Section A-Research paper
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EVALUATION OF DRUG UTILIZATION AND GI BLEEDING ASSOCIATED WITH ANTI-COAGULANTS IN CARDIOLOGY DEPARTMENT AT A TERTIARY CARE HOSPITAL

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ABSTRACT

BACKGROUND AND AIM: Drug utilization studies are important for improving quality and safety of healthcare. By analyzing prescription pattern, health professionals can identify areas of improvement.

Anticoagulant are commonly prescribed medications in cardiology department. Over dosage of anticoagulants could lead to risk of bleeding whereas under dosage of anticoagulant lead to Venous thromboembolism. According to the study by joint commission, sentinel 7.2% of adverse reaction caused by anti-coagulant. Therefore, with the study we aim to evaluate prescription pattern along with prevalence of GI bleeding associated with anticoagulant in cardiology department.

METHODOLOGY: For a duration of 6 months, a prospective observational study was conducted in the cardiology inpatient department of a tertiary care hospital located in Bengaluru.

RESULT: Heparin was the most commonly prescribed drug in 162-study population. Patients were more diagnosed with Ischemic heart disease. Majority of the anticoagulant were prescribed in the age group of 61-70 years. Out of 162 prescriptions, 160 were found to be rational (98.7%) and 2 were irrational (1.3%). GI bleeding was reported in 1 case (0.617%) prescribed with anticoagulants.

CONCLUSION: In our study, males were prone to cardiovascular diseases. Some of the prescriptions were found to be irrational and did not follow guidelines, reported with acute GI bleeding and identified with major and moderate drug interactions. Our study conclude that inappropriate utilization pattern of anticoagulant not only compromise the patient safety but also increases the risk of adverse event. Therefore, it is crucial to address these issues to continuous monitoring, adherence to guidelines and improve awareness among healthcare professionals to optimize the use of anticoagulant medication and enhance patient safety.

INTRODUCTION

A drug utilization study primarily examines various aspects of medication usage, such as prescription practices, dispensing procedures, administration methods, and the associated events,

considering both medical and non-medical factors.[3] The primary objective is to evaluate and promote the rationality of drug usage within a given population. It also helps to know the effectiveness of the drug and adverse effect to enhance the patients therapeutic outcome.

Anticoagulants are indeed a class of drugs commonly referred to as "blood thinners" because they help prevent the formation of blood clots or thrombi. However, it's important to note that these medications do not actually "thin" the blood but rather interfere with the blood clotting process to reduce the risk of clot formation and extension[2]. These medications fall into the category of high-risk drugs and are commonly prescribed for both preventive and therapeutic purposes to address various conditions, including acute and deep venous thromboembolism, myocardial infarction, atrial fibrillation, rheumatic heart disease, unstable angina, and to prevent blockages in the coronary artery and during cardiac invasive procedures.[4]

Anticoagulants are classified into different categories based on their administration route and mechanism of action. The oral anticoagulants, including warfarin and acenocoumarol, are commonly used for long-term therapy to prevent and treat various thromboembolic conditions. The parenteral anticoagulants, such as unfractionated heparin (UFH) and low molecular weight heparin (LMWH) like enoxaparin and dalteparin, are often used for short-term therapy when rapid anticoagulation is required. Direct thrombin inhibitors, like lepirudin, are also used as parenteral anticoagulants.

Some of the drawbacks associated with a medication, specifically mentioning its narrow therapeutic effect, delayed onset and offset of action, potential drug interactions, and the need for protein monitoring such as INR, prothrombin time, aPTT, and platelet count. These drawbacks can indeed lead to complications such as bleeding and thrombosis, and can have several negative impacts on patient outcomes, healthcare costs, and mortality rates. Lack of proper monitoring and inappropriate dosing can contribute to increased hospital stays, decreased therapeutic effectiveness, and overall poor health outcomes.

The incidents mentioned have indeed spurred the development of non-vitamin K antagonist oral anticoagulants (NOACs) such as rivaroxaban, apixaban, and dabigatran. These newer agents have been approved for the prevention of stroke and systemic embolism in patients with atrial fibrillation, as well as for the treatment and prevention of venous thromboembolism.[1] An estimate of 7 million worldwide use oral anticoagulants for treatment of chronic disease. Anticoagulants contribute to almost 7.2% of all adverse medication as reported by Joint Commission sentinel event database.[6]

Therapeutic anticoagulation plays an important role in treating thromboembolic disease. Individual response to a standard dose is not always foreseeable. Variable patient specific factors such as rate of drug elimination make it complicated.[2]

Anticoagulants present two critical concerns: under dosing may result in clinical thromboembolism, while overdosing can lead to bleeding and hemorrhagic disorders. The analysis of drug utilization plays a vital role in encouraging the rational use of drugs and ensuring effective management of formularies. Through the assessment of drug utilization, healthcare professionals are able to proactively prevent medication errors, drug-drug interactions, adverse drug reactions, toxicity issues, and instances of therapeutic duplication. Furthermore, it aids in identifying different prescribing patterns and achieving improved therapeutic outcomes.[6]

AIM AND OBJECTIVES:

AIM: To assess the drug utilization of anticoagulants by analyzing the prescription pattern along with prevalence of GI bleeding in the cardiology department at tertiary care hospital.

OBJECTIVES:

PRIMARY: Analyze the appropriateness of prescription with regard to the Anticoagulation guideline proposed by University Hospital Dorset Anticoagulation (UHDA) guideline.

SECONDARY:

- To identify the possible drug interaction of anticoagulants with other drugs used in the treatment regimen (Lexicomp).
- To identify the prevalence rate of GI bleeding during anticoagulation therapy

METHODOLOGY

STUDY SITE: The proposed study was conducted in the inpatient department of **Cardiology, tertiary care hospital, Bengaluru.**

STUDY DESIGN: Study was a prospective observational study

STUDY DURATION: Duration of the study was six months

STUDY SAMPLE: Sample size was 162.

STUDY CRITERIA:

1. **Inclusion criteria:**
   - All Genders above the age 18 years.
   - Patients diagnosed with cardiovascular diseases.
   - Individuals prescribed with at least one anticoagulant medication.
   - Patients who are compliant to participate.
2. **Exclusion criteria:**
   - Age less than 18 years.
   - Patients receiving anticoagulants who are on dialysis.
   - Patients who are alcoholic.
   - Patients having comorbidity conditions like peptic ulcer, gastroesophageal reflux, cancer, renal disease and liver cirrhosis.
   - Patients prescribed with NSAIDs.
   - Psychiatric patients receiving anticoagulant.
   - Pregnant and lactating women.
   - Patients who are not compliant to sign the informed consent form.

STATUS OF HUMAN ETHICAL CLEARANCE:

After receiving approval from the Institutional Human Ethics Committee of a tertiary care hospital in Bengaluru, the proposed study was initiated.

STUDY OUTCOMES:

- To understand the prescription pattern of anticoagulants among patients with cardiovascular diseases.
- To understand the prevalence rate of GI bleeding due to anticoagulant therapy.

STUDY PROCEDURE

STEP 1: A prospective observational study was conducted at tertiary care hospital

STEP 2: Inpatients from cardiology department who satisfy the inclusion criteria was considered for the study.

STEP 3: The demographics, medication and clinical data was documented in data collection form.

STEP 4: From the documented data prescription pattern was analyzed based on the UHDA guidelines.

STEP 5: In addition the potential drug-drug interactions was identified among the medications prescribed using lexicomp drug database.

STEP-6: Prevalence rate of GI bleeding due to anticoagulant therapy was documented with the help of CDSCO ADR reporting form.

STEP-7: Obtained data was subjected to statistical analysis.

Variables that are estimated in the study:

1. Age and gender of the enrolled patient
2. Length of hospital stay
3. Infection/Disease encountered in the enrolled patient
4. Anticoagulant prescription pattern
5. Route of administration
6. Duration of therapy
7. National essential drug list
8. GI bleeding and other ADRs

Statistical Analysis:

- Descriptive statistics was performed. All the data was analyzed by Microsoft excel.
- Based on cases enrolled, out of 59 patients 7 were prescribed with anticoagulants in 1 week.
- From the formula, the sample size was calculated as 162.

Study Benefit to Patient and Society:

The participation of patients will help to analyse the appropriateness of prescription with anticoagulants, ADR and drug-drug interaction by assuring the rationality, but no direct benefit will be achieved.

Study Risk and Discomfort:

• Prescription data may contain personal and clinical information about patients, which can be considered sensitive. If a patient feels uncomfortable with the data collection process from their prescription, they should have the option to deny or withdraw their participation without any negative consequences.

• There is no significant risk involved in the participation.

RESULT

SOCIO DEMOGRAPHIC DETAILS:

AGE/GENDER

As per the study sample size, 162 patients were enlisted. Out of this, 114 were male (70.4) and 48 female (29.6). Males are prone when compared to females in the study population. Patients enlisted ranges from the 24 to 87 years of age. The mean age and standard deviation were found to be 59.31±13.441. Maximum number of patients were within the age group of 61-70 years of age.

Table 1:- Mean and standard deviation of age

Sex	Frequency	Precent
Female	48	29.6
Male	114	70.4
Total	162	100

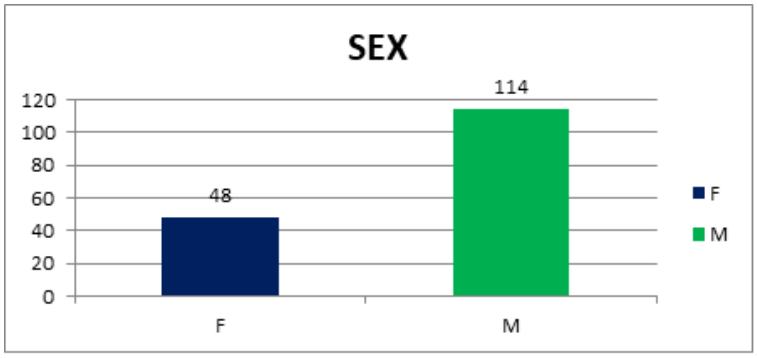

Figure 1:- Bar chart representation of gender distribution in our study population

Table 2:- Gender wise distribution

Parameter	Mean	SD
Age	59.31	13.441

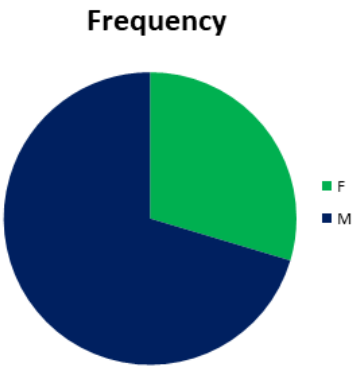

Figure 2:-Pie chart distribution of gender

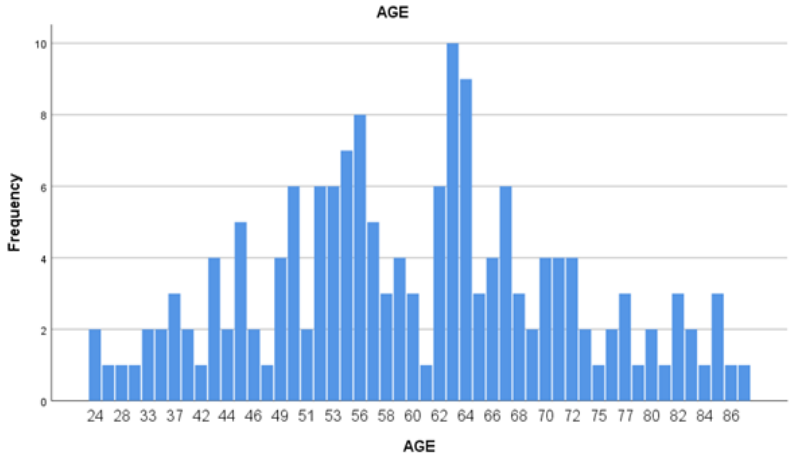

Figure 3:- Bar chart distribution of age

LENGTH OF HOSPITAL STAY:

The length of hospital stay of the patient differ from minimum of 1 day to maximum of 10 days. Most number of patients had stayed for a period 3 days. The Mean and standard deviation of the duration of stay was found to be 3.8 ± 1.801.

Table 3:- Length of Hospital Stay

LENGTH OF HOSPITAL STAY	Frequency	Percent
1 day	2	1.2
10 days	2	1.2
2 days	26	16
3 days	67	41.4
4 days	35	21.6
5 days	9	5.6
6 days	5	3.1
7 days	5	3.1
8 days	9	5.6
9 days	2	1.2
Total	162	100

Figure 4:- Bar chart representation of length of hospital stay

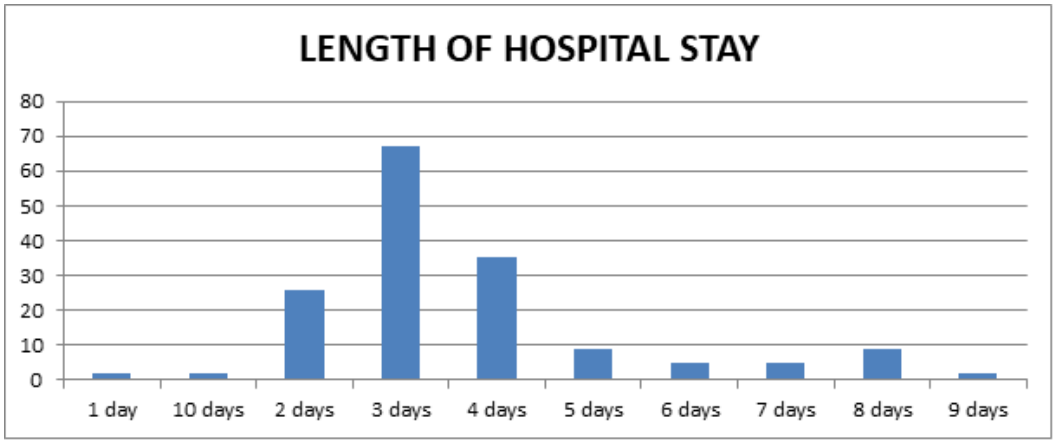

Table 4:- Mean and Standard Deviation of Length of hospital stay

Variable	Mean	Std. Deviation
Length of hospital stay	3.8 days	1.801

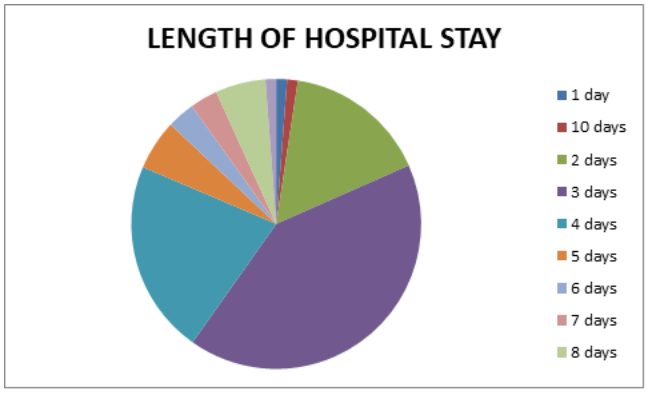

Figure 5:- Pie chart representation of length of hospital stay

DISEASE:

Out of 162 patients, the subjects were diagnosed to Ischemic heart disease (IHD) (59.8%),ACS (31.48%), Aortic regurgitation (1.2%), Atrial fibrillation (3.01%), IWMI (16.04%), AWMI (29.62%), CCF (9.25%), NSTEMI (16.66%), LBBB (1.23%), ASD (0.61%), CHD (0.61%), AW STEMI (3.08), MVS (0.61%). Ischemic heart disease was found to be the most frequent disease condition followed by AWMI, NSTEMI, IWMI, CCF in other prominent disease conditions diagnosed.

Table 5:- Disease condition distribution in our study population

DISEASE	FREQUENCY	PERCENTAGE(%)
IHD - ISCHEMIC HEART DISEASE	97	59.87654
ACS- ACUTE CORONARY SYNDROME	51	31.48148

AR- AORTIC REGURGITATION	2	1.234568
AF- ATRIAL FIBRILLATION	5	3.08642
AWMI- ANTERIOR WALL MYOCARDIAL INFARCTION	48	29.62963
IWMI- INFRIOR WALL MYOCARDIAL INFARCTION	26	16.04938
CCF- CONGESTIVE CARDIAC FAILURE	14	8.641975
NSTEMI- NON ST ELEVATED MYOCARDIAL INFARCTION	27	16.66667
LBBB- LEFT BUNDLE BRANCH BLOCK	2	1.234568
FVR- FOREARM VASCULAR RESISTANCE	5	3.08642
ASD- ATRIAL SEPTAL DEFECT	1	0.617284
CHD- CONGENITAL HEART DISEASE	1	0.617284
AW STEMI- ANTERIOR WALL ST ELEVATION MYOCARDIAL INFARCTION	5	3.08642
MVS-MITRAL VALVE STENOSIS	1	0.617284
TOTAL PATIENTS	162	

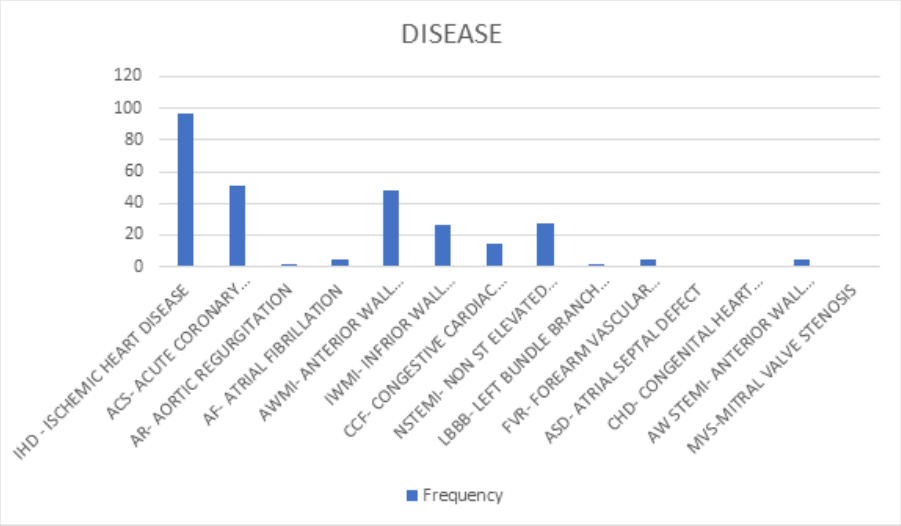

Figure 6:- Bar chart representation of distribution of disease condition in our study population

ANTICOAGULANT PRESCRIPTION PATTERN:

The anticoagulants such as Heparin, Enoxaparin, Fondaparinux, Rivaroxaban, Apixaban, and Acenocoumarol were prescribed to the patients. Most commonly prescribed anticoagulant is heparin followed by Acenocoumarol, Fondaparinux, Enoxaparin, Rivaroxaban, and Apixaban.

Table 6:- Anticoagulants prescribed in our study period

ANTICOAGULANT PRESCRIBED	Frequency	Percent
INJ.ENOXAPARIN	4	2.46
INJ.FONDAPARINUX	5	3.08

INJ.HEPARIN	154	95.06
T.APIXABAN	2	1.23
T.RIVAROXABAN	3	1.85
TAB. ACENOCOUMAROL	6	3.7
Total Number of patients	162	

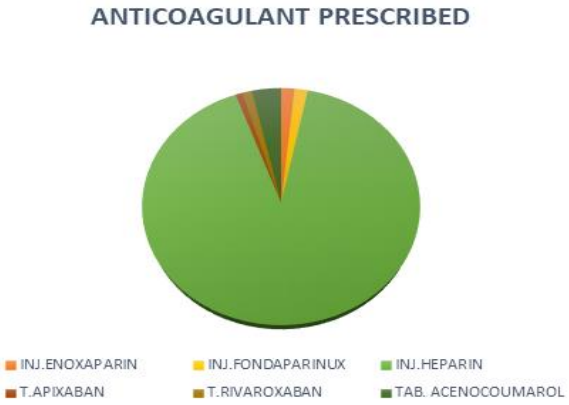

Figure 7:- Pie chart representation of anticoagulants prescribed

The therapy consists of both monotherapy and combination therapy of anticoagulants. Out of the study population 93.2% was prescribed with monotherapy and 6.8% with combination therapy.

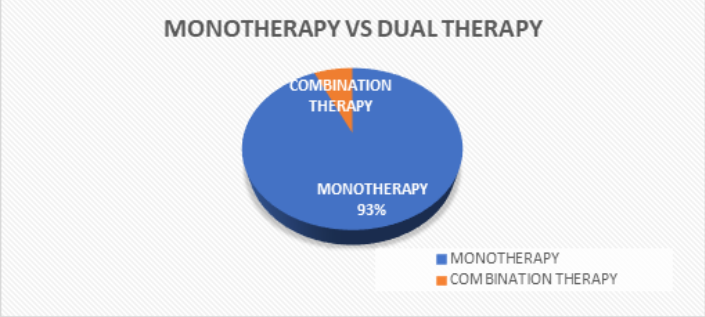

Figure 8:- Pie chart representation of monotherapy v/s combination therapy

Inj Heparin(144), Inj Enoxaparin(4), Inj Fondaparinux(1) and Tab.Rivaroxaban (2) were prescribed as monotherapy, in which inj heparin was prescribed in most of the patients (88.9%). Inj Heparin + Inj Fondaparinux, Inj Heparin + Tab.Acenocoumarol, Inj Heparin + Tab Rivaroxaban, Inj Heparin + T.Apixaban, Tab. Acenocoumarol + Inj Fondaparinux was administered in combination therapy to the patients.

Table 7:- Anticoagulants prescription pattern

Anti Coagulant Prescription	Frequency	Percent
Inj. Enoxaparin	4	2.5
Inj. Fondaparinux	1	0.6
Inj. Heparin	144	88.9
Inj. Heparin + Inj. Acenocoumarol	5	3.1

Inj. Heparin + Inj. Fondaparinux	2	1.2
Inj. Heparin + T. Apixaban	2	1.2
Inj. Heparin + T. Rivaroxaban	1	0.6
T. Acenocoumarol + Inj. Fondaparinux	1	0.6
T. Rivaroxaban	2	1.2
Total	162	100

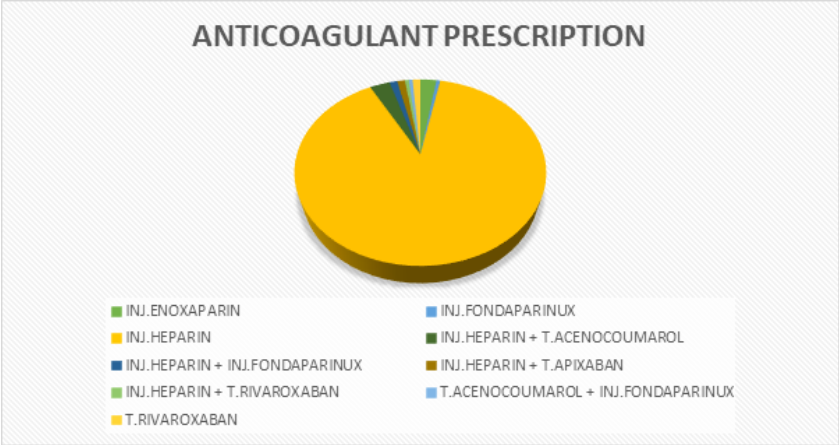

Figure 9:- Pie chart representation of anticoagulant prescription pattern

ROUTE OF ADMINISTRATION

The route of administration of anticoagulants prescribed parenterally and orally. 151 patients were given parenterally, 2 were given orally and 9 were given with both. More number of patients were given parenteral route of administration (93.2%) followed by combination (5.55%).

Table 8:- Route of administration of anticoagulants

	Frequency	Percent
Oral	2	1.23 %
Parenteral	151	93.2 %
Oral + Parenteral	9	5.55 %

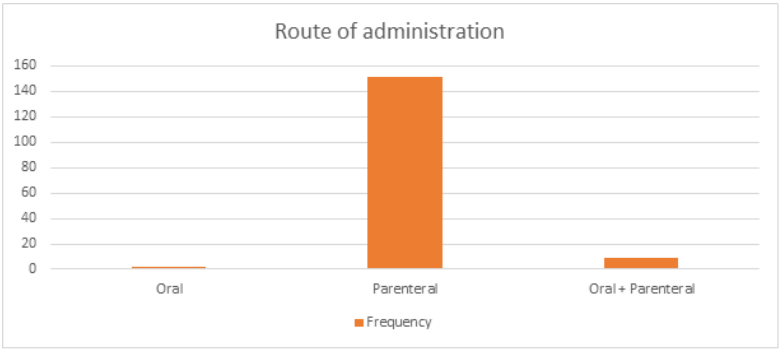

Figure 10:- Bar chart representation of route of administration distribution of anticoagulants

DURATION OF THERAPY:

Anti Coagulation therapy within the study population ranges from 1 day to 9 days.

Table 9:- Duration of therapy of anticoagulants

ANTICOAGULANT PRESCRIBED	1 day	2 days	3 days	4 days	5 days	6 days	7 days	8 days	9 days	Total
INJ.ENOXAPARIN	0	0	1	2	1	0	0	0	0	4
INJ.FONDAPARINUX	1	0	1	1	0	1	0	0	0	4
INJ.HEPARIN	146	24	30	20	5	6	1	3	1	236
T.APIXABAN	0	2	0	0	0	0	0	0	0	2
T.RIVAROXABAN	1	0	2	0	0	0	0	0	0	3
TAB. ACENOCOUMAROL	2	1	4	1	1	0	0	0	0	9
Total	150	27	38	24	7	7	1	3	1	258

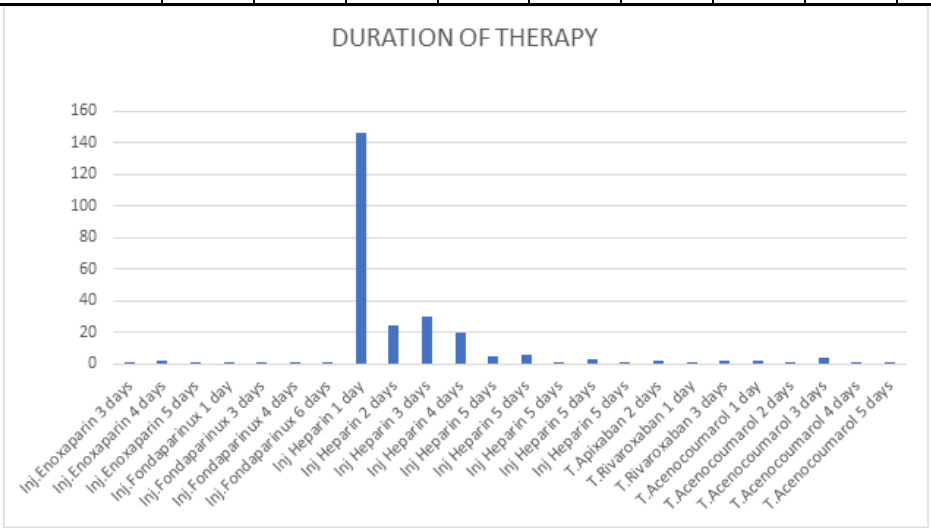

Figure 11:-Bar chart representation of duration of therapy of anticoagulants

NATIONAL ESSENTIAL DRUG LIST:

As per the national essential drug list, within the anticoagulants prescribed to the study population enoxaparin and heparin are present. Heparin was administered to 154 patients out of which 123 patients were prescribed with the dosage mentioned in the national essential druglist.

Enoxaparin was administered to 4 patients, the dosage prescribed was within the national essential drug list.

Table 10:- Distribution of anticoagulants in national essential drug list

DRUG IN NEDL	A	P	Total
INJ.ENOXAPARIN	0	4	4
INJ.FONDAPARINUX	4	0	4
INJ.HEPARIN	31	123	154
T.ACENOCOUMAROL	6	0	6

T.APIXABAN	2	0	2
T.RIVAROXABAN	3	0	3
Total	46	127	173

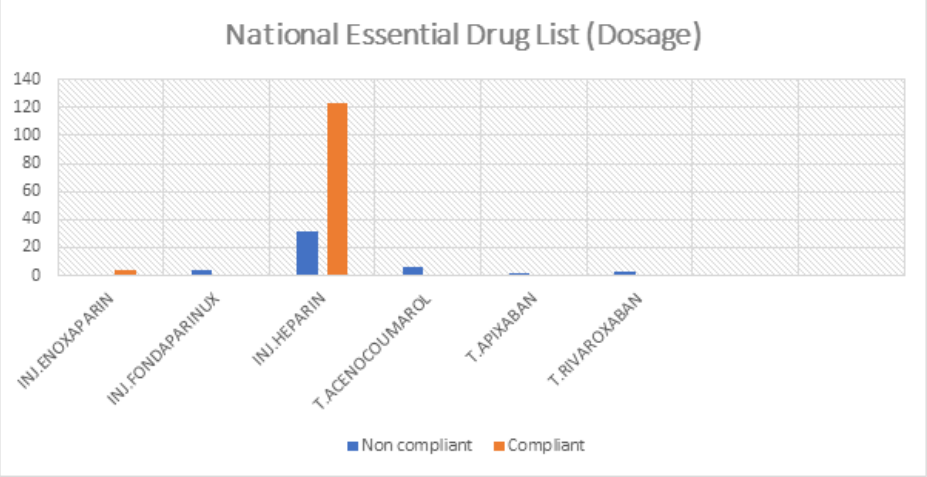

Figure 12:- Bar chart representation of distribution of anticoagulants in NEDL

GI BLEEDING AND OTHER ADRs:

Within the study population of 162 patients, 1 patient with acute GI bleeding and 1 patient with haematuria was reported. The prevalence of GI bleeding was found to be **0.617%**

Table 11:- Incidences of GI bleeding

GI BLEEDING OR ANY ADR				
ANTICOAGULANT PRESCRIBED	ACUTE GI BLEED	HEMATURIA	NO	TOTAL
INJ ENOXAPARIN	0	0	4	4
INJ HEPARIN	1	1	142	144
INJ HEPARIN+TAB.ACENOCOUMAROL	0	0	5	5
INJ.FONDAPARINUX	0	0	1	1
INJ.HEPARIN+INJ.FONDAPARINUX	0	0	2	2
INJ.HEPARIN+T.APIXABAN	0	0	2	2
INJ.HEPARIN+T.RIVAROXABAN	0	0	1	1
T.ACENOCOUMAROL+INJ.FONDAPARINUX	0	0	1	1
TAB.RIVAROXABAN	0	0	2	2
Total	1	1	160	162

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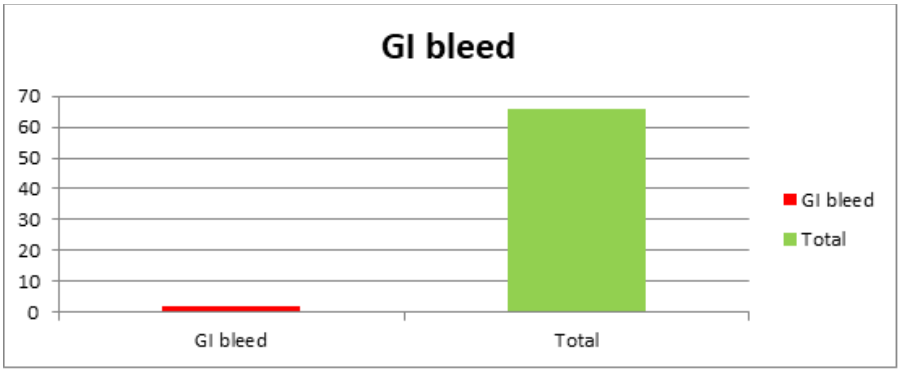

Figure 13:-Bar chart representation of prevalence of GI bleeding in our study

DRUG INTERACTION:

Among 162 prescriptions, 118 drug interactions were found. 117 was found to be moderate and 1 to be major. Heparin and Nitroglycerin (50.6%) were most frequently encountered drug interaction. Drug interaction between Tab.Rivaroxaban and Tab.Ticagrelor was determined as a major drug interaction.

The least (seen drug interactions were Inj Heparin+ Inj Cangrelor, Inj Heparin+ Tab. Acenocoumarol, Tab. Acenocoumarol+ Tab. Amiodarone, Tab.Acenocoumarol + Tab.Cefoperazone, Tab.Rivaroxaban + Tab.Ticagrelor, Tab.Rivaroxaban + Tab.Verapamil.

72.2% were found with moderate drug interaction in 162 prescriptions and 1% with major drug interaction were found.

Drug prescribed in patient which cause major drug interaction was discontinued and physician monitored the side effects in patients with moderate drug interactions.

Table 12:- Distribution of severity of drug interaction of anticoagulants with other drugs

DRUG INTERACTION	FREQUENCY	PERCENT
Moderate	117	72.2%
Major	1	0.6%
Total no of patients	162	

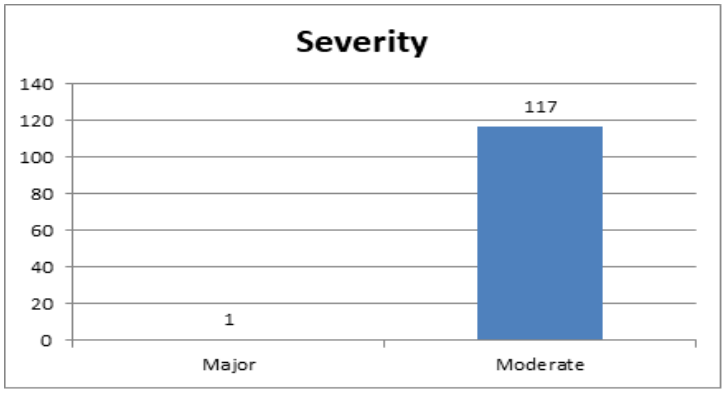

Figure 14:- Bar chart representation of distribution of severity of drug interactions of anticoagulants in our study

Table 13:- Drug interaction of anticoagulants with other drugs

DRUG 2		DRUG 1				Total
	SEVERITY	Inj.Heparin	T.Acenocoumarol	T.Apixaban	T.Rivaroxaban	
Inj.Abciximab	Moderate	8	x	x	x	8
Inj.Cangrelor	Moderate	1	x	x	x	1
Inj.Nitroglycerin	Moderate	82	x	x	x	82
Inj.Tirofiban	Moderate	11	x	x	x	11
T.Acenocoumarol	Moderate	1	x	x	x	1
T.Acetaminophen	Moderate	x	5		x	5
T.Amiodarone	Moderate	x	1	2	x	3
T.Cefoperazone	Moderate	x	1	x	x	1
T.Cefuroxime	Moderate	x	4	x	x	4
T.Ticagrelor	Major	x	x	x	1	1
Verapamil	Moderate	x	x	x	1	1
Total	Major	0	0	0	1	1
	Moderate	103	11	2	1	117

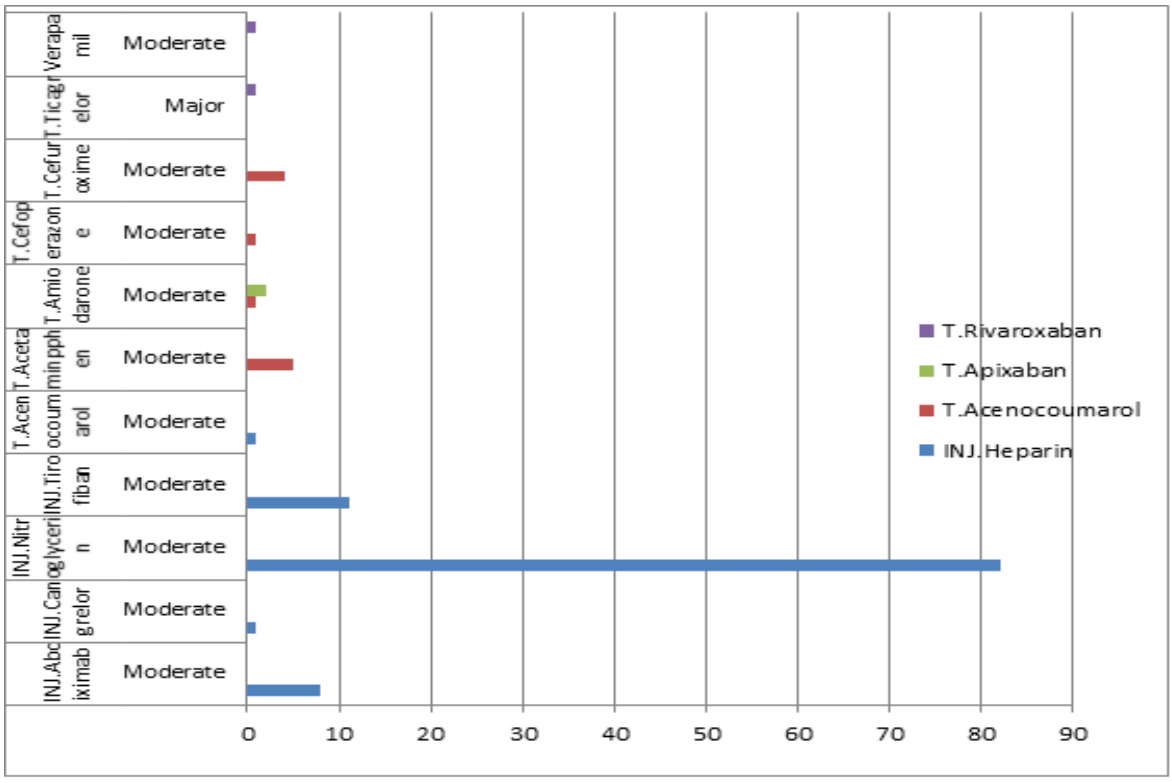

Figure 15:- Bar chart representation of distribution of drug interaction of anticoagulants with other drugs

RATIONAL USE OF DRUGS:

From 162 prescriptions collected 160 were rational (98.7%) as per UHDA guidelines and 2 prescriptions were irrational (1.23%).

Table 14:- Rational use of anticoagulants in our study

Rational	98.7%
Irrational	1.23%

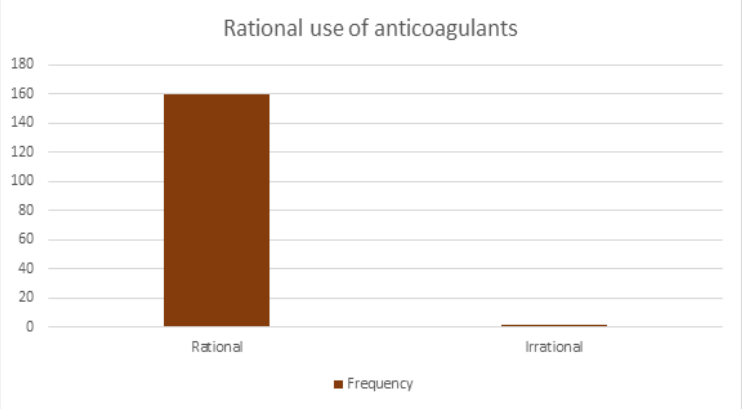

Figure 16:- Bar chart representation of distribution of rational use of anticoagulants

DISCUSSION:

Anticoagulants are the drugs which prevents the blood from clotting by suppressing the synthesis of clotting factors. Cardiovascular diseases are one among the leading cause of death. Anticoagulant therapy has greater advantage in preventing cardiovascular diseases. Therefore, it decreases mortality & morbidity rate in cardiovascular diseases. Irrational use of Anticoagulants will lead to the increase in the risk of bleeding. It is necessary to monitor the risk of bleeding in patients undergoing with anticoagulation therapy. Our study focused on evaluating the drug utilization by analysing the prescription pattern with the prevalence of Gl bleeding in cardiology department by using standard guidelines.

From our study we analysed that males are more prone when compared to female this result was supported by other studies conducted by Vineela Chadalavada[6] and Shahrzad Raouf[3] . Anticoagulants are administered majorly for the patients who are of 61 -70 years of age. The mean age of study population was found to be 59.38 ± 13.441.Results shows the length of hospital stay of patients who were administered with anticoagulants varies with type of disease condition. From our result we can say that the duration of anticoagulant therapy in our study population range from 1-9 days.

162 patients diagnosed with following diseases Ischemic heart disease, Acute coronary syndrome, Atrial Fibrillation, Anterior wall myocardial infarction, Inferior wall myocardial infarction, Congestive cardiac failure, Non-ST Elevated myocardial infraction, Left bundle branched block, Atrial septal defect Congenital heart disease, Anterior wall ST elevated myocardial infarction, Mitral wall stenosis.

The study results showed that Inj. heparin was the first common prescribed drug (95.06%) and the second one was Acenocoumarol (3.7%) which is near to Shahrzad Raouf.,et al.[3] results, reporting the Heparin & Enoxaparin were the most commonly used drugs which was supported by

Chadalavada.,et al.[6] results reporting Heparin and Acenocoumarol are most commonly used drugs.

Our study indicates that most of patients received monotherapy. It was found that parenteral drugs were more prone than oral drugs. 93. 2% received parenteral drugs ,1.23% received oral drugs, only 5.55% received combination of parenteral & oral drugs. The parenteral anticoagulants are used when rapid anticoagulation is required because the oral forms take several days to achieve antithrombotic effect. This result was supported by the study Shivashankar.V.,et al.[20].

Heparin & Enoxaparin are the drugs within the prescription collected which is present in the National essential drug list. Heparin was administered to 154 patients out of which 123 prescriptions were compliant to dosage regimen stated within the National essential drug list. Enoxaparin was administered to 4 patients and was compliant to the dosage regimen as per NEDL. In our study population, we observe GI bleeding (0.617%) was found in only 1 case of the total study population and Haematuria in 1 case of total study population. ADR seen in 2 cases whereas the remaining 160 population (98.7%) was not having the ADR. This result was supported by Aarathi R.,et al.[9].

In our study, to compute drug interaction (Lexicomp drug database) was used to analyse the drug drug interaction in the prescription. Prescription analysed with drug-drug interaction was found to be 118(72.83%). Totally 118 interactions were identified which include 1 major interaction and 117 moderate interactions. Similar interaction was reported in the study conducted by Shivashankar V.,et al.[20]. It was shown that Rivaroxaban and Ticagrelor co-administration increase the risk of bleeding. The above prescription should be monitored during the treatment course. In our study population of 162 prescriptions, 160 prescriptions (98.7%) was found to be rational and follows the UHDA guidelines and 2 prescriptions (1.23%) were found to be irrational.

CONCLUSION:

The utilization pattern of anticoagulant drugs requires continuous and repeated monitoring to ensure therapeutic efficacy, identify potential drug interactions, and monitor for adverse drug reactions (ADRs). It is essential to consider patient characteristics and concomitant therapies when prescribing anticoagulants, as they can significantly impact the appropriate use of these medications. Our study observed that males in the age group of 61-70 years were more affected, indicating a specific population that may require additional attention and monitoring when prescribing anticoagulants.

It is concerning that some of the prescriptions in our study were found to be irrational and did not follow standard guidelines, resulting in acute gastrointestinal (GI) bleeding. This highlights the importance of improving awareness among healthcare professionals, particularly pharmacists, regarding rational prescribing practices for anticoagulants. Pharmacists play a crucial role in ensuring the safe and appropriate use of medications, including anticoagulants, and they can contribute to improving patient safety by actively participating in the monitoring of parameters that evaluate the safety of anticoagulant drug use.

Compliance to anticoagulant therapy is also a vital factor in improving patient outcomes and reducing the risk of bleeding. Patient education, counselling, and close monitoring by healthcare providers, including pharmacists, can help promote adherence to anticoagulant therapy and ensure optimal treatment outcomes. Inappropriate utilization patterns of anticoagulants not only

compromise patient safety but also increase the risk of adverse events. It is crucial to address these issues through continuous monitoring, adherence to guidelines, and improved awareness among healthcare professionals to optimize the use of anticoagulant medications and enhance patient safety.

Authors Contributions

Each author made an equivalent contribution to the design of the study, as well as the data collection and interpretation and manuscript writing. Additionally, each author reviewed and gave their approval for the final product.

Conflict of Interest

No conflicts of interest exist among any of the authors.

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The authors are willing to provide the data sets used and analyzed in the present study upon reasonable request.

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