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Prescribing pattern in coronary artery disease of Indian railway hospital

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ABSTRACT

The objective of this study was to assess the prescribing pattern in coronary artery disease of Indian railway hospital. The prospective, interventional and follow up study was conducted in inpatient department of cardiology. Coronary artery disease patients were enrolled into the study by considering inclusion and exclusion criteria. Details of demography, treatment and other medical details were captured in patient data collection form at baseline. Medication knowledge of the patient was assessed using medication knowledge assessment questionnaire assessment questionnaire at baseline after which the patient was counselled systematically. Medication knowledge of the patient were reassessed at first follow up and second follow up followed by counselling by pharmacist. Pattern of different drugs prescribed in coronary artery disease were analyzed. 150 patients were enrolled in the study of which 78 (52%) were male patients and 72 (48%) were female patients. The male to female ratio among the patients was 3:2. The incidence of CAD was more common in male compared to female. Among 150 prescriptions analyzed anti-platelet drugs were prescribed in 149 (99.3%) patients. Out of these (n=149), a fixed dose combination (75 mg) of aspirin and clopidogrel was found to be used in 145 (96.66%) and aspirin (150 mg) and clopidogrel (75 mg) singly were used in 130 (87.24%) of the patients. Aspirin alone was used in very few patients 11 (7.38%) and in least no. of patients 9(6.04%) clopidogrel alone was used. The most commonly prescribed drug classes in coronary artery disease were antiplatelet drugs followed by antihyperlipidemics and antibiotics. This was followed by anti-anginal drugs, antihypertensives and anticoagulants. Polypharmacy (9.68 drugs per prescription) was noticed. Very few drugs were prescribed by generic name. The prescribing pattern could be improved by reducing the number of drugs per prescription and by prescribing generic drugs to reduce the economic burden of the patients.

Keywords: Antihyperlipidemics, Antiplatelet drugs, Coronary artery disease, Prescription pattern, Hypertension

INTRODUCTION

Coronary artery disease (CAD) are a group of disorders of the heart and blood vessels which include coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolism. CADs are the leading non-communicable diseases and also leading cause of death and disability in the world [21]. More people die annually from CADs than from any other cause [22]. An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths. Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke [11-13]. By 2030, almost 23.6 million people will die from CADs, mainly from heart disease and stroke. These are projected to remain the single leading causes of death [1-5].

Coronary artery disease (CAD) is mainly due to atherosclerosis (plaque in artery walls) of the inner lining of the blood vessels that supply blood to the heart [23]. CAD begins when hard cholesterol substances (plaques) are deposited within a coronary artery [16-20]. The plaques narrow the internal diameter of the arteries which may cause a tiny clot to form, which can obstruct the flow of blood to the heart muscle. This reduces the supply of oxygen and nutrients to the heart muscles, which is essential for proper functioning of heart [6-10].

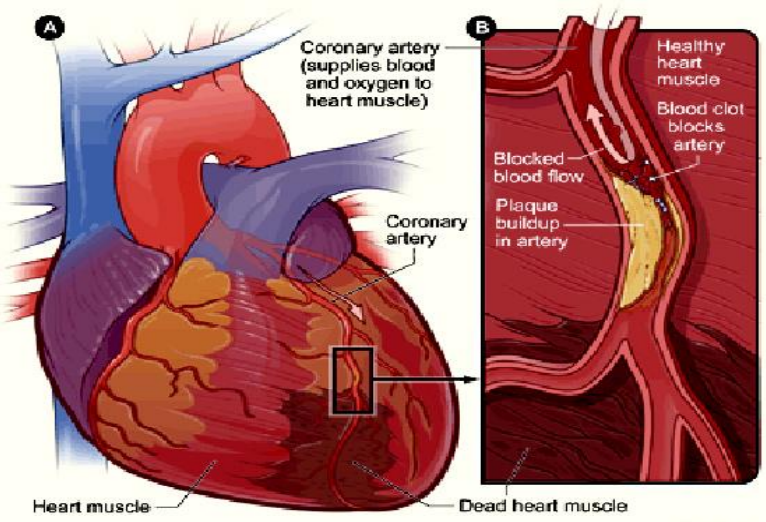

Figure: 1. Coronary artery disease

This may eventually result in a portion of heart being suddenly deprived of its blood leading to death of that area of heart tissue resulting in a chest pain or heart attack.

Definition

Coronary artery disease is the Impedance or blockage of one or more arteries that supply blood to the heart, usually due to atherosclerosis hardening of the arteries.

Epidemiology

Coronary artery disease as of 2010 was the leading cause of death globally resulting in over 7 million deaths. This is up from 5.2 million deaths in 1990. It may affect individuals at any age but becomes dramatically more common at progressively older ages, with approximately a tripling with each decade of life. Males are affected more often than females.

It is estimated that 60% of the world's cardiovascular disease burden will occur in the South Asian subcontinent despite only accounting for 20% of the world's population. This may be secondary to a combination of genetic predisposition and environmental factors. Organizations such as the Indian Heart Association are working with the World Heart Federation to raise awareness about this issue.

Coronary heart disease (CHD) is the leading cause of death for both men and women and accounts for approximately 600,000 deaths in the United States every year.

CAUSES AND RISK FACTORS OF CAD

Causes

Coronary artery disease is thought to begin with damage or injury to the inner layer of a coronary artery, sometimes as early as childhood. The damage may be caused by various factors, including:

- Smoking
- High blood pressure
- High cholesterol
- Diabetes or insulin resistance
- Sedentary lifestyle

Once the inner wall of an artery is damaged, fatty deposits (plaque) made of cholesterol and other cellular waste products tend to accumulate at the site of injury in a process called atherosclerosis. If the surface of the plaque breaks or ruptures, blood cells called platelets will clump at the site to try to repair the artery. This clump can block the artery, leading to a heart attack.

Risk factors

Risk factors for coronary artery disease include:

Age

Simply getting older increases your risk of damaged and narrowed arteries.

Sex

Men are generally at greater risk of coronary artery disease. However, the risk for women increases after menopause.

Family history

A family history of heart disease is associated with a higher risk of coronary artery disease, especially if a close relative developed heart disease at an early age. Your risk is highest if your father or a brother was diagnosed with heart disease before age 55 or if your mother or a sister developed it before age 65.

Smoking

People who smoke have a significantly increased risk of heart disease. Exposing others to your secondhand smoke also increases their risk of coronary artery disease.

High blood pressure

Uncontrolled high blood pressure can result in hardening and thickening of your arteries, narrowing the channel through which blood can flow.

High blood cholesterol levels

High levels of cholesterol in your blood can increase the risk of formation of plaques and atherosclerosis. High cholesterol can be caused by a high level of low-density lipoprotein (LDL), known as the "bad" cholesterol. A low level of high-density lipoprotein (HDL), known as the "good" cholesterol, can be a sign of atherosclerosis.

Diabetes

Diabetes is associated with an increased risk of coronary artery disease. Type 2 diabetes and coronary artery disease share similar risk factors, such as obesity and high blood pressure.

Overweight or obesity

Excess weight typically worsens other risk factors.

Physical inactivity

Lack of exercise also is associated with coronary artery disease and some of its risk factors, as well.

High stress

Unrelieved stress in your life may damage your arteries as well as worsen other risk factors for coronary artery disease.

Sleep apnea

This disorder causes you to repeatedly stop and start breathing while you're sleeping. Sudden drops in blood oxygen levels that occur during sleep apnea increase blood pressure and strain the cardiovascular system, possibly leading to coronary artery disease.

High sensitivity C-reactive protein

High sensitivity C-reactive protein (hs-CRP) is a normal protein that appears in higher amounts when there's inflammation somewhere in your body. High hs-CRP levels may be a risk factor for heart disease. It's thought that as coronary arteries narrow, you'll have more hs-CRP in your blood.

High triglycerides

This is a type of fat (lipid) in your blood. High levels may raise the risk of coronary artery disease, especially for women.

Homocysteine

Homocysteine is an amino acid your body uses to make protein and to build and maintain tissue. But high levels of homocysteine may increase your risk of coronary artery disease.

Risk factors not linked to obesity, high cholesterol, hypertension, etc:

C-reactive protein (CRP)

Research has indicated that CRP concentration is associated with future risk of a wide range of common diseases, including: heart attack, stroke, deaths from various cancers, chronic lung disease, injuries, and other conditions. CRP is produced by the liver in response to injury or infection. Muscle cells within coronary arteries also produce CRP. However, this study suggests that the causality seems unlikely.

Fibrinogen

A blood protein which is involved in the blood clotting process. Excess levels may encourage the clumping of platelets, resulting in the formation of clots.

Lipoprotein (a)

May undermine the body's ability to dissolve blood clots. Lipoprotein (a) forms when an LDL particle attaches to a specific protein.

SINGS AND SYMPTOMS OF CAD

A common symptom of coronary artery disease (CAD) is angina. Angina is chest pain or discomfort that occurs if an area of heart muscle doesn't get enough oxygen-rich blood.

Angina may feel like pressure or squeezing in chest. Also feel it in shoulders, arms, neck, jaw, or back. Angina pain may even feel like indigestion. The pain tends to get worse with activity and go away with rest. Emotional stress also can trigger the pain.

Another common symptom of CAD is shortness of breath. This symptom occurs if CAD causes heart failure. When heart failure, heart can't pump enough blood to meet body's needs. Fluid builds up in lungs, making it hard to breathe.

The severity of these symptoms varies. They may get more severe as the build up of plaque continues to narrow the coronary arteries.

If coronary arteries narrow, they can't supply enough oxygen-rich blood to heart especially when it's beating hard, such as during exercise. At first, the decreased blood flow may not cause any coronary artery disease symptoms. As plaque continues to build up in coronary arteries, however, may develop coronary artery disease signs and symptoms, including:

Chest pain (angina)

Feel pressure or tightness in chest, as if someone were standing on chest. This pain, referred to as angina, usually occurs on the middle or left side of the chest. Angina is generally triggered by physical or emotional stress.

The pain usually goes away within minutes after stopping the stressful activity. In some people, especially women, this pain may be fleeting or sharp and felt in the neck, arm or back.

Shortness of breath

If heart can't pump enough blood to meet body's needs, may develop shortness of breath or extreme fatigue with exertion.

Heart attack

A completely blocked coronary artery may cause a heart attack. The classic signs and symptoms of a heart attack include crushing pressure in chest and pain in shoulder or arm, sometimes with shortness of breath and sweating.

PATHOPHYSIOLOGY OF CAD

Limitation of blood flow to the heart causes ischemia (cell starvation secondary to a lack of oxygen) of the myocardial cells. Myocardial cells may die from lack of oxygen and this is called a myocardial infarction (commonly called a heart attack). It leads to heart muscle damage, heart muscle death and later myocardial scarring without heart muscle regrowth. Chronic high-grade stenosis of the coronary arteries can induce transient ischemia which leads to the induction of a ventricular arrhythmia, which may

terminate into ventricular fibrillation leading to death.

Typically, coronary artery disease occurs when part of the smooth, elastic lining inside a coronary artery (the arteries that supply blood to the heart muscle) develops atherosclerosis. With atherosclerosis, the artery's lining becomes hardened, stiffened, and swollen with calcium deposits, fatty deposits, and abnormal inflammatory cells to form a plaque. Deposits of calcium phosphates (hydroxyapatites) in the muscular layer of the blood vessels appear to play not only a significant role in stiffening arteries but also for the induction of an early phase of coronary arteriosclerosis.

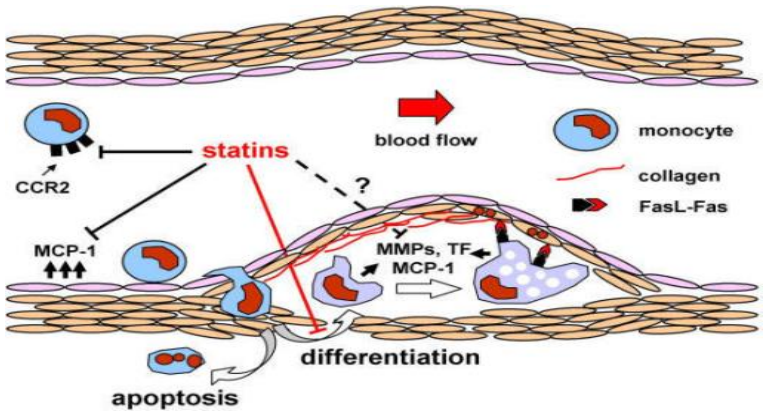

Figure 2. Pathophysiology of CAD

This can be seen in a so-called metastatic mechanism of calciphylaxis as it occurs in chronic kidney disease and haemodialysis. Although these patients suffer from a kidney dysfunction, almost fifty percent of them die due to coronary artery disease. Plaques can be thought of as large "pimples" that protrude into the channel of an artery, causing a partial obstruction to blood flow.

Most commonly involved locations

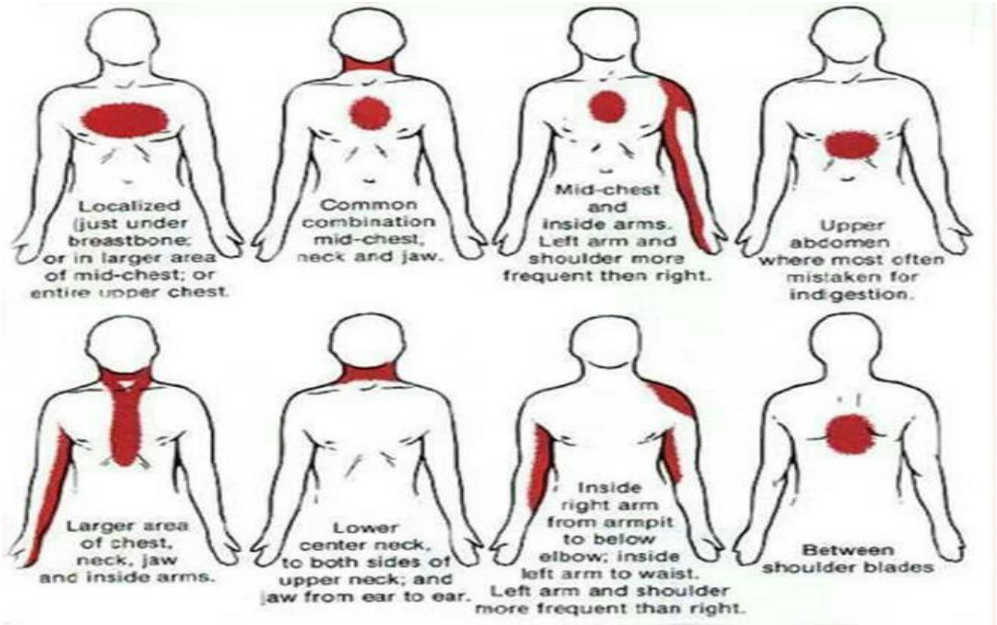

Figure 3. Commonly involved locations in CAD

DIAGNOSIS OF CAD

For symptomatic patients, stress echocardiography can be used to make a diagnosis for obstructive coronary artery disease. The use of echocardiography,

Stress cardiac imaging, and/or advanced non-invasive imaging is not recommended on individuals who are exhibiting no symptoms and are otherwise at low risk for developing coronary disease.

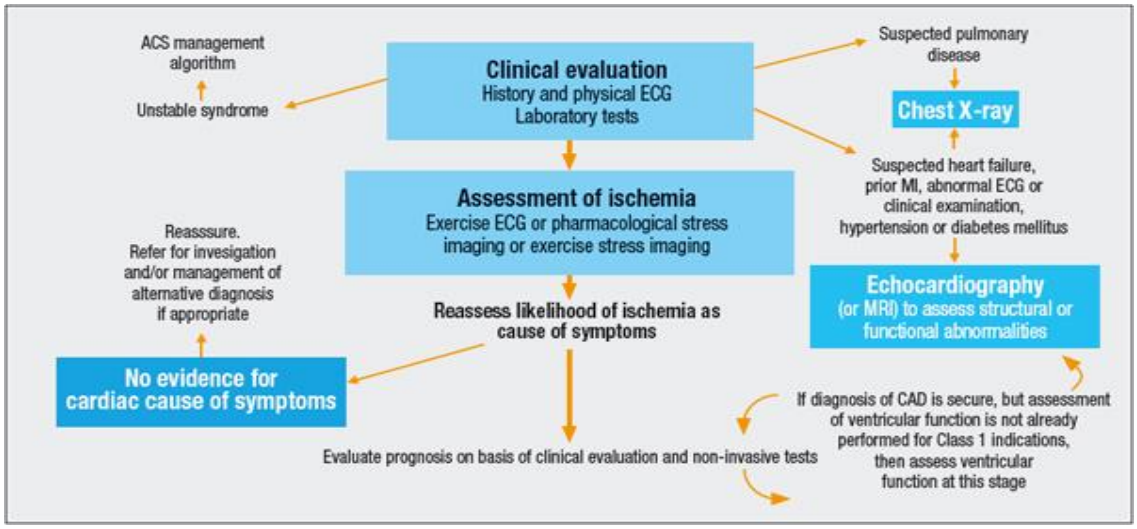

Figure 4. Diagnosis of CAD

CAD has always been a tough disease to diagnose without the use of invasive or stressful activities. The development of the Multifunction Cardiogram (MCG) has changed the way CAD is diagnosed. The MCG consists of a 2 lead resting EKG signal which is transformed into a mathematical model and compared against tens of thousands of clinical trials to diagnose a patient with an objective severity score, as well as secondary and tertiary results about the patient's condition.

The results from MCG tests have been validated in 8 clinical trials. Which resulted in a database of over 50,000 patients where the system has demonstrated accuracy comparable to coronary angiography 90% overall sensitivity, 85% specificity.

This level of accuracy comes from the application of advanced techniques in signal processing and systems analysis combined with a large scale clinical

Database which allows MCG to provide quantitative, evidence-based results to assist physicians in reaching a diagnosis. The MCG has also been awarded a Category III CPT code by the American Medical Association in the July 2009 CPT update.

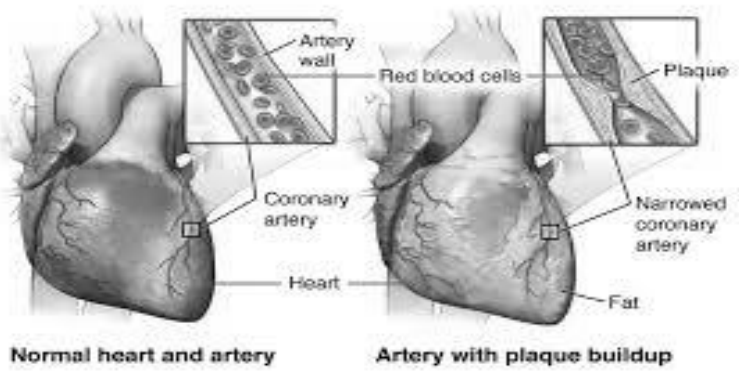

Figure 5. Difference between normal and effected heart

The diagnosis of "Cardiac Syndrome X" - the rare coronary artery disease that is more common in women, as mentioned, an "exclusion" diagnosis. Therefore, usually the same tests are used as in any patient with the suspicion of coronary artery disease:

Electrocardiogram (ECG)

An electrocardiogram records electrical signals as they travel through heart. An ECG can often reveal evidence of a previous heart attack or one that's in progress.

Echocardiogram

An echocardiogram uses sound waves to produce images of heart. During an echocardiogram, and can determine whether all parts of the heart wall are contributing normally to heart's pumping activity.

Parts that move weakly may have been damaged during a heart attack or be receiving too little oxygen. This may indicate coronary artery disease or various other conditions.

Stress test

If signs and symptoms occur most often during exercise, walk on a treadmill or ride a stationary bike during an ECG. This is known as an exercise stress test. In some cases, medication to stimulate heart may be used instead of exercise.

Another stress test known as a nuclear stress test helps measure blood flow to heart muscle at rest and during stress. It's similar to a routine exercise stress test but with images in addition to an ECG. A tracer is injected into bloodstream, and special cameras can detect areas in heart that receive less blood flow.

Cardiac catheterization or angiogram

To view blood flow through heart, doctor may inject a special dye into coronary arteries. This is known as an angiogram. The dye is injected into the arteries of the heart through a long, thin, flexible tube (catheter) that is threaded through an artery, usually in the leg, to the arteries in the heart.

Heart scan

Computerized tomography (CT) technologies can help to see calcium deposits in arteries that can narrow the arteries. A CT coronary angiogram, in which receive a contrast dye injected intravenously during a CT scan, also can generate images of heart arteries. The diagnosis of coronary disease underlying particular symptoms depends largely on the nature of the symptoms. The first investigation is an electrocardiogram (ECG/EKG), both for "stable" angina and acute coronary syndrome. An X-ray of the chest and blood tests may be performed.

Table 1.Criteria of diagnosis in CAD

	Diagnosis of CAD	
	Sensitivity (%)	Specificity (%)
Exercise ECG [a, 91, 94, 95]	45–50	85–90
Exercise stress echocardiography[96]	80–85	80–88
Exercise stress SPECT[96-99]	73–92	63–87
Dobutamine stress echocardiography[96]	79–83	82–86
Dobutamine stress MRI[b,100]	79–88	81–91
Vasodilator stress echocardiography[96]	72–79	92–95
Vasodilator stress SPECT[96, 99]	90–91	75–84
Vasodilator stress MRI[b,98, 100-102]	67–94	61–85
Coronary CTA[c,103-105]	95–99	64–83
Vasodilator stress PET[97, 99, 106]	81–97	74–91

TREATEMENT OF CORONARY ARTERY DISEASE

Non-pharmacological treatment

- Compliance -- give careful advice about disease, treatment, and self-help strategies
- Diet -- ensure adequate general nutrition and, in obese patients, weight reduction
- Salt -- advise patients to avoid high salt content foods and not to add salt (particularly in severe cases of congestive heart failure)
- Fluid -- urge overloaded patients and those with severe congestive heart failure to restrict their fluid intake
- Alcohol -- advise moderate alcohol consumption (abstinence in alcohol related cardiomyopathy)
- Smoking -- avoid smoking (adverse effects on coronary disease, adverse haemodynamic effects)
- Exercise -- regular exercise should be encouraged
- Vaccination -- patients should consider influenza and pneumococcal vaccinations.

Table No: 2 Guidelines for selecting the most appropriate First –line drugs for coronary artery disease

Class of drugs	Definite indications	Possible indications	Definite contraindications	Relative contraindications
Diuretics	Heart failure elderly patients systolic HTN	Diabetes	Gout	Dyslipidemia
Beta blockers	Angina post –MI tachyarrythmia heart failure	Pregnancy diabetes	Heart block	Dyslipidemia physically active asthma COPD
CCBs	Metabolic syndrome angina elderly systolic HTN diabetes	Peripheral vascular disease CVA	Heart block	Congestive heart failure
ACEIs	Metabolic syndrome heart failure LVH post MI proteinuria diabetes	CVA	Pregnancy and lactation hyperkalemia	Moderate renal failure
ARBs	Metabolic syndrome T2DM LVS ACEI induced cough	Heart failure CVA	Pregnancy and lactation hyperkalemia	Moderate renal failure

Table No: 3 Guidelines for selecting the most appropriate second line drugs for coronary artery disease

Class	Drug	Dosage (mg/day)	Dosing frequency / day
Diuretics	Hydrochlorothiazide	6.25 – 12.5	1 – 2
	Chlorthalidone	6.25- 12.5	1
	Indapamide	1.5 – 2.5	1
	Amiloride	5 -10	1 – 2
	Triamterene	50 – 100	1 – 2
	Spironolactone	25 – 50	1 – 2
Beta blockers	Metoprolol	25 – 100	1 – 2
	Bisoprolol	1.5 – 10	1
	Nebivolol	2.5 – 5	1
CCBs	Amlodipine	2.5 – 20	1
	Clinidipine	5 – 10	1
	Diltiazem	90 – 360	1
	Nifedipine (long acting)	10 – 40	1
	Verapamil	80 – 240	1 – 2
ACEIs	Enalapril	2.5 – 20	1 – 2
	Lisinopril	2.5 – 20	1

	Ramipril	1.25 – 10	1 – 2
	Perindopril	2 – 8	1 – 2
	Quinapril	10 – 80	1 – 2
ARBs	Valsartan	40 – 160	1
	Irbesartan	150 – 300	1
	Telmisartan	40 – 160	1
	Olmesartan	20 – 40	1
Centrally acting	Clonidine	0.1 – 0.3	2
	Methyldopa	500 – 1500	2
	Moxonidine	0.2 – 0.4	1 – 2
Vasodilators	Hydralazine	25 – 100	2
	Minoxidil	2.5 – 5	1 – 2

Pharmacological treatment

Table 4. Pharmacological treatment of CAD

Class of drug	Drug	Daily dosage
ACEI (Angiotensin converting enzyme inhibitors)	Captopril Enalapril	*initial dose 6.25 to 12.5 mg three times daily, increasing to 25–50 mg three times daily* *initial dose 2.5–5.0 mg twice daily, increasing to 10–20 mg twice daily*
CCBs (Calcium Channel Blockers)	Nifedipine (sustained release formulations)	*Starting at 30 mg increasing to 120 mg once daily*
Thiazide diuretics	Hydrochlorothiazide Bendrofluazide	*Starting at 12.5 mg increasing to 25 mg once daily* *2.5 mg as a single daily dose.*
Beta-blockers	Propranolol Atenolol Metoprolol	*80 mg twice daily* *Starting at 50 mg to 100mg once daily* 50–100 mg twice daily
Lipid lowering therapy	Simvastatin,	*Initial dose 10 mg once at night, increasing to 40 mg once at night*
Antiplatelet therapy	Aspirin	*Starting at 75-100 mg daily*
Hypoglycemic drugs	Glibenclamide Metformin	*Starting at 2.5 mg increasing to 5 mg twice daily before meals* *Starting at 0.5 g increasing to 1.0 g three times daily*

Medications for the Treatment of Stable Coronary Artery Disease

Table 5. Medications for the Treatment of Stable Coronary Artery Disease

Medication/Medication class	***Use***	**Comments**
Antihypertensive agents ACE inhibitors	Patients with hypertension, diabetes mellitus, chronic kidney disease, or left ventricular dysfunction.	Decrease mortality.
Angiotensin receptor blockers	All patients with hypertension, diabetes, chronic kidney disease, or left ventricular dysfunction, and in whom ACE inhibitors are not tolerated.	No additional benefit compared with ACE inhibitors; may be considered in combination with ACE inhibitors for heart failure with left ventricular dysfunction.
Beta blockers	All patients with history of MI, acute coronary syndrome, or left ventricular dysfunction, unless contraindicated.	Decrease mortality; avoid $beta_2$ selective agents and agents with intrinsic sympathomimetic properties
Calcium channel blockers	Patients in whom beta blockers are not tolerated	Avoid short-acting nifedipine (Procardia)
Nitrates	Patients with anginal symptoms despite use of beta blockers or calcium channel blockers	Evidence lacking on mortality benefit
Antiplatelet agents Aspirin Clopidogrel (Plavix)	patients (75 to 162 mg per day), unless contraindicated[3] Patients in whom aspirin is contraindicated or not tolerated	Decreases nonfatal MI, strokes, vascular deaths Approved for acute coronary syndrome, recent MI, stroke, peripheral arterial disease, or coronary stent placement
Lipid-lowering agents Ezetimibe (Zetia)	Patients who have not achieved LDL goal despite statin therapy or who are intolerant of statins	Evidence lacking on mortality benefit
Fibrates	Patients with triglycerides of 200 to 499 mg per dL (2.26 to 5.64 mmol per L) and non-HDL > 130 mg per dL (3.37 mmol per L) triglycerides ≥ 500 mg per dL (5.65 mmol per L)	Reduction to non-HDL < 100 mg per dL (2.59 mmol per L) reasonable; treat if triglycerides ≥ 500 mg per dL to prevent pancreatitis
Fibrates	Patients with triglycerides of 200 to 499 mg per dL (2.26 to 5.64 mmol per L) and non-HDL > 130 mg per dL (3.37 mmol per L) triglycerides ≥ 500 mg per dL (5.65 mmol per L)	Reduction to non-HDL < 100 mg per dL (2.59 mmol per L) reasonable; treat if triglycerides ≥ 500 mg per dL to prevent pancreatitis
Nicotinic acid	Same as for fibrates; triglycerides of 200 to 499 mg per dL and non-HDL > 130 mg per dL; triglycerides ≥ 500 mg per dL	Same as for fibrates; reduction to non-HDL < 100 mg per dL reasonable; treat if triglycerides ≥ 500 mg per dL to prevent pancreatitis
Statins	Patients with a baseline LDL ≤ 100 mg per dL	Initiate with lifestyle measures; reduction to LDL < 70 mg per dL (1.81 mmol per L) or high-dose statin therapy reasonable

Note: Non-HDL = total cholesterol minus HDL cholesterol.

ACE = angiotensin-converting enzyme; HDL = high-density lipoprotein; LDL = low-density lipoprotein; MI = myocardial infarction.

DRUGS

Medications to Suppress Platelet Activity

Aspirin

Low doses (typically 75 to 81 mg/day) are sufficient to irreversibly acetylate serine 530 of cyclooxygenase (COX)-1. This effect inhibits platelet generation of thromboxane A2, resulting in an antithrombotic effect

Clopidogrel

Is an inhibitor of platelet activation and aggregation through the irreversible binding of its active metabolite to the P2Y12 class of ADP receptors on platelets.

Eptafibitide

Is a highly specific GP IIb/IIIa receptor antagonist that competes with fibrinogen, vWF and other adhesive ligands for the binding site on GP IIb/IIIa, thereby preventing their ability to bind to the activated platelet.

Heparin

It produces its major anticoagulant effect by inactivating thrombin and activated factor X (factor Xa) through an antithrombin (AT)-dependent mechanism

Ticlopidine

Is a thienopyridine which, when metabolized by the body, irreversibly blocks the ADP receptor on the surface of platelets. Without ADP, fibrinogen does not bind to the platelet surface, preventing platelets from sticking to each other.

Medications to Reduce Cholesterol

Bile acid sequestrants

Cholestyramine

Is a bile acid sequestrant, which binds bile in the gastrointestinal tract to prevent its reabsorption.

Colesevelam

Hydrochloride is a non-absorbed, lipid-lowering polymer that binds bile acids in the intestine, impeding their reabsorption.

Colestipol

Hydrochloride is a non-absorbed, lipid-lowering polymer that binds bile acids in the intestine, impeding their reabsorption. As the bile acid pool becomes depleted, the hepatic enzyme, cholesterol 7-(alpha)-hydroxylase, is upregulated, which increases the conversion of cholesterol to bile acids.

Clofibrate

Is used to lower cholesterol and triglyceride (fat-like substances) levels in the blood. This may help prevent medical problems caused by such substances clogging the blood vessels.

Fenofibrate

Is a triglyceride rich particles and reduced secretion of VLDL underlie the hypotriglyceridemic effect of fibrates.

Gemfibrozil

Is a potent lipid regulating drug whose major effects are to increase plasma high density lipoproteins (HDL) and to decrease plasma triglycerides (TG) in a wide variety of primary and secondary dyslipoproteinemias

Statins

Atorvastatin

Is a selective, competitive inhibitor of HMG-CoA reductase, the rate-limiting enzyme that converts 3-hydroxy-3methylglutaryl-coenzyme A to mevalonate a precursor of sterols, including cholesterol.

Fluvastatin

Selectively and competitively inhibits the hepatic enzyme hydroxymethylglutaryl-coenzyme A (HMG-CoA) reductase.

Lovastatin

Is a lactone metabolite isolated from the fungus Aspergillus terreus with cholesterol-lowering and potential antineoplastic activities.

Pravastatin

Is a reversible inhibitor of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, the enzyme that catalyzes the conversion of HMG-CoA to mevalonate, and reduces VLDL and TG and increases HDL-C.

Rosuvastatin

Is a selective and competitive inhibitor of HMG-CoA reductase, the rate-limiting enzyme that converts 3-hydroxy-3-methylglutaryl coenzyme A to mevalonate, a precursor of cholesterol.

Simvastatin

Competitively inhibiting HMG-CoA reductase.

BETA BLOCKERS

Atenolol

Is a beta-adrenergic blocking agent

Carvedilol

Is both a non-selective beta adrenergic receptor blocker (β1, β2) and an alpha adrenergic receptor blocker (α1). The S (-) enantiomer accounts for the beta blocking activity.

Metoprolol

Competes with adrenergic neurotransmitters such as catecholamines for binding at beta (1)-adrenergic receptors in the heart. Beta(1)-receptor blockade results in a decrease in heart rate, cardiac output, and blood pressure.

Nadonol

Is a non-selective beta blocker; that is, it non-selectively blocks both beta-1 and beta-2 receptors. It has a preference for beta-1 receptors, which are predominantly located in the heart, thereby inhibiting the effects of catecholamines and causing a decrease in heart rate and blood pressure.

Propranolol

Is a non-selective beta blocker; that is, it blocks the action of epinephrine (adrenaline) and norepinephrine (noradrenalin) at both β1- and β2-adrenergic receptors. It has little intrinsic sympathomimetic activity, but has strong membrane stabilizing activity (only at high blood concentrations, e.g. overdose). Propranolol is able to cross the blood-brain-barrier and exert effects in the central nervous system in addition to its peripheral activity.

Timolol

Is a beta1 and beta2 (non-selective) adrenergic receptor blocking agent that does not have significant intrinsic sympathomimetic, direct myocardial depressant, or local anaesthetic (membrane-stabilizing) activity.

CALCIUM CHANNEL BLOCKERS

Amlodipine

Is a dihydropyridine calcium antagonist calcium ion antagonist or slow-channel blocker that inhibits the transmembrane influx of calcium ions into vascular smooth muscle and cardiac muscle.

Felodipine

Is specific cellular action of selectively inhibiting transmembrane influx of calcium ions into cardiac muscle and vascular smooth muscle.

Isradipine

Is a dihydropyridine calcium channel blocker. It binds to calcium channels with high affinity and specificity and inhibits calcium flux into cardiac and smooth muscle.

Nicardipine

Is a calcium ion influx inhibitor slow channel blocker or calcium channel blocker. It inhibits calcium ions from entering cardiac and vascular smooth muscle cells.

Nifedipine

Is vasodilatory effects involves pH-dependent inhibition of calcium influx via inhibition of smooth muscle carbonic anhydrase.

Nimodipine

Is a calcium channel blocker. The contractile processes of smooth muscle cells are dependent upon calcium ions, which enter these cells during depolarization as slow ionic transmembrane currents.

ACE Inhibitors and arbs

Benazepril

Inhibit angiotensin-converting enzyme (ACE). ACE is a peptidyl dipeptidase that catalyzes the

conversion of angiotensin I to the vasoconstrictor substance, angiotensin II.

Captopril

Angiotensin converting enzyme (ACE) inhibitors. ACE inhibitors are used for treating high blood pressure, heart failure, and for preventing kidney failure due to high blood pressure and diabetes.

Enalapril

Inhibits angiotensin-converting enzyme (ACE). ACE is a peptidyl dipeptidase that catalyzes the conversion of angiotensin I to the vasoconstrictor substance, angiotensin II.

Fosinopril

Is hydrolyzed by esterases to the pharmacologically active form, fosinoprilat, a specific competitive inhibitor angiotensin-converting enzyme (ACE).

Lisinopril

Is a peptidyl dipeptidase that catalyzes the conversion of angiotensin I to the vasoconstrictor substance, angiotensin II. Angiotensin II also stimulates aldosterone secretion by the adrenal cortex.

Moexipril

Moexiprilat lowers blood pressure is believed to be primarily inhibition of ACE activity.

Perindopril

Is a pro-drug for perindoprilat, which inhibits ACE. Perindoprilat lowers blood pressure is believed to be primarily inhibition of ACE activity.

Quinapril

Inhibits angiotensin converting enzyme, an enzyme which catalyses the formation of angiotensin II from its precursor, angiotensin I. Angiotensin II is a powerful vasoconstrictor and increases blood pressure through a variety of mechanisms.

Ramipril

Is a ramiprilat inhibit ACE. Angiotensin converting enzyme is a peptidyl dipeptidase that catalyzes the conversion of angiotensin I to the vasoconstrictor substance, angiotensin II. Angiotensin II also stimulates aldosterone secretion by the adrenal cortex.

Trandolapril

Is a non-sulfhydryl angiotensin-converting enzyme (ACE) inhibitor with antihypertensive activity. As a prodrug, trandolapril is converted by de-esterification in the liver into its active form trandolaprilat.

Irbesartan

Is a angiotensin receptor blockers (ARBs) which also includes valsartan, losartan, and candesartan.

Losartan

Is a longer acting metabolite, E-3174, lower blood pressure by antagonizing the renin-angiotensin-aldosterone system (RAAS); they compete with angiotensin II for binding to the type-1 angiotensin II receptor (AT1) subtype and prevents the blood pressure increasing effects of angiotensin II.

Telmisartan

Blocks the vasoconstrictor and aldosterone-secreting effects of angiotensin II by selectively blocking the binding of angiotensin II to the AT1 receptor in many tissues, such as vascular smooth muscle and the adrenal gland. Its action is therefore independent of the pathways for angiotensin II synthesis.

Valsartan

Blocks the vasoconstrictor and aldosterone-secreting effects of angiotensin II by selectively blocking the binding of angiotensin II to the AT1 receptor in many tissues, such as vascular smooth muscle and the adrenal gland.

Surgical treatment

Treatment for patients with stable coronary artery disease is medical therapy and lifestyle modification. In some cases, however, surgery to increase blood flow to ischemic areas can be added to the treatment program to improve a patient's heart function.

In general, coronary revascularization should be considered for patients who still have debilitating angina after optimal medical therapy. The two

types of coronary revascularization procedures are percutaneous coronary interventions (PCI) and coronary artery bypass grafts (CABG).

- **PCI** is usually indicated for patients with significant narrowing of one, two, or—at most—three major coronary arteries when the left ventricle is functioning normally.
- **CABG** is indicated for patients with more than two arterial constrictions, with weakened left ventricles, or with diabetes.

PERCUTANEOUS CORONARY INTERVENTION (PCI)

PCI, also commonly known as coronary angioplasty or simply angioplasty, is used to unclog blocked coronary arteries. If PCI is recommended, the patient may be transferred to an interventional radiology suite, where the procedure takes place. The procedure involves threading a catheter into the constricted region of an artery and expanding a balloon to flatten the plaque back against the walls of the artery. Usually, a wire mesh support called a stent is left in the region to hold the artery open. Some stents are coated with medications that are slowly and continuously released into the artery. These are called drug-eluting stents. The drugs help prevent the artery from becoming blocked with scar tissue that can form in the artery. Typically, the PCI catheter is inserted under local anaesthesia using X-ray fluoroscopy.

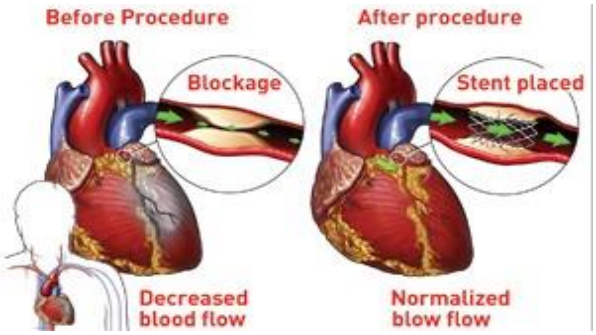

Figure 6. Percutaneous coronary intervention

The PCI catheter is threaded through the femoral artery into the heart to the area where the coronary artery is narrowed. The procedure can take between 30 minutes and 2 hours. PCI gives a sufficient increase in blood flow to initially reduce angina in >95% of cases. Approximately one fifth of treated arteries narrow again within 6 months, and angina returns within 6 months in about 1 of 10 patients. In-stent restenosis (narrowing) is a continued concern with coronary angioplasty. Recent studies have shown that using drug-eluting balloon angioplasty to reopen a blocked stent is a promising treatment option in this situation.

CORONARY ARTERY BYPASS GRAFT (CABG)

Coronary artery bypass surgery is the most common open-heart operation performed in the United States, with over 500,000 procedures performed each year. CABG may be contraindicated in elderly patients and in patients with end-stage kidney disease, lung disease, and peripheral vascular disease, as these patients are at higher risk for complications. The procedure involves attaching an unclogged blood vessel to a blocked coronary artery beyond the obstruction. One or both internal thoracic (also called internal mammary) arteries can be rerouted or a piece of the saphenous vein or the radial artery can be made into a conduit. The surgery is done under general anaesthesia and takes between 3 to 6 hours. Usually, the procedure is done by temporarily stopping the heart and oxygenating the blood with a cardiopulmonary bypass machine. When patients have no other serious disease, there is <1 % mortality from a first-time CABG surgery.

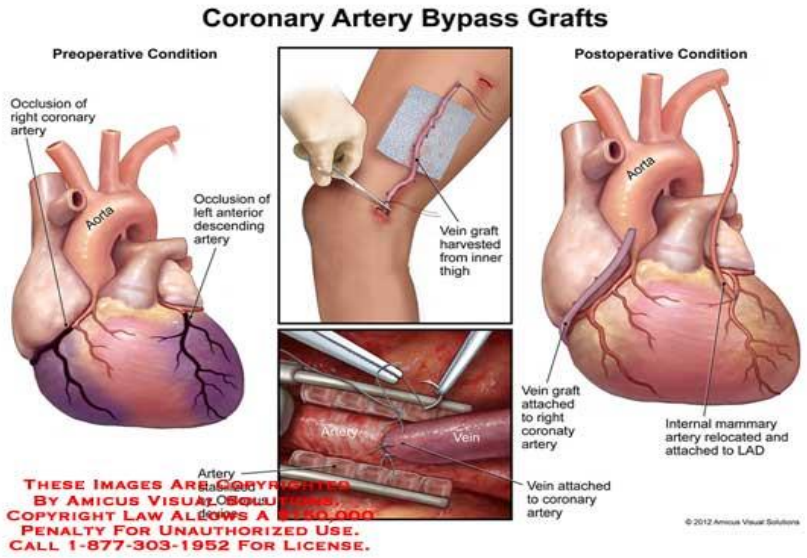

Figure 7. Coronary artery bypass grafting

There are two main types of bypass surgery: conventional (arrested heart) and "beating heart" CABG.

Conventional CABG

Conventional (or "on pump") CABG is performed on an arrested (stopped) heart through an incision down the middle of the patient's chest. The patient's heart is stopped with medications, and blood is routed to a heart-lung bypass machine, which CO2 and supplies oxygen, thus bypassing the processes carried out by the heart and lungs. The reoxygenated blood is returned to the body to nourish it. The patient may need blood transfusions (donor blood, blood harvested during the procedure and returned to the patient, or self-donations made in advance of surgery) to replenish blood volume, red blood cells, or platelets. To reduce oxygen demand, the patient is placed in therapeutic hypothermia.

"Beating Heart" CABG

In "beating heart" (or "off pump") bypass surgery, the heart is not stopped, the heart lung bypass machine is not used, and the patient remains at normal or only slightly lowered temperature. Indications for this type of surgery include patients who have diabetes, lung disease, kidney disease, or a previous history of stroke. Beating heart surgery often allows patients to be discharged from the hospital more quickly than with conventional CABG, and the avoidance of the heart-lung machine has been shown to reduce the need for transfusions. Patients with this procedure may also have a lower risk for infection, stroke, and kidney complications

Long-term goals for treatment

- Support the patient in living a comfortable life without pain and with the fewest possible restrictions
- Prevent the development of an acute coronary syndrome
- Slow or reverse the degree of atherosclerosis
- Reduce the cardiovascular risk factors in the patient's life

METHODOLOGY

Study protocol

Study protocol was prepared by conducting extensive literature search. Study protocol contained information on need for the study, objectives, methodology and review of literature.

Study settings

The study was carried out at in patient Department of cardiology of South Central Railway Hospital, Secunderabad.

Study design

This was a prospective, observational, study.

Study site

The study was carried out at South Central Railway Hospital, Secunderabad. South Central Railway Hospital and Secunderabad. This group is India's leading healthcare institutions offering multi- specialty tertiary care of international standards. South Central Railway Hospital, Secunderabad. Situated at mettuguda has earned the reputation for being one of the best tertiary care multi-super specialty hospitals in India. It is a 300-bedded hospital providing tertiary level multi-specialty care services. It provides specialized services in Gastroenterology, Minimal Access Surgery, Cardiology and Cardio Thoracic Surgery, Nephrology, Urology, Neurology, Orthopaedics.

Study criteria

The patients visiting the cardiac in patient departments were enrolled in to the study after taking their consent and by considering following inclusion and exclusion criteria.

Inclusion criteria

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

Exclusion criteria

- Patients who were under day care management.
- Patients who were not willing to participate in the study.
- Patients who were in critical condition.
- Patients who are diagnosed with other cardiac diseases.

Source of data

The data was collected from the patients who met the inclusion criteria. To study the prescribing patterns, relevant details of every in-patient with coronary artery disease were collected in suitably designed proforma. The relevant data on drug prescription of each patient was collected from the in-patient record. The demographic data (age, sex), the diagnosis by the treating cardiologist was obtained from the in-patient case records of each patient. Also, associated co-morbid conditions, risk factors identified for developing coronary artery disease were noted from the medical records. The drug data - drugs, dosage form, dose, route of administration, frequency were noted. The laboratory parameters which were monitored during the treatment such as blood pressure, blood glucose levels, lipid profile, serum creatinine levels, serum electrolytes, prothrombin time, international normalized ratio (INR) were also recorded. Any other relevant data required which could not be obtained from case records were obtained by interviewing the patients, their caretakers or health care providers.

Informed consent form (ICF)

Once the patient were selected based on study criteria, the informed consent was obtained from them verbally then they were enrolled into the study.

Study materials

The following study materials were prepared and used for the study:

- Patient data collection form.
- Patient information leaflet.

Patient Data Collection Form

This extended from was developed to provide a comprehensive set of questions to consider using when developing a case questionnaire for investigation of outbreaks of unknown respiratory illness. These questions cover a range of topic areas including: patient and family contact information, occupation, travel history and other exposures of intrest, extensive past medical history review and a comprehensive list of potential laboratory tests completed. The first page of the form allows for collection of basic demographic, symptom, and exposure information from a patient interview. The second page collects objective clinical and laboratory testing information and is to be completed by an interview with the treating / reporting physician or a review of the ill person's medical record.

Patient Information Leaflet (PIL)

A patient information leaflet was specially designed by consulting the physicians and clinical pharmacist and also referring the standard textbooks and journal articles. The PIL contained all the necessary information on coronary artery disease, its symptoms, management, therapeutic agents and their adverse effects. The language used in the PIL was non-technical and easily understandable by the patients.

Study procedure

The following data was collected and recorded in the data collection form- demographic details (name, age, sex), drugs (name of the drug, dosage form, dose, route of administration, frequency), principal diagnosis and co-morbid conditions. To study the drug prescribing patterns in coronary artery disease, all patients included in the study were considered for analysis. The trade names of drugs were deciphered and classified into pharmacological groups that included aspirin, clopidogrel - antiplatelet agents, beta-blockers, ACEI or ARBs, calcium channel blockers (CCBs), statins, other lipid-lowering medicines such as fenofibrate, short- and long-acting nitrates, potassium channel openers (e. g, nicorandil), heparin and other anticoagulants such as dalteparin sodium and enoxaparin sodium, diuretics, bronchodilators, antibiotics, multivitamins, diabetic medications, and other medications. Utilization of different classes of drugs as well as individual drugs was analysed and presented as percentage. The average number of drugs per prescription and the percentage of drugs prescribed by generic name were determined. The percentage encounters with an antibiotic prescribed were also determined.

Study method table

Table 6. Study Method Table

Procedure	Base line (day 0)	First follow Up (30 ± 10 days)	Second follow Up (60 ± 10 days)
1. Written ICF	✓		
2. Patient demographics	✓		
3. FH, SH	✓		
4. Medical and medication history	✓		
5. Medication safety assessment	✓	✓	✓
6. Medication knowledge assessment	✓	✓	✓
7. Medication adherence assessment (MAA)			
8. Barriers to MAA	✓		
9. Patient counseling	✓	✓	✓
10. Patient information leaflet	✓	✓	✓

RESULTS

A total number of 150 patients were enrolled in the study of which 78 (52%) were male patients and 72 (48%) were female patients. The male to female ratio among the patients was 3:2. The incidence of CAD was more common in male compared to female.

Various co-morbid conditions like hypertension, diabetes mellitus, hypothyroidism, dyslipidemia were seen among patients and many of these were found to be risk factors of coronary artery disease. Hypertension and diabetes were the two most common co-morbid conditions found in most of the patients which increase the risk of coronary artery disease.

Treatment of coronary artery disease involves various categories of drugs namely antiplatelet drugs, anticoagulants, fibrino-lytics, anti-anginal drugs, antihypertensives, antihyperlipidemic agents, bronchodilators, antibiotics. The usages of these drugs were recorded and analysed.

Table 7. Details of the Patients based on Co-morbid Conditions

Co-morbid condition	No. of patients (n=150)	Percentage (%)

Hypertension	39	26.2%
Hypertension+Diabetes	41	27.3%
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	24	16%
Diabetes mellitus	3	2%
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	32	21.3%
Others(Asthma, COPD, PND, APD)	7	4.6%
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	4	2.6%

CKD = Chronic Kidney disease, COPD = Chronic obstructive Pulmonary Disorder, PND = Paroxysmal Nocturnal Dyspnoea, APD = Acid Peptic Disorder

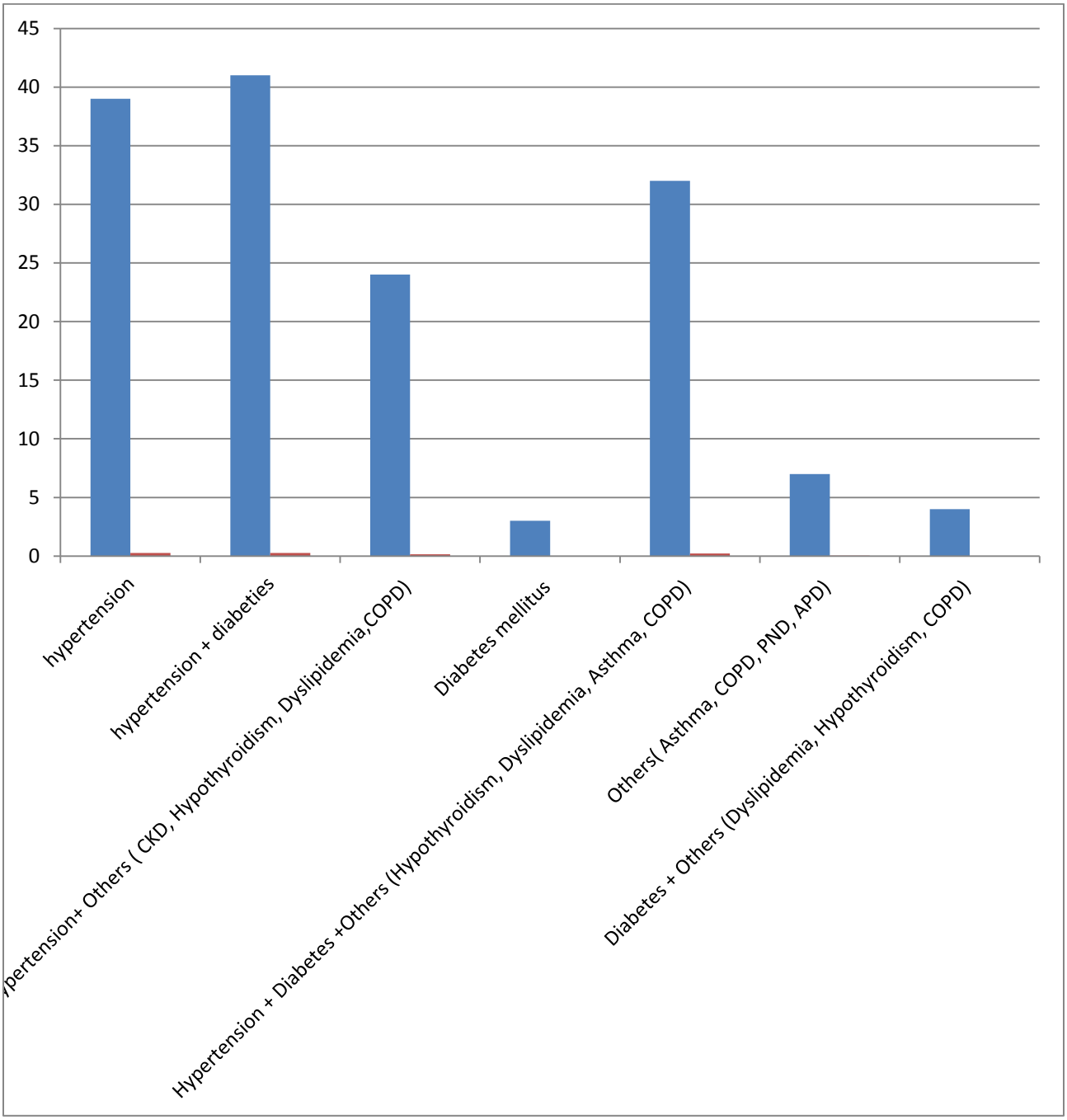

Table 8. Different Categories of Drugs Prescribed to the Patients

Drug categories	No. of Patients (n=150)	Percentage (%)
Antiplatelets	149	99.33%
Antihyperlipidemic	132	88%
Antibiotics	128	85.33%
Anti-anginal	116	77.33%
Antihypertensives	150	100%
Anticoagulants	96	64%
Diuretics	101	67.33%
Bronchodilators	29	19.33%

Different combinations of anti-thrombotic drugs, which include the antiplatelet drugs (aspirin, clopidogrel), anticoagulants (heparin, enoxaparin sodium, dalteparinsodium), fibrinolytic (streptokinase, tenecteplase) were prescribed. The % and no. of patients received anti-thrombotic drugs.

Table 9: Different variables used for the drug class of anti platelets

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	50	33.55
Hypertension+Diabetes	41	27.51
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	30	20.13
Diabetes mellitus	0	0
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	28	18.79
Others(Asthma, COPD, PND, APD)	0	0
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	0	0

Table 10: Different variables used for the drug class of antibiotics

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	0	0
Hypertension+Diabetes	30	23.43
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	19	14.84
Diabetes mellitus	14	10.93
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	20	15.62
Others(Asthma, COPD, PND, APD)	32	25
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	13	10. 15

Table 11: Different variables used for the drug class of anti hyperlipidemics

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	42	31.81
Hypertension+Diabetes	41	31.06
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	39	29.54
Diabetes mellitus	0	0
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	10	7.57
Others(Asthma, COPD, PND, APD)	0	0
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	0	0

Table 12: Different variables used for the drug class of anti hypertensives

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	54	36
Hypertension+Diabetes	48	32
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	35	23.33
Diabetes mellitus	0	0
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	13	8.66
Others(Asthma, COPD, PND, APD)	0	0
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	0	0

Table 13: Different variables used for the drug class of anti anginals

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	39	33.62
Hypertension+Diabetes	35	30.17
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	18	15.51
Diabetes mellitus	0	0
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	15	12.93
Others(Asthma, COPD, PND, APD)	0	0
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	9	7.75

Table 14: Different variables used for the drug class of diuretics

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	8	7.92
Hypertension+Diabetes	10	9.90
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	39	38.61

Diabetes mellitus	35	34.65
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	0	0
Others(Asthma, COPD, PND, APD)	0	0
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	9	8.91

Table 15: Different variables used for the drug class of anti coagulants

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	30	31.25
Hypertension+Diabetes	32	33.33
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	24	25
Diabetes mellitus	0	0
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	10	10.41
Others(Asthma, COPD, PND, APD)	0	0
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	0	0

Table 16: Different variables used for the drug class of anti bronchodilators

Co-morbid condition	No. of patients	Percentage (%) 0f patients
Hypertension	0	0
Hypertension+Diabetes	0	0
Hypertension+ Others (CKD, Hypothyroidism, Dyslipidemia,COPD)	7	24.13
Diabetes mellitus	0	0
Hypertension + Diabetes +Others (Hypothyroidism, Dyslipidemia, Asthma, COPD)	10	34.48
Others(Asthma, COPD, PND, APD)	8	27.58
Diabetes + Others (Dyslipidemia, Hypothyroidism, COPD)	4	13.79

Table 17: Combination of Anti-thrombotic Drugs Prescribed to the Patients

Drug combinations	No. of patients (n=150)	Percentage (%)
Antiplatelets	59	39.33%
Antiplatelets +Anticoagulants	89	59.33%
Antiplatelets+Anticoagulants+Fibrinolytics	2	1.33%

The anti-platelet drugs aspirin and clopidogrel were used to reduce the cardiovascular mortality and non- fatal myocardial infarction in coronary artery disease. Among 150 prescriptions analysed anti-platelet drugs were prescribed in 149 (99.3%) patients. Out of these (n=149), a fixed dose combination (75 mg) of aspirin and clopidogrel was found to be used in 145 (96.66%) and aspirin (150 mg) and clopidogrel (75 mg) singly were used in 130 (87.24%) of the patients. Aspirin alone was used in very few patients 11 (7.38%) and in least no. of patients 9(6.04%) clopidogrel alone was used. All these drugs were prescribed in oral dosage form.

Table 18: Details of Anti-platelet Drugs Prescribed to the Patients

Drug	No. of patients (n=149)	Percentage (%)
Clopidogrel	9	6.04%
Aspirin	11	7.38%
Aspirin + Clopidogrel	130	87.24%

Anticoagulant drugs prescribed include heparin and low molecular weight heparins- dalteparin sodium and enoxaparin sodium. These were prescribed in the form of injections given either by IV or SC route of administration.

Table 19: Details of Anticoagulant Drugs Prescribed to the Patients

Drug	No. of patients (n=96)	Percentage (%)
Enoxaparin sodium	45	46.87%
Heparin	36	37.5%
Dalteparin sodium	15	15.62%

Details of prescribed antianginals

Table 20: Details of Anti-anginal Drugs Prescribed to the Patients

Drug	No. of patients (n=116)	Percentage (%)
Nitrates	80	68.96%
Nicorandil	7	6.03%
Ivabradine	4	3.44%
Nitrates + Nicorandil	10	8.62%
Nitrates + Ivabradine	11	9.48%
Nicorandil + Ivabradine	1	0.86%
Nitrates + Nicorandil + Ivabradine	3	3.58%

Anti-hyperlipidemics

Table 21: Details of anti-hyperlipidemic Drugs Prescribed to the Patients

Drug	No. of patients (n=132)	Percentage (%)
Atorvastatin	98	74.24%
Rosuvastatin	6	4.54%
Fenofibrate	4	3.03%
Atorvastatin + Fenofibrate	17	12.87%
Atorvastatin+ Rosuvastatin	2	1.51%
Rosuvastatin + Fenofibrate	5	3.78%

Anti-hypertensive's

Table 22: Details of anti-hypertensive Drugs Prescribed to the Patients

Drug	No. of patients (n=150)	Percentage (%)
Beta-blockers	**89**	59.33%
Beta-selective	87	97.75%
Non-selective	2	2.24%

Alpha and beta blockers	**20**	**13.33%**
Carvedilol	20	13.33%
ACEI	**44**	**29.33%**
Ramipril	39	88.63%
Enalapril	5	11.36%
ARBs	**41**	**27.33%**
Losartan	24	58.53%
Telmisartan	11	26.82%
Olmesartan	6	14.63%
Calcium channel blockers	**35**	**23.33%**
Amlodipine	28	80%
Diltiazem	7	20%

Combination of antihypertensive

Table 23: Combination of Anti-hypertensive's Prescribed to Patients

Drug Combinations	No. of patients (n=103)	Percentage (%)
Beta blockers+ ACE Inhibitors	20	19.41%
Beta blockers+ Calcium channel blockers	10	9.70%
ACE Inhibitors+ Calcium channel blockers	2	1.53%
Beta blockers+ ACE Inhibitors+ Calcium channel blockers	1	0.97%

Diuretics

Table 24: Details of Diuretics Prescribed to the Patients

Drugs	No. of patients (n=101)♣	Percentage (%)
Frusemide	70	69.30%
Torsemide	42	41.58%
Hydrochlorothiazide	15	14.85%
Spiranolactone	14	13.86%
Amiloride	9	8.91%

♣*One prescription may contain more than one diuretic.*

Bronchodilators

Table 25: Details of Bronchodilator Drugs Prescribed to the Patients

Drug	No. of patients (n=29) ♣	Percentage (%)
Theophylline + Etophylline	21	72.41%
Salbutamol + Ipratropium bromide	13	44.82%
Budesonide	5	17.24%
Levosalbutamol	2	6.89%
Salmeterol	1	3.44%

♣*One prescription may contain more than one bronchodilator*

Antibiotics

Table 26: Details of antibiotics Prescribed to the Patients

Drug	No. of patients (n=128) ♣	Percentage (%)
Cephalosporins	92	71.87%
Quinolones	16	12.5%
Aminoglycosides	10	7.81%
Penicillins	6	4.68%
Others	4	3.12%

♣*One prescription may contain more than one bronchodilator*

Miscellaneous drugs

Table 27: Miscellaneous Drugs Prescribed

Drug	No. of patients (n=150)	Percentage (%)
Pantoprazole	140	93.33%
Lactulose	59	39.33%
Diphenhydramine	40	26.6%
NSAIDS	39	26%
Alprazolam	36	24%
Paracetamol	35	23.33%
Thyroxin sodium	13	8.66%
Amiodarone	11	7.33%

Out of 150 patients, 80(53.33%) patients had diabetes mellitus. Most of the patients were prescribed with human actrapid insulin during hospital stay of treatment. The doses of insulin were given based on the blood glucose levels.

Very few patients were prescribed with oral hypoglycaemic agents. The total number of drugs prescribed among 150 in-patients (prescriptions) with the diagnosis of coronary artery disease included in the study was 1453. The average number of drugs per patient (prescription) was determined and found to be 9.68. The number of drugs prescribed by generic name was only 65 (4.47%). Amikacin, ceftriaxone and heparin were the drugs prescribed by generic name.

Table 28: Details of Prescriptions Expressed in Numbers (percentage)

Details of prescriptions	Number
Total no. of patients prescriptions analyzed	150
Total number of drugs prescribed	1453
Average number of drugs per prescription	9.68
Number of drugs prescribed by generic name out of total number of drugs prescribed	65(4.47%)

DISCUSSION

In a study conducted by Kamath A et al., of the 349 patients, 81% were males and 19% females and 40% were more than 65 years of age. In a retrospective study conducted by Tasneem Sandozi and Fouzia Nausheen, of the 150 patients was studied, 78 of these patients were men and 72 of them were women. Average age of men was

61years (Range 36-83 years) and of women was 60 years (Range 30- 80 years).

In the present study, out of 150 patients, 52% were male and 48 % and 60% were more than 65 years of age. The results of this study were found to be in consistence with previous studies and indicated that male were more prone to coronary artery disease compared to female and the risk increased with increasing age. In a study conducted by Jorg Muntwyler, et al., the drug prescription rates for antithrombotic agents, beta-blockers, ACE-inhibitors/angiotensin receptor blockers and lipid lowering drugs were 91%, 58%, 50% and 63% respectively. In the present study, the drug prescription rates of anti-thrombotic agents were 99.41%, beta-blockers 59.41%, ACE-inhibitors/angiotensin receptor blockers and lipid lowering drugs were 52.35% and 95.29% respectively. The prescription rate of lipid lowering drugs in this study were comparatively very high than the previous study.

In a study conducted by Tasneem Sandozi and Fouzia Nausheen the drug utilization of various antiplatelet drugs were as aspirin alone (25.71%), aspirin & clopidogrel (60.00%), whereas in the present study, the prescription rate of Aspirin alone was 5.88% and combination of aspirin & clopidogrel (91.76%). The present study the combination of aspirin and clopidogrel were prescribed in more number of patients compared to previous study. In a study conducted by Tasneem Sandozi and Fouzia Nausheen drug prescription rates for unfractionated heparin (55.71%), Low molecular weight heparin (20.00%). In another study by Banerjee S., et al., unfractionated heparin was used in 36.8% of the patients and low molecular weight heparin in 25.2% [20]. In the present study, the prescription rate of unfractionated heparin (40%) and low molecular weight heparin (62.73%). The results of this study were in not in consistence with previous studies. A greater variation in the use of anticoagulant was observed. In the present study, the use of low molecular weight heparin was much higher than unfractionated heparin. In a study conducted by Supratim Datta the overall use of antihypertensives in coronary artery disease was follows, Calcium channel blockers (73%), Beta blockers (37.2%), ACEIs (42.3%). A study conducted by Jorg Muntwyler, et al., observed the drug prescription rates for beta-blockers, ACE-inhibitors/angiotensin receptor blockers as 58% and 50% respectively. In the present study, the use of antihypertensives were as follows calcium channel blockers (21.18%), Beta blockers (59.41%), ACEIs (27.06%).The previous study indicated high use of calcium channel blockers, whereas in the present study beta-blockers were found to be the preferable choice of antihypertensive prescribed more frequently.

CONCLUSION

In this study, it was observed that the risk for coronary artery disease increased with increasing age. Hypertension and diabetes were the most common co-morbid conditions associated with coronary artery disease. The most commonly prescribed drug classes for main indications in coronary artery disease were anti-platelet drugs 149 (99.41%) followed by anti-hyperlipidemics 142 (95.29%), anti-anginal drugs 117(80.59%). This was followed by anti-hypertensives and anticoagulants 90 (64.71%) respectively. Extensive polypharmacy (9.68 drugs per prescription) was noticed in the prescriptions. The prescribing pattern can be improved by reducing the number of drugs per prescription. Very few drugs were prescribed by generic name. The economic burden of the patients can be reduced by prescribing generic drugs. The study of prescribing pattern is a component of medical audit that does monitoring and evaluation of the prescribers as well as recommends necessary modifications to achieve rational and cost-effective medical care. The results of this study on drug prescribing pattern can provide a framework for continuous prescription audit in a hospital in-patient setting. This will help prescribers improve patient management by rationalizing prescribing practices.

SUMMARY

Coronary artery disease is the Impedance or blockage of one or more arteries that supply blood to the heart, usually due to atherosclerosis hardening of the arteries. Pharmacotherapy is the mainstay of management of coronary artery disease.

Pattern of different drugs prescribed in coronary artery disease were analyzed. 150 patients were enrolled in the study of which 78 (52%) were male

patients and 72 (48%) were female patients. The male to female ratio among the patients was 3:2. The incidence of CAD was more common in male compared to female. Among 150 prescriptions analysed anti –platelet drugs were prescribed in 149 (99.3%) patients. Out of these (n=149), a fixed dose combination (75mg)of aspirin and clopidogrel was found to be used in 145 (96.66%) and aspirin (150mg) and clopidogrel (75mg) singly were used in 130 (87.24%) of the patients. Aspirin alone was used in very few patients 11 (7.38%) and in least no. Of patients 9 (6.04%) clopidogrel alone was used.

The most commonly prescribed drug classes in coronary artery disease were antiplatelet drugs followed by anti hyperlipidemics and antibiotics. This was followed by anti anginal drugs, anti hypertensives and anti coagulants. Polypharmacy (9.68 drugs per prescription) was noticed. Very few drugs were prescribed by generic name. The prescribing pattern could be improved by reducing the number of drugs per prescription and by prescribing generic drugs to reduce the economic burden of the patients.

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