WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 13, 1629-1649. Research Article ISSN 2277– 7105

PRESCRIBING PATTERN OF DRUGS IN CORONARY ARTERY DISEASEPATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

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Article Received on
05 Sept. 2021,

Revised on 26 Sept. 2021,
Accepted on 17 October 2021

DOI: 10.20959/wjpr202113-22105

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ABSTRACT

Coronary artery disease also called as ischemic heart disease or coronary heart disease is mainly caused due to atherosclerosis of inner lining of the vessels (plaque buildup in coronary artery walls) that supply blood to the heart. A prospective observational study was conducted in an inpatient department of cardiology in a tertiary care hospital. The duration of the study was 4 months i.e., from October 2018 to January 2019. Ninety-one patients were enrolled in the study of which 64(70.3%) were male and 27(29.7%) were female. Maximum patients belonged to the age group of 51-60years in which 28(30.8%) were male and 8(8.8%) were female. Among co-morbid conditions hypertension and diabetes mellitus were most commonly observed in patients. In this study, Most commonly prescribed cardiovascular single drugs were anti-hypertensives(26.06%) followed by antiplatelets(25.17%) and commonly prescribed cardiovascular FDCs were combination of antihypertensive drugs (46.43%) followed by combination of antiplatelet drugs (30.36%). The average number of drugs per prescription was 9.23. Antibiotics were prescribed to 31.90 % patients and injection was prescribed to 68.10% patients. Cardiovascular drugs prescribed from the 2017 WHO model list of essential medicines were 34.26%. Among drug-drug interactions, moderate interactions were most commonly found followed by major interactions. Present

study results indicate that pharmacist and physician can work in collaboration to bring better patient outcomes.

KEYWORDS: Prescribing pattern, coronary artery disease, WHO prescribing indicators, cardiovascular drugs, polypharmacy, drug-drug interactions.

INTRODUCTION

Cardiovascular diseases are a group of disorders of heart and blood vessels. It has become the leading cause of death globally.[1] Ischemic heart disease and stroke are considered as the predominant cause and are accountable for >80% of CVDs death. When compared to European population, cardiovascular diseases affect Indians at least 10 years earlier and in their most prolific midlife years. About 23% of people die because of cardiovascular disease before the age of 70 years in western population, while in India the percentage is 52%.[2] It is estimated that 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke and over three quarters of CVD deaths occur in low- and middle-income countries. Out of the 17 million premature deaths (under the age of 70) due to non-communicable diseases in 2015, 82% are in low- and middle-income countries, and 37% are caused by CVDs.[1]

Coronary artery disease has emerged as an epidemic in India. According to the projections of National Commission and Macroeconomics and Health, Government of India, the total no. of coronary artery disease patients in India at the turn of the century was 30 million (5.3% of adult population) which could increase to more than 62 million (8.1%) by the year 2016.[3]

Coronary artery disease also called as ischemic heart disease or coronary heart disease is mainly caused due atherosclerosis of inner lining of the vessels (plaque buildup in coronary artery walls) that supply blood to the heart.

Coronary artery disease begins when plaques are deposited within the coronary artery. These plaques are made-up of high cholesterol a substance. These plaques narrow the internal diameter of the arteries resulting in the formation of a tiny clot that obstructs the blood flow to heart muscle. This may eventually results in decreased oxygen and nutrients supply to the heart leading to the death of that area of heart tissue resulting in angina or heart attack.

The treatment for CAD involves use of different categories of drugs such as anti-platelet drugs, anti-coagulants, anti-anginal drugs, beta-blockers, angiotensin converting enzyme

inhibitors (ACEI), antiotensinII receptor blockers (ARBs), calcium channel blocker, diuretics etc. Effective screening, evaluation and treatment approach for CAD are well established in high-income countries, but these strategies have not been fully implemented in India.[4]

Evidence based guidelines from randomized control trials recommend that aspirin, beta adrenergic blockers, ACEI and hydroxyl methyl-glutarate coenzyme A reductase inhibitors to be used in patients with symptomatic chronic stable angina or asymptomatic survivors of acute myocardial infarction and following percutaneous coronary intervention or coronary bypass surgery for secondary prevention of myocardial infarction, stroke and death.[5]

It has been hypothesized that if used appropriately, these drugs can help in decreasing the long-term risk of cardiovascular events and mortality as much as by 75%. However, actual impact depends on the extent to which they are utilized in practice.[5]

Prescribing is the most essential tool used by physicians to cure illness, alleviate symptoms and prevent future disease. It is a complex intellectual task that requires formulation of a suitable treatment regimen from many thousands of treatments available, taking into account the infinite variation in the patients they encounter.

Rational prescribing is a systematic approach, which involves making of (differential) diagnosis, estimating prognosis, establishing treatment goals, selecting the most appropriate treatment and monitoring the effects of that treatment. The aim is to maximize clinical effectiveness, minimize harms, avoid wasting scarce healthcare resources and respect patient choice.[6]

Drug utilization studies helps to identify problems in prescribing pattern. It provides a favorable feedback to the prescriber and help to modify treatment strategies, thus providing a patient with appropriate drug therapy.[7]

Pharmacist plays an important role in this process. In collaboration with physician and other healthcare professionals pharmacist can improve the drug therapy and quality of life of patients.[8]

Therefore, this study attempts to assess the drug utilization pattern in the treatment of coronary artery disease.

METHODOLOGY

A prospective observational study was conducted in an inpatient department of cardiology in a tertiary care hospital. The duration of the study was 4 months i.e., from October 2018 to January 2019. Ninety-one patients were enrolled in the study.

STUDY CRITERIA

Inclusion criteria

All the in-patients diagnosed with coronary artery disease by a consultant cardiologist, in the cardiology department were included in the study

Exclusion criteria

Patients below 18 years.

Patients in other departments of the hospital.Seriously and mentally ill patients.

Pregnant and lactating women.

Data collection

The relevant data of each patient was collected from in-patient record and was documented in the specially designed data collection form. The data collection form comprised of patient demographics like age and gender, medical history, lab investigations, final diagnosis, treatment details such as name of the drug, dosage form , frequency , route of administration.

Data analysis

WHO core prescribing indicators and other additional parameters was utilized to assess the rationality of prescriptions:

Who core prescribing indicators includes[9]

- Average number of drugs per encounter
- Percentage of drugs prescribed by generic name
- Percentage of encounters with an injection prescribed
- Percentage of encounters with an antibiotic prescribed
- Percentage of drugs prescribed from an Essential Drug List /Formulary

Other parameters assessed were as follows

- Gender wise distribution.
- Age wise distribution.

- Distribution of presenting symptoms.
- Common co-morbid conditions observed in patients with CADs
- Common Fixed Dose Combinations (FDC) prescribed.
- Common individual drugs prescribed.
- Drug-drug interactions.

Statistical analysis

Data obtained was then entered into MS excel 2010. Descriptive statistics was used to analyze data and was expressed as counts and percentages.

RESULTS

In the present study, out of 91 patients, 64(70.3%) were male and 27(29.7%) were female. Maximum patients belonged to the age group of 51-60years in which 28(30.8%) were male and 8(8.8%) were female followed by the age group of 61-70years in which 14(15.4%) were male and 8(8.8%) were female**. Table 1**

Majority of patients were brought to the hospital with dyspnea followed by chest pain as presenting symptoms. **Table 2**

Table 1: Age wise distribution of study patients.

Age group	Total Pt (n=91)	No of Males	No of Females	% of Males	% of Females
21-30	1	1	0	1.1	0
31-40	4	3	1	3.3	1.1
41-50	20	13	7	14.3	7.7
51-60	36	28	8	30.8	8.8
61-70	22	14	8	15.4	8.8
71-80	5	3	2	3.3	2.2
81-90	3	2	1	2.2	1.1
Total	91	64	27	70.3	29.7

Table 2: Distribution of presenting symptoms.

Reasons	No of Patients (91)	%
Dyspnoea	40	44.0
Chest Pain	39	42.9
Palpitation	4	4.4
Pedal Oedema	3	3.3
Fever	2	2.2
Cough	6	6.6
Sweating	6	6.6
Giddiness	3	3.3

In the present study, both hypertension and diabetes mellitus were the most common co-morbid condition observed in patients, which increases the risk of coronary artery disease. **Table 3**

Table 3: Distribution of co-morbid conditions in patients.

Sl No	COMORBIDITIES	No	Percentage
1	NO COMORBIDITIES	19	20.9
2	HTN + DM	31	34.1
3	HTN	16	17.6
4	DM	7	7.7
5	HTN + DM + HYPOTHYROIDISM	4	4.4
6	HTN + HYPOTHYROIDISM	2	2.2
7	HYPOTHYROIDISM	1	1.1
8	DM + CKD	1	1.1
9	DM + CKD + HYPOTHYROIDISM + ANEMIA	1	1.1
10	HTN + CKD	1	1.1
11	HTN + COPD	1	1.1
12	HTN + DM + ANEMIA	1	1.1
13	HTN + DM + CKD	1	1.1
14	HTN +DM + CKD + HYPOTHYROID	1	1.1
15	HTN + DM + DYSLIPIDEMIA + ANEMIA + STROKE	1	1.1
16	HTN + DM + NEPHROLITHIASIS	1	1.1
17	HTN + EPILEPSY + HERNIA	1	1.1
18	HTN + SPONDYLITIS	1	1.1
	TOTAL	91	100

Details of categories of single cardiovascular drugs

In this present study, categories of cardiovascular drugs prescribed were Antihypertensives 117(26.06%), Antiplatelets 113(25.17%), Antianginals 79 (17.59%), Antihyperlipidemics 79 (17.59%), anticoagulants 46(10.24%), Ionotropic agents 9 (2.00%), Others 5(1.11%) and antiarrhythmics 1 (0.22%) as shown in the **Figure 1**

In the present study, single anti-platelet drugs prescribed were aspirin 51(45.13%), Clopidogrel 35(30.97%), ticagrelor 18(15.93%), prasugrel 8(7.08%) and cilostazol 1 (0.88%). **Figure 2**

In the present study, most common single anticoagulants prescribed were heparin 27(58.70%) followed by Enoxaparin 3(6.52%) and fondaprinux sodium 3(6.52%). **Figure 3**

In the present study single anti-anginals prescribed were Nitroglycerin 35(44.30%), Nicorandil 22(27.85%), Ranolazine 8(10.13%), Trimetazidine 7(8.86%), Ivabradine,

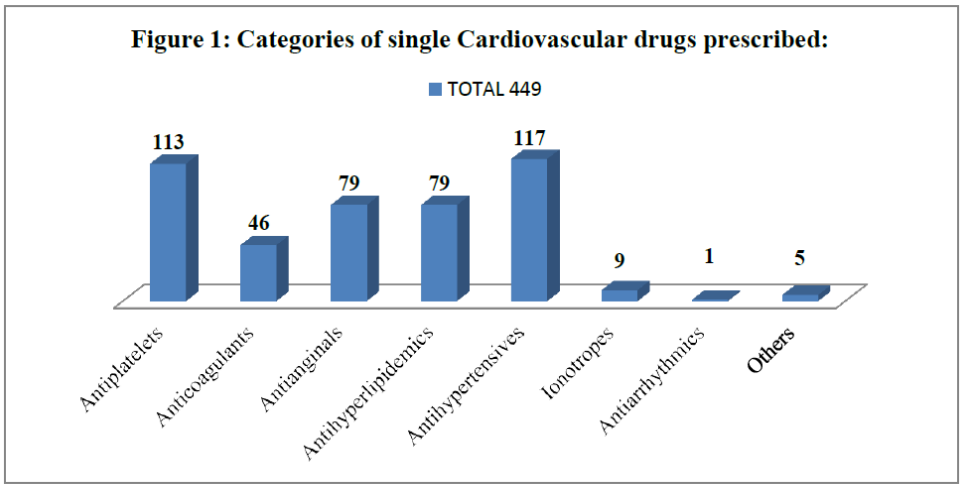
Isosorbide mononitrate 1(1.27%) and Isosorbide dinitrate 1(1.27%). **Figure 4**

Among Antihypertensives, most commonly prescribed class was Beta-blockers 45 (38.46%) followed by Diuretics 21(17.95%), ACE inhibitors 18(15.38%), Calcium Channel Blockers 15(12.82%%), Angiotensin Receptor Blockers 12(10.26%) and α blockers and α+β blockers 6(5.13%). **Figure 5.** Details of antihypertensive classes is given in the **Table 4**

Among single antihyperlipidemics, Atorvastatin 64(81.01%) was most commonly prescribed followed by Rosuvastatin 15(8.99%). **Figure 6**

Among ionotropic drugs, Digoxin was most commonly prescribed followed by Dobutamine and Noradrenaline. **Table 5**

Among anti-arrhythmic drugs, amiodarone was prescribed in one prescription.



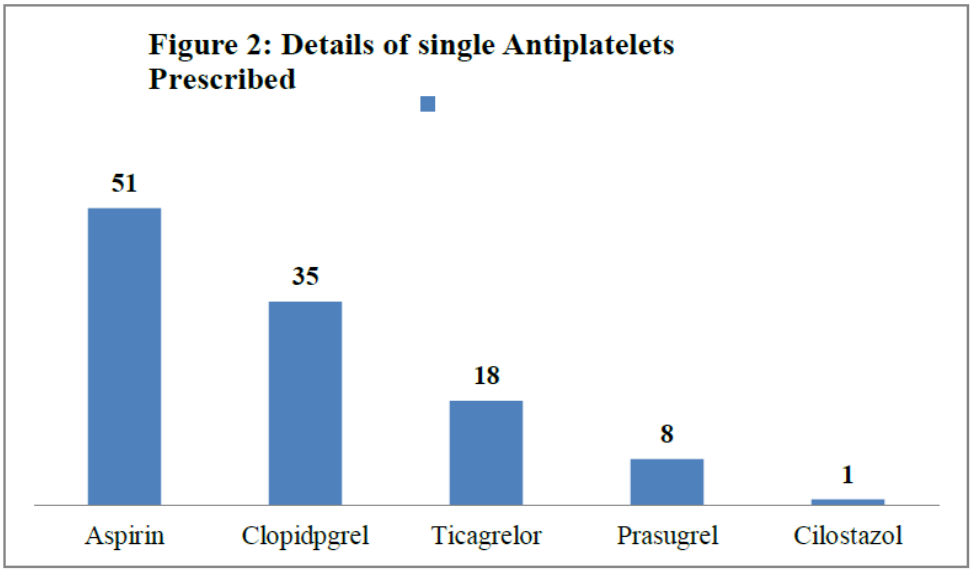


Figure 3: Details of single Anticoagulants prescribed:

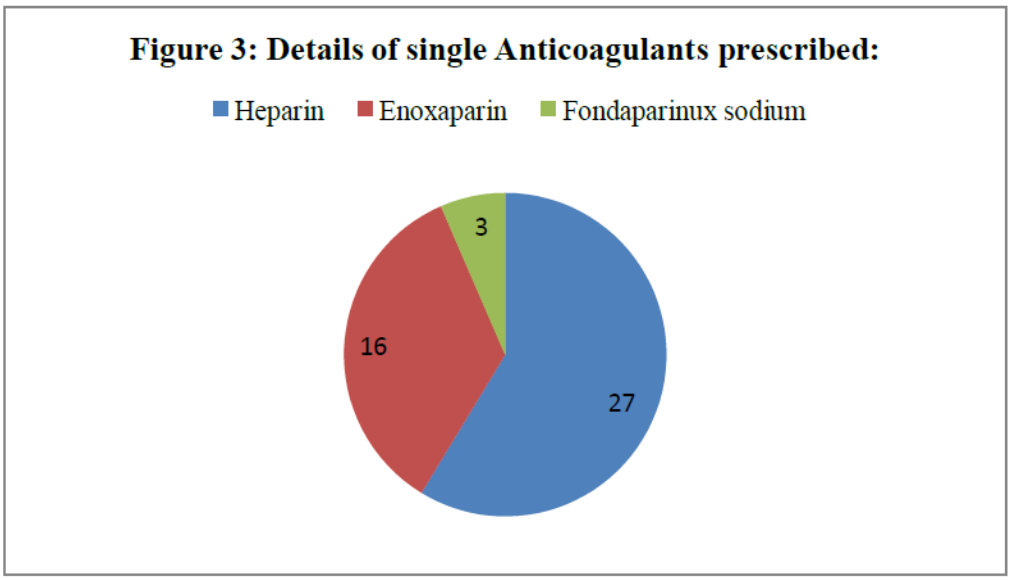


Figure 4: Details of single Antianginals prescribed:

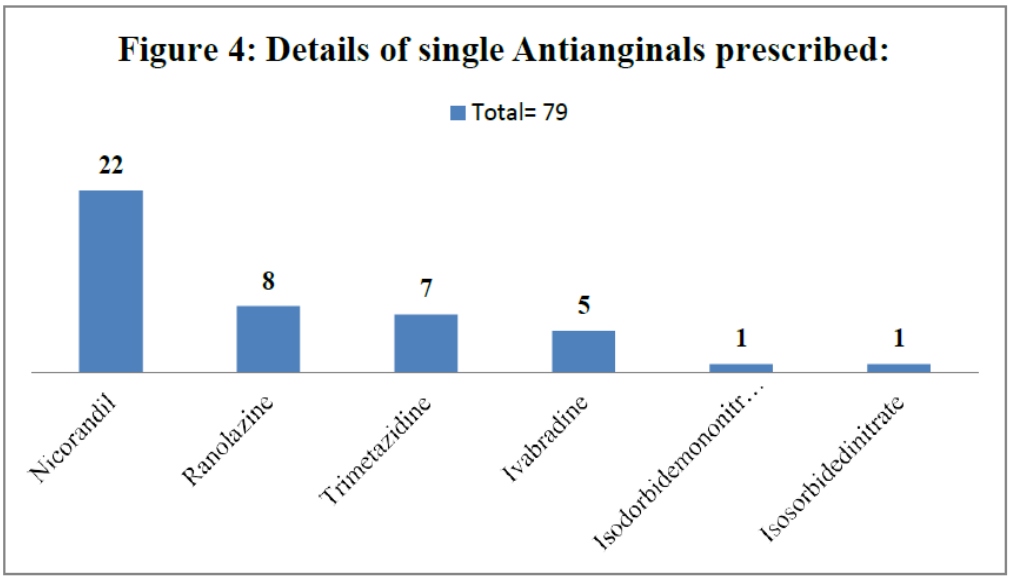
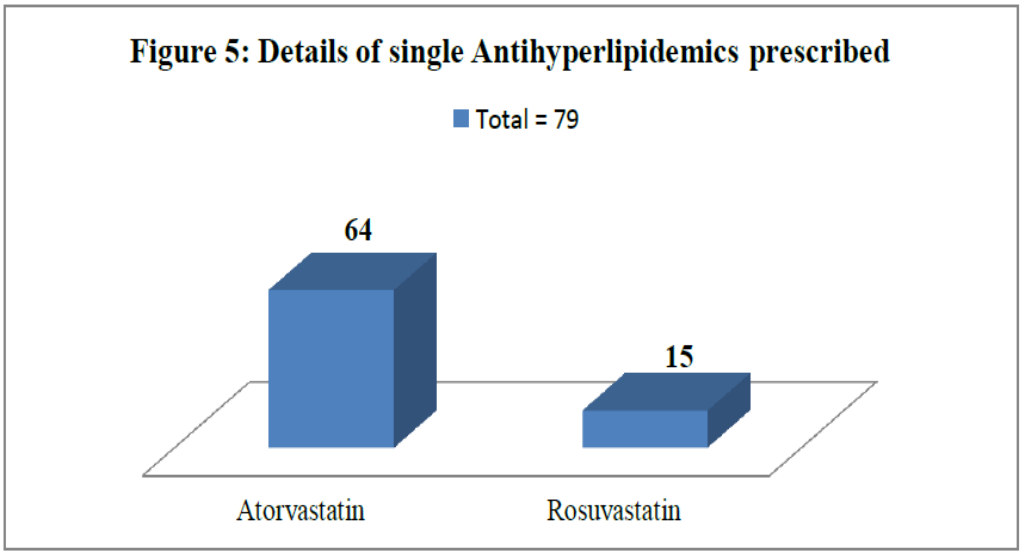


Figure 5: Details of single Antihyperlipidemics prescribed



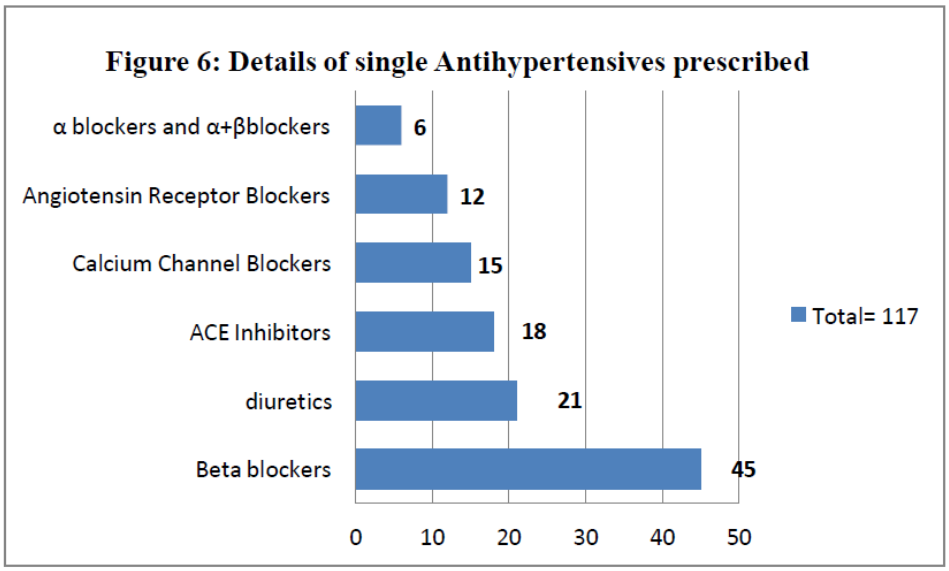


Table 4: Details of single antihypertensive class of drugs.

Details of Antihypertensive Classes		
ACE Inhibitors	**No. of drugs prescribed**	**%**
Ramipril	13	72.2
Enalapril	5	27.8
Total	18	100
ARB Inhibitors	**No. of drugs prescribed**	**%**
Telmisartan	9	75.0
Losartan	3	25.0
Total	12	100
Calcium ChannelBlockers	**No. of drugs prescribed**	**%**
Diltiazem	6	40.0
Amlodipine	5	33.3
Verapamil	1	6.7
BenedipineHCl	3	20.0
Total	15	100
Beta Blockers	**No. of drugs prescribed**	**%**
Metoprolol succinate ER	31	68.89
Metoprolol	4	8.89
Bisoprolol	7	15.56
Nebivolol	3	6.67
Total	45	100
α Blockers and α+βBlockers	**No. Of Drugs Prescribed**	**%**
Prazosin	2	33.33
Carvedilol	4	66.67
Total	6	100
Diuretics	**No. Of Drugs Prescribed**	**%**
Furosemide	11	52.38
Torsemide	6	28.57
Spironolactone	2	9.52
Epleronone	2	9.52
Total	21	100

Table 5: Details of single ionotropic agents.

Ionotropic agents	No. of drugs prescribed	%
Digoxin	5	55.56
Dobutamine	2	22.22
Noradrenaline	2	22.22
Total	9	100

Details of Cardiovascular fixed dose combinations

Among cardiovascular fixed dose combinations, the most commonly prescribed category was antihypertensives 26(46.43%) followed by antiplatelets 17(30.36%) and antihyperlipidemic+antiplatelet 13(23.21%). **Table 6.**

Among anti-hypertensive FDCs, telmisartan+hydrochlorthiazide (26.92%) were most commonly prescribed. Details of antihypertensive fixed dose combinations are shown in **Table 7**

Atorvastatin+Aspirin (69.23%) was commonly prescribed antihyperlipidemic+antiplatelet combination. Details of antihyperlipidemic+antiplatelets are depicted in the **Table 8**

Among antiplatelet FDCs, Aspirin+clopidogrel (82.45%) was most commonly used among patients followed by Prasugrel+Aspirin (17.65%). **Table 9**

Table 6: Details of Categories of Cardiovascular FDCs prescribed.

Category	No. of drugs prescribed	%
Antihypertensives	**26**	**46.43**
Antihyperlipidemic + Antiplatelet	**13**	**23.21**
Antiplatelets	**17**	**30.36**
Total	**56**	**100.00**

Table 7: Details of Antihypertensive FDCs prescribed.

Antihypertensives	No. of drugs prescribed	%
Telmisartan + Hydrochlorthiazide	7	26.92
Furosemide + Spironolactone	3	11.54
Torsemide + Spironolactone	3	11.54
Telmisartan + Metoprolol	2	7.69
Olmesartan + Medoxomil	2	7.69
Sacubitril + Valsartan	1	3.85
Olmesartan + Metoprolol	1	3.85
Perindopril +Indapamide	1	3.85
Furosemide + Amiloride	1	3.85
Azilsartan + Medoxomil	1	3.85

Olmesartan+Medoxomil+Chlorthalidone	1	3.85
Metoprolol + Clinidipine	1	3.85
Telmisartan+ Clinidipine	1	3.85
Amlodipine + Atenolol	1	3.85
Total	26	100

Table 8: Details of Antihyperlipidemic+Antiplatelet FDCs prescribed.

Antihyperlipidemics +Antiplatelets	No. of drugs prescribed	%
Atorvastatin + Aspirin	9	69.23
Atorvastatin + Clopidogrel	2	15.38
Rosuvastatin + Clopidogrel	1	7.69
Rosuvastatin + Clopidogrel +Aspirin	1	7.69
Total	13	100

Table 9: Details of Antiplatelet FDCs prescribed.

Antiplatelets	No. of drugs prescribed	%
Aspirin+ Clopidogrel	14	82.35
Prasugrel + Aspirin	3	17.65
Total	17	100

Details of drug therapy in cardiovascular disease patients

In 91 prescriptions analyzed, a total number of 840 drugs were prescribed. Among these, 505 were cardiovascular drugs and 335 were non-cardiovascular drugs.

A total of 702 drugs were prescribed as single drug. Of these cardiovascular single drugs were 449 and non cardiovascular single drugs were 253. A total of 138 drugs were prescribed as Fixed Dose Combinations. Of these, cardiovascular FDCs were 56 and non cardiovascular FDCs were 82.

Out of 505 cardiovascular drugs, 34.26% were from the year 2017 WHO model list of essential medicines and 65.74% were not from the essential list of drugs. **Table 10**

In this present study, the average number of drugs per prescription was 9.23. In all the prescriptions, both generic name and brand name were mentioned. Antibiotics were prescribed in 31.90 % patients and injection was prescribed in 68.10% patients. **Table 11**

Table 10: Drug therapy details in cardiovascular disease patients.

Drug therapy details in cardiovascular disease patients	N (%)
Total number of prescriptions analyzed (Number)	91
Total number of drugs prescribed	840
Total number of Cardiovascular drugs prescribed	505 (60.1%)
Total number of non cardiovascular drugs prescribed	335 (39.9%)
Total number of single drugs prescribed	702 (83.57%)
Total number of single cardiovascular drugs prescribed	449 (63.96%)
Total number of single non cardiovascular drugs prescribed	253 (36.04%)
Total number of fixed dose combinations prescribed	138 (16.43%)
Total number of cardiovascular FDC prescribed	56 (40.58%)
Total number of non cardiovascular FDC prescribed	82 (59.42%)
Cardiovascular drugs prescribed from 2017 WHO model list of essentialmedicines	173 (34.26%)
Cardiovascular drugs not prescribed from 2017 WHO model list of essentialmedicines.	332 (65.74%)

Table 11: Assessment of Prescribing indicators as per WHO.

S.No.	Prescribing indicators as per WHO	%
1	Average number of drugs per prescription (number)	9.23
2	Percentage of drugs prescribed by generic name	100%
3	Percentage of encounters with an antibioticprescribed	31.90%
4	Percentage of encounters with an injectionsprescribed	68.10%
5	Percentage of cardiovascular drugs prescribed fromWHO model list of essential medicines (2017)	34.26%

Details of single non-cardiovascular drugs

Out of 253 non-cardiovascular single drugs, 74(29.25%) were antacids, 50(19.76%) were other drugs, 41(16.21%) were antidiabetics, 35(13.83%) were antibiotics, 23(9.09%) were stool softeners, 13(5.14%) were NSAIDs, 9(3.56%) were bronchodilators and 8(3.16%) were benzodiazepines and as shown in the **Table 12.**

Table 12: Details of single non-cardiovascular drugs prescribed.

Category	N	%
Antacids	74	29.25
Antibiotics	35	13.83
Antidiabetics	41	16.21
benzodiazepines	8	3.16
NSAIDs	13	5.14
Bronchodilators	9	3.56
Stool softeners	23	9.09
Other drugs	50	19.76
Total	253	100.00

Details of non-cardiovascular fixed dose combinations

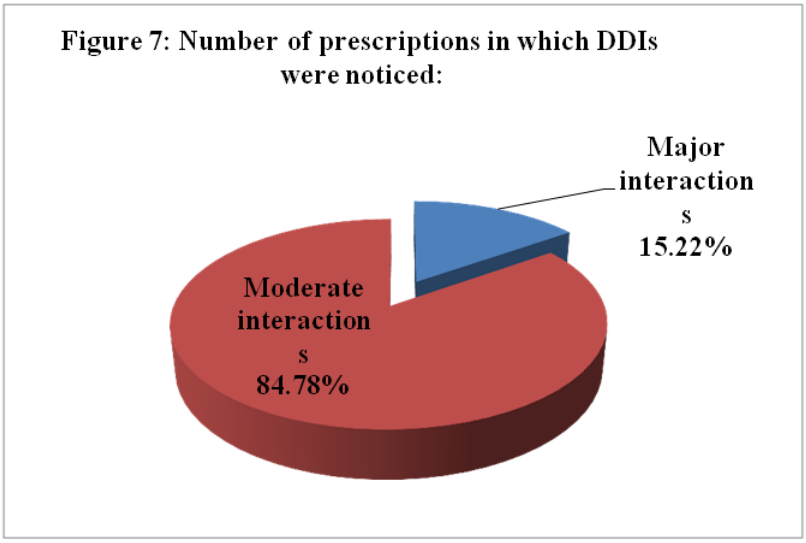
Out of 82 non-cardiovascular fixed dose combinations, 38(46.34%) were nutritional supplements, 10(12.20%) were antiallergic/expectorants/mucolytics, 9(10.98%) were antidiabetics, 9(10.98%) were bronchodilators, 7(8.54%) were antibiotics, 5(6.10%) were other drugs and 4(4.88%) were antacids. **Table 13**

Table 13: Details of non-cardiovascular fixed dose combinations.

Category	N	%
Antiallergic /Expectorants/Mucolytics	10	12.20
Nutritional Supplements	**38**	46.34
Antibiotics	7	8.54
Antacids	4	4.88
Antidiabetics	9	10.98
Bronchodilators	9	10.98
Other Drugs	5	6.10
Total	82	100.00

Drug-Drug interactions

In this present study, out of 91 prescriptions, major interactions were found in 14(15.22%) prescriptions and moderate interactions were found in 78 (84.78%) prescriptions. Data is represented in **Table 14**



DISCUSSION

Regarding sex wise distribution, in the present study, the majority of the patients were male sex i.e., 70.3% and females accounted for 29.7%. The present study is in accordance with the study conducted by **Vakade K** *et al.*, in which males were 64.63% and females were 35.37%.[10]

In the present study maximum patients were in the age group of 51-60years in which 28(30.8%) were male and 8(8.8%) were female. The present study results were similar to the study conducted by **Rakesh B** *et al.*, in which maximum patients were of 51-60 years of age in which 17 were male and 11 were female.[5]

In the present study, both hypertension and diabetes mellitus were the most common co-morbid condition associated with coronary artery disease patients. The study is in accordance with the study results of **Kerker S** *et al.*, where hypertension and diabetes were the most commonly noted co-morbidities.[7]

In the present study, most commonly prescribed categories of cardiovascular drugs prescribed were Antihypertensives 117(26.06%) followed by Antiplatelets 113(25.17%), Antianginals 79 (17.59%), Antihyperlipidemics 79 (17.59%) which is similar to the study conducted by **Boggula N** *et al.*, in which Antihypertensives (38.4%) were commonly prescribed, followed by Antiplatelets (34.2%).[11]

In the present study most commonly prescribed single anti-platelet drugs were aspirin 51(45.13%), followed by Clopidogrel 35(30.97%) which in accordance with the study results

of **Thomas B** *et al*., where most commonly prescribed Antiplatelets were Aspirin (46.03%) followed by Clopidogrel (41.40%).[12]

In the present study, most common single anticoagulants prescribed were heparin 27(58.70%) followed by Enoxaparin 3(6.52%). The present study results were in consistence with the study conducted by **Dawalji S** *et al*., in which Enoxaparin (47.27%) was prescribed more frequently, followed by Heparin(40%).[13]

In the present study among single anti-anginals most commonly prescribed drugs were Nitroglycerin 35(44.30%) followed by Nicorandil 22(27.85%) which is in contrast to the study conducted by **Banerjee S** *et al.*, where isosorbide mononitrate was more commonly prescribed drug. In the present study, the use of isosorbide mononitrate was found to be 1.27%.[14]

Among Antihypertensives, most commonly prescribed class was Beta-blockers 45 (38.46%) followed by Diuretics 21(17.95%). The present study was similar to the study by **Zafar F** *et al.*, where beta-blockers (52%) were most commonly prescribed followed by loop diuretics (42%).[15]

In the present study, Atorvastatin 64(81.01%) was most commonly prescribed followed by Rosuvastatin 15(8.99%).

In a study conducted by **Sreedevi K** *et al*., the different statins prescribed were atorvastatin (261 prescriptions) followed by Rosuvastatin (26 prescriptions).[16]

Among ionotropic drugs, Digoxin was most commonly prescribed followed by Dobutamine and Noradrenaline. This study results were similar to the study by **Thomas B** *et al*., in which Digoxin (10%) was frequently used among Ionotropes.[12]

In the present study, among anti-hypertensive FDCs, Telmisartan+Hydrochlorthiazide (26.92%) were most commonly prescribed and Atorvastatin+Aspirin (69.23%) was commonly prescribed antihyperlipidemic+antiplatelet combination. The study results were in accordance with the study conducted by **Slathia I** *et al*., which observed that Telmisartan+Hydrochlorthiazide (23.19%) was the commonly prescribed Antihypertensive FDC followed by Antiplatelets+Antihyperlipidemic FDC- Aspirin+Atorvastatin (20.29%).

Among antiplatelet FDCs, Aspirin+clopidogrel (82.45%) was most commonly used among patients followed by Prasugrel+Aspirin (17.65%).[17] Whereas the study conducted by **Dawalji S** *et al*., reported that prescription rate of aspirin and clopidogrel were 91.76%.[13]

The association of physicians of India recommends that dual antiplatelet therapy should be given to all patients with MI and also those with ST Segement elevation myocardial infarction (STEMI).[4] The mechanism of action of both the drugs are as follows: Aspirin inhibits platelet activation through TXA2 pathway and the active metabolite of clopidogrel selectively inhibits the binding of adenosine diphosphate (ADP) to its platelet $P2Y_{12}$ receptor and the subsequent ADP-mediated activation of the glycoprotein GPIIb/IIIa complex, thereby inhibiting platelet aggregation.clopidogrel inhibits platelet activation by a mechanism different from aspirin and the combination therapy with aspirin may offer benefits over either drug used alone.[4][18]

In this present study, the average number of drugs per prescription was 9.23 which is similar to the study conducted by **Dawalji S** *et al*., where average number of drugs per prescription was found to be 9.68.[13]

In the present study, drugs were prescribed by generic name. It is recommended to prescribe drugs by generic name to promote rational use of drugs. Clause 1.5 of the Indian Medical Council (Professional Conduct, Etiquette, and Ethics) Regulations, 2002, states that: "Use of generic names of drugs: Every physician should, as far as possible, prescribe drugs with generic names and he/she shall ensure that there is a rational prescription and use of drugs." This clause was modified on September 21, 2016 (No. MCI-211(2)/2016(Ethics)/131118) and notified in the Gazette of India on October 08, 2016; the modification read as follows: "Use of generic names of drugs: Every physician should prescribe drugs with generic names legibly and preferably in capital letters and he/she shall ensure that there is a rational prescription and use of drugs."[19]

Percentage of antibiotics prescribed was 31.90% which is less when compared to the previous studies conducted by **Summoro** *et al.* (66.5%) and **Lalan** *et al*. (46.17%).[20][21]

In the present study, 34.26% of cardiovascular drugs were from the year 2017 WHO model list of essential medicines. The percentage of cardiovascular drugs prescribed from essential medicines list were less when compared to the previous studies by **Kerker** *et al*. and **Slathia**

*et al***,** where percentage of cardiovascular drugs prescribed from EDL was 92.79%and 82.8% respectively.[7][17]

In the present study, percentage of encounters with an injections prescribed were 68.10% which was much higher than the studies conducted by **Ravi** *et al* (7.89%) and **Aswani** *et al* (34.99%).[22][4]

In this present study, out of 91 prescriptions, major interactions were found in 14(15.22%) prescriptions and moderate interactions were found in 78 (84.78%) prescriptions. In the previous study by **Boggula** *et al*.**,** moderate drug interactions were 81.09% and major drug interactions were 9.14%. Another previous study by **Thomas B** *et al*, it was found that the major drug interaction were 54% and moderate interactions were 47%.

In inpatients, the risk of having potentially interacting drug combinations may increase because new drugs are often added to the existing drug therapy. DDIs are a concern for patients and health care professionals, as polypharmacy is becoming more common in managing complex diseases or comorbidities and the consequences can range from untoward effects to drug-related morbidity and mortality.[22]

In the present study various cardiovascular drug combinations were used. The potential benefits of drug combinations should be weighed against the seriousness of the DDI, taking into the availability of alternatives. If drug therapy is of such importance that it outweighs the potential risks, and if no safer alternative drugs are evident, then the risks of a potential DDI may be tolerated and the treatment can be continued.[22]

CONCLUSION

In this study, it was observed that the risk for coronary artery disease increased with increasing age and majority of cases were in the age group of 51-60 years. Hypertension and diabetes were the most common co-morbid conditions associated with coronary artery disease. These co-morbid conditions if not controlled can become a risk factor for different cardiovascular diseases. In this study, most commonly prescribed categories of cardiovascular drugs were Antihypertensives followed by Antiplatelets. Extensive polypharmacy (9.23drugs per prescription) was noticed in the prescriptions. The study showed higher incidence of drug use as single agents (83.57%) which is appreciable. In this study, prescribers were mentioning generic name of the drug, dosage, frequency along with

brand name. Regular prescription reviews, tapering or withdrawing of the drug if the potential risk outweighs the benefit of their continuation, can be considered by health care professionals. Several standard criteria such as Beers criteria – 2015, STOPP/START criteria, can be referred for safe prescribing in the geriatric age groups.[7] The Hospitals should verify their drug usage with standard treatment guidelines or frame the guidelines if not existent.

The prescribing pattern can be improved if both pharmacist and physician can work in collaboration to bring better clinical outcomes.

Limitations of the study

1. Small sample size
2. Short study duration and follow-up.
3. Monitoring patients for longer period would reflect more accurate profile of the natural time frame of the medication views.

Future scope of the study

1. This study may be helpful in identifying the new concept of prescription pattern assessment of patients in different disease conditions.
2. Pharmacoeconomic evaluation studies of medication therapy can be done to assess the burden of coronary artery disease in the population to avoid unnecessary costs of medication.
3. Pharmacoepidemiological studies can be done to study the uses and effects of drugs in well-defined populations.

Abbreviations

ACEI - Angiotensin converting enzyme inhibitors

ARBs - Angiotensin receptor blockers

CAD - Coronary artery disease

CVDs - Cardiovascular diseases

CKD - Chronic kidney disease

DM - Diabetes mellitus

DDI - Drug-drug interactions

DUR - Drug utilization review

DUE - Drug utilization evaluation

DDI – Drug-Drug interactions

DVT - Deep vein thrombosis

EDL - Essential drug list

FDC - Fixed dose combination

HF - Heart failure

IHD - Ischemic heart disease **MI -** Myocardial infarction **RHD -** Rheumatic heart disease

WHO - World health organization

STEMI - ST Segement elevation myocardial infarction

TXA2 - Thromboxane A2 **ADP -** Adenosine diphosphate

Conflict of interest

All the authors declare that there is no potential conflict of interest in the study.

ACKNOWLEDGEMENT

Authors are thankful to the cardiology department of the hospital for allowing us to carry out the research work.

REFERENCES

1. Cardiovascular diseases (CVDs) [Internet].Who.int.2019 [cited 2018 Dec 15] Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds).
2. Prabhakaran D, Jeemon P, Roy A. Cardiovascular Diseases in India. *Circulation*, 2016; 133(16): 1605-1620. doi:10.1161/circulationaha.114.008729
3. Indrayan A. Forecasting cardiovascular disease cases and associated mortality in India. National Commission for Macroeconomics and Health, Government of India: New Delhi, 2004.
4. Aswani B, K. P, Yanadaiah P, Sujatha S. A Study On Prescribing Pattern Of Cardiovascular Drugs And Potential Drug-Drug Interactions In An Inpatient Cardiology Unit Of A Cardiac Care Hospital At Tirupathi. *Eur J Pharm Med Res.*, 2016; 3(8): 294-305.
5. Rakesh B, Suresha B, Himaja J, Joy E, Varghese A. Assessment of prescribing pattern in coronary artery disease. *International Journal of Allied Medical Sciences and Clinical Research*, 2016; 4(4): 698-715.
6. Maxwell S. Rational prescribing: the principles of drug selection. *Clinical Medicine*, 2016; 16(5): 459-464.
7. Kerkar S, Bhandare P. Study of utilisation trends of drugs in patients admitted with cardiovascular diseases at a tertiary care hospital in Goa. *International Journal of*

ScientificReports, 2017; 3(12): 311-317. doi:10.18203/issn.2454-2156.intjscirep20175385

8. Drug Utilization Review | AMCP.org [Internet]. Amcp.org. 2019 [cited 2018 Dec 18]. Available from: https://www.amcp.org/about/managed-care-pharmacy-101/concepts-managed-care-pharmacy/drug-utilization-review
9. How to Investigate Drug Use in Health Facilities: Selected Drug Use Indicators - EDM Research Series No. 007: Chapter 2: Core drug use indicators: Group 1: Prescribing indicators [Internet]. Apps.who.int. 2018 [cited 2019 Mar 4]. Available from: http://apps.who.int/medicinedocs/en/d/Js2289e/3.1.html
10. Vakade K, Thorat V, Khanwelkar C, Jadhav S, Sanghishetti V. A study of prescribing pattern of drugs in patients of cardiovascular emergencies at a tertiary care hospital of Western Maharashtra. *International Journal of Research in Medical Sciences,* 2016; 4(2): 556-561. doi:10.18203/2320-6012.ijrms20160314
11. Boggula N, Amaravadi D, Laxmapuram S, Sabavat S, Bakshi V. A study on prescription pattern of cardiovascular drugs in inpatient department at a tertiary care centre. Int J *Pharm Pharm Sci*., 2018; 8(2): 27-32.
12. Thomas B, TJ C, Sabu N, ES L, Baby N, K M, T S. Prescribing Pattern of Cardiovascular Drugs - A Prospective Observational Study. *Int J Pharm Pract,* 2018; 10(4): 287-292.
13. Dawalji S, K V, Thota S, Venisetty P, Venisetty R. Prescribing Pattern in Coronary Artery Disease: A Prospective Study. Int. J Pharm Sci Rev Res., 2014; 3(3): 24-33.
14. Banerjee S, Kumar V, Ramachandran P, Kamath A. Does the pharmacological management of unstable angina vary with age and gender – a descriptive study. *Journal ofClinical and Diagnostic Research,* 2010; 4: 3150-3157.
15. Zafar F, Ali H, Naveed S, Korai OU, Rizvi M, Naqvi GR, et al. Drug Utilization Patternin Cardiovascular Diseases: A Descriptive Study in Tertiary Care Settings in Pakistan. J Bioequiv Availab, 2015; 7(1): 59-62.
16. Sreedevi K, Rao VJ, Fareedullah MD, Vijayakumar S. A study on prescription pattern of statins in cardiovascular disease. Der Pharmacia Lettre, 2011; 3: 393-396.
17. Slathia I, Jadhav P, Deb P, Verma S. Drug utilization study in Cardiology outpatient department at a tertiary care hospital. Int J Basic Clin Pharmacol, 2017; 6(9): 2276.
18. Plavix (Clopidogrel Bisulfate): Uses, Dosage, Side Effects, Interactions, Warning.RxList. https://www.rxlist.com/plavix-drug.htm. Accessed December 16, 2018.
19. Andrade C, Rao T. Prescription writing: Generic or brand?. *Indian J Psychiatry,* 2017; 59(2): 133-137.
20. Summoro T, Gidebo K, Kanche Z, Woticha E. Evaluation of trends of drug-prescribing

patterns based on WHO prescribing indicators at outpatient departments of four hospitals insouthern Ethiopia. *Drug Des Devel Ther*., 2015; 9: 4551-4557.

21. Lalan B, Hiray R, Ghongane B. Drug Prescription Pattern Of Outpatients In A Tertiary Care Teaching Hospital In Maharashtra. *Int J Pharm and Bio Sci.*, 2012; 3(3): 225-229.
22. Kulkarni V, Swaroopa Bora S, Sirisha S, Saji M, Sundaran S. A study on drug–drug interactions through prescription analysis in a South Indian teaching hospital. *Ther Adv DrugSaf.*, 2013; 4(4): 141-146.