwari Yashwant Narawade

Received*:* 20-07-2022
Revised*:* 03-08-2022
Accepted*: 20*-08-2022
Published*: 04*-09-2022

Abstract: ***Background:***Osteoarthritis (OA) is the most prevalent degenerative joint disease worldwide and a major cause of pain, disability, and reduced quality of life. Although traditionally considered a non-inflammatory condition, increasing evidence suggests that inflammatory mediators play a critical role in disease progression. Biomarkers such as C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α) have been implicated in cartilage degradation and symptom severity. Understanding the relationship between these biomarkers and clinical outcomes may improve disease monitoring and therapeutic management.***Objective:***To evaluate the association between inflammatory biochemical markers and clinical outcomes among osteoarthritis patients receiving pharmacological treatment in an orthopedic setting.***Methods:***A prospective observational study was conducted among 180 patients diagnosed with primary osteoarthritis attending the orthopedic outpatient department of a tertiary care hospital. Clinical assessment included pain intensity using the Visual Analog Scale (VAS), functional status using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and radiographic grading according to the Kellgren-Lawrence classification. Serum CRP, ESR, IL-6, and TNF-α levels were measured at baseline. Pharmacological treatment patterns and their impact on clinical outcomes were evaluated over six months.***Results:***The mean age of participants was 59.8 ± 9.6 years, with females accounting for 63.3% of cases. Elevated CRP and IL-6 levels were significantly associated with higher pain scores and worse WOMAC scores ($p < 0.05$). Patients with advanced radiographic OA demonstrated significantly higher inflammatory biomarker concentrations compared with those having mild disease. NSAIDs were prescribed in 82.2% of patients, followed by paracetamol (61.1%), glucosamine-chondroitin preparations (38.9%), and intra-articular corticosteroids (16.7%). Patients showing reductions in biomarker levels during follow-up exhibited significant improvement in pain and functional outcomes.***Conclusion:***Inflammatory biomarkers are significantly associated with disease severity and clinical outcomes in osteoarthritis. Monitoring these biomarkers alongside conventional clinical assessments may improve therapeutic decision-making and patient management.

Keywords:Osteoarthritis, Inflammatory Biomarkers, C-Reactive Protein, Interleukin-6, Pharmacological Management, Clinical Outcomes.

European Journal of Clinical Pharmacy
Print ISSN: 2385-409X, **Online ISSN**: 3105-0409
Website: https://farmclin.com/

INTRODUCTION

Osteoarthritis (OA) is a chronic degenerative disorder characterized by progressive cartilage degradation, subchondral bone remodeling, osteophyte formation, and synovial inflammation. It affects more than 300 million individuals globally and represents one of the leading causes of disability among older adults.

Historically, OA was considered a purely mechanical disease resulting from cartilage wear and tear. However, recent evidence has demonstrated that inflammation contributes significantly to disease pathogenesis. Synovial inflammation promotes the production of pro-inflammatory cytokines including interleukin-1β (IL-1β), IL-6, TNF-α, and matrix metalloproteinases, which accelerate cartilage destruction and joint degeneration.

Biochemical markers provide objective measures of disease activity and may facilitate early diagnosis, prognosis, and treatment monitoring. Elevated serum levels of CRP, ESR, IL-6, and TNF-α have been reported in OA patients and are associated with pain severity and radiographic progression.

Current pharmacological management focuses primarily on symptom relief using non-steroidal anti-inflammatory drugs (NSAIDs), acetaminophen, corticosteroids, and symptomatic slow-acting drugs for osteoarthritis (SYSADOAs). Understanding the relationship between inflammatory biomarkers and therapeutic outcomes may enhance individualized treatment strategies.

The present study aimed to evaluate inflammatory biomarkers among osteoarthritis patients and determine their association with clinical outcomes following pharmacological intervention

MATERIALS AND METHODS

Study Design
Prospective observational study.

Study Setting
Orthopedic outpatient department of a tertiary care teaching hospital.

Study Duration
Twelve months.

Sample Size
180 patients diagnosed with primary osteoarthritis.

Inclusion Criteria
- Age ≥40 years.
- Radiologically confirmed osteoarthritis.
- Willingness to participate.
- Ability to provide informed consent.

Exclusion Criteria
- Rheumatoid arthritis.
- Autoimmune diseases.
- Active infections.
- Malignancy.
- Recent major trauma or surgery.

Data Collection
Patient data included:
- Age and gender.
- Body mass index (BMI).
- Duration of disease.
- Site of osteoarthritis.
- Medication history.

Biochemical Parameters
Venous blood samples were analyzed for:
- C-reactive protein (CRP)
- Erythrocyte sedimentation rate (ESR)
- Interleukin-6 (IL-6)
- Tumor necrosis factor-alpha (TNF-α)

Clinical Assessment
Pain Assessment
Visual Analog Scale (VAS)

Functional Assessment
Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

Radiological Assessment
Kellgren-Lawrence grading system.

Statistical Analysis
Data were analyzed using SPSS version 25. Correlations between biomarker levels and clinical outcomes were assessed using Pearson correlation coefficient. Statistical significance was considered at $p < 0.05$.

RESULTS

Demographic Characteristics

Table 1. Baseline Characteristics

Characteristic	Value
Total Patients	180
Mean Age (years)	59.8 ± 9.6
Female	114 (63.3%)
Male	66 (36.7%)
Mean BMI (kg/m²)	28.7 ± 4.2

Distribution of Osteoarthritis Severity

Table 2. Kellgren-Lawrence Grades

Grade	Patients (%)
Grade I	18 (10.0)
Grade II	67 (37.2)
Grade III	61 (33.9)
Grade IV	34 (18.9)

Biomarker Levels

Table 3. Baseline Biomarker Levels

Biomarker	Mean ± SD
CRP (mg/L)	8.4 ± 3.1
ESR (mm/hr)	28.7 ± 11.5
IL-6 (pg/mL)	14.2 ± 5.4
TNF-α (pg/mL)	10.8 ± 4.1

Correlation with Clinical Outcomes

Table 4. Correlation Between Biomarkers and VAS Scores

Biomarker	Correlation Coefficient (r)
CRP	0.61
ESR	0.47
IL-6	0.69
TNF-α	0.53

All correlations were statistically significant ($p < 0.05$).
Higher biomarker levels were associated with greater pain intensity and poorer functional outcomes.

Pharmacological Management

Table 5. Prescribed Medications

Drug Category	Frequency (%)
NSAIDs	148 (82.2)
Paracetamol	110 (61.1)
Glucosamine-Chondroitin	70 (38.9)
Topical Analgesics	55 (30.6)
Corticosteroid Injection	30 (16.7)

Clinical Improvement after Six Months

Patients showing reduction in CRP and IL-6 levels demonstrated:

- 38% reduction in VAS pain score.
- 32% improvement in WOMAC score.

Improved mobility and daily activity performance

DISCUSSION

The present study demonstrated significant associations between inflammatory biomarkers and disease severity among osteoarthritis patients. Elevated CRP and IL-6 levels correlated strongly with pain intensity and functional disability.

These findings support emerging evidence that OA is not solely a degenerative disease but also involves chronic low-grade inflammation. Cytokines such as IL-6 and TNF-α contribute to cartilage degradation

through activation of matrix metalloproteinases and inflammatory signaling pathways.

NSAIDs remained the most frequently prescribed medications due to their anti-inflammatory and analgesic properties. Patients exhibiting reductions in inflammatory markers experienced superior clinical outcomes, suggesting that biomarker monitoring may assist in evaluating treatment response.

The findings are consistent with previous studies reporting significant associations between systemic inflammatory markers and OA progression. Incorporating biochemical marker assessment into routine orthopedic practice may facilitate early identification of high-risk patients and optimize therapeutic interventions.

Limitations

- Single-center study.
- Moderate sample size.
- Limited follow-up duration.
- Biomarker measurements performed only at selected intervals.

CONCLUSION

Inflammatory biomarkers, particularly CRP and IL-6, are significantly associated with pain severity, functional impairment, and radiographic progression in osteoarthritis patients. Pharmacological interventions resulting in reduced inflammatory activity are associated with improved clinical outcomes. Biomarker-guided management may represent a valuable strategy for optimizing osteoarthritis treatment and monitoring disease progression.

REFERENCES

1. Hunter DJ, Bierma-Zeinstra S. Osteoarthritis. Lancet. 2019;393(10182):1745–1759.
2. Goldring MB, Goldring SR. Osteoarthritis. J Cell Physiol. 2007;213(3):626–634.
3. Loeser RF, Goldring SR, Scanzello CR, Goldring MB. Osteoarthritis: a disease of the joint as an organ. Arthritis Rheum. 2012;64(6):1697–1707.
4. Martel-Pelletier J, Barr AJ, Cicuttini FM, et al. Osteoarthritis. Nat Rev Dis Primers. 2016;2:16072.
5. Mobasheri A, Batt M. An update on biomarkers in osteoarthritis. Ann Phys Rehabil Med. 2016;59(5–6):333–339.
6. Kraus VB, Blanco FJ, Englund M, Karsdal MA, Lohmander LS. Biomarkers in osteoarthritis. Osteoarthritis Cartilage. 2015;23(8):1233–1244.
7. Berenbaum F. Osteoarthritis as an inflammatory disease. Osteoarthritis Cartilage. 2013;21(1):16–21.
8. Scanzello CR, Goldring SR. The role of synovitis in osteoarthritis pathogenesis. Bone. 2012;51(2):249–257.
9. Greene MA, Loeser RF. Aging-related inflammation in osteoarthritis. Osteoarthritis Cartilage. 2015;23(11):1966–1971.
10. Pelletier JP, Martel-Pelletier J. Inflammation in osteoarthritis. Arthritis Res Ther. 2014;16(2):130.
11. Yusuf E. Metabolic factors in osteoarthritis. Open Rheumatol J. 2012;6:114–119.
12. Neogi T. Clinical significance of bone changes in OA. Osteoarthritis Cartilage. 2013;21(2):204–209.
13. Sokolove J, Lepus CM. Role of inflammation in OA. Ther Adv Musculoskelet Dis. 2013;5(2):77–94.
14. Hochberg MC, Altman RD, April KT, et al. American College of Rheumatology recommendations for OA management. Arthritis Care Res. 2012;64(4):465–474.
15. Bannuru RR, Osani MC, Vaysbrot EE, et al. OARSI guidelines for management of knee OA. Osteoarthritis Cartilage. 2019;27(11):1578–1589.
16. McAlindon TE, Bannuru RR, Sullivan MC, et al. OARSI recommendations for OA management. Osteoarthritis Cartilage. 2014;22(3):363–388.
17. Karsdal MA, Michaelis M, Ladel C, et al. Disease-modifying treatments for OA. Osteoarthritis Cartilage. 2016;24(12):2013–2021.
18. Robinson WH, Lepus CM, Wang Q, et al. Low-grade inflammation as key mediator in OA. Nat Rev Rheumatol. 2016;12(10):580–592.
19. Glyn-Jones S, Palmer AJR, Agricola R, et al. Osteoarthritis. Lancet. 2015;386(9991):376–387.
20. Abramoff B, Caldera FE. Osteoarthritis: Pathology, diagnosis, and treatment. Med Clin North Am. 2020;104(2):293–311.