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Original Research Article

# Ischemic heart disease in patients: Incidence, risk factors, management and outcomes in tertiary care hospital

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ABSTRACT

**Aims and Objectives:** Ischemic heart disease stands as the primary cause of death globally, impacting both developed and developing nations alike. Despite a decline in mortality rates in affluent countries, IHD still claims a significant one-third of lives among those aged 35 and above which necessitates urgent comprehensive strategies to mitigate its growing burden on cardiovascular health worldwide. This study aims to evaluate the incidence, risk factors, management, and outcomes of hospitalized IHD cases in a tertiary care setting.

**Materials and Methods:** Conducted over six months, the prospective cross-sectional study included 303 adult inpatients diagnosed with IHD, excluding pregnant women, psychiatric patients, and children. Data collected from patient records, laboratory tests, and imaging studies were meticulously analysed using statistical software to determine frequencies, percentages, and mean values.

**Results:** Among 6,897 inpatients observed, IHD cases accounted for 4.39%, predominantly affecting males aged 51-60. Risk factors such as hypertension, diabetes mellitus, smoking, alcohol consumption, and a family history of cardiovascular diseases were prevalent. Non-ST-elevation myocardial infarction (NSTEMI) was the most common presentation, managed primarily with antiplatelet and antihyperlipidemic therapies. Percutaneous coronary intervention with stenting was performed in 92% of surgical cases, resulting in clinical improvement for 92.4% of patients with a low mortality rate of 1.7%.

**Conclusion:** This study underscores the higher prevalence of IHD in middle-aged males with specific risk factors. It highlights effective treatment outcomes and emphasizes the ongoing need for targeted preventive measures and management strategies to reduce the impact of IHD globally.



## 1. Introduction

Ischemic Heart Disease (IHD), also known as Coronary Artery Disease (CAD), is a severe cardiovascular condition affecting populations worldwide. It is the leading cause of death across both developed and emerging nations, driven by lifestyle choices, environmental factors, and genetic predispositions. IHD is characterized by recurring chest pain or discomfort due to inadequate blood supply to the heart muscle. The term "ischemic" refers to insufficient blood flow and oxygen. This condition results from plaque buildup on the coronary arteries, often exacerbated by cholesterol accumulation and inflammation. Over time, these plaques narrow the arteries, reducing oxygen-rich blood flow to the heart muscle, a process known as atherosclerosis.[1,2]

IHD is the leading global cause of death, impacting both developed and developing nations.[3] A study from a tertiary care hospital in Bagalkot, Karnataka, reported a 7.58% prevalence of IHD, with 4.81% symptomatic and

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2.77% asymptomatic cases, predominantly affecting males (60.22%, p<0.001).[4] In India, cardiovascular diseases, chiefly IHD and stroke, account for over 80% of CVD-related deaths, with an alarming age-standardized death rate of 272 per 100,000, exceeding the global average of 235. These statistics underscore the urgent need for robust strategies to address the rising burden of cardiovascular diseases and enhance national cardiovascular health.[5]

IHD varies by gender, age, lifestyle, and medical conditions. Men's risk increases around age 45, while women's risk rises significantly post-menopause, around age 55, due to falling estrogen levels. Men often have obstructive coronary artery disease, whereas women more commonly suffer from non-obstructive forms, which are harder to diagnose and treat. Environmental factors, such as air pollution, further increase risk, particularly in older adults, women, and those with diabetes or obesity. A family history of early heart disease, especially before age 65 in women or 55 in men, is a significant risk factor. Dietary habits significantly impact IHD, with high intake of refined carbohydrates and saturated fats leading to obesity, elevated cholesterol, and atherosclerosis. Non-cardiovascular conditions like autoimmune diseases, chronic kidney disease, diabetes, HIV/AIDS (particularly in older adults on treatment), mental health disorders (anxiety, depression), metabolic syndrome, obesity, and sleep disorders (e.g., sleep apnea) also increase IHD risk. Effective management through lifestyle changes, medication, and timely intervention is essential for reducing IHD incidence and severity.[6]

In order to make a diagnosis, a medical professional will initially inquire about the symptoms, health, and family history. Cardiac biomarkers assume a position of profound significance in the expeditious and precise diagnosis, as well as the subsequent management, of acute coronary syndrome, while concurrently providing valuable insights into prognosis. The timeliness of diagnosis, particularly during the critical "golden period," is of paramount importance, as it enables the initiation of therapeutic interventions at the earliest juncture, potentially mitigating or even reversing myocardial damage. If diagnosed with acute coronary syndrome (unstable angina or acute myocardial infarction), patients should remain hospitalized and prioritize rest. In cases where a coronary artery is fully blocked leading to myocardial infarction, immediate treatment aims to reopen the artery as swiftly as possible due to the critical nature of time in preserving heart muscle function and patient outcome.[7,8]

### *1.1. Literature Review*

Gupta R and Yusuf S conducted a prospective study on Challenges in management and prevention of ischemic heart disease in low socioeconomic status people in LLMICs.[9] Two sets of IHD risk factors were important in LLMICs. The first relates to lifestyle factors, including smoking and other forms of tobacco use, alcohol abuse, poor quality diet (consumption of low quantities of fruit and vegetables and high consumption of carbohydrates, trans fats, and foods laced with chemical pollutants), indoor and ambient air pollution, and sedentariness. All these risk factors were widely prevalent in LLMICs, especially among those of low SES. Legislations exist to control these factors, yet the level of implementation is low. They valuated levels of hypertension control in 44 LMICs with data from 1.1 million participants and reported hypertension in 17.6%. In those with hypertension, 73.6% had their BP measured, 39.2% were aware of their diagnosis, 29.9% received treatment, and 10.3% had it under control.

Prabhakaran D et al., conducted a cross-sectional study on Cardiovascular disease in India.[5] The prevalence rates in adults from different cross-sectional surveys conducted at different time points cannot be directly compared, the overall trends were informative. The prevalence of IHD in 1960 in urban India was 2%, and increased 7-fold to ≈14% by 2013. Similarly, it more than quadrupled in rural areas, from 1.7% to 7.4% between 1970 and 2013. These prevalence estimates were probably an underestimate of the burden, because the methods of estimation were based on insensitive tools. In addition, the higher case fatality among Indians following acute coronary syndrome (ACS) could also result in the underestimation of prevalence. The Macroeconomic Commission for Health estimated that the absolute number of IHD patients in India will increase from 36 million in 2005 to 62 million in 2015 (a ≈70% increase).

Sharma D et al.,[10] performed a retrospective study on Pattern of Cardiovascular Disease among admitted patients in a tertiary care teaching hospital. A total of 2268 patient's data were taken from the ward register. The data was collected and analysed with descriptive and inferential statistics using SPSS 18.0 version during the period from 1st June to 30th August 2018. The age ranged between 12 to 95 years with a mean (SD) 61.23(16.34 years). More than half (51%) of the patients were female gender. Forty-six percentages of the patients were in the age group of 56 - 75 years. More than 1/3rd (35%) was diagnosed with ischemic heart disease (IHD) followed by hypertension (22.8%) and arrhythmia (13.4%). There was a significant association between age and gender with the pattern of cardiovascular disease.

## 2. Methods and Materials

### *2.1. Sources of data and materials*

1. Patient case records
2. Laboratory data
3. Self-designed patient profile form
4. Patient medication chart
5. Self-designed surgery report form

6. Framingham risk score chart
7. Killip-Kimball classification

### 2.2. Method of data collection

This cross-sectional study focused on IHD, enrolling subjects who met inclusion criteria and consented. Data included demographics, presenting complaints, IHD types, angiographic profiles, hemodynamic (including cardiogenic shock), treatments, and inpatient mortality trends. Incidence rates were analysed by age, gender, and comorbidities (hypertension, diabetes, hyperlipidaemia). Cardiovascular risk factors were assessed via medical, medication, social, and family histories, and the Framingham Risk Score. Cardiac biomarkers and non-laboratory investigations (e.g., ECGs, X-rays, echocardiograms, stress tests, CT scans) were evaluated. Treatment approaches, including surgeries, were documented, with daily reviews monitoring disease progress and therapy efficacy using the Killip-Kimball classification. Statistical analysis provided frequencies, percentages, and means for interpretation, ensuring comprehensive study outcomes assessment.

#### 2.2.1. Statistical analysis

1. The collected data was meticulously entered into Microsoft Excel 2021 to facilitate the creation of a comprehensive report.
2. The report included detailed tables, charts, and graphs, providing a thorough analysis of counts and percentages derived from the data.
3. Statistical analysis of the data was conducted using IBM SPSS version 26, renowned for its advanced capabilities in data analysis.
4. A significance level of $p > 0.05$ was adopted for determining statistical significance in the study.

## 3. Ethical Consideration

1. Confidentiality was upheld throughout the study.
2. Written informed consent was obtained from each subject before the case assessment.
3. No physical harm was inflicted on the patients as no interventions were carried out.

### 3.1. Ethical clearence

Ethical approval for the study was judiciously secured from the esteemed ethics committee of the study site. The research was carried out by utilizing officially sanctioned surveillance data for the purpose of analysis.

## 4. Results

### 4.1. Incidence

During the study period, a total of 6897 patients were admitted to the hospital. Among them, 303 patients were diagnosed with Ischemic IHD, which accounts for 4.39% of the total patient population. The data was given in Figure 1.

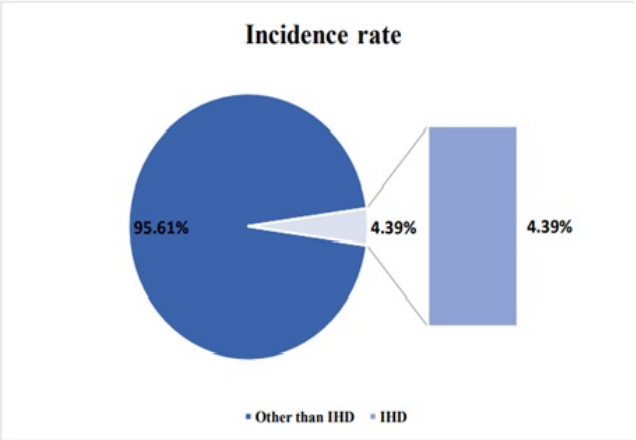


**Figure 1:** Incidence rate of IHD in this study

#### 4.1.1. Demographic details of study participants

In the group of 303 patients, 214 (70.6%) were male, and 89 (29.4%) were female. Among males, 68 patients were aged 51-60 years. Among females, the largest subgroup was 32 patients aged 61-70 years. These demographic insights highlight notable patterns within the patient population studied. The data is listed below:

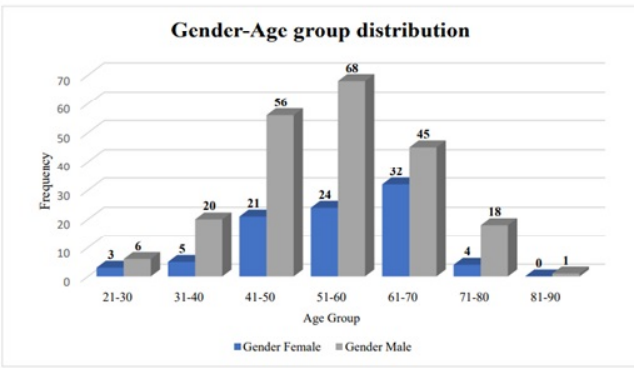


**Figure 2:** Gender distribution of patients with their age group

### 4.2. Length of hospital stay

Hospitalization durations among the 303 patients ranged from 1 to 17 days. The most common durations were around 3 days for 80 patients and approximately 4 days for 59 patients. The average hospital stay across the cohort was 4.51 days, indicating both typical length and variability in hospitalization periods.

The data is given in the Table 1 below:

**Table 1:** Mean length of hospital stay

| | No. of Patients (*n*) | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| **Length of hospital stay** | 303 | 1 | 17 | 4.51 | 2.471 |

### *4.3. Comorbidities*

Among the 303 inpatients, a significant majority of 206 individuals, comprising 68% of the total cohort, presented with co-morbid conditions. Within this subset, it was notable that 77 patients, constituting 25.4% of those with co-morbidities, concurrently exhibited Hypertension and Type 2 Diabetes Mellitus. Following closely were 41 patients (13.5%) presenting with Hypertension alone, and 24 patients (7.9%) with Diabetes Mellitus alone within the co-morbid patient group.

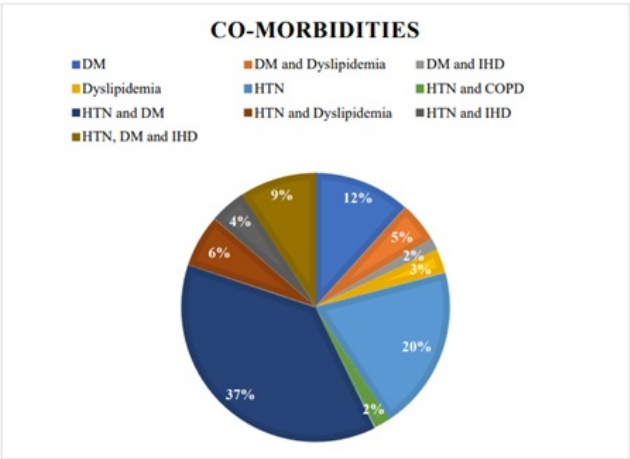


**Figure 3:** Comirbid conditions of the study participants

### *4.4. Family history*

Within the cohort of 303 cases, 36 participants had documented family histories of various ailments. Notably, cardiac diseases, including hypertension, angina, and myocardial infarction (MI), were prevalent in approximately 20 cases (6.6%) within this subset. Endocrine disorders, particularly Diabetes Mellitus, were also notable, documented in the family history of 8 cases (8.8%) among the participants.

### *4.5. Social habits*

Within the cohort of 303 cases, 106 participants were identified with addictive behaviours. Smoking was notably predominant, with approximately 43 individuals (14.2% of total cases) identified as smokers. Following closely were individuals who both smoked and consumed alcohol,

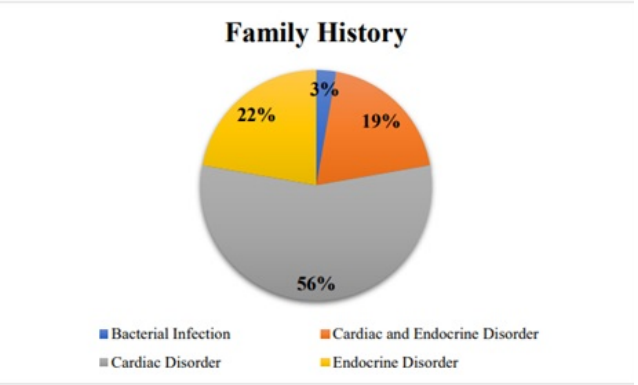


**Figure 4:** Family history of the study participants

totalling 42 participants (13.9% of cases).

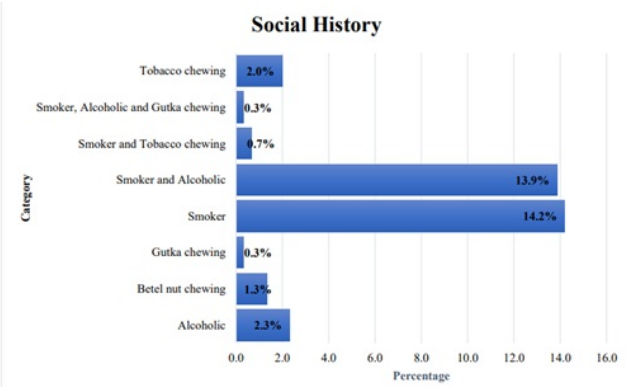


**Figure 5:** Addictive habits of the enrolled patients

### *4.6. Framingham risk stage*

Among the 274 individuals categorized by Framingham risk stages, a distinct pattern was observed. The largest group, comprising 182 individuals (60.1%), fell into the intermediate risk stage for cardiovascular disease (CVD). In contrast, the low-risk category included 48 cases (15.8%), while the high-risk stage was represented by 44 individuals (14.5%).

### *4.7. Cardiac biomarkers*

Among the 303 cases analyzed, 100 showed positive cardiac biomarkers indicative of cardiac injury or myocardial damage.

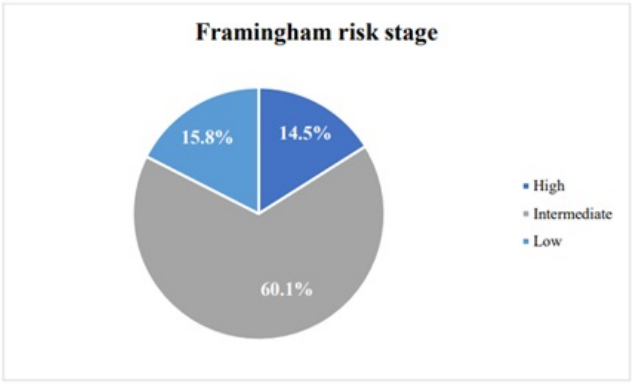


**Figure 6:** Framingham risk stage observed among the study participants

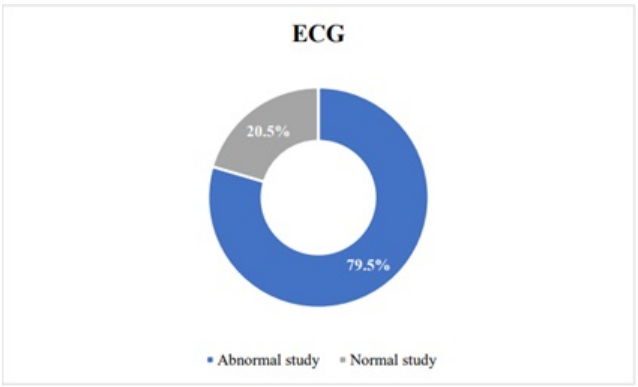


**Figure 8:** ECG analysis

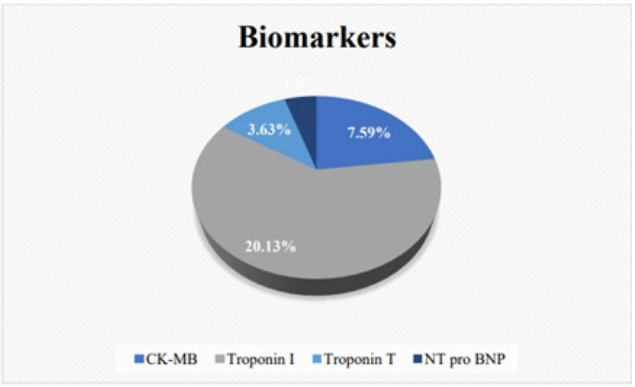


**Figure 7:** Cardiac biomarkers in the study participants

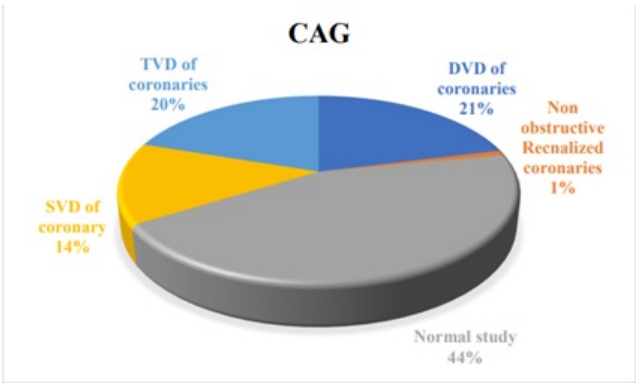


**Figure 9:** Coronary angiogram analysis

Within this subset, Troponin I was the most prevalent biomarker, detected in approximately 61 cases (20.13% of the total). CK-MB followed closely, observed in about 23 cases (7.59% of the 100 cases with positive biomarkers).

### *4.8. Electrocardiogram*

An electrocardiogram is essential for diagnosing cardiac issues by differentiating normal from pathological waveforms. In a study of 303 participants, 241 (79.5%) had abnormal ECG readings. Conversely, a smaller subset of 62 participants (20.5% of the total) exhibited ECG readings within the normal range.

### *4.9. Coronary angiogram*

Coronary angiography (CAG) is crucial for diagnosing and evaluating the severity of ischemic heart disease. In this study of 303 cases, 242 underwent CAG. Among these, 107 (35.3%) had normal results, 51 (16.8%) had double vessel disease, 48 (15.8%) had triple vessel disease, and 34 (11.2%) had single-vessel or small vessel disease. Additionally, some cases showed non-obstructive recanalized coronaries.

### *4.10. Diagnosis*

Among 303 patients, non-ST-segment elevation myocardial infarction (NSTEMI) was most common, affecting 100 individuals (33.0%). ST-segment elevation myocardial infarction (STEMI) and unstable angina were each seen in 66 cases (21.8%). Effort angina occurred in 43 cases (14.2%), while stable angina and atypical angina were found in 18 cases (5.9%) and 8 cases, respectively. Silent angina and Prinzmetal angina were reported in 1 case each (0.3%).

### *4.11. Treatment*

This study reveals the drug therapy patterns for ischemic heart disease in a cohort of 303 prescriptions. Antiplatelet agents were the most common, prescribed in 271 cases (89.4%). Anti-hyperlipidemic medications followed, with 236 prescriptions (77.9%). Anticoagulants were the third most prescribed, at 138 cases (45.5%). Vasodilators were used in 72 cases (23.8%), and thrombolytics had the lowest rate, with 40 prescriptions (13.2%).

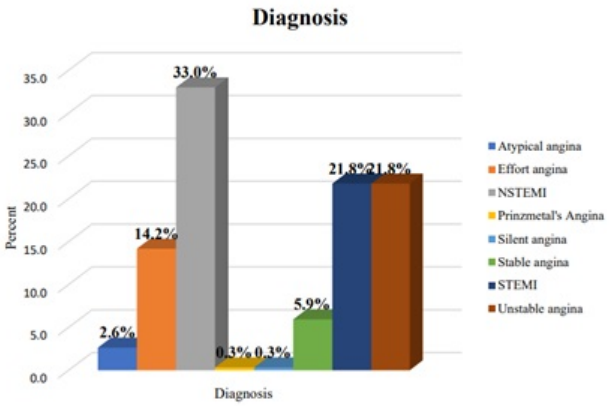


**Figure 10:** Diagnosis of the study participants

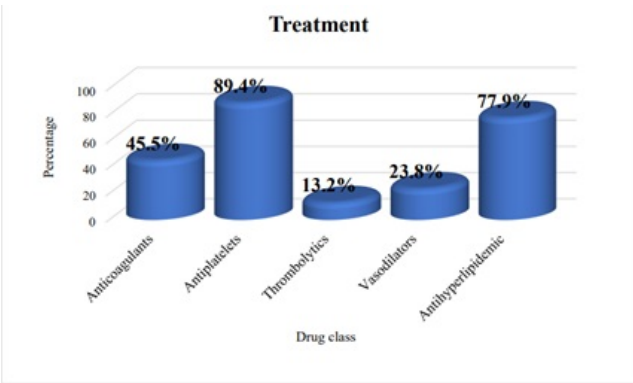


**Figure 11:** Distribution of medications

### 4.12. *Surgery*

In this comprehensive study involving 303 cases, 124 patients underwent surgical interventions to address their cardiac conditions. Among them, the majority—114 individuals (37.6%)—opted for Percutaneous Transluminal Coronary Angioplasty (PTCA) combined with stent placement, a sophisticated approach. A smaller group of approximately 7 cases (2.3%) underwent Coronary Artery Bypass Grafting (CABG), a more traditional and intricate procedure. Notably, within this subset of 124 cases, 3 individuals (1.0%) encountered challenges during PTCA due to calcified vessels, necessitating alternative approaches.

### 4.13. *Treatment for comorbidities*

In the cohort of 303 study participants, various classifications of medications were prescribed to address coexisting medical conditions. Antihypertensive agents were the most commonly prescribed, accounting for approximately 169 (55.8%) prescriptions. Anti-diabetic medications followed as the second most prevalent category, with roughly 78 (25.7%) prescriptions. Diuretics constituted

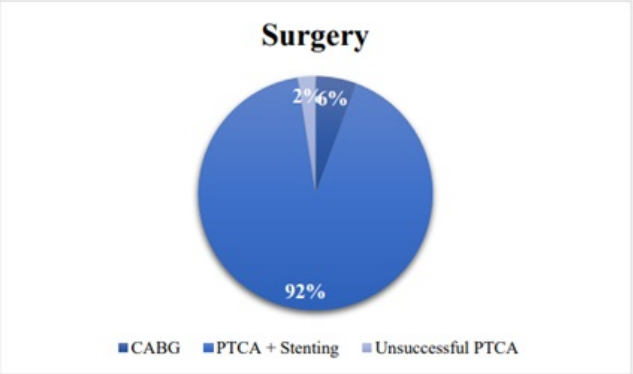


**Figure 12:** Surgical interventions

the third principal category, prescribed in approximately 55 (18.2%) cases. An "other" category encompassing medications such as thyroid drugs, antacids, antihistamines, analgesics, mucolytics, and antitussives, among others, was prescribed in approximately 50 (16.5%) cases.

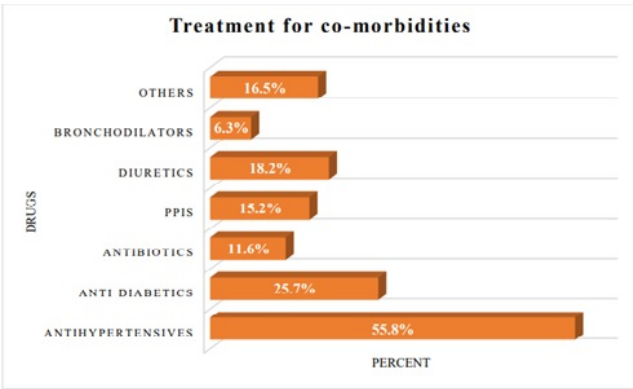


**Figure 13:** Medications given to treat comorbidities

### 4.14. *Outcome*

Among the 303 cases reviewed, significant clinical outcomes were noted. The majority, 280 patients (92.4%), showed notable clinical improvement, indicating effective medical care. However, 13 patients (4.3%) opted for alternative actions against medical advice, highlighting decision-making complexities. Three patients (1.0%) required specialized management and were referred to the Cardiothoracic and Vascular Surgery department. Additionally, 2 patients (0.7%) were discharged upon request, potentially influenced by unique medical circumstances. Unfortunately, 5 cases (1.7%) resulted in mortality, underscoring the challenging nature of medical interventions and outcomes in ischemic heart disease.

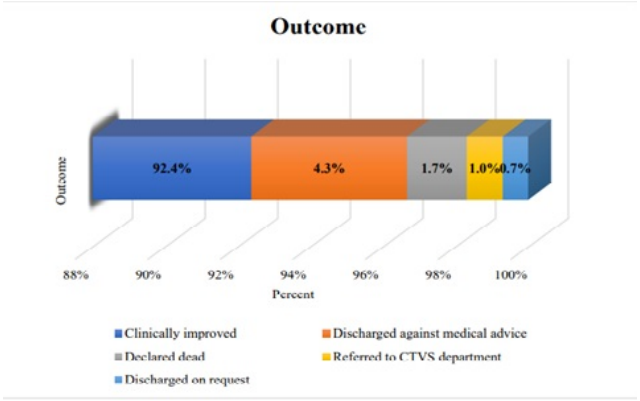


**Figure 14:** Outcome observed in this study

### *4.15. Intervention*

Following clinical interventions among 303 participants, significant incidents were noted: a major drug interaction between spironolactone and telmisartan causing hypokalemia, emphasizing the need for careful medication management; a stent rejection with hemoglobin decline and hypokalemia, stressing post-procedure monitoring; and two cases of therapeutic duplication in cardiovascular medications, highlighting the importance of accurate medication reconciliation.

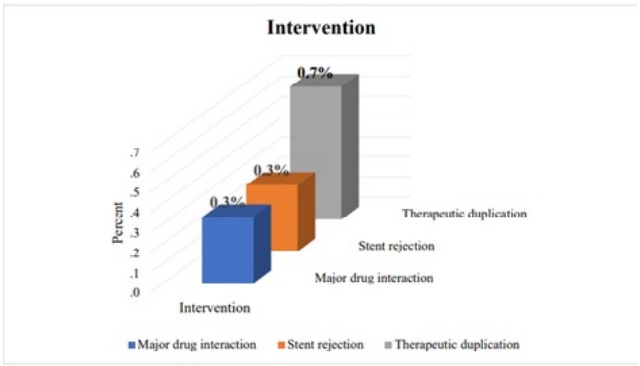


**Figure 15:** Various interventions found in the study

### *4.16. Killip-Kimball classification*

In the assessment of 303 cases using the Killip-Kimball classification, distinct patterns emerged to categorize the severity of cardiovascular disease. The largest group, comprising 151 cases (49.8%), fell into class I, indicating relatively mild cardiac impairment. Class II, representing a moderate level of cardiac involvement, included 104 cases (34.3%). Class III, indicating more advanced cardiovascular compromise, encompassed 36 cases (11.9%). The least observed category was class IV, which included patients in cardiogenic shock, representing the most severe and critical cardiac condition.

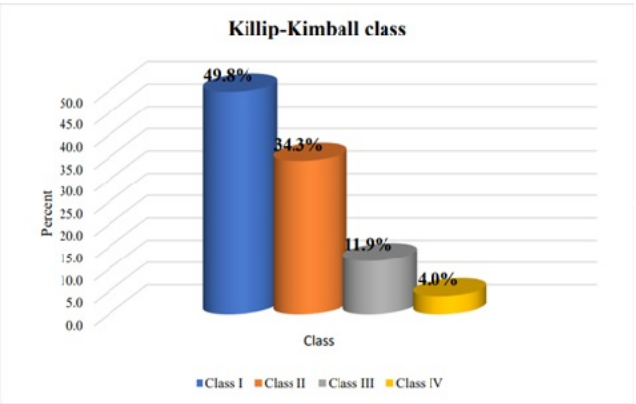


**Figure 16:** Killip-Kimball classification

## 5. Discussion

The evaluation of IHD risk, management, and outcomes revealed key insights into the prevalence, disease patterns, and treatment approaches for IHD patients. It highlighted significant variations in healthcare and mortality rates for ACS patients. The study detailed the clinical presentation, biomarker identification, surgical interventions, and disease prognosis but noted limitations in exploring ACS risk factors. It found that 70.6% of IHD cases were in men aged 51-60, while 29.4% were in women aged 61-70, with an average hospitalization duration of 4.51 days. Sadeghi et al.[11] reported a rise in age-standardized IHD incidence in the Eastern Mediterranean Region (EMR) despite reductions in age-standardized DALYs and mortality, with the IHD burden still exceeding global norms.[11] Li and Zhang identified 24 risk factors for IHD, with key contributors including high systolic blood pressure, high LDL cholesterol, smoking, air pollution, and high sodium intake.[12] The study found that IHD was more common in patients with both hypertension and diabetes than with either condition alone. A notable 20 patients had a family history of cardiac disorders. Smoking and alcohol consumption were identified as major risk factors. The Framingham risk score indicated an intermediate risk for most patients, highlighting the complexity of IHD risk assessment. Ford and Berry note that about 50% of angina patients show no obstructive coronary disease, with many having microvascular or vasospastic angina, especially women. Long-term evidence does not favour beta-blockers over calcium channel blockers for efficacy or safety.[13] Troponin I is a common biomarker, while ECGs mostly show ST elevation and T wave inversion. Coronary angiography frequently reveals double vessel disease. NSTEMI, STEMI and unstable angina are the most common IHD types. Treatment mainly includes antiplatelet and antihyperlipidemic drugs, with fibrinolysis

used in only 5% of cases due to financial and access issues. Streptokinase is the primary fibrinolytic agent, and antihypertensive and antidiabetic drugs are commonly used for comorbidities. Devitt M recommends beta-blocker therapy for all stable IHD patients with normal left ventricular function after myocardial infarction or acute coronary syndromes, for a duration of three years.[14] Aspirin should be used indefinitely unless contraindicated, in which case clopidogrel is a suitable alternative. Dipyridamole should not be used as an antiplatelet therapy. The study involved 124 patients undergoing various surgical interventions, with a focus on Percutaneous Transluminal Coronary Angioplasty (PTCA) and stenting. Three PTCA procedures were unsuccessful due to calcified vessels. Nowbar A. N et al.observed significant disparities in age-standardized IHD mortality rates, with Ukraine (324 per 100,000) and Kazakhstan (97) significantly higher than the U.S. (60), Brazil (54), and the U.K. (46).[15] The study also noted therapeutic redundancies and a harmful interaction between spironolactone and telmisartan, leading to hypokalaemia that required potassium supplementation. Additionally, stent rejection caused a drop in haemoglobin and hypokalaemia, managed by a blood transfusion. The patient stabilized after two days of intensive care, illustrating the complexity of IHD management.

## 6. Conclusion

The six-month study at Sapthagiri Institute of Medical Sciences and Research Centre found an IHD incidence rate of 4.39% among hospitalized patients, excluding those in OBG, psychiatric, and paediatric departments. IHD was most prevalent in males aged 51-60, with a mean hospitalization of 4.5 days. Risk factors included hypertension, diabetes, family history of cardiovascular disease, smoking, and alcohol use. Elevated Troponin I levels and abnormal ECGs were common, and NSTEMI was the most frequent IHD presentation, treated mainly with antiplatelets and antihyperlipidemics. Among 124 patients undergoing surgery, 92% received PTCA with stenting. Most patients showed clinical improvement, with a low mortality rate of 1.7%. The study also noted one drug interaction and one instance of stent rejection, highlighting the complexities of IHD management.

## 7. Limitations

This study has several limitations that need addressing. Firstly, due to its 6-month duration, it only collected limited data. Secondly, it was a single-centre observational study, so its results can't be applied to the entire national population. Thirdly, because of the study's limited timeframe, it didn't track patient outcomes post-discharge, including their long-term quality of life or the effects of surgical interventions or therapeutic management. This lack of follow-up could result in incomplete data. Fourthly, the small sample size means the findings may not be representative of a larger population.

## 8. Source of Funding

None.

## 9. Conflict of Interest

None.

## 10. Acknowledgment

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