International Journal of Pharmacy and Biological Sciences-IJPBS™ (2019) 9 (3): 1120-1146
Online ISSN: 2230-7605, Print ISSN: 2321-3272
Research Article | Biological Sciences | Open Access | MCI Approved
UGC Approved Journal

Prescribing Pattern of Non-Steroidal Anti-Inflammatory Drugs (NSAIDS) In Orthopedic Patients

Chinju Anil[1], Dan Monsy[2], Mohamed Thayub[3], Pandala Sreenivasula Reddy[4] and Leena Pavitha P*
[1, 2, 3, 4] Pharm D Intern CL Baid Metha College of Pharmacy, Chennai.
*Assistant Professor, CL Baid Metha College of Pharmacy, Chennai.

Received: 28 Mar 2019 / Accepted: 30 Apr 2019 / Published online: 1 Jul 2019
*Corresponding Author Email: leenapavitha28@gmail.com

Abstract

Aim: *The aim of the study is to evaluate Prescribing pattern of NSAIDs which includes Prevalence, Indication and Categories of drug used in a Tertiary Care Hospital and Community clinical care set up.* ***Methodology:*** *An Observational Study was carried out over a period of 6 months. A total of 203 Prescription were collected, documented and analyzed in OPD and total of 256 Prescriptions was collected and analyzed in the community clinical setup. The Rationality of the prescriptions was evaluated using WHO core indicators 2017, NLEM 2015 and DU90%. Drug consumption by the patients was calculated using DDD/1000/day and the patient under the risk of developing ADR was assessed using 299FM.4 guidelines by NHS. The Pattern of the drug prescribing was assessed using WHO core indicators 2017.* ***Results:*** *Of the 203 cases. The most encountered NSAID was Paracetamol 62.75% among the class of NSAIDs used Non-Selective COX inhibitors 32.15% were more preferred over selective COX 2 inhibitors 5.10% Only 21% drugs were prescribed by generic name, compliance with the NLEM was found to be 59.94%. Five out of nine drugs constitute to DU90% and Risk factors of the drugs were assessed. Of 256 prescriptions analyzed in the OPD Ketorolac 97 (65.99%) was the preferred drug of choice, Non-Selective COX inhibitors was more preferred. Only 1.20% drugs were prescribed by generic name, compliance with the NLEM was found to be 5.02%.* ***Conclusion:*** *In the present study showed that Paracetamol was used commonly for the indications of fracture and arthritic conditions in IPD. Ketorolac was used for short term therapy of pain and inflammation in OPD. Nonselective COX inhibitors more preferred over COX 2 inhibitors.*

Keywords
NSAIDs, Paracetamol, Non-Selective COX inhibitors, pain, inflammation.

*****

INTRODUCTION

Non-Steroidal Anti-Inflammatory Drugs are the class of drugs which are one of the most frequently used drugs throughout the world through proven efficacy as Analgesics, Anti-pyretic and Anti-Inflammatory agents. Anti-inflammatory drugs were historically derived from the extracts of plants which contains salicylates notably willow tree of genus Salix which

were known for their medicinal value in reducing pain, fever and inflammation. Acetyl salicylic acid (ASA) or Aspirin was developed in the year 1897 by Felix Hoffman and salicylates were found to be the active components of willow supplement. Sir John Vane explained that inhibition of the production of prostaglandins is the main mechanism behind the effect of Non-Steroidal Anti-inflammatory drugs.1
NSAIDs were found to have chief clinical application as anti-inflammatory agents in the treatment of musculoskeletal disorders, such as Rheumatoid arthritis and osteoarthritis. They are also used widely in the treatment of Headache, Migraine, Dental and Menstrual pain. In general, NSAIDs provide only symptomatic relief from pain and inflammation associated with the disease. A number of NSAIDs are approved by the FDA for the treatment of Ankylosing Spondylitis and Gout. The use of NSAIDs for mild Arthropathies together with rest and physical therapy generally is found to be effective 2. Over the past two decades, Non-Steroidal Anti-inflammatory Drugs (NSAIDs) have had a key role in these major indications. NSAIDs constitute the largest single group of drugs used worldwide, constituting more than 20% of all drug prescriptions 3.

ADVERSE EFFECTS OF NSAIDS 4

Table No 1: Adverse Effects of NSAIDs

GASTROINTESTINAL	Nausea, Anorexia Gastric Irritation Erosions Peptic Ulceration Gastric Bleeding/Perforation Esophagitis, Gastric discomfort, Dyspepsia, Diarrhoea
RENAL	Na+ And Water Retention Chronic Renal failure Nephropathy Papillary Necrosis
CVS	Increase In Blood Pressure Risk Of Myocardial Infarction
HEPATIC	Raised Transaminases Hepatic Failure
CNS	Headache Mental Confusion Vertigo Behavioural Disturbances Seizure Precipitation
HAEMATOLOGICAL	Bleeding Thrombocytopenia Haemolytic Anaemia Agranulocytosis
	Asthma Exacerbation

OTHERS	Rhinitis, Pruritus Nasal Polyposis Skin Rashes Angioedema

PRESCRIBING PATTERN

As there are many varieties of NSAIDs available and it is always difficult for a practitioner to select a particular NSAID on rational basis. They are increasingly used for variety of indication like Rheumatoid Arthritis (RA), Osteoarthritis (OA) and Low Back Ache (LBA)13. Various studies, have described the pattern of poly pharmacy involved the use of NSAIDs that are unnecessary, expensive, irrational, inadequate amount or by self- medication. Periodic evaluation of drug utilization, patterns enables suitable modification in the NSAIDs prescribed to increase the therapeutic benefit and to minimize the adverse effect14. Prescribing pattern studies are undertaken to scrutinize, assess and to advocate the various amendment in the prescribing behavior of health care professional to ensure that medical care is rational. Study of prescribing pattern provides information on the rational use of drugs as rational use of the drug are based on the rational prescribing.15

Rational use of medicine defined as patient receive medications appropriate to the clinical needs, in dose that meet their own individual requirements for an adequate period of time and at the low cost. Prescription has to hold a special importance regarding the rational use of drug safety and efficacy. It is necessary to have a prescribing pattern for NSAIDs as it consumed by large number of people around the world resulting in enormous drug exposure and associated risk. Hence, NSAIDs are the most prescribed classes of drugs in the orthopedic department for various indications.

PRESCRIBING INDICATORS

WHO defines rational prescribing as an application of an appropriate drug by appropriate route in an adequate dose, over a sufficiently long period of time. An important use of this study is to describe drug use pattern and prescribing behavior. A number of five core prescribing indicators to quantify the impact of essential drug programs have been developed16. These indicators are as follows:

Average Number of drugs per encounter /prescription

Purpose: To measure the degree of poly pharmacy

Calculation:

$$\frac{\text{Total number of different drug prescribed}}{\text{Number of encounter surveyed}}$$

Percentage of drugs prescribed by Generic names

Purpose: To measure the drug prescribed by generic name

Calculation:

$$\frac{\text{Number of drug prescribed by generic name}}{\text{Total number of drugs prescribed}} \times 100$$

- Percentage of encounters with antibiotics prescribed
- Percentage of encounter with an injection prescribed.

Purpose: To measure the overall level of use of two important but commonly over used drug therapy.

Calculation:

$$\frac{\text{No. of patients encounters during which an antibiotic or injection prescribed}}{\text{Total number of encounters surveyed}} \times 100$$

Percentage of drug used from Essential drug list or formulary.

Purpose: To measure the degree to which practices conform to a national drug policy, as indicated by prescribing from the national essential drug list or formulary for the types of facility surveyed.

Calculation:

$$\frac{\text{No. of drugs prescribed which are listed on the essential drug list}}{\text{Total number of drugs prescribed}} \times 100$$

National List of Essential Medicines (NLEM)

Essential medicines, as defined by the WHO, are the medicines that "satisfy the priority health care needs of the population". These are the medications to which people should have access at all times. The WHO has published a model list of essential medicines in April 2015.The WHO list contains both core list and a complementary list.

The core list presents a minimum list of medicine need for basic health care system that contains the most efficacious safe medicine for priority conditions whereas the complementary lists presents essential medicine for priority diseases, for which specialized diagnostic or monitoring facilities are needed. This list is considered important because it forms the basis of national drug policy in more than 155 countries both in the developed and developing world.

Each and every country is encouraged to prepare their own lists taking into the consideration of local priorities. About 150 countries have published an official essential drugs list that enables health authorities especially in developing countries to optimize pharmaceutical resources.1

NLEM OF NSAIDS 2015

Table No 2: NLEM OF NSAIDs

DRUG	ROUTE	DOSE
DICLOFENAC	Parenteral	Tablet 50 mg
	Systemic	Injection 25 mg/ml
	Topical	
IBUPROFEN	Parenteral	Tablet 200 mg
	Systemic	Tablet 400 mg
	Topical	Oral liquid 100 mg/5 ml
MEFENAMIC ACID	Parenteral	Capsule 250 mg
	Systemic	Capsule 500 mg
	Topical	Oral liquid 100 mg/5 ml
PARACETAMOL	Parenteral	Tablet 500 mg
	Systemic	Tablet 650 mg
	Topical	Injection 150 mg/ml
		Suppository 80 mg
		Suppository 170 mg

METHODS USED IN MEASURING DRUG UTILIZATION

A. DRUG UTILIZATION (DU) 90%

DU 90% is an innovative approach to assess drug prescribing. Using this approach, the drug that represents 90% present of the drug prescription /sales volume are identified. The rationale behind the DU 90% on an assumption that a low number of products prescribed associated with more rational prescribing practices. Furthermore, the approach can be used to assess what proportion of drugs that represent 90% of the volume is made up by drugs listed in an essential drug list

DU 90% does not directly reflect the quality of drug prescribed but it is a useful tool in quality assessment process which is more depth. The approach can be used for exploring drugs prescribing data in a effective way.

DU90% identifies the numbers of drugs making up to 90% of the total volume, measured in Defined Daily Dose (DDD) or number of prescription (NP), during a certain period of time.

According to DU90% concept a physician using few, well known and prove drug alternatives in the daily practice, would provide a more rational prescribing

and hence a higher quality of care is achieved. It is a purely descriptive prescription indicator.

The Size of the DU90% segment helps us to access the rational prescribing. A large number of drugs in the DU90% segment indicates less rational prescribing. On the other hand, a small number of drugs in DU90% could suggest a more rational prescribing. The assumption is that less is used as prescribing indicator in DU90%.3

B. DEFINED DAILY DOSE (DDD)

The DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults. It will only be assigned for drugs that already have an Anatomical Therapeutic Chemical (ATC) classification code. DDD is a unit of measurement and does not necessarily reflect the recommended or prescribed daily dose.17

Drug consumption data presented in DDDs only give a rough estimate of consumption and not exact of actual use. DDD is commonly calculated as DDD/1000/day.

DDD/1000/Day

$$\frac{\text{Total no. of dosage unit prescribed} \times \text{strength of each dosage unit}}{\text{DDD} \times \text{Duration of study} \times \text{Total sample size}} \times 1000$$

FIXED DOSE COMBINATION (FDC)

According to WHO expert committee on specifications for pharmaceuticals preparations a FDC can be defined as a combination of two or more active drugs in a fixed ratio of doses. This term is generically means a particular combination of active components, irrespective of the formulation or brand.

Rationality of FDC's should be based on certain aspects such as:

- The drugs in the combination should act in different mechanisms.
- The pharmacokinetics must not be widely different.
- The combination should not have supra additive toxicity of the ingredients. According to WHO expert committee, combination drug should only be used when there are no alternative of single drug available for the treatment.

FDC of NSAIDs are widely prescribed in India although there are not recommended, as they are directed against the same targets. None of the present available FDC of NSAIDs is listed in national list of essential drugs. Fixed dose combinations are valuable only when they are developed according to rational pharmacokinetic and pharmacodynamics criteria and when the benefits have been supported by evidence based data and well-designed clinical studies.12

Example 1: NSAID- NSAID: Acelofenac + Paracetamol, etc

Example 2: NSAID- Analgesics: Paracetamol + Tramadol, etc

Example 3: NSAID- Enzymes: Aceclofenac + serrtiopeptidase, etc

RISK FACTORS

The differences in the anti-inflammatory activity between NSAIDs are small. However, there is Considerable variation in individual response and Tolerance to these drugs. The choice of NSAID depends on individual response, risk factors and Adverse effects (particularly gastrointestinal (GI) and cardiovascular (CV) complications). As adverse-effects are dose and duration dependent, the lowest effective dose for the shortest duration possible should be used. CV and GI risk assessment should be performed before prescribing. NSAIDs should be avoided if Possible in patients with a history of vascular Disease, a high risk of CVD, or GI risk factors. Bad prescribing habits lead to ineffective and unsafe treatment, exacerbation or prolongation of illness, distress and harm to the patient, and higher cost. Diclofenac and COX IIs have increased cardiovascular risk over reduce GI damage.18

299FM.4 GUIDELINE FOR PRESCRIBING NON-STEROIDAL ANTI- INFLAMMATORY DRUGS (NSAIDs) IN ADULTS

Risk factors direct the choice of NSAID to be used

Gastrointestinal Risk Factors	Cardiovascular Risk Factors
>65	65 years (especially in males)
Previous GI history	Established cardiovascular disease
Concomitant Anti Platelets	Hypertension
Anticoagulants, SSRIS, Oral Steroids	Heart Failure
Serious co morbidity e.g. CVD,	Diabetes
Diabetes	Long term use(2weeks)

Table No Table 3: Risk Factor Associated with the use of NSAIDS

ROLE OF PHARMACIST

- To facilitate the safe and rational use of drugs in the populations.
- The rational use of a drug for an individual patient is a prescription of the right drug at the right dose along with the complete information in a cost effective manner.
- Drug utilization research can also provide insight to the efficacy of the drug use.

Drug utilization research can increase our understanding on how drugs are being used as follows:

- It can be used to estimate the number of patients exposed to a specific drug within a given period of time.
- It can describe the extended of use at a certain moment or in a certain area (Ex., In a Country, Region, Community or Hospital). It is most meaningful when they form part of a continuous evaluation system, that is when the patterns are followed over time and trends in drug use can be discerned. Researchers can estimate to what extent drugs are being used i.e., properly used, over used or under used.
- It can determine the pattern or profile of drug use and extend to which alternative drugs are being used to treat particular conditions.
- It can be used to compare the observed patterns of drug use for the treatment of a certain disease with current recommendation or guideline.
- It can be used in the application of quality indicators to patterns of drug utilization.

Pharmacist can play a major role in the evaluation of usage pattern of drugs by doing the following:

- Reviewing the drug use or prescribing pattern.
- Providing feedback to clinicians and other relevant group based on the results
- Developing criteria and standards which describes optimal drug usage
- Promote appropriate drug use through education and other intervention. 25,40

AIM AND OBJECTIVE

The aim and objective of this study is to evaluate the prescribing patterns of NSAIDS in both In-patients and out-patients Department of Orthopedics, the commonly prescribed NSAIDS their indication and categories were also evaluated in this study along with the drug consumption using DDD/1000/day and the rationality of prescription using DU90% was assessed using WHO core indicators. DU 90% is an innovative approach to assess drug prescribing. Using this approach, the drug that represents 90% present of the drug prescription /sales volume are identified. The rationale behind the DU 90% on an assumption that a low number of products prescribed associated with more rational prescribing practices. Furthermore, the approach can be used to assess what proportion of drugs that represent 90% of the volume is made up by drugs listed in an essential drug list.

The prescribing indicators were assessed as per the WHO core indicators it defines rational prescribing as an application of an appropriate drug by appropriate route in an adequate dose, over a sufficient period of time. The important use of this study is to describe drug use pattern and prescribing behavior. A number of five core prescribing indicators are developed to quantify the impact of essential drug programs they are to measure the degree of poly pharmacy, to measure the drug prescribed by generic name, to measure the overall level of use of two important but commonly over used drug therapy, and to measure the degree to which practices conform to a national drug policy, as indicated by prescribing from the national essential drug list or formulary.

The patients under risk using the prescribing guidelines by NHS were also assessed in this study. The choice of NSAID depends on individual response, risk factors and adverse effects (particularly gastrointestinal (GI) and cardiovascular (CV)

complications). As adverse-effects are dose and duration dependent, the lowest effective dose for the shortest duration possible should be used. CV and GI risk assessment should be performed before prescribing the NSAIDS to the patients.

This study was conducted in a tertiary care hospital setup and in a community setup, both in- patients and out-patients were included from the Orthopedic Department respectively.

METHODOLOGY

IP DEPARTMENT METHODOLOGY

Study Type:

Pharmacoepidemiology study.

Study Design:

A cross sectional, non-interventional, observational study.

Study site:

The study was carried out in a Tertiary Care Hospital, Chennai.

Study population:

Patients receiving Non-Steroidal Anti-Inflammatory Drugs in the Orthopedic Inpatient Department of a tertiary care Hospital.

Sample size:

A total of 203 cases were studied.

Study period:

The study was carried out for a period of 6 months from the month of January to June 2017.

Data collection:

Data collection was made by using the following inclusion and exclusion criteria.

Inclusion criteria:

- Patient above the age of 18years were included in the study. Both Male and Female patients of above the age of 18 years were enrolled in the study.
- Patient with co-morbidities like DM, HTN, CAD, COPD, Asthma etc were included in the study.
- IP patients who were receiving NSAIDs in Department of Orthopedic.
- Patient who have undergone surgery like Knee Replacement, Hip Replacement or any other orthopedic surgeries were included in the study.

Exclusion criteria:

- Pregnant and Lactating women were excluded from the study.
- Psychiatric Patients.
- Critically ill-patients
- Patient who were prescribed with Acetylsalicylic acid (Aspirin) as an anti-platelet medication
- Patients with incomplete medical profile form

STUDY PROCEDURE

- The study was carried out from the month of January to June 2017, in the Inpatient Department of Orthopaedics, Tertiary Care Hospital, Chennai.

Prescription containing NSAIDs were documented in designed Proforma with the following details:

Demographic profile:

- Name, Age Gender, IP Number Clinical condition for which NSAIDs are used.
- Details of NSAIDs prescription: Brand and Generic Name, Class, Dose, Dosage, Route, Frequency and Duration. details of Fixed dose combination, If any
- Details of any Gastro -protective drugs prescribed.
- Average number of drugs prescription.
- All the Personal details of the patients were kept confidential.

Analysis of Results was done by using Microsoft Excel 2007.

OP DEPARTMENT METHODOLOGY

Study Type:

Pharmacoepidemiology study.

Study Design:

A cross sectional, non-interventional, observational study.

Study site:

The study was carried out in community clinical setup, Chennai

Study population:

Patients receiving Non-Steroidal Anti-Inflammatory Drugs in the community clinical setup.

Sample size:

A total of 256 prescriptions were studied.

Study period:

The study was carried out for a period of 6 months from the month of January to June 2017.

Data collection:

Data collection was made by using the following inclusion and exclusion criteria.

Inclusion criteria:

- Patient above the age of 18years were included in the study. Both Male and Female patients of above the age of 18 years were enrolled in the study.
- Patient with co-morbidities like DM, HTN, CAD, COPD, Asthma etc. were included in the study.
- Patients who were receiving NSAIDs in Department of Orthopedic.
- Patients with history of surgery like Knee Replacement, Hip Replacement or any other orthopedic surgeries were included in the study.

Exclusion criteria:

- Pregnant and Lactating women were excluded from the study.
- Psychiatric Patients.
- Patient who were prescribed with Acetylsalicylic acid (Aspirin) as an Antiplatelet medication.

STUDY PROCEDURE

- The study was carried out from the month of January to June 2017 in Orthopaedic Community clinical setup, Chennai.

Prescription containing NSAIDs were documented in designed Proforma with the following details:

Demographic profile:

- Name, Age Gender, OP Number Clinical condition for which NSAIDs are used.
- Details of NSAIDs prescription: Brand and Generic Name, Class, Dose, Dosage, Route, Frequency and Duration.
- details of Fixed dose combination, If any
- Details of any Gastro -protective drugs prescribed.
- Average number of drugs prescription.

All the Personal details of the patients were kept confidential.

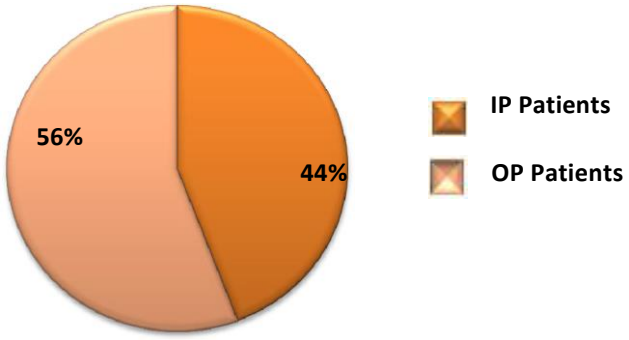
RESULTS

In the present study, 459 prescriptions were studied. Out of which 203 (44.2%) were in Patients in Tertiary care hospital and 256 (55.7%) were OP patients in community clinical set up. (Table-4; Fig. 2)

Table 4: Department wise Distribution of the patients (n=459)

Department	No of Patients (n=459)	Percentage %
IP Patients	203	44.2
OP Patients	256	55.7

Fig 2: Department wise Distribution of the patients



RESULTS ANALYSED IN INPATIENT DATA

6.1 PRESCRIBING INDICATORS:

Prescribing Indicators were assessed as per the WHO core indicators. This indicates about the drug use pattern and prescribing behavior.

In our study the total number of NSAIDS prescribed was 357; Average number of NSAIDs per prescription was 1.75.

The Number of drugs prescribed by generic name was 75 (21.0%), Number of antibiotics encountered with NSAIDs was 100(28.1%), Number of NSAIDs prescribed by injectable was 108(30.2%) and Number of NSAIDS prescribed from National List of Essential Medicine was 214 (59.9%) Table 5.

Table 5: WHO Prescribing Indicators (n=203)

Prescribing Indicators	
Total No. of NSAIDs Prescribed	357
Average No. of NSAIDs per Prescriptions	1.75

Prescribing indicators	Total	Percentage (%)	Standard
No. of Drugs Prescribed by Generic Name	75	21.0	100%
No. of Antibiotics encountered with NSAIDs	100	28.1	20.0-26.8%
No. of NSAIDs Prescribed by Injectable	108	30.2	13.4-24.1%
No. of NSAIDs Prescribed from NLEM	214	59.9	100%

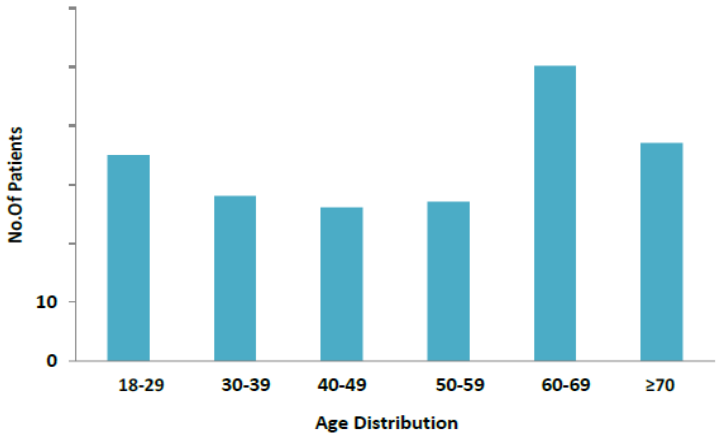
6.2 AGE DISTRIBUTION

Of 203 in Patients included in the study, 35 (17.2%) Patients were in the age group of 18-29 years, 28 (13.7%) Patients were in the age group of 30-39 years, 26 (12.8%) Patients were in the age group of 40-49 years, 27 (13.3%) Patients were in the age group of 50– 59 years, 50 (24.6%) Patients were in the age group of 60-69 years, 37 (18.2%) Patients were in above or equals to the age of ≥ 70 years (Table-6; Fig.3)

Table 6: Age distribution of the study population (n=203)

Age (years)	No. of Patients (n=203)	Percentage (%)	Confidence Interval (95%)
18-29	35	17.2	23.27-25.85
30-39	28	13.7	33.14-35.82
40-49	26	12.8	42.43-44.95
50-59	27	13.3	53.41-55.7
60-69	50	24.6	63.04-64.96
≥70	37	18.2	74.05-78.17

Fig. 3: Age distribution of the study population



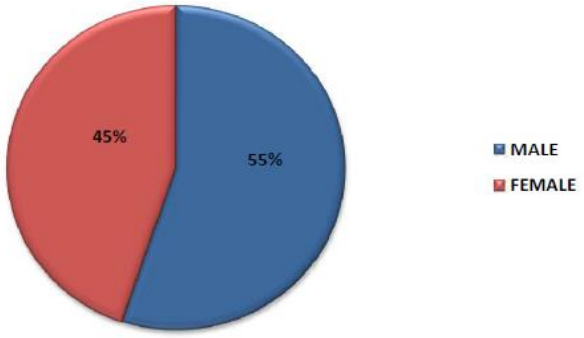
6.3 GENDER DISTRIBUTION

Of 203 In Patients in the study, 112 (55.1%) were male patients and 91 (44.8%) were female patients (Table-7; Fig.-4).

TABLE 7: Gender Distribution of the study population (n=203)

Gender	Frequency (n=203)	Percentage (%)
Male	112	55.1
Female	91	44.8

Fig. 4: Gender Distribution of the study population



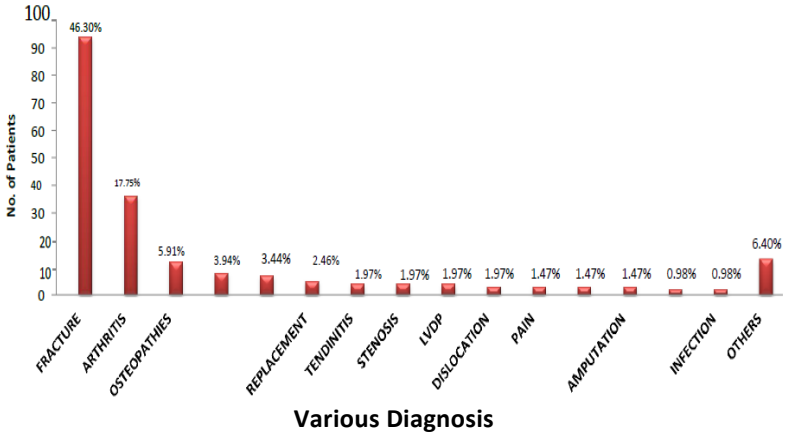
6.4 DIAGNOSIS

Table.8 and Fig.5 depicts that 94 (46.3%) patients were Fracture, 36 (17.7%) patients were Arthritis, 12 (5.9%) patients were osteopathies , lower back ache was found to be 8 (3.9%) patients , 7 (3.4%) patients were implant removal, 5 (2.4%) patients were Replacement,4 (1.9%) patients were Tendinitis,4 (1.9%) patients were stenosis , 4 (1.9%) patients were LVDP, 3 (1.4%) patients were Dislocation,3 (1.4%) patients were pain, , 3 (1.4%) patients were Tunnel Syndrome, 3 (1.4%) patients were Amputation, 2 (0.9%) patients were Lumbar radiculopathy, 2 (0.9%) patients were infection, 13 (6.4%) patients were in the category of others.

Table 8: Distribution of Diagnosis (n=203)

Condition	Frequency (n=203)	Percentage (%)
Fracture	94	46.3
Arthritis	36	17.7
Osteopathies	12	5.9
Lower back ache	8	3.9
Implant removal	7	3.4
Replacement	5	2.4
Tendinitis	4	1.9
Stenosis	4	1.9
LVDP	4	1.9
Dislocation	3	1.4
Pain	3	1.4
Tunnel syndrome	3	1.4
Amputation	3	1.4
Lumbar radiculopathy	2	0.9
Infection	2	0.9
Others	13	6.4

Fig. 5: Distribution of Diagnosis



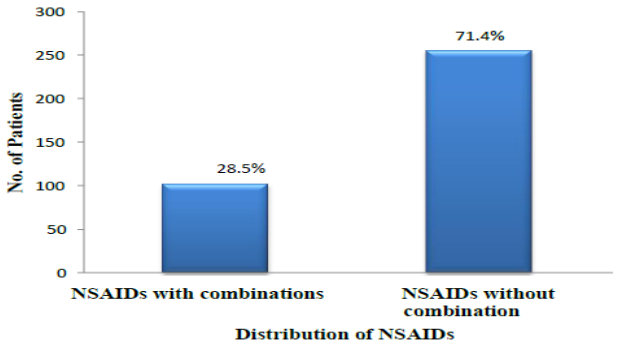
6.5 NSAID DISTRIBUTION

Table .9 and Fig .6 depicts that 102 (28.5%) patient was on NSAIDs with combinations and 255 (71.4%) patient was on NSAIDs without combination

Table 9: Distributions of NSAID (n=357)

NSAIDs (n=357) (%)	No. of drugs	Percentage
NSAIDs with Combinations	102	28.5
NSAIDs without Combinations	255	71.4

Fig. 6: Distribution of NSAIDs



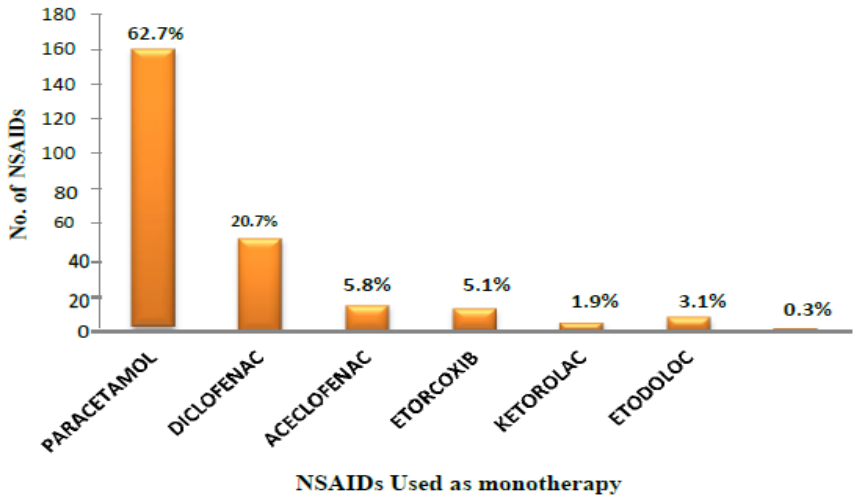
6.6 NSAIDS PRESCRIBED AS MONOTHERAPY

Table.10 and Fig.7 depicts that 160 (62.7%) Patients were prescribed with Paracetamol, 53 (20.7%) were on Diclofenac, 15 (5.8%) were on Aceclofenac, 13 (5.1%) were on Etorocoxib, 5 (1.9%) were on ketorolac, 8 (3.1%) were on Etodoloc, 1 (0.3%) were on Mefenamic acid.

Table 10: Number of NSAIDs Prescribed as Monotherapy (n=255)

NSAIDs	No. of drugs (n=255)	Percentage (%)
Paracetamol	160	62.7
Diclofenac	53	20.7
Aceclofenac	15	5.8
Etoricoxib	13	5.1
Ketorolac	5	1.9
Etodoloc	8	3.1
Mefenamic acid	1	0.3

Fig. 7: Number of NSAIDs Prescribed as Monotherapy



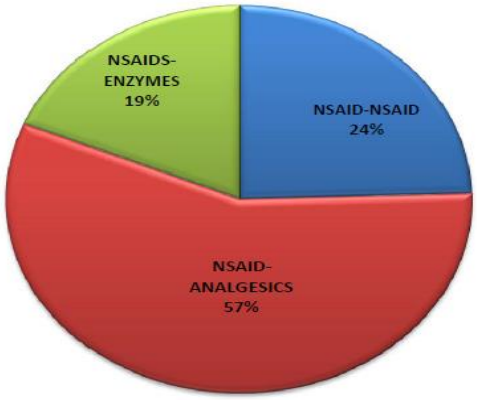
6.7 FIXED DOSE COMBINATIONS

Table.11 and Fig.8 depicts that, out of 203 prescriptions 102 prescriptions were containing Fixed Dose Combinations among which 25 (24.5%) were NSAIDs & NSAIDs, 58 (56.8%) were NSAIDs & Analgesics, 19 (18.6%) contained NSAIDs and Enzymes.

Table 11: Fixed Dose Combinations (n=102)

FDCS	No. of drugs (n=102)	Percentage (%)
NSAID-NSAID	25	24.5
NSAID-Analgesics	58	56.8
NSAIDS-Enzymes	19	18.6

Fig. 8: Fixed Dose Combinations



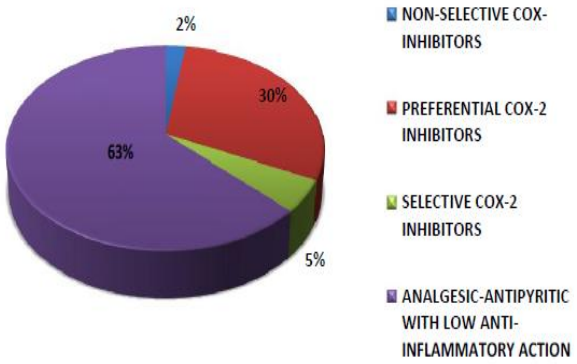
6.8 CLASS OF NSAIDs

Of 255 NSAIDs prescribed, 6 (2.3%) were Non Selective COX Inhibitors, 13 (5.1%) were Selective COX-2 inhibitors, 76 (29.8%) were Preferential COX-2 Inhibitors, 160 (62.7%) were Analgesics-Antipyretic with low Anti-inflammatory Action (Table.12; Fig.9).

Table 12: Class of NSAIDs (n=255)

Class	Class (n=255)	Percentage (%)
Non-Selective COX-Inhibitors	6	2.3
Preferential COX-2 Inhibitors	76	29.
Selective COX-2 Inhibitors	13	5.1
Analgesic-Antipyretic with Low Anti- Inflammatory Action	160	62.7

Fig. 9: Class of NSAIDs



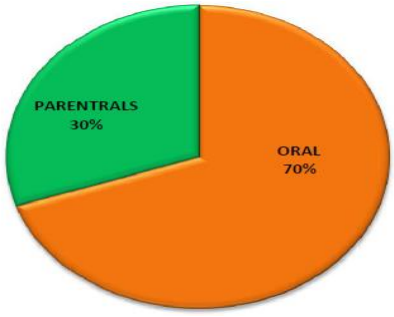
6.9 ROUTE OF ADMINISTRATION

Of 357 NSAIDs 249 (69.7%) were administered Orally, 108 (30.2%) were administered by Parenteral route. (Table-13; Fig.-10)

Table 13: Route of Administration (n=357)

Route	No. of drugs (n=357)	Percentage (%)
Oral	249	69.7
Parenteral	108	30.2

Fig. 10: Route of Administration



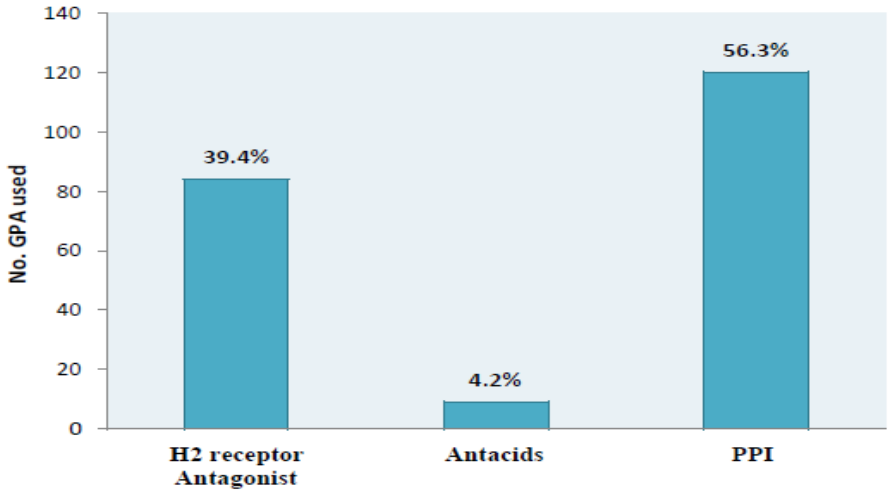
6.10 GASTRO PROTECTIVE AGENTS

Table.14 & Fig.11 depicts that 213 Gastro protective agents were prescribed along with NSAIDs. 84 (39.4%) were H2 receptor Antagonist, 9 (4.2%) were Antacids and 120 (56.3%) were Proton Pump Inhibitors.

Table14: Gastro Protective Agents (n=213)

Agents	No. of drugs (n=213)	Percentage (%)
H2 receptor Antagonist	84	39.4
Antacids	9	4.2
PPI	120	56.3

Fig. 11: Gastro Protective Agents



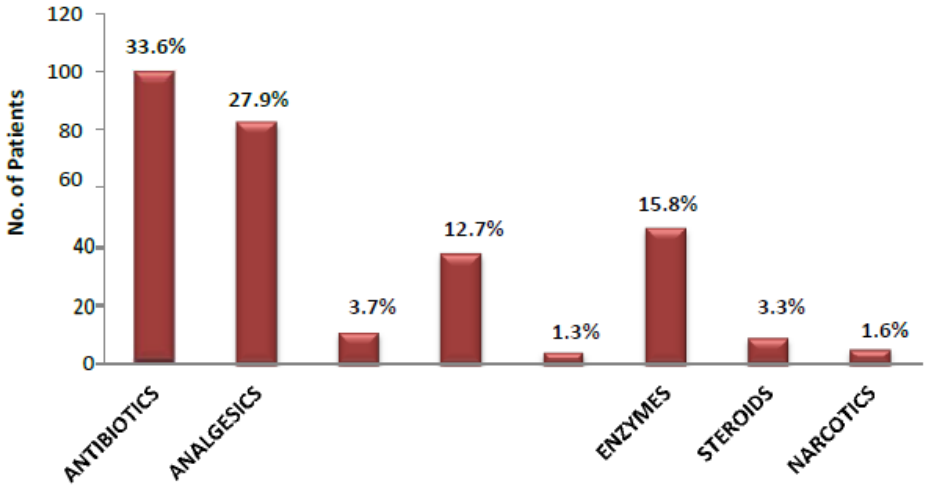
6.11 CONCOMITANT MEDICATIONS

Of 297 concomitant medications 100 (33.6%) were Antibiotics, 83 (27.9%) were Analgesics, 11 (3.7%) were Calcium supplements, 38 (12.7%) were Vitamins supplements, 4 (1.3%) were Collagen Peptide, 47 (15.8%) were Enzymes, 9 (3.0%) were Steroids, 5 (1.6%) were Narcotics (Table-15; Fig.-12)

Table 15: Concomitant Medications (n=297)

Concomitant Medication	No. of drugs (n=297)	Percentage (%)
Antibiotics	100	33.6
Analgesics	83	27.9
Calcium supplements	11	33.7
Vitamins supplements	38	112.7
Collagen peptide	4	11.3
Enzymes	47	115.8
Steroids	9	33.3
Narcotics	5	11.6

Fig. 12: Concomitant Medications



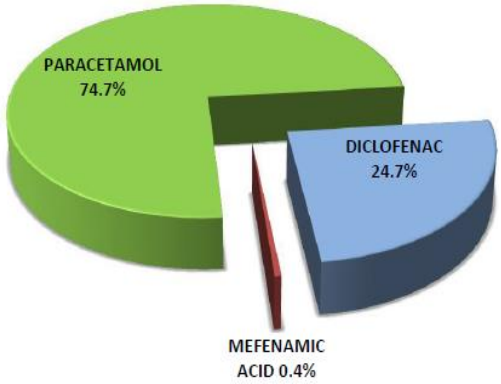
6.12 DRUGS FROM NLEM

Table.16 and Fig.13 depicts the list of drugs from NLEM, among which 53 (24.7%) were Diclofenac, 1 (0.4%) were Mefenamic acid and 160 (74.7%) were Paracetamol.

Table 16: Drugs from NLEM (n=214)

Drugs	No. of drugs (n=214)	Percentage (%)
Diclofenac	53	24.7
Mefenamic acid	1	0.4
Paracetamol	160	74.7

Fig. 13: Drugs from NLEM



6.13 Daily Defined Dose (DDD):

The WHO has recommended the ATC classification/DDD system as a tool for presenting drug utilization research to improve the quality of drug use. The ATC classification divides drugs into different groups according to the organ or system on which they act and their chemical, pharmacological and therapeutic properties. The DDD is the assumed average maintenance dose for a drug used for its main indications in adults. DDD is calculates as:

$$\text{DDD/1000/Day} = \frac{\text{Total no. of dosage unit prescribed} \times \text{strength of each dosage unit}}{\text{DDD} \times \text{Duration of study} \times \text{Total sample size}} \times 1000$$

Drug Utilization (DU90%):

DU90% is expressed in terms of DDD, it shows number of drugs constitute to 90% of prescription, five of the nine NSAIDS prescribed in the study constitute to DU90%.

TABLE 17: Details of NSAIDs constituting to DU90%

S.No	Drug	ATC Code	DDD	No of Drugs	DDD/ 1000/Day	Du 90%
1	PARACETAMOL	NO2BE01	3000mg	160	17.59	34.00
2	DICLOFENAC	MO1AB05	100mg	53	14.31	27.66
3	ACECLOFENAC	MO1AB16	200mg	15	9.79	18.93
4	ETORICOXIB	MO1AH	60mg	13	3.55	6.86
5	ETODOLOC	MO1AB08	400mg	8	2.59	5.01
	5 OUT OF 9 DRUGS CONSTITUTE TO DU90%					
6	ACECLOFENAC +PARACETAMOL	MO1BX	200mg +1000mg	16	2.4	4.64
7	KETOROLAC	MO1AB15	30mg	5	0.82	1.59
8	IBUPROFEN + PARACETAMOL	NO2BE51	400mg +500mg	6	0.58	1.12

9	MEFENAMIC ACID	MO1AG01	1000mg	1	0.1	0.19

6.14 RISK FACTORS

Despite the clinical efficacy, NSAIDs are well known for Gastro Intestinal side effects. In COX 2 Selective and most NSAIDS can be associated with increased cardiovascular risk which has prompted the necessity for assessment of both GI and CV risk in patients who need these medications.

Table 18: GI Risk Factors

GI RISK FACTORS	n	Percentage (%)
Age Above 65	60	29.5%
History Of GI	5	2.4%
History Of CV	14	6.9%
High Dose NSAIDs	17	8.3%
Serious Co-Morbidity	79	38.9%
Long Term Use	58	28.5%
Concomitant Drugs	16	7.8%

Table 19: CV Risk factor

CV RISK FACTORS	n	Percentage (%)
Age Above 65	60	29.5%
No. of Male Patients Above 65	24	11.8%
History Of CV Disease	14	6.8%
History Of DM	34	16.7%
History Of HT	29	14.2%

RESULTS ANALYSED IN OPD 6.15 PRESCRIBING INDICATORS:

- Prescribing Indicators were assessed as per the WHO core indicators. This indicates about the drug use pattern and prescribing behavior.
- In our study the total number of NSAIDS prescribed was 498; Average number of NSAIDS per prescription was 1.94.
- The Number of drugs prescribed by generic name was 6 (1.2%), Number of antibiotics encountered with NSAIDs was 57 (11.4%), Number of NSAIDs prescribed by injectable was 108 (21.6%) and number of NSAIDS prescribed from National List of Essential Medicine was 25 (5%).

Table 20: WHO Prescribing Indicators (n=256)

Prescribing Indicators	
Total No. of NSAIDs Prescribed	498
Average No. of NSAIDs per Prescriptions	1.94

Prescribing Indicators	Total	Percentage(%)	Standard
No. of Drugs Prescribed by Generic Name	6	1.2	100%
No. of Antibiotics encountered with NSAIDs	57	11.4	20.0-26.8%
No. of NSAIDs Prescribed by Injectable	108	21.6	13.4-24.1%
No. of NSAIDs Prescribed from NLEM	25	5	100%

6.16 AGE DISTRIBUTION

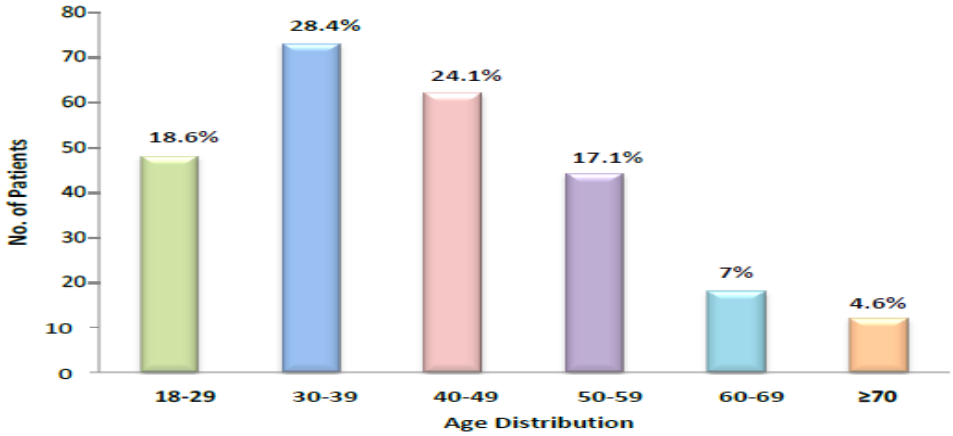
Among 256 Patients, 48 (18.6%) Patients were in the age group of 18-29 years, 73 (28.4%) Patients were 30-39 years of age, 62 (24.1%) Patients were in the age group of 40-49 years, 44 (17.1%) Patients were in the age group of 50-59 years, 18 (7%) Patients were 60-69 years of age, above or equal to 70 years

of age consist of 12 (4.6%) patients. (Table.21; Fig. 14)

Table 21: Age distribution of the study population (n=256)

Age (Years)	No. of patients (n=256)	Percentage (%)	Confidence interval (95%)
18-29	48	18.6	25.12-27.04
30-39	73	28.4	34.74-36.17
40-49	62	24.1	43.99-45.65
50-59	44	17.1	53.94-55.92
60-69	18	7	63.36-66.64
≥70	12	4.6	76.48-84.25

Fig. 14: Age distribution of the study population



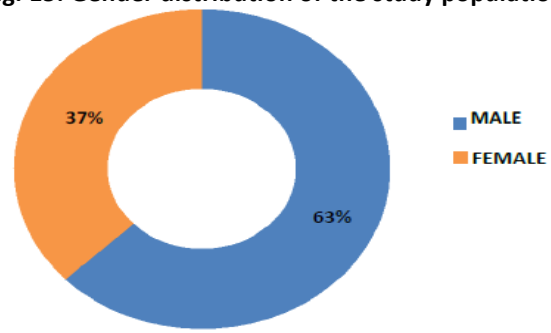
2.17 GENDER DISTRIBUTION

Out of 256 OP Patients, about 161 (62.8%) were male patients and 95 (37.1%) were female patients. (Table - 22; Fig.-15).

Table 22: Gender Distribution in the study population (n=256)

Gender	Frequency (n=256)	Percentage (%)
Male	161	62.8
Female	95	37.1

Fig. 15: Gender distribution of the study population



6.18 DIAGNOSIS

Table.23 and Fig.16 depicts that 62 (24.2%) patient were found to be Fracture, 27 (10.5%) patient were Arthritis, 68 (26.5%) patient were sprain, osteopathies was found to be 6 (2.3%) in patients, 24 (9.3%) patients were low back pain, 9 (3.5%) patients were musculoskeletal pain, 7 (2.7%) patients were inflammation, 5(1.9%) patients were Epicondylitis, 8 (3.1%) patients were Hematoma, 8 (3.1%) patients

were Disc prolapse, 2 (0.7%) patients were Brusitis, 30(11.7%) patients were in the category of Others.

Table 23: Distribution of Diagnosis (n=256)

Conditions	No. of Patients (n=256)	Percentage (%)
Fracture	62	24.2
Arthritis	27	10.5
Sprain	68	26.5
Osteopathies	6	2.3
Low back pain	24	9.3
Musculoskeletal pain	9	3.5
Inflammation	7	2.7
Epicondylitis	5	1.9
Hematoma	8	3.1
Disc prolapse	8	3.1
Brusitis	2	0.7
Others	30	11.7

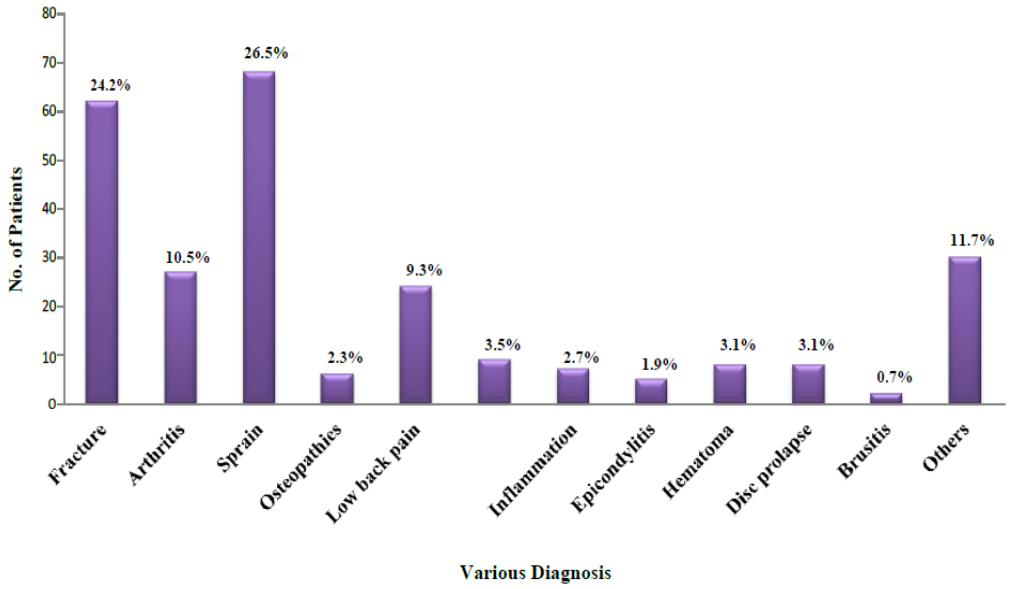


Fig. 16: Distribution of Diagnosis

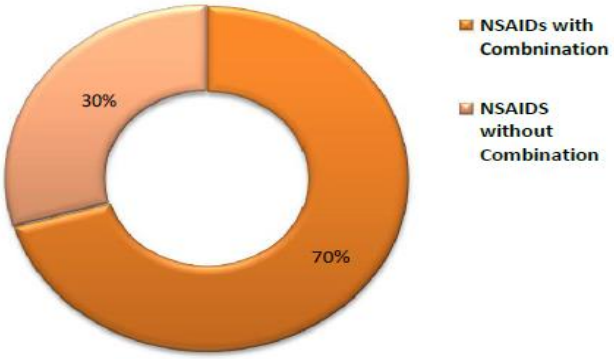
6.19 NSAID DISTRIBUTION

Table- 24 and Fig.- 17 depicts that, 351 (70.4%) were on NSAIDs with combinations and 147 (29.5%) were NSAIDs without combination.

Table 24: Distribution of NSAIDs (n=498)

NSAIDs	No. of drugs (n=498)	Percentage (%)
NSAIDs with Combinations	351	70.4
NSAIDs without Combinations	147	29.5

Fig. 17: Distribution of NSAIDs



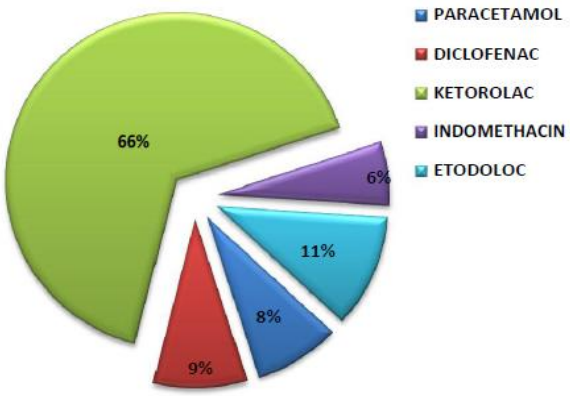
6.20 NSAIDS PRESCRIBED AS MONOTHERAPY

Table.25 and Fig.18 depicts that 12 (8.1%) patients were prescribed with Paracetamol, 13 (8.8%) Patients were prescribed with Diclofenac, 97 (65.9%) Patients were prescribed with Ketorolac, 9 (6.1%) Patients were prescribed with Indomethacin, 16 (10.8%) Patients were prescribed with Etodoloc.

Table 25: Number of NSAIDs Prescribed As Monotherapy (n=147)

NSAIDs	No. of drugs (n=147)	Percentage (%)
Paracetamol	12	8.1
Diclofenac	13	8.8
Ketorolac	97	65.9
Indomethacin	9	6.1
Etodoloc	16	10.8

Fig. 18: Number of NSAIDs Prescribed As Monotherapy



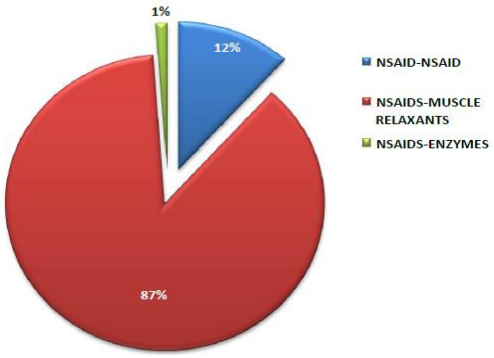
6.21 FIXED DOSE COMBINATIONS

Table.26 and Fig.19 depicts that, out of 453 prescriptions 258 prescriptions were containing Fixed Dose Combinations among which 30 (11.6%) were NSAIDs & NSAIDs, 3 (1.6%) were contained NSAIDs and Enzymes, 225 (87.2%) were Prescription containing NSAIDs and MR.

Table 26: Fixed Dose Combinations (n=258)

FDCs	No. of drugs (n=258)	Percentage (%)
NSAID-NSAID	30	11.6
NSAIDS-Muscle Relaxants	225	87.2
NSAIDS-Enzymes	3	1.1

Fig. 19: Fixed Dose Combinations



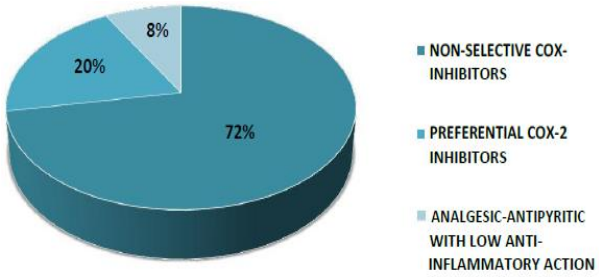
6.28 CLASS OF NSAID

Of 147 NSAIDs prescribed 106 (72.1%) were Non Selective COX Inhibitors, 29 (19.7%) were Preferential COX-2 Inhibitors, 12 (8.1%) were Analgesics- Antipyretic with low Anti-inflammatory Action (Table-27; Fig.-20)

Table 27: Class of NSAIDs (n=147)

Class	No. of drugs (n=147)	Percentage (%)
Non-selective COX-inhibitors	106	72.1
Preferential COX-2 inhibitors	29	19.7
Analgesic-Antipyretic with low anti- inflammatory action	12	8.1

Fig. 20: Class of NSAIDs



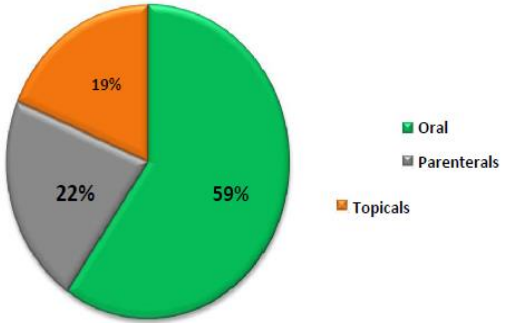
6.29 ROUTE OF ADMINISTRATION

Of 498 NSAIDs 249 (59.6%) were Administered Orally, 108 (21.6%) were Administered by Parenteral route, 93 (18.6%) were given Topical (Table.28; Fig.21).

Table 28: Route of Administration (n=498)

Route	No. of drugs (n=498)	Percentage (%)
Oral	297	59.6
Parenteral	108	21.6
Topicals	93	18.6

Fig. 21: Route of Administration



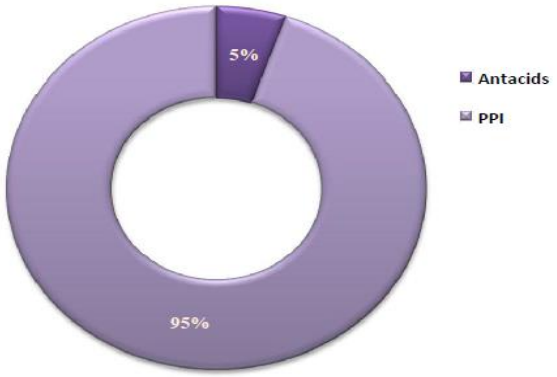
6.30 GASTRO PROTECTIVE AGENTS

Table.29 & Fig. 22 depicts that among 167 Gastro protective agents prescribed along with NSAIDs, 9 (5.3%) were Antacids and 158 (94.6%) were Proton Pump Inhibitors.

Table 29: Gastro Protective Agents (n=167)

Agents	No. of drugs (n=167)	Percentage (%)
Antacids	9	5.38
PPI	158	94.6

Fig. 22: Gastro Protective Agents



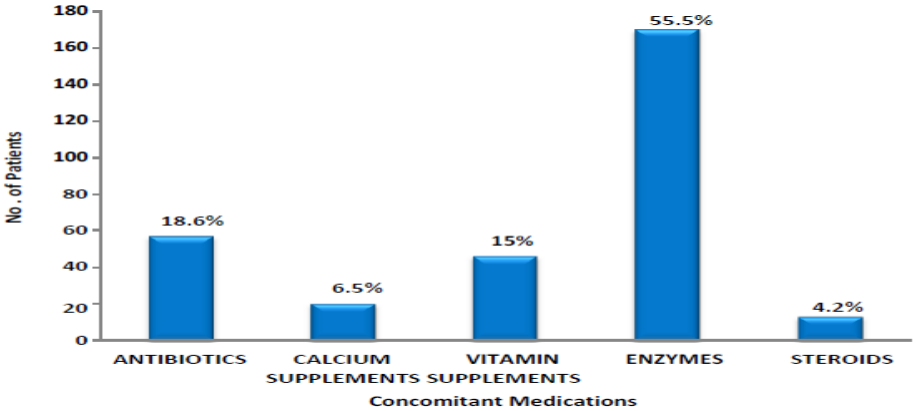
6.31 CONCOMITANT MEDICATIONS

Of 306 concomitant medications, 57 (18.63%) were Antibiotics, 20 (6.54%) were calcium supplement, 46 (15.03%) were Vitamin supplements, 170 (55.56%) were Enzymes, 13 (4.25%) were steroids. (Table.30; Fig.23)

Table 30: Concomitant Medications (n=306)

Adjuvants	No. of drugs (n=306)	Percentage (%)
Antibiotics	57	18.6
Calcium Supplements	20	6.5
Vitamins Supplements	46	15
Enzymes	170	55.5
Steroids	13	4.2

Fig. 23: Concomitant Medications



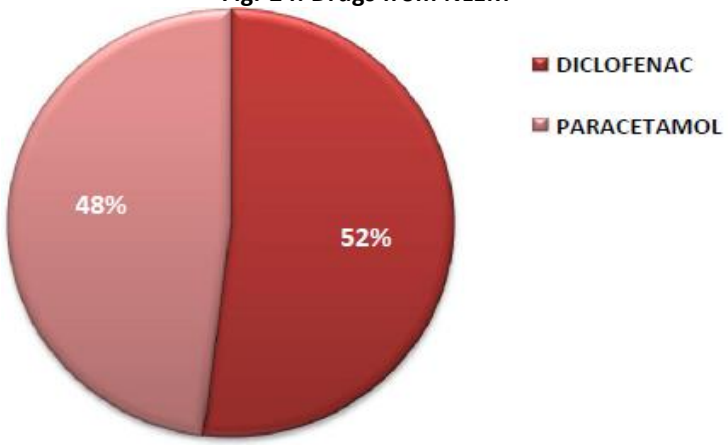
6.32 DRUGS FROM NLEM

Table.31 and Fig.24 depicts the list of drugs from NLEM, among which 13 (52 %) were Diclofenac and 12 (48%) were Paracetamol.

Table 31: Drugs from NLEM (n=25)

NSAIDs	No. of drugs (n=25)	Percentage (%)
Diclofenac	13	52
Paracetamol	12	48

Fig.-24: Drugs from NLEM



DISCUSSION

The study of prescribing pattern helps to monitor and evaluate prescribing practices of medical practitioners to make medical care more rational. As per WHO rational use of medicines that the patient receives the right medication for the adequate period at the lowest cost.

For promotion of rational drug therapy, WHO has formulated certain guidelines for the evaluation of drug use. The prescribing indicators by WHO include average drug per prescription, percentage of drug prescribed by generic name, percentage of antibiotics encountered, percentage of injections used, and percentages of drug prescribed from NLEM. With regard to average number of prescriptions in IP department was 1.75% which is acceptable when compared with standard deviation (1.6-1.8) value from WHO. This finding is not similar to the study conducted by K. Kanaga santhosh *et al*.,[30] It is preferable to keep number of drugs per prescription low as possible because poly pharmacy leads to increased risk of drug interactions, prescribing errors. Percentage of drugs prescribed by generic name was 21% which is acceptable when compared with other studies carried out by Ubedulla. S *et al* [23] reported only 4.25% which is very low when compared to the standard (100%). The percentage of antibiotics encountered was found to be 28.01% and it slightly exceeded the standard value (20.0-26.80%). The study conducted by Upabadhya P *et al*.,[51] reported same as present study IP department. Judicial use of antibiotic is necessary to prevent emergence of resistance and it is ideal to use after culture and sensitivity. IP result shows the percentage of injection as 30.25% which is higher than the standard value (13.4-24.1%). This is in contrast to the study done by K. Kanaga santhosh *et al*.,[30] Minimum use of injection is preferred to reduce the risk of infection through parental route. Compliance to the NLEM in IP was 59.94% which shows that further compliance is needed to achieve the standard of 100%, even though it is comparable with other Indian studies.

In our study the OP department reported 1.94% drugs per prescription which is similar to our IP Result but slightly higher than the standard value. The drugs prescribed by generic name was 1.20% which is very poor when compared to the standard value indicated by WHO and it is in contrast to the IP result. This result revealed that Brand name usage is more popular, and we must educate and encourage our medical practitioner to adhere strictly to Generic name. Percentage of the antibiotics prescribed is 11.44% which falls under the acceptable range and it is less than the IP result. The percentage of Injection was found to be 21.6% which is also acceptable when compared with the

standard value. The compliance to NLEM is poor when compared to our IP results, and it needs more attention to reach the WHO standard of 100%.

In our study the number of male patients who attend both IP and OP department were found to be higher than female patients. In the IP department number of male patients were 112 (55.17%) and number of female patients were 91(44.83%). In the OP department the number of male patients were 161 (62.89%) and female patients were 95 (37.11%). It was similar to the study conducted by Choudhury DK

et al.,[16] showed that 59.29% are males and 40.75% were female.

In our present study age distribution among patients revealed that IP and OP results are in contrast to each other. In IP 50 (24.63%) patients were found between the age group of 60-69 years and in OP 73(28.40%) patients were found between the age group of 20-39 years. The study conducted by kulkarni. D *et al.* [11], in OP department shows that 78 (39%) patients were in the age group of 21-40 yrs and the study conducted in the IP department by Choudhury DK *et al*.,[16] that shows 23(46%) in the age group of 21-30 yrs. So the studies show similarity to the OP result.

The common indication for attending the orthopaedic IPD was fracture 94 (46.30%), arthritis 36 (17.75%), osteopathies 12(5.91%) and others. Whereas in the OPD it was sprain 68(26.56%), fracture 62 (24.22%), arthritis 27 (10.55%) and others. The common indication for attending orthopedic OPD was Low back ache and spondylosis in a study conducted by Shankar P.R et al., [57] and in another study conducted in eastern Nepal reported that maximum number of fractures were the reason for admission. Das BP *et al.,*[52]

Out of 203 prescriptions in IPD 255 (71.3%) were NSAIDs without combination and 102 (28.57%) were NSAIDs with combinations. In the OPD among 256 prescriptions 147 (29.52%) were NSAIDs without combination and 357(70.48%) were NSAIDs with combinations.

Among the use NSAIDs as monotherapy in the IPD 160 (62.75%) was Paracetamol, 53 (20.7%) was Diclofenac and 15 (5.88%) was Aceclofenac. In the OPD 97 (65.99%) Ketorolac, 16 (10.88) Etodolac, 13 (8.84%) Diclofeanac. The study conducted by Rahman MS *et al.,* shows similar report with the present IPD result were Paracetamol was most commonly prescribed NSAID[40.] Paracetamol was the most commonly prescribed NSAID in our study as most of the patients were in Geriatric category based on NICE and ACRA use of Paracetamol with lowest effective dose was the safest drug of choice for the management of pain and inflammation. In contrast to that in the OPD drugs from the class of Nonselective inhibitors were commonly used. Both of these drugs are suitable for short term therapy for the management of pain and inflammation.

In the IPD, among FDC's the most commonly prescribed was NSAIDs and Analgesics 58 (56.86%), NSAID and NSAID 25 (24.51%), and FDC of NSAID and Enzymes were 19 (18.63%). In OPD the common FDC were NSAID and Muscle Relaxants 255 (87.20%), NSAID and NSAID 30 (11.62%), NSAID and Enzymes were 3 (1.33%). The study conducted by Douglas R *et al.,*[56] United states NSAID and analgesic was the most commonly used FDC which is similar to our present study. However synergistic effect was not shown in many drug combinations and moreover the combination can increase the chance of Adverse events. Some combinations like Paracetamol with Tramadol are synergistic with each other.

In the current study, in IPD the most preferred class of NSAID was Analgesic-Anti pyritic with slow anti-inflammatory action 160 (62.75%), followed by Nonselective COX Inhibitors 82 (32.15%) and Selective COX Inhibitors 13 (5.10%). In the OPD the most preferred class of NSAID was Nonselective COX inhibitors 135 (91.4%) followed by Analgesic-Anti pyretic with low anti-inflammatory action 12 (8.16%).

From our study it is evident that Nonselective NSAIDs are more preferred over the selective COX 2 inhibitors in both the IP and OP departments. Sharma *et al.,* also described the similar result[19]. This result points toward the reversal of trends back to the use of conventional NSAIDs and this change have come with the recent reports of increased cardiovascular toxicity associated with selective COX 2 inhibitors. After the withdrawal of Refocoxib and Valdecoxib from the market in 2004 there is a sudden decline in the use of selective COX inhibitors. Even though they are used because they proved to be safe in patients with GI risk factors [19.]

In the present study, both IP and OP department the main Route of Drug Administration was Oral, followed by Parenteral route. Topical routes were also used in the OPD. Topical route causes a high local concentration in cutaneous and sub-cutaneous area of the body with low systemic delivery and thereby significantly improving the therapeutic efficacy and minimizing systemic side effects. The study carried out by Alam N *et al*., shows the most commonly preferred ROA was Oral, followed by Topical and Parenteral [34]

Among the GPA, in our study, PPI was the most commonly used 120 (56.34%) in IPD and 158 (64.06%) in OPD. The usage of antacid was same in both the departments

9(4.23%) and H_2RA was only used in the IPD 84 (39.44%). PPI were most effective than H_2 Blockers in preventing GI adverse effects. High frequency of GPA prescription attributed to prescriber's preference for Non-Selective NSAIDs which are more prone to GI side effects. Similar results were shown in study done by S Kumar *et al*.[21]

The usage of Co- Medication in our study was found to be Antibiotics 100 (33.67%), followed by

Analgesics 83 (27.94%), Enzymes 47 (15.82%) and others in the IPD. Whereas in the OPD the most commonly used co-medication was Enzymes170 (55.56%), Antibiotics 57(18.63%), calcium supplements 20 (6.54%) in the OPD. S Kumar *et al.,* reported that antibiotics 64.25%, vitamin 55.5% and calcium supplement 15.5% in his study. [21]

In the current study, the drugs used from the NLEM in IPD are Paracetamol 160 (74.76%) Diclofenac 53 (23.76%) and Mefanamic acid 1 (0.76%) and in the OPD it was found to be Diclofenac 13 (52%) and Paracetamol 12 (48%) which is very poor and has to be improved.

The WHO has recommended ATC classification / system as the tool for presenting Drug Utilization Research to improve the quality of Drug Use. The daily Defined Dose is the assumed average maintenance dose for a drug used for its main indications in adults. It provides a fixed unit of measurement that is independent of price and formulation. The major benefit of studying Drug Utilization using DDD is the dosage and duration of use are both factored into the calculation. DDD / 1000 / Day provides a rough estimate of proportion of the study population that may be treated daily with certain drugs.

DU90% is a descriptive prescription indicator and DU90% identifies the number of drugs making up to 90% of the total volume measured in DDD or Number of prescriptions, during a certain period of time. The overall changes in the drug use can be identified in the DU90% profile. The concept of DU90% a physician using few well known proved drug alternatives in daily practice provide a more rational prescribing and hence a higher quality of care. In our study DU90% is expressed in terms of DDD and five of the nine drugs constitute to DU90%. So, further rationalization is possible.

The drugs constitute to DU90% were Analgesic-Anti pyretic with low anti-inflammatory action followed by Nonselective COX inhibitors and selective COX 2 inhibitors. In study conducted by Kulkarni D *et al.,* Five out of seven NSAIDs prescribed constitute to DU90% of which Nonselective COX inhibitors and Analgesic-Anti pyretic with low anti-inflammatory action are involved.[3]

NSAIDs are generally well tolerated but their use has been associated with significant risk for potential serious GI and CV risk. In 2016 FDA recommended using the lowest effective NSAID dose for the shortest duration consistent with individual patient treatment goals. It has been estimated that NSAIDs associated dyspepsia occurring 50% of the patients, 80% will have erosion and nearly all patients will demonstrate sub epithelial hemorrhage and 50% will develop ulcers. The relative risk in CV thrombotic events associated with NSAID use in patients with and without known CV disease or risk factor. The risk of NSAID increases with higher dose. Nonselective COX inhibitors are more associated with GI side effects whereas selective COX inhibitors and Diclofenac are associated with CV risk. The current study indicates most commonly encountered risk factor is 79 (38.91%) patients with serious co-morbidity like DM, HTN, CVD, etc., followed by age, patients with the age above 65 was 60(29.55%) and 58 (28.57%) patients are with the risk of long term use of NSAIDs.

CONCLUSION

- In the present study NSAIDs were more prevalently used in middle age and geriatric male patients. Paracetamol and ketorolac were most frequently prescribed as monotherapy for the management in the orthopaedics department. The preferred mode of therapy is by oral route and various other medications were also prescribed concomitantly for specific purposes like GPA, MR, enzymes, antibiotics and other drugs. Despite the reports of relative GI safety, ibuprofen was being under prescribed.
- Paracetamol was most commonly used for the indications of fracture and arthritic conditions in IPD. Ketorolac was used for the short-term therapy of pain and inflammation in OPD. Nonselective COX inhibitors more preferred over COX 2 inhibitors. The choice of COX 2 selective inhibitors for particular conditions like sprain, fracture etc., should be based on number of factors including toxicity, concomitant disease, age, and renal function.
- Our study highlighted the need to maximize the prescribing patterns according to NLEM and to accelerate prescribing pattern by means of generic use. Where clinical pharmacist could play important role in selection of drugs and to do educational intervention on promotion of rational prescribing drugs like NSAIDs.
- The drug consumption showed deviation from normal daily defined dose. Hence implementation of drug policy was essential.
- Pharmacist can play major role in the implementation of NHS guidelines in the hospital will be helpful in monitoring the inpatients to avoid GI and CV risk factors and further to provide more safe and effective management of NSAIDs in orthopaedics department.

FUTURE DIRECTIONS OF THE STUDY

- By conducting further analyses in various pharmaceuticals and categorizing acceptable incremental cost effectiveness ratios based on the disease severity and expected level of improvement in disease condition, drug prices that reflect the value of new pharmaceuticals and that are reasonable to be reimbursed can be suggested.
- The guidelines for prescribing NSAIDs will be prepared and followed.
- The medication adherence can be studied.
- SCORE (Standard Calculator of Risk for Events) may be used to assess the patients with high GI risk.

REFERENCE

1. *Sadhotra.A, Gupta A, Walia R, Sandhu HS. Drug Utilization of NSAIDs in Outpatient Department in orthopaedics of a tertiary care Hospital. Indian J Appl Res. 2016; 6(10):339-41.*
2. Robersts LJ. Anagesic Anti pyretic and Anti-inflammatory agents. In: Hardman J.G, et al.(eds.) *The pharamacological basis of therapeutics*. 10th edition. Newyork: Mc Graw Hill;2001. p.687-7148
3. *Kulkarni.D, B.N Kokila, Sahu S.K. Drug Utilization 90%:an innovative method in assessing quality of drug prescription with specific reference to Non-steroidal anti-inflammatory drug prescription. Int J Basic Clinc Pharmacol .2016; 10(5):1746-51.*
4. Tripathi KD. *Essentials of Medical Pharmacology*. 7th edition. New Delhi:Jaypee Brothers;2013.p.197-209.
5. *Ilango K,Valentina P. Text book of Medicinal chemistry.Volume 1. 2nd Edition.Chennai:Keerthi Publishers;2015.p.412-413.*
6. *Rang HP, Dale MM, Ritter JM, Flower RJ. Rang and Dale's pharmacology.6th*
7. *Wilkins LW, Harvry RA, Finkel R.(eds.) Lippincott's Illustrated Reviews Pharmacology.5th Edition. Philadelphia: Wolters Kluwer;2012. p.525-538.*
8. *Schuna AA, Buys LM, Elliott ME. Rheumatoid Arthritis, Osteo Arthritis.In; Dipiro JT,Talbert RL.(eds.) Pharmacotherpy a Pathophysologic Approach.8th*
9. *James W. Atchison. NSAIDs for the management of musculo skeletal pain; current perspectives and novel strategies for improving safety. 2013;19 suppl 9a: S3-5.*
10. *Chou.R, Gordon DB, Rosenberg JM, Warner L, Carter T,Murphy J et al.* Guidelines on the Management of Postoperative Pain.J Pain Manag Med.2016;17(2): 137-157.
11. *Kulkarni.D. A Study of Prescribing Pattern of Non-Steroidal Anti-Inflammatory Drugs in a rural teaching hospital. J Evolution Med Dent Sci. 2016;2(32):6089-93*
12. *Elsy M. I, Ajitha K. N, Sanal kumar K.B.Prescribing pattern of Analgesics in Orthopedics Department of an Indian Tertiary Care Teaching Hospital in Kerala. Kerala Med J. 2011; (4):*149–52.
13. *R Jyothi, D. Pallavi, Pundarikaksha. A study of Prescribing pattern of Non-Steroidal Anti-Inflammatory Drugs in Orthopedic OPD at a Tertiary Care Hospital. Natl J Basic Med Sci.2013; 4(1):71-74.*
14. *Purkayastha.A, Roy.D. Prescription Patterns of Analgesics in orthopaedic Out Patient Department at a tertiary care Hospital in silchar,Assam. World J Pharm Pharm Sci. 2016;5(10):1146-52.*
15. *Inglae P.K, Patil H.P. Study of Rational Prescribing and Dispensing of Prescriptions with Non-Steroidal Anti-Inflammatory Drugs in Orthopedics Outpatient Department. Asian J Pharm Clin Res. 2016;(4):278-80.*
16. *ChoudhuryD.K, Bezbaruah B.K. Prescribing Patterns of Analgesics In orthopaedic in Patient Department at tertiary care Hospital in Guwathi,Assam, North East India. Indian J Pharmacol.2016;48(4):377-81.*
17. *Indian Pharmacopoeia commission. National Formulary of India.4th edition. New Delhi:* Government of India Ministry of Health & Family Welfare*;2011.*
18. Khairudin K.A, Jatau A.I, Manan M.M. Utilization Pattern of Non-Steroidal Anti-Inflammatory Drugs at a Primary Health Care in Malaysia. Ind. J Pharm. Edu. Res. 2017;51(1):156-61
19. *Sharma.T, Dutta. D, Dhasmana D.C. Prescribing Pattern of NSAID in Orthopedic OPD of a tertiary care teaching hospital in Uttaranchal. JK science.2006; 8(3):160-62.*
20. Shehnaz S.I. Prescribing patterns in the Orthopedics outpatient department in GMC Hospital, Ajman, United Arab Emirates, In: *Arifullah. M, sreedharan. J.(eds.)* Proceedings of the 6th Annual Scientific Meeting of Gulf Medical University;2014Nov 5-6; Ajman, UAE; 2014.p 120-30.
21. Kumar.S, Thakur.P.K, Sowmiya k. Evaluation of prescribing pattern of NSAIDs in south indian teaching hospital. JCMC.2016:6(18):54-58.
22. *Dubey A.K,* Upadhyay D.K, PR Shankar. Prescribing patterns in the orthopaedics outpatient department in a teaching hospital in Pokhara, western Nepal. Kathmandu Uni Med J.2007;5(1):16-21.
23. Ubedulla. S, Seakar N.C, Jayashree.T. Prescription trends in department of orthopedics at tertiary care teaching hospital. J Chem Pharm Res.2013;5(11):512-17.
24. *V.Singh, P Yadhav..*Current trends of prescribing patterns of NSAIDs in an orthopaedic OPD in a teaching Hospital. Inj J Pharm Bio Sci.2014;5(2):486-91.
25. Birkett D, Smet P. Introduction to drug utilization research [Internet]. Switzerland: world health organization; 2003 sep10. Available from: http://apps.who.ind/medicinedocs/ en/d/Js4876e/.
26. Banerjee I, Bhadury T, Agarwal M. Prescribing pattern in orthopedics outpatient department of a medical college in India. Int J Basic Clin Pharmacol 2015; 4:1175-78.
27. Lee S.H, Han C.D. Prescription Pattern of NSAIDs and the Prevalence of NSAID-induced Gastrointestinal Risk Factors of Orthopaedic Patients in Clinical Practice in Korea. J Korean Med Sci. 2011; 26:561-67.

28. Ong CKS, Lirk P, Tan CH, Seymour RA. An evidence-based update on Non-steroidal anti-inflammatory drugs. Clinical medicine and research 2007;5(1):19-34.
29. A. Nagla, P.Wadagbalkar, S.Raipurkar. Prescription pattern study of drugs in Orthopedics Outpatient department (OPD) of a Rural Medical College Hospital & Research centre in MP. Indian J Orthop. 2016;2(4):367-71.
30. K. Kanagasanthosh, Topno .I. A study on recent trends of prescribing pattern in orthopaedic Out-patient department from a tertiary care teaching hospital.IJP.2015;6(4):7549-59.
31. *Latha. R.A, Srinivasu. K, Naik. A.B.* A Study of Prescribing Pattern of Non-Steroidal Anti Inflammatory Drugs in Orthopedic Out Patient Department at a Tertiary Care Hospital. *J Evolution Med Dent Sci*. 2015;4(4):559-64.
32. Maheshwari.P., D Praveen.Drug Utilization Evaluation (Due) of analgesics in Tertiary Care Teaching Hospital. IJFST.2014;2(1):57-65.
33. Jain M, Patil T. A Prospective Study on Drug Utilization Pattern of NSAIDs in Patients Attending Orthopaedics OPD of a Tertiary Care Hospital. Int Arch Bio Med Clin Res. 2016;2(3):55-57.
34. Sanji.N, U Shetal., K.Ramachandra. Trends in Non-Steroidal Anti-Inflammatory Drug Utilization in the orthopaedic outpatient unit of a tertiary care Hospital in india. Pharmacologyonline.2010;4:375-81.
35. Alam N, Bharathwaj. A, Tiwari.R. Drug utilization pattern of patients using NSAIDs in south delhi hospital. Int j pharm pharm sci.2012; 4:703-07.
36. Manohar VR, Rashmi B.R. A prospective prescription pattern of NSAIDs drugs among general practitioners in dakshianakannada districts of southern of india. IRJP.2015;5:420-22.
37. T.S Padmanabha, K Bhaskara, G Manu. Post-Operative utilization pattern of analgesics in orthopedic department of an indian tertiary care teaching hospital. IJCPCR.2016; 6(1):27-31.
38. M Mujahid, M Sharma, M Aqil. Drug utilization and adverse drug reaction monitoring in NSAIDs users in a south delhi Hospital. IJRPC .2012;2(1):2231-81.
39. Beg MA, Dutta SB, Bawa S, Kaur A, Vishal S, Kumar U. Drug utilization pattern of analgesics as a teaching tool for rational therapy to MBBS students in a medical college at Dehradun, Uttarakhand, India. Int J Basic Clin Pharmacol. 2017; 6:842-4.
40. Rah*man. MS, Begum. Z.A.* Prescribing pattern of non-steroidal anti-inflammatory drugs at outpatient departments of teaching hospitals. Bangladesh J Pharmacol.2007; 2:1-6.
41. Kumar A, Yadav S, Sah, Kumar R. Prescribing trends of NSAID used in dental outpatient department of a tertiary hospital in Nepal. Int J Pharm Pharm Sci. 2012; 4(3):1779-82.
42. Brattwall M,TuranL,Jakobsson J. Musculoskeletal pain-prescription of NSAID and weak opoid by primary health care physicians in sweden 2004-2008 a retrospectrive patients record review. J Pain Res. 2010; 43:131-35.
43. Kim HC, Lee MC, Moon YW, Seo SS, Lee KW, Lee JH, Choi CH et al. Pattern of use of oral NSAIDs with or without co-prescription of gastroprotective agents for arthritic knee by Korean practitioners. Knee Surg Relat Res.2011;23(4):203-07.
44. Valkhoff VE, Van soest EM, Masclee GM, De bie S, Mazzaglia G, Molokhia M, et al. Prescription non selective NSAID's, COXIBS and gastroprotective agents in the era of rofecoxib withdrawal. Aliment Pharmacol Ther.2012;36(8):790-99.
45. Dhabali AA, Awang R, Hamdan Z, Zyoud Sh. Associations between prescribing NSAID's and the potentials prescription problems in a primary care setting. Inj J Clin Pharmacol.2012;50(12):851-61.
46. Bueno H, Bardagi A, Patrignani P, Merino E, Luis A, Rodrigueg G.Use of NSAIDs and type-specific risk of acute coronary syndrome. The Am. J. Cardiol. 2010; 105:1102-06.
47. Hyllested M, Jones S, Pedersan J, Kehlet H. Comparative effect of paracetamol, NSAIDs or their combination in prospective pain management: a qualitative review. British J Anaesth.2002;88(2):199-214.
48. Paul D, Chauhan K. Study on usage pattern of NSAIDs among different practice categories in Indian clinical setting. Eur J ClinPharmacol. 2005;60(12):889-92.
49. Moor N. Ibuprofen: a journey from prescription to over the counter use. J R Soc Med.2007;100(48):2-6.
50. Jadhav MP, Jadhav PM, Mutke AP, Sonawane SD, Patil BD, Nayak NB, Sonawale AS, et al. A prospective observational study to assess quality of life and prescription pattern in osteoarthritisn patients at tertiary health centre in Mumbai. Indian J Med Sci.2011; 65(2):58-63.
51. Upadhyaya P, Jain S, Khan ZY, Abhijeet K. Assessment of prescription pattern in a private teaching hospital in India. Int J Pharm Sci. 2013;3(2):219-22.
52. Das BP, Adhikari N, Garg M, Rauniar GP, Naga Rani MA. Utilization pattern of nonsteroidal anti-inflammatory drugs (NSAIDs) in orthopaedic practice at a tertiary care hospital in eastern Nepal. J Nep Med Assoc 2000; 39:315-18.
53. National List of Essential Medicines of India[Internet]. Kolkata. 2015; Available from: http://www.cdsco.nic.in/writereaddata/National%20List%20of%20Essential %20Medicine-%20final%20 copy.pdf. [last accessed on 2014 Mar 25].
54. WHO Collaborating Centre for Drug Statistics Methodology (Norway). Guidelines for ATC Classification and DDD Assignment. Oslo: Norwegian Institute of public Health; 2017a.
55. WHO Collaborating Centre for Drug Statistics Methodology (Norway). ATC Index with DDDs. Oslo: Norwegian Institute of public Health; 2017b.
56. Douglas R, Gangadhar R. Utilization Pattern of NSAIDs and Gastro protective Agents: A Prospective Analysis in Patients with Musculoskeletal Pain in A Tertiary Care Hospital. Int j Ant.Radio.Surg.(online).2016; 5(3):MO 01-05.

57. PR Shankar, *Dubey A.K,* Upadhyay D.K. Prescribing patterns in the orthopaedics outpatient department in a teaching hospital in Pokhara, western Nepal. Kathmandu Uni Med J.2006;4(14):1-6.