Original Research Article

RATIONALIZING OSTEOARTHRITIS PHARMACOTHERAPY: A WHO PRESCRIBING INDICATORS-BASED ASSESSMENT OF DRUG UTILIZATION PATTERNS AT A TERTIARY CARE INSTITUTION

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ABSTRACT

Background: Osteoarthritis is the most prevalent chronic degenerative joint disease and a leading cause of disability globally. Rational drug prescribing is essential for optimizing therapeutic outcomes and minimizing adverse effects. This study evaluated prescribing patterns against WHO core prescribing indicators and evidence-based guidelines. The aim is to analyze current trends in prescribing patterns of medications used in osteoarthritis treatment and evaluate rationality of prescribing practices against WHO standards and international guidelines. **Materials and Methods:** A prospective observational study was conducted over 12 months (October 2021–October 2022) at Vijayanagar Institute of Medical Sciences, Ballari. A total of 187 osteoarthritis patients aged 35–80 years were evaluated using pre-designed case recording forms documenting demographics, clinical data, and complete prescription details. Data were analyzed using descriptive statistics in SPSS software version 16.0. **Result:** Female predominance was observed (66%). The majority of patients (58%) were aged 46–60 years. Knee joint involvement was most common (81%). NSAIDs were the most frequently prescribed drug class (55.89%), with diclofenac most common (51.9%), followed by paracetamol (39.6%) and aceclofenac (32.1%). Gastroprotective agents were prescribed in 43.7% of patients, with pantoprazole most preferred (41.8%). Symptomatic slow-acting drugs for osteoarthritis (SYSADOA) were prescribed in only 9.3% of patients. Combination therapy (73.3%) dominated over monotherapy (26.7%). Polypharmacy was observed in only 7% of prescriptions. Generic drug prescribing was 95.2%. Average drugs per prescription was 3.02. Oral route was most common (78.2%), followed by topical (11.4%) and injectable (10.2%) routes. WHO core prescribing indicators revealed 69.2% of drugs from the National List of Essential Medicines 2022. **Conclusion:** WHO core prescribing indicators demonstrate rational and evidence-based prescribing practices at the institution. High generic prescribing (95.2%) and adherence to essential medicines list (69.2%) reflect good rational drug use. Opportunities exist to optimize pharmacotherapy through increased paracetamol and SYSADOA utilization via targeted physician education and periodic prescription audits.

INTRODUCTION

Osteoarthritis (OA) is a chronic, progressive musculoskeletal degenerative disorder of multifactorial etiology characterized by destruction of articular cartilage, subchondral sclerosis, and associated synovial changes. The pathophysiology involves loss of articular cartilage as the primary change, followed by secondary changes including subchondral bone remodeling, osteophyte formation, bone marrow lesion development, and changes in the synovium, joint capsule, ligaments, and periarticular muscles.[1,2] The disease manifests with recurring episodes of joint pain, joint stiffness, swelling, decreased range of motion and crepitus. Symptoms typically develop progressively rather than appearing suddenly, and radiographic confirmation reveals joint space narrowing,

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increased subchondral bone density, thickening, subchondral cysts, and marginal bony excrescences.[3]

Osteoarthritis is the most common chronic disease of the joints and represents a significant cause of disability globally. The increasing prevalence of osteoarthritis across all age groups, particularly in elderly populations, has created a substantial burden on healthcare systems and substantially impacts quality of life.[4] Pain relief is a central component of osteoarthritis management, and pharmacotherapy plays a crucial role in symptom control and functional improvement. Multiple treatment options are available, including acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, topical analgesics, intra-articular injections with corticosteroids and hyaluronic acid, and adjunctive therapies such as gastroprotectives, diacerin, glucosamine sulfate, chondroitin sulfate, calcium, and vitamin D supplements.[5,6]

Rational drug prescribing is defined as the appropriate selection of drugs in the correct dose, at proper time intervals, and for sufficient duration to maximize therapeutic benefit while minimizing adverse effects. Irrational drug use is recognized as a global problem, encompassing issues such as prescribing with brand names, inappropriate polypharmacy, antibiotic overuse, and excessive injection prescriptions. The World Health Organization (WHO) has developed standardized drug use indicators to evaluate prescribing patterns in healthcare institutions, assessing the quality of prescribing practices in both acute and chronic illness management. Drug prescribing studies provide valuable feedback to clinicians and create awareness regarding rational medicine use, enabling periodic evaluation and modification of prescribing practices to increase therapeutic benefits and decrease associated adverse effects.[7,8]

Periodic analysis of prescribing patterns in osteoarthritis management provides institutional data for identifying deviations from evidence-based guidelines, monitoring adherence to rational prescribing principles, and implementing targeted interventions to optimize pharmacotherapy. Given the substantial disease burden of osteoarthritis and the central role of pharmacotherapy in its management, systematic evaluation of contemporary prescribing patterns at healthcare institutions is essential.[6,9] The present study was planned to analyze the prescribing patterns of drugs used in the treatment of osteoarthritis at a tertiary care hospital and to assess adherence to WHO core prescribing indicators and evidence-based guidelines, thereby providing institutional-specific data to optimize drug therapy, enhance rational prescribing practices, and improve patient outcomes in osteoarthritis management. The aim of the study was to analyze the current trends in prescribing patterns of medications used in the treatment of osteoarthritis and to evaluate the rationality of prescribing practices against WHO standards and international guidelines.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Orthopaedics in collaboration with the Department of Pharmacology at Vijayanagar Institute of Medical Sciences (VIMS), Ballari, a tertiary care hospital in Karnataka, India. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment.

The study was conducted over 12 months, from October 4, 2021, to October 4, 2022, with each patient followed up for 6 months from the date of initial data collection. Sample size was calculated using the formula $N = 4 \times P \times Q / L^2$, considering 12% as the anticipated prevalence of quality-of-life improvement by pharmacotherapy in osteoarthritis patients, with a precision (L) of 5%, yielding a calculated sample size of 168 patients. Accounting for a 10% non-response rate and 95% confidence interval, the final sample size was determined to be 187 patients.

Patients aged 35 to 80 years with a confirmed diagnosis of osteoarthritis, regardless of gender, and who provided written informed consent, were included in the study. Patients with other inflammatory joint diseases (rheumatoid arthritis, ankylosing spondylitis, psoriasis, gout, neuropathic, congenital, or metabolic conditions affecting joints), those with a history of gastrointestinal, renal, cardiac, or liver disease, psychiatric illness, or those with surgical indications for osteoarthritis management were excluded from the study.

Data collection was performed using a pre-designed case recording form that documented patient demographics, brief history, clinical data, and complete prescription details including drug name, dose, route of administration, and duration of therapy. All data were collected from patients fulfilling the inclusion and exclusion criteria who were evaluated in the Orthopaedics department. The collected data were subsequently analyzed to examine current prescribing patterns in the management of osteoarthritis. Data analysis was performed using SPSS software version 16.0, with results expressed using descriptive statistics.

RESULTS

Demographic Characteristics: A total of 187 patients with osteoarthritis were enrolled in the study. The gender distribution analysis revealed female predominance, with 123 patients (66%) being female and 64 patients (34%) being male. Age group stratification demonstrated that the majority of patients, 108 (58%), were in the 46–60 years age group, followed by 63 patients (34%) in the 61–75 years group, 11 patients (6%) in the 35–45 years

group, and 5 patients (2.4%) above 75 years of age. [Table 1]

Joint Involvement: Among the various joint sites affected by osteoarthritis, the knee joint was the most commonly involved, affecting 151 patients (81%). This was followed by polyarticular involvement in 15 patients (8%), hand osteoarthritis in 13 patients (7%), and spinal osteoarthritis in 8 patients (4%). [Table 2]

Prescription Pattern Analysis: Analysis of the number of drugs per prescription showed considerable variation in prescribing practices. Among the 187 prescriptions analyzed, 69 prescriptions (36.9%) contained 2 drugs, 63 prescriptions (33.7%) contained 3 drugs, 41 prescriptions (21.9%) contained 4 drugs, 10 prescriptions (5.3%) contained 5 drugs, and 4 prescriptions (2.1%) contained 6 drugs. The results demonstrate that combination therapy (137 prescriptions, 73.3%) was the predominant prescribing pattern compared to monotherapy (50 prescriptions, 26.7%). The data further reveals that polypharmacy (use of 4 or more concurrent medications) was observed in only 7% of prescriptions (13 patients), whereas 93% of patients (174 patients) did not receive polypharmacy. [Table 3]

Drug Classes and Specific Medications: Non-steroidal anti-inflammatory drugs (NSAIDs) were the most frequently prescribed drug class, administered in 185 prescriptions (55.89%), followed by acetaminophen in 74 prescriptions (22.3%), opioids in 38 prescriptions (11.4%), and corticosteroids in 34 prescriptions (10.2%). [Table 4]

Among individual NSAID prescriptions, diclofenac was the most commonly prescribed drug in 97 prescriptions (51.9%), followed by paracetamol in 74 prescriptions (39.6%) and aceclofenac in 60 prescriptions (32.1%). Other NSAIDs included piroxicam (11 prescriptions, 5.9%), ibuprofen (8 prescriptions, 4.3%), nimusulide (5 prescriptions, 2.7%), and rofecoxib (4 prescriptions, 2.1%). Among opioids, tramadol was prescribed in 38 prescriptions (20.3%). Corticosteroid use included prednisolone in 29 prescriptions (15.5%) and deflazacort in 5 prescriptions (2.7%). [Table 5] The predominance of diclofenac reflects its widespread use as a first-line NSAID in osteoarthritis management at the institution, although paracetamol, recommended as the preferred initial analgesic by EULAR guidelines, was prescribed in only 39.6% of patients.

Adjunctive Therapies: Gastroprotective agents were prescribed in 98 patients (43.7%), with pantoprazole being the most preferred drug (41.8% of gastroprotective prescriptions). Other adjunctive therapies included vitamin D supplementation in 41 patients (18.3%), calcium supplementation in 34 patients (15.1%), skeletal muscle relaxants in 30 patients (13.3%), and symptomatic slow-acting drugs for osteoarthritis (SYSADOA), specifically diacerin and glucosamine sulfate combinations in 21 patients (9.3%). [Table 6]

Drug Nomenclature and Route of Administration: Among 565 total drug prescriptions, 538 (95.2%) were prescribed using generic nomenclature, while only 27 prescriptions (14%) employed brand names, indicating strong adherence to rational prescribing practices using generic medications. Regarding route of administration, 493 drugs (78.2%) were prescribed via the oral route, 38 drugs (11.4%) were prescribed topically, and 34 drugs (10.2%) were prescribed as injectables. [Table 7]

WHO Core Prescribing Indicators: Assessment of WHO core prescribing indicators revealed the following metrics: the average number of drugs prescribed per patient was 3.02, the percentage of drugs prescribed by generic name was 95.22%, the percentage of drugs prescribed as injections was 10.2%, the average number of antibiotics per prescription was nil, and the percentage of drugs prescribed from the National List of Essential Medicines (NLEM) 2022 was 69.2%. These indicators collectively suggest rational and evidence-based prescribing practices at the institution. [Table 8]

Table 1: Age distribution of osteoarthritis patients in the study population

Age Group (years)	Number of Participants	Percentage
35–45	11	6%
46–60	108	58%
61–75	63	34%
Above 75	5	2.4%
Total	187	100%

Table 2: Distribution of osteoarthritis patients according to joints involved

Site of Involvement	Number of Cases	Percentage
Knee	151	81%
Polyarticular/Multiple joints	15	8%
Hand	13	7%
Spine	8	4%

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Table 3: Number of drugs prescribed per prescription in osteoarthritis patients

Number of Drugs	Number of Prescriptions	Percentage
2	69	36.9%
3	63	33.7%
4	41	21.9%
5	10	5.3%
6	4	2.1%

Table 4: Different classes of drugs administered in osteoarthritis patients

Drug Class	Number	Percentage
NSAIDs	185	55.89%
Acetaminophen	74	22.3%
Opioids	38	11.4%
Corticosteroids	34	10.2%

Table 5: Details of individual drugs prescribed in the management of osteoarthritis

Drug Name	Number of Prescriptions	Percentage
Diclofenac	97	51.9%
Paracetamol	74	39.6%
Aceclofenac	60	32.1%
Tramadol	38	20.3%
Prednisolone	29	15.5%
Piroxicam	11	5.9%
Ibuprofen	8	4.3%
Nimusulide	5	2.7%
Deflazacort	5	2.7%
Rofecoxib	4	2.1%

Table 6: Adjunctive drug therapy prescribed in osteoarthritis patients

Adjunctive Drug Class	Number of Prescriptions	Percentage
Gastroprotectives	98	43.7%
Vitamin D	41	18.3%
Calcium	34	15.1%
Skeletal Muscle Relaxants	30	13.3%
SYSADOA	21	9.3%

Table 7: Routes of administration of drugs used in osteoarthritis management

Route of Administration	Number of Drugs	Percentage
Oral	493	78.2%
Topical	38	11.4%
Injectable	34	10.2%

Table 8: WHO core prescribing indicators for osteoarthritis prescriptions in the study

WHO Core Prescribing Indicator	Value
Average number of drugs per prescription	3.02
Percentage of drugs prescribed by generic name	95.22%
Percentage of drugs prescribed as injections	10.2%
Average number of antibiotics per prescription	Nil
Percentage of drugs from NLEM 2022	69.2%

DISCUSSION

Osteoarthritis is the most common chronic degenerative joint disease globally and a significant cause of disability in both elderly and increasingly younger populations.[4] This prospective observational study examined the prescribing patterns of drugs used in managing osteoarthritis at a tertiary care institution over 12 months, enrolling 187 patients. Our findings provide valuable insights into current therapeutic practices and offer important implications for rational drug use.

Demographic Characteristics and Disease Prevalence: The present study demonstrated female predominance (66%) in osteoarthritis patients, consistent with findings from comparable studies. Poornima et al. (2015) reported 63% female predominance in their 200-patient cohort, while Siddiqui et al. (2022) found 58.3% females among 300 patients.10,11 Similarly, Patil and Nara (2017) documented 60% female predominance.[12] However, Kumar et al. (2019) reported an unusual male predominance of 56.07% in their study of 428 patients, suggesting institutional and geographic variations in disease presentation.[13] The mean age in our study (46–60 years as peak prevalence) aligns with multiple studies: Poornima et al. reported a mean age of 56.2 years, Siddiqui et al. documented 46–60 years as the most affected group (60%), and Patil and Nara reported 56.46 ± 7.4 years.[10-12] This consistency across multiple centers validates the age-specific burden of osteoarthritis in middle-aged and elderly populations.

Joint Involvement Patterns

Knee joint involvement was the most commonly affected site in our study (81%), similar to findings across comparable cohorts. Poornima et al. (2015) reported 72% knee involvement, Siddiqui et al. (2022) found 86%, and Jhanwar et al. (2013) documented 82.9% knee involvement in their 978-prescription analysis.[10,11,14] The predominance of knee osteoarthritis in our population reflects its weight-bearing nature and susceptibility to mechanical stress, as noted by Jhanwar et al., who attributed this pattern to cultural factors such as squatting and cross-leg sitting positions prevalent in Indian populations.[14]

NSAID Prescribing Patterns and First-Line Therapy: NSAIDs were the most commonly prescribed drug class in our study (55.89%), with diclofenac being the most preferred individual agent (51.9%). This finding aligns with the majority of comparable studies. However, our study shows notably higher diclofenac preference compared to several other centers. Siddiqui et al. (2022) found etoricoxib most commonly prescribed (28.3%) followed by aceclofenac (18%), suggesting a shift toward selective Cox-2 inhibitors in some institutions.[11] Ahmed et al. (2024) reported aceclofenac as the most common NSAID (44%) followed by diclofenac (30%), indicating institutional preferences for different NSAID classes.[15] Conversely, Jhanwar et al. (2013) documented diclofenac as the most commonly prescribed (63.3%), consistent with our findings. Poornima et al. (2015) preferred etoricoxib (43%), suggesting that institutional prescribing policies and cost considerations influence NSAID selection.[14] The continued prominence of diclofenac in our institution despite broader NSAID availability reflects its established efficacy and lower cost compared to selective Cox-2 inhibitors.

Paracetamol Underutilization: Paracetamol was prescribed in only 39.6% of our patients, predominantly in combination therapy. This represents significant underutilization compared to evidence-based guidelines. The EULAR 2003 recommendations prioritize paracetamol as the oral analgesic to try first, noting its efficacy at 2600–4000 mg daily with excellent long-term safety profiles (Jordan et al., 2003). Patil and Nara (2017) reported remarkably higher paracetamol utilization at 77.04%, suggesting that prescribing practices vary considerably.[12,16] Miceli-Richard et al. (2004), in their large RCT of 779 patients, found paracetamol efficacy comparable to NSAIDs in certain patient subpopulations, particularly those with mechanical pain without significant inflammation.[17] The present study's lower paracetamol utilization likely reflects institutional practice patterns favoring NSAIDs for more pronounced anti-inflammatory effects, despite comparable efficacy in selected patients. This observation aligns with findings from Kumar et al. (2019) and Gupta et al. (2018), who also reported paracetamol underutilization, suggesting a systemic preference for NSAIDs across Indian tertiary care centers.[13,18]

Combination Therapy Prevalence: Combination therapy (73.3%) was the predominant prescribing pattern in our study, compared to monotherapy (26.7%). This frequency aligns with findings from comparable studies. Siddiqui et al. (2022) documented similar combination patterns, while earlier studies reported even higher rates: Patil and Nara (2017) reported combination therapy in 88.42%, and Jhanwar et al. (2013) documented 76.9% prescriptions with more than two drugs.[11,12,14] The present study's 73.3% combination therapy rate reflects a balanced approach between rationality and clinical complexity. The most common combination was NSAID + NSAID (Diclofenac + Paracetamol in 23.35%), similar to patterns documented by other centers. This combination approach provides improved analgesic efficacy, though it raises concerns regarding appropriate dosing and potential additive adverse effects if not carefully monitored.

Polypharmacy Assessment: Polypharmacy (use of 4 or more concurrent medications) was observed in only 7% of prescriptions in our study, considerably lower than reported in general geriatric populations. Turabian (2020) noted that polypharmacy affects 40–50% of all older adults, with frequencies ranging from 17% in those aged 65–74 years to 33% in those aged ≥95 years.[19] The lower rate in our osteoarthritis-specific cohort (7%) reflects focused therapeutic regimens targeting joint pain and inflammation rather than multiple comorbidities. This rational approach minimizes risks of adverse drug-drug interactions and improves medication adherence, as emphasized by Turabian's analysis showing that ADR frequency increases from 6% with 2 medications to nearly 100% with 8 or more medications.[19]

Gastroprotective Agent Prescription: Gastroprotective agents were prescribed in 43.7% of our patients, predominantly pantoprazole (41.8%). This rate is moderate and evidence-based, as NSAIDs carry documented gastrointestinal risks. Poornima et al. (2015) reported 56% gastroprotective usage with rabeprazole preference (46.4%), while Ahmed et al. (2024) and other centers showed variable rates (12–94%).10 The EULAR recommendations (Jordan et al., 2003) support gastroprotective co-prescription in patients at increased gastrointestinal risk, particularly with non-selective NSAIDs.[16] Our moderate rate suggests institution-specific risk stratification rather than universal gastroprotection, which may reflect variable assessment of individual gastrointestinal risk factors.

SYSADOA Underutilization: Disease-modifying osteoarthritis drugs (SYSADOA), including diacerin and glucosamine sulfate, were prescribed in only 9.3% of our patients, consistent with findings across comparable studies. Poornima et al. (2015) reported

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42% SYSADOA usage, representing notably higher utilization.10 Jhanwar et al. (2013) documented only 16.8% diacerin and 23% etoricoxib prescription, with SYSADOA described as "under prescribed."14 Ahmed et al. (2024) reported 34% DMOADs utilization.[15] The EULAR recommendations (Jordan et al., 2003) support glucosamine sulfate (1A evidence) and chondroitin sulphate (1A evidence) for symptomatic effects in knee osteoarthritis.[16] Our low SYSADOA prescription rate likely reflects concerns regarding cost-effectiveness and perceived clinical efficacy among prescribers, as noted by multiple authors. This represents an area for potential improvement through guideline-based educational interventions.

Generic Prescribing and WHO Indicators: Generic prescribing in our study (95.2%) represents excellent adherence to rational drug use principles and exceeds rates reported in most comparable studies. Patil and Nara (2017) documented 91.7% generic prescribing, while Gupta et al. (2018) and other centers reported variable rates (58–95%).[12,18] The WHO core prescribing indicators in our study (average 3.02 drugs per patient, 10.2% injectable medications, 69.2% from essential medicines list) suggest rational and evidence-based prescribing practices. Raj et al. (2024) reported similar indicators with average 2.8 drugs per prescription and 58% generic prescribing, highlighting that our institution's practices align with international standards for rational drug use.[20]

Limitations, Advantages and Clinical implications: This single-center prospective study has limitations including restricted generalizability, primary osteoarthritis-only enrollment, temporal rather than long-term outcome capture, absent adverse event monitoring, and incomplete confounding variable documentation. However, it demonstrates significant advantages: prospective design ensuring superior data quality, adequate sample size (n=187), orthopedics-pharmacology collaboration, detailed drug specification documentation, WHO core prescribing indicators implementation, and systematic methodology enhancing reproducibility. Clinical implications include institutional benchmarking data supporting evidence-based optimization, with high generic prescribing (95.2%) validating rational drug use, low polypharmacy (7%) demonstrating appropriate complexity, and SYSADOA underutilization (9.3%) highlighting improvement opportunities. WHO indicator alignment validates institutional rational practices. Key implementation priorities include targeted physician education, formulary modifications promoting paracetamol and SYSADOA utilization per EULAR guidelines to optimize osteoarthritis pharmacotherapy.

CONCLUSION

Our study demonstrates prescription patterns consistent with evidence-based osteoarthritis management at a tertiary care institution, with particular strengths in generic prescribing and appropriate NSAID utilization. Future opportunities include enhanced paracetamol prescribing for suitable patients, expanded SYSADOA utilization in early-stage disease, and continued emphasis on rational prescribing through guideline implementation and periodic prescription audits.

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