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PRESCRIBING PATTERNS OF MYOCARDIAL INFARCTION WITH AN OVERVIEW ON WHO PRESCRIBING INDICATORS- A CLINIC BASED STUDY

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ABSTRACT

A prospective observational study was conducted over a 6-month period on myocardial infarction (MI) patients in a cardiac care centre. The study found that the prevalence of MI was highest in the age group of 50-60 years and males were more affected than females. Hypertension was identified as the major modifiable contributing factor for MI, followed by alcohol consumption. Chest pain was the most common clinical presentation among MI patients. The study also highlighted the prescription patterns of various drug classes in the management of MI. Overall, the study emphasized the importance of rational prescribing practices and the use of generic drug names to improve patient compliance and minimize costs.

KEYWORDS: Myocardial infarction, Hypertension, Chest pain, Atorvastatin, Nitroglycerin.

INTRODUCTION

Myocardial infarction also known as heart attack, is caused by complete cessation or decreased blood flow to the portion of the myocardium. It may be silent and undetected or it can be a catastrophic event leading to hemodynamic deterioration and sudden death. Most MI are due to the underlying coronary artery disease which is the leading cause of death in the United States. (Thygesen K, et al., 2007). It is the most prevalent kind of CHD. When a coronary artery is blocked or almost blocked, there is a significant decrease in blood flow, which leads to myocardial infarction, which affects a portion of the heart muscle that is supplied by the blocked artery. ST-segment elevation myocardial infarction (STEMI) and non-ST-segment elevation myocardial infarction (NSTEMI) are the two clinical scenarios for MI. MI is the world's primary cause of illness and mortality.

It is the cause of more than 15% of annual deaths among the great majority of NSTEMI patients compared to STEMI patients. In every age group, men have a higher prevalence of MI than women. (Ojha N et al., 2023). Over 90% of the risk for an acute MI is accounted for by modifiable risk factors. Nine risk factors—including obesity, alcohol consumption, physical inactivity, smoking, dyslipidaemia, psychosocial stressors, diabetes mellitus, hypertension, and a diet poor in fruits and vegetables—were found to be substantially linked to acute MI in the 52 nations studied. (Chadwick Jayara et al., 2019). Over 16.5 million Americans above 20 are estimated to have coronary artery disease, according to 2015 mortality data from the National Health Interview Survey (NHANES) -CDC data from 2011 to 2014. Across all age groups, the frequency was higher in men than in women.

In US adults older than 20, the overall prevalence of myocardial infarction was 3.0%. (Ojha N et al., 2024). One important factor in the burden of CVD (cardiovascular disorders) is MI. The primary factors influencing the decrease in the death rate from coronary heart disease are the evaluation of case fatality and myocardial infarction incidence.

Because of the coronary artery occlusion, the myocardium is deprived of oxygen and prolonged deprivation of oxygen supply leads to myocardial cell death and necrosis. Patients present chest discomfort or pressure that radiates to the jaw, neck, shoulder, and or arm. Cardiovascular diseases are more prevalent in India. Myocardial infarction affects more than 15% of population and its morbidity is also very high. (Mishra J et al., 2022).

The main elements that are considered while evaluating myocardial infarction are cardiac biomarkers, clinical characteristics, and ECG results.

ST-segment elevation in two continuous leads, is larger than 5 mm in males under 40 and more than 2 mm in men over 40; in women, it is greater than 1.5 mm in leads V2-V3. These are among the ECG abnormalities and T-wave alterations and ST-segment depression. An acute myocardial infarction may manifest as a hyperacute T-

wave with significant symmetrical T-waves in two continuous leads, which may precede ST-segment elevation.

Troponin typically rises and falls gradually, whereas biochemical indicators of myocardial necrosis rise and fall more quickly in CK-MB.

Non-ST-elevation MI (NSTEMI) and ST-elevation MI (STEMI) are not the same. Heart enzyme levels are raised, the ECG displays ST elevation, and there is total thrombus blockage in STEMI. While the ECG displays ST depression and cardiac enzymes are observed to be increased in NSTEMI, the occluding thrombus causes either partial or full occlusion of a major artery. (Ghafoor et al., 2020).

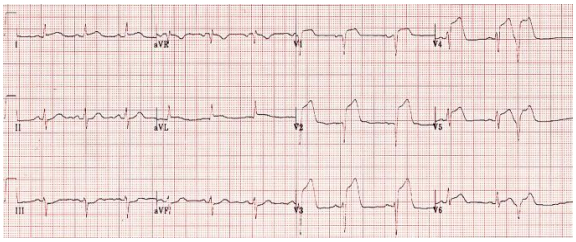

Figure -1: ECG showing ST elevation in leads I, aVL and V1-V6, consistent with acute anterolateral MI. ECG indicates electrocardiogram; MI, myocardial infarction. (Ghafoor et al., 2020).

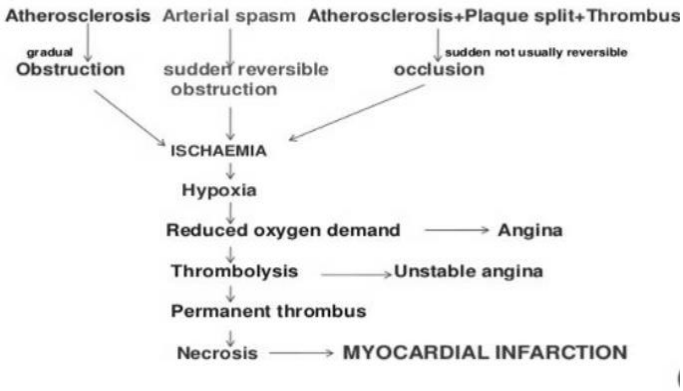

Figure 2: Representation of pathophysiology of myocardial infarction. (Monika S et al., 2015) (N.), an Overview of Myocardial Infarction with their Pathology, Pathophysiology, Epidemiology and Causes, Int. l J. of Pharmacy Res; 2015; 6(1): 1-7.

The classic symptoms of myocardial infarction are chest pain and shortness of breath. The most common symptoms include chest pain which travels from left arm to neck, shortness of breath, sweating. (Lu L et al., 2015). Risk factors for MI include Physical inactivity, smoking, alcohol consumption, dyslipidaemia, diabetes mellitus, hypertension, obesity, Age. (Fransson E et al., 2014; Prescott E et al., 1998); Biyik I et al., 2007; (Zhiyong Du et al., 2023; Fisher M et al., 1999; Rakugi H et al., 1996; Negroiu CE et al., 2023; Sagris M et al., 2022). An acute myocardial infarction is the most frequent cause of cardiogenic shock. Five to ten percent of patients with acute myocardial infarction have cardiogenic shock. The most prevalent presentation of CS in the context of AMI is severe left ventricular (LV) dysfunction, which usually follows anterior MI. (Samsky, Marc D et al., 2021).

Myocardial infarction can be managed with

- Routine PCI or rescue PCI can be scheduled if the patient meets reperfusion requirements and can be transferred to a PCI center within 60 to 90 minutes following a fibrinolytic drug bolus. If fibrinolysis is to be performed, fibrin-specific drugs such as reteplase, alteplase, or tenecteplase (class I) should be used. (Ibanez B et al., 2018).

- Chewable aspirin with a loading dose of 162 mg to 325 mg that is nonenteric coated must be given to all patients suffering from STEMI and NSTEMI right away. Furthermore, patients should have an established intravenous line, and if their oxygen saturation drops below 91%, they should receive oxygen supplementation. In addition to sublingual nitroglycerin, opioids may be utilized to treat pain if the patient's blood pressure is within a reasonable range. (Jneid H et al., 2017; Larson EA et al., 2019; Bath PM et al., 2018; Adamski P et al., 2018).

- The principal therapeutic strategy for STEMI entails rapid reperfusion. Emergent PCI is the preferable approach. Patients should get dual antiplatelet medication before PCI. This entails ticagrelor, an adenosine diphosphate inhibitor receptor (P2Y12 inhibitor), and intravenous heparin infusion. During PCI, a direct thrombin inhibitor or a glycoprotein IIb/IIIa inhibitor may also be used. When a STEMI is diagnosed, reperfusion with an intravenous thrombolytic agent should be tried if PCI is not accessible

within 90 minutes. The first line of treatment for stable, asymptomatic NSTEMI patients is usually medical, with an emphasis on antiplatelet medicines and other suitable drugs. PCI, however, can be carried out if needed within 48 hours of admission. It has been demonstrated that using this postponed PCI approach can reduce hospital stays and increase in-hospital mortality for NSTEMI patients.

- For MI include high density statins, which lower cholesterol and stabilize atherosclerotic plaques. (Ibanez B et al., 2018), ACE (Angiotensin converting enzyme) inhibitors (Goyal A et al., 2024), Beta blockers (Joo SJ et al., 2023).

- Giving up smoking is the secondary preventive step that saves the most money. Atherosclerosis and myocardial infarction are strongly correlated with smoking's pro-thrombotic effect. (Anand SS et al., 2008; Piepoli MF et al., 2016)

W.H.O. INDICATORS

The prescribing indicators measure the performance of healthcare providers in five key areas related to the appropriate use of medicines. (Ofori-Asenso R et al., 2016) They are based on an analysis of patient clinical encounters. A prescriber's sensitivity to rational prescription may be increased by this type of practice.

WHO prescribing indicators in mi

Average number of drugs per medical prescription

This indicator helps in investigating polypharmacy, which is a major factor contributing to adverse drug reactions and drug-drug interactions (DDIs).

Percentage of drugs prescribed by generic name

This indicator helps in controlling drug costs in the health service. It also assesses the prescriber's influence by drug promotion.

Percentage of drugs prescribed from essential drug list

This indicator helps in controlling the overall cost of medications.

Percentage of prescriptions with an antibiotic

This parameter assesses the excess use of antibiotics which contributes to bacterial resistance.

Percentage of prescribed injectable drugs

This indicator helps to evaluate the unnecessary use of injectables that can cause prick troubles to the patient, necrosis if wrongly administered or sometimes serious complications such as anaphylactic reactions and adverse reactions.

METHODOLOGY

The study is conducted for a period of 6 months (2023 to 2024).

It is a prospective cross-sectional observation study.

The study was conducted in a cardiac care centre located in Hanamkonda region

Study criteria

Inclusion Criteria

1. Patients who are diagnosed with Myocardial infarction both Inpatients and Outpatients.
2. Participants above the age of 20 years of either gender
3. Participants who are stable and communicable
4. Participants with co-morbidities (obesity, hypertension, diabetes)

Exclusion criteria

1. Participants with age less than 20 years of age of either gender
2. Participants who are not stable and not willing to participate in the study
3. Pregnant and lactating women

Source of the data include patient case sheets, prescriptions, lab and diagnostic data, interaction with patients and caretakers. The obtained data was calculated using MS-Excel -2011.

RESULTS

A study based on prescribing patterns for myocardial infarction with associated co-morbidities was conducted for six months duration and the obtained data was analysed In this study, 200 patients with myocardial infarction were reviewed who were attending the cardiac care centre.

1. Distribution based on Age and Gender: A total of 200 patients were enrolled in the study of which 130 (65%) were male and 70 (35%) were female patients.

Table 1: Distribution of data based on Age and Gender.

Age Ranges	Males	Percentage (%)	Females	Percentage (%)2	Total (%)
30-40	7	7	1	1	4
40-50	31	31	14	14	22.50
50-60	60	60	34	34	47
60-70	16	16	14	14	15
70-80	15	15	6	6	10.50
80-90	1	1	1	1	1
Total	130	65	70	35	100

2. Distribution of data based on co-morbid conditions: From the past medical history analysis various co-morbid conditions were associated with MI. Hypertension was the most prevalent comorbidity (40.89%) followed by diabetes (27.16%). Whereas 69 (22.04%) with both hypertension & Type 2 diabetes. And the least (0.64%) were with dyslipidemia.

Table 2: Co-morbid conditions associated with MI.

Co-morbid conditions	No. of patients	Percentage %
Hypertension	128	40.89
Hypertension + diabetes	69	22.04
Hypothyroidism	3	0.96
Diabetes	85	27.16
Kidney dysfunction	26	8.31
Dyslipidemia	2	0.64

3. Distribution of patients based on social habits

Among 200 MI patients, 107 were presented with social habits (107/200%) of which 92 were alcoholics & 15 were smokers.

Table 3: Distribution of data based on social habits.

Social Habits	No. of patients	Percentage (%)
Alcohol	92	85.98
Smokers	15	14.02
Total	107	100.00

4. Distribution of data based on clinical manifestations

Out of 200 patients, 94 patients (40.52%) presented chest pain, 82 patients (35.34%) presented generalized weakness, and 25 patients (10.78%) presented shortness of breath. And the least presented symptom was sweating 3 (1.29%).

Table 4: Distribution of data based on clinical manifestations.

Clinical Manifestation	No. of patients	Percentage (%)
Chest pain	94	40.52
Weakness	82	35.34
SOB	25	10.78
Pedal edema	5	2.16
Fever	5	2.16
Cough	5	2.16
Sweating	3	1.29
Palpitations	5	2.16
Shoulder pain	4	1.72
Giddiness	4	1.72

5. Distribution of data based on different categories of drugs prescribed in MI patients

Most prescribed category of drugs were Antihypertensives (28.40%), followed by Antiplatelets (17.82%), Antidiabetic (12.31%), lipid-lowering agents (9.61%) and NSAIDs (6.59%).

Table 5: Different categories of drugs prescribed to patients.

Drug category	Percentage (%)
Antihypertensives	28.40
Antiplatelets	17.82
Lipid lowering agents	9.61
Anti-diabetic	12.31
Antibiotics	2.05
Anti-anginal	1.84
NSAID	6.59
PPI	6.16
ARNI	3.24
Nitrates	4.54
Antihistamines	2.48
Vasodilator	3.14
Anticoagulant	0.54
Anti-inflammatory	1.30

6. Distribution of data based on cardiovascular drugs prescribed to MI patients

Anti-anginal drugs like nicorandil have been prescribed to 4.95% of patients. Lipid-lowering agents like Atorvastatin were found in 12.64% of patients. ARB like telmisartan has been prescribed to 10.62% of patients. Among beta-blockers, metoprolol has been prescribed to 25.27% of patients. Diuretics like spironolactone + torsemide were found in 5.31% of patients.

Table 6: Cardiovascular drugs prescribed to MI patients.

Class of drug	Name of drug	No. of prescriptions prescribed with drug	Percentage (%)
Anti – angina	Nicorandil	27	3.74
	Isosorbide dinitrate	10	1.38
	Ranolazine	4	0.55
	Trimetazidine	11	1.52
Hypolipidemic	Rosuvastatin	20	2.8
	Atorvastatin	69	9.57
ACE inhibitors	Ramipril	33	4.57
Angiotensin receptor blockers	Telmisartan	58	8.04
	Valsartan	30	4.17
Calcium channel blocker	Clinidipine	41	5.7
Beta blockers	Metoprolol	138	19.14
	Bisoprolol	13	1.80
Diuretics	Furosemide	2	0.27
	Torsemide	25	3.46
	Chlorthalidone	4	0.55
	Spironolactone + torsemide	29	4.02
Adrenergic drugs	Noradrenaline	2	0.27
Angiotensin receptor neprilysin inhibitor	Sacubitril	30	4.16
Antiplatelet	Aspirin + clopidogrel	2	0.27
	Ticagrelor	71	9.84
	Aspirin	82	11.38
	Clopidogrel	20	2.8
Total		721	100

7. Distribution of data based on other drugs given to MI Patients

Diclofenac (6.14%) was the most commonly prescribed NSAID. Among PPI pantoprazole (18.09%) was mostly prescribed. Metformin (22.53%) and dapagliflozin (18.77%) were the most commonly prescribed hypoglycemics. And among antihistamines, Bilastine (2.05%) was most commonly prescribed.

8. WHO prescribing indicators

Table 7: Other drugs given to MI Patients.

WHO prescribing indicator	No. of drugs	Number (%)	WHO standard
Average number of drugs per encounter	4.08	4.08	1.6- 1.8
Percentage of encounters with an antibiotic prescribed	03	1.5	20-26.8
Percentage of drugs prescribed in generic name	15	1.3	100
Percentage of encounters with an injection prescribed	06	3	13.4-24.1
percentage of drugs from EDL	636	53.26	100

DISCUSSION

A prospective observational study on prescribing patterns in MI patients was conducted. A total of 200 patients were reviewed during 6 months study period, it was observed that MI was prevalent among males (65%) and the most affected age group among male patients was 50 to 60 years accounting for 60 males. The results were in accordance to a study conducted by Deshmukh S et al., 2017 where males were mostly affected with similar age group. Hypertension was the most commonly associated comorbidity in MI in the study which is around 44.91%. The results were similar to studies conducted by Stephen T. Vernon et al., 2019; George J et al., 2013; Prabhakaran D et al., 2008. Among 200 MI patients, 107 patients were with social habits such as alcohol consumption & smoking. Alcohol was the most presented social habit (85.98%) followed by smoking (14.02%). This indicate that presence of social habit can decrease the risk of MI. Similar risks were seen in study conducted by Ramesh P et al., 2015.

In this study, the major clinical manifestation presented among patients was chest pain (40%), weakness (35.34%), SOB (25%). The study results were similar to study conducted by Gadappa et al., 2024. This indicated that most of patients have presented standard clinical symptoms of MI. Prescribing patterns in MI has a major role in

controlling of MI and its associated events and further complications. In this study, 14 various category drugs were prescribed among the MI patient prescriptions. The major drug categories prescribed were Antihypertensives (28.4%), Antiplatelets (17%) & Anti-diabetic agents (12%) that reflect the treatment of major contributing factor for MI in the study, whereas in study conducted by Ian A Scott et al., 2003; Venu Menon et al., 2006; F Venturini et al., 1995. The most prescribed drug category was Antihypertensives.

In this study, among Antihypertensives, Betablockers is prescribed in 138 prescriptions followed by ARBs that were present in 88 prescriptions. Metoprolol was the most commonly prescribed Beta blocker and Telmisartan was most commonly prescribed ARB. Metformin (66 prescriptions) and Dapagliflozin (55 prescriptions) were most commonly prescribed Antidiabetic drugs. Aspirin & ticagrelor was the mostly prescribed Antiplatelet drugs encanted in 84 prescriptions & 71 prescriptions respectively. NSAIDs and opioids analgesics were other drug categories prescribed mostly followed by Anti-ulcer drugs where as in a study conducted by Chandana N et al., 2019 the most commonly prescribed category was Anticoagulants and most commonly prescribed drug was metoprolol.

The average number of drugs per prescription encounter was 4.08% which was justifiable even though it is more than WHO standard (1.6-4.8), as they were prescribed for cardiovascular emergency (Myocardial infarction). This cannot be considered as poly pharmacy as there is need for empirical therapy till diagnosis becomes clearer and for management of life-threatening conditions.

Prescribing drugs under generic names increases patient compliance, minimizes drug costs and the chance of duplication is avoided. The percentage of drugs prescribed by generic names was about 5.1%. According to WHO standard, the percentage of antibiotics prescribed was 1.5%. The WHO recommended value is (20-26.8) that is less than 30%.

The percentage of encounters with an injection prescribed was 3%; this is lower than the WHO standard value (13.4-24.1). This is justifiable in case of drugs which is need immediate action. The drugs like low molecular heparin, insulin etc should be given by injectable routes in emergency situations. In the present study, these drugs were used for immediate action and to save patients from life-threatening conditions. Prescribing from the essential drug list means rational prescribing. The present study revealed that the percentage of drugs prescribed from the essential drug list was found to be 53.26%.

CONCLUSION

In this study, MI was mostly prevalent among male patients who were hypertensive and associated social habits. Hence the most prescribed drugs were Antihypertensives, Beta blockers along with antiplatelet treatment were mostly prescribed in the prescriptions were known to control MI effectively. The no. of drugs per prescription was relatively higher. This may be due to their associated comorbidities.

CONFLICT OF INTEREST

The authors have no conflicts of interest regarding this investigation**.**

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