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RESEARCH ARTICLE

Clinical Profile and Determinants of In-Hospital Mortality and Severe Left Ventricular Dysfunction in Patients with Coronary Artery Disease: A Retrospective Observational Study

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Abstract: ***Background***: Coronary artery disease (CAD) remains a leading cause of morbidity and mortality worldwide. Identification of determinants of in-hospital mortality and severe left ventricular systolic dysfunction is essential for risk stratification and improving outcomes, particularly in tertiary care settings. ***Objective*** To evaluate the clinical profile and identify determinants of in-hospital mortality and severe left ventricular systolic dysfunction (EF <35%) among patients with CAD. ***Methods*** This retrospective observational study included 161 adult patients admitted with confirmed CAD to a tertiary care centre in Kerala between January 2012 and December 2016. Demographic characteristics, comorbidities, renal function, and echocardiographic parameters were extracted from medical records. Severe left ventricular systolic dysfunction was defined as ejection fraction (EF) <35%. Associations between baseline variables and in-hospital mortality as well as EF status were analyzed using the Chi-square test. A p-value <0.05 was considered statistically significant. ***Results*** Among 161 patients, 78.3% were male, and 59% were aged above 65 years. Diabetes mellitus (67.7%) and hypertension (59.6%) were highly prevalent. Severe left ventricular systolic dysfunction (EF <35%) was observed in 65.2% of patients. The overall in-hospital mortality rate was 19.9%. Chronic obstructive pulmonary disease (COPD) (χ^2 = 8.91, p = 0.003) and smoking (χ^2 = 5.21, p = 0.022) were significantly associated with in-hospital mortality. Age, gender, diabetes, hypertension, renal function, and EF category were not significantly associated with mortality. Age category showed a significant association with reduced EF (χ^2 = 14.27, p = 0.003), with the highest prevalence observed in patients aged 50–65 years. ***Conclusion*** In this cohort of CAD patients, severe left ventricular systolic dysfunction was highly prevalent and in-hospital mortality was substantial. COPD and smoking emerged as significant determinants of mortality, while traditional cardiometabolic risk factors were not independently associated with short-term outcomes. Comprehensive management addressing pulmonary comorbidities and modifiable risk factors may improve in-hospital survival among CAD patients.

Keywords: Coronary artery disease; In-hospital mortality; Left ventricular dysfunction; Ejection fraction; COPD; Smoking; Tertiary care..

INTRODUCTION

Coronary artery disease (CAD) continues to represent the most significant contributor to global cardiovascular morbidity and mortality (1). It results from progressive atherosclerotic narrowing of the coronary arteries, leading to compromised myocardial perfusion. Clinically, CAD presents across a spectrum that includes chronic stable angina, silent ischemia, and acute coronary syndromes such as unstable angina and myocardial infarction (2). Despite advances in pharmacological therapy, preventive cardiology, and interventional procedures, CAD remains a dominant cause of hospital admissions and deaths worldwide.

The global impact of CAD is substantial and continues to evolve. Cardiovascular diseases account for nearly one-third of all deaths globally, with CAD constituting the largest proportion (3,4). Although age-adjusted mortality rates have declined in many regions due to improved awareness and treatment strategies, the absolute burden continues to rise as a result of demographic transitions, aging populations, urbanization, and increasing prevalence of modifiable risk factors such as hypertension, diabetes mellitus, dyslipidemia, smoking, and obesity (4,5). Low- and middle-income countries now shoulder a disproportionate share of this burden.

Left ventricular systolic dysfunction is one of the most serious complications of CAD and significantly influences prognosis. Reduction in left ventricular ejection fraction (LVEF), particularly values below 35%, reflects extensive myocardial damage and is associated with increased in-hospital mortality, recurrent ischemic events, and long-term adverse outcomes (6,7). Patients with severe left ventricular dysfunction frequently have multivessel coronary involvement and multiple comorbidities, which further complicate management and worsen survival.

Management of advanced ischemic cardiomyopathy remains challenging. While optimized medical therapy

forms the foundation of treatment, selected patients may benefit from revascularization procedures such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) (8,9). Although surgical revascularization has demonstrated survival benefit in certain high-risk groups, patients with severe left ventricular dysfunction continue to face elevated perioperative and in-hospital mortality (9). Identification of high-risk clinical characteristics is therefore essential for appropriate risk stratification and treatment planning. Understanding the demographic profile, comorbidity patterns, and clinical determinants associated with in-hospital mortality and severe left ventricular systolic dysfunction is crucial for improving patient outcomes. Regional differences in disease presentation and healthcare access necessitate locally generated evidence to guide clinical decision-making.

Hence, the present retrospective observational study was undertaken to evaluate the clinical profile of patients with coronary artery disease and to identify determinants of in-hospital mortality and severe left ventricular systolic dysfunction (EF <35%).

METHODOLOGY

Study Design

This was a retrospective observational hospital-based study conducted to evaluate the clinical profile and determinants of in-hospital mortality and severe left ventricular systolic dysfunction among patients admitted with coronary artery disease (CAD).

Study Setting and Period

The study was carried out in a tertiary care centre in Kerala. Medical records of patients admitted between January 2012 and December 2016 were reviewed. All eligible cases during this five-year period were considered for analysis.

Study Population

The study included adult patients aged 18 years and above who were admitted with a confirmed diagnosis of coronary artery disease. Diagnosis was established based on clinical presentation supported by electrocardiographic findings, cardiac biomarkers, echocardiographic evaluation, and/or coronary angiographic evidence. A total of 161 patients who fulfilled the eligibility criteria and had complete records were included in the final analysis.

Inclusion and Exclusion Criteria

Patients with documented CAD and available echocardiographic assessment of left ventricular ejection fraction were included. Patients with congenital heart disease, primary non-ischemic cardiomyopathy, significant primary valvular heart disease, incomplete medical records, or repeat admissions during the study period were excluded. In cases of multiple admissions, only the first hospitalization was considered for analysis.

Data Collection

Data were obtained from inpatient case records, laboratory reports, echocardiography reports, and discharge summaries. A structured data extraction format was used to collect demographic information, clinical characteristics, comorbidities, laboratory parameters, and outcome measures.

Study Variables

Demographic variables included age and gender. Age was categorized into four groups: <50 years, 50–65 years, 65–75 years, and >75 years. Clinical variables included the presence of diabetes mellitus, hypertension, chronic obstructive pulmonary disease (COPD), smoking status, dyslipidemia, and renal function based on serum creatinine levels.

Left ventricular ejection fraction (LVEF) was assessed using two-dimensional echocardiography during admission. Severe left ventricular systolic dysfunction was defined as LVEF less than 35%, and patients were categorized into EF <35% and EF ≥35% groups.

The primary outcomes of interest were in-hospital mortality and the presence of severe left ventricular systolic dysfunction.

Operational Definitions

In-hospital mortality was defined as death occurring during the index hospital admission. Diabetes mellitus and hypertension were identified based on documented diagnosis or ongoing treatment. COPD was defined as a previously documented diagnosis in the medical record. Smoking status referred to active smoking at the time of admission. Severe left ventricular systolic dysfunction was defined as LVEF <35% measured by transthoracic echocardiography.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software. Categorical variables were expressed as frequencies and percentages. Associations between baseline variables and in-hospital mortality, as well as between baseline variables and EF category, were assessed using the Chi-square test or Fisher's exact test where appropriate. A p-value less than 0.05 was considered statistically significant.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. As the study was retrospective and record-based, the requirement for informed consent was waived. Patient confidentiality was maintained by anonymizing data prior to analysis.

RESULTS

Table 1. Baseline Characteristics of Study Population (n = 161)

Variable	Category	n (%)
Age Category	<50 years	11 (6.8)
	50–65 years	55 (34.2)
	65–75 years	65 (40.4)
	>75 years	30 (18.6)
Gender	Male	126 (78.3)
	Female	35 (21.7)
Diabetes Mellitus	Present	109 (67.7)
Hypertension	Present	96 (59.6)
COPD	Present	11 (6.8)
Smoking	Present	5 (3.1)
EF <35%	Present	105 (65.2)
Mortality	Survived	129 (80.1)
	Expired	32 (19.9)

A total of 161 patients with confirmed coronary artery disease (CAD) were included in the analysis. The majority were male (78.3%), with females constituting 21.7% of the cohort.

Most patients were elderly, with 40.4% aged 65–75 years and 18.6% above 75 years. Only 6.8% were below 50 years of age.

Severe left ventricular systolic dysfunction (EF <35%) was observed in 65.2% of patients. Diabetes mellitus was present in 67.7%, and hypertension in 59.6%. COPD was documented in 6.8% of patients, while 3.1% were smokers.
The overall in-hospital mortality rate was 19.9% (32/161).

2. Association Between Baseline Characteristics and Mortality

Table 2. Association Between Baseline Variables and In-Hospital Mortality

Variable	Category	Mortality No n (%)	Mortality Yes n (%)	χ^2	p-value
Age Category	**<50 yrs**	8 (72.7)	3 (27.3)		
	50–65 yrs	48 (87.3)	7 (12.7)		
	65–75 yrs	52 (80.0)	13 (20.0)		
	>75 yrs	21 (70.0)	9 (30.0)	4.07	0.254
Gender	**Female**	26 (74.3)	9 (25.7)		
	Male	103 (81.7)	23 (18.3)	0.96	0.328
Diabetes	**Yes**	89 (81.7)	20 (18.3)	0.49	0.482
Hypertension	**Yes**	77 (80.2)	19 (19.8)	0.001	0.974
Smoking	**Yes**	2 (40.0)	3 (60.0)	5.21	0.022
COPD	**Yes**	5 (45.5)	6 (54.5)	8.91	0.003
EF Category	**EF <35%**	84 (80.0)	21 (20.0)		
	EF ≥35%	45 (80.4)	11 (19.6)	0.003	0.957

Age and Gender
Mortality was highest among patients aged >75 years (30%) and lowest among those aged 50–65 years (12.7%). However, age category was not significantly associated with mortality ($\chi^2 = 4.07$, $p = 0.254$).
Mortality among females (25.7%) was numerically higher than males (18.3%), but this difference did not reach statistical significance ($\chi^2 = 0.96$, $p = 0.328$).

3. Clinical Variables and Mortality
Severe left ventricular dysfunction (EF <35%) did not show a significant association with mortality (20.0% vs 19.6%; $\chi^2 = 0.003$, $p = 0.957$).
Hospital stay duration and recurrent admissions were also not significantly associated with mortality ($p > 0.05$).

4. Comorbidities and Mortality
Diabetes mellitus ($p = 0.482$), hypertension ($p = 0.974$), dyslipidemia ($p = 0.625$), and hypothyroidism ($p = 0.407$) were not significantly associated with mortality.

However:

- Smoking demonstrated a statistically significant association with mortality (60% mortality in smokers vs 18.6% in non-smokers; $\chi^2 = 5.21$, $p = 0.022$).
- COPD showed a strong and highly significant association with mortality (54.5% mortality in COPD patients vs 17.3% in non-COPD patients; $\chi^2 = 8.91$, $p = 0.003$).

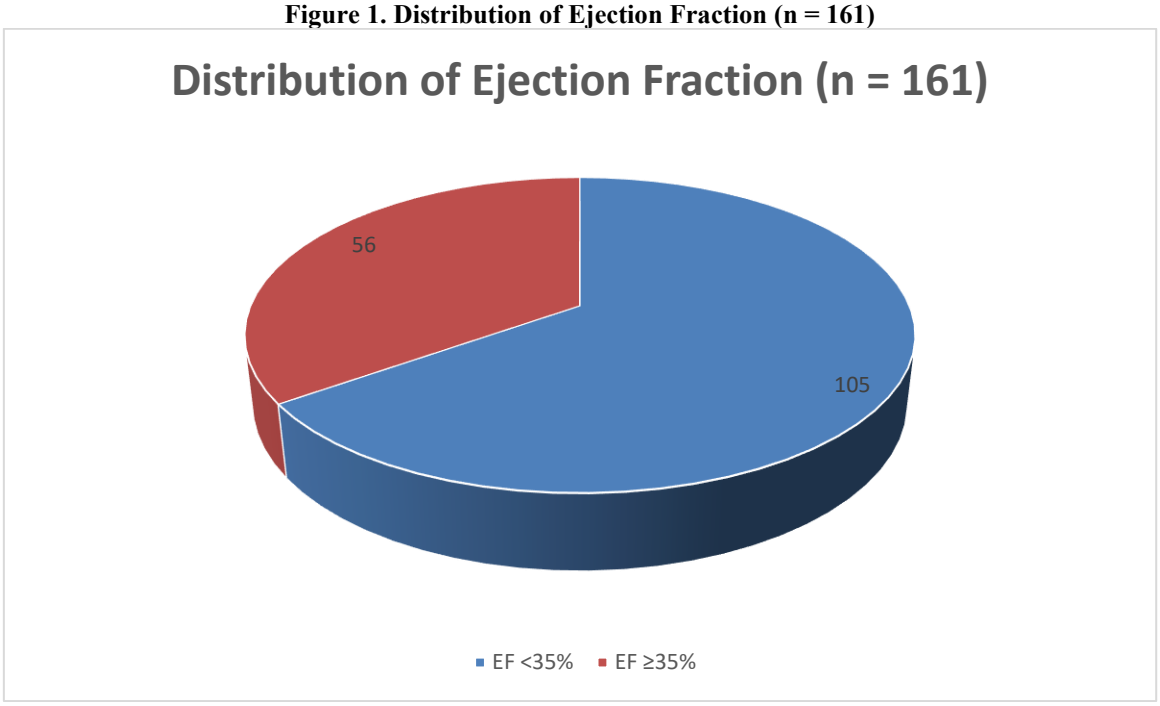
Among all variables studied, COPD emerged as the strongest predictor of in-hospital mortality.

5. Renal Function and Mortality

Creatinine category did not demonstrate a significant association with mortality ($\chi^2 = 0.366$, $p = 0.947$).

In this cohort of CAD patients, COPD and smoking were significantly associated with in-hospital mortality. Traditional cardiometabolic risk factors and reduced ejection fraction were not independently associated with mortality.

Figure 1. Distribution of Ejection Fraction (n = 161)



Out of 161 patients, 105 (65.2%) had reduced ejection fraction (<35%), while 56 (34.8%) had EF ≥35%.

This indicates a predominance of advanced systolic dysfunction in the study population.

Table 3. Association Between Baseline Variables and Reduced EF (<35%)

Variable	Category	EF <35% n (%)	EF ≥35% n (%)	χ^2	p-value
Age Category	<50 yrs	7 (63.6)	4 (36.4)		
	50–65 yrs	46 (83.6)	9 (16.4)		
	65–75 yrs	33 (50.8)	32 (49.2)		
	>75 yrs	19 (63.3)	11 (36.7)	14.27	**0.003**
Gender	Female	18 (51.4)	17 (48.6)		
	Male	87 (69.0)	39 (31.0)	3.75	0.053
Diabetes	Yes	73 (67.0)	36 (33.0)	0.46	0.498
Hypertension	Yes	63 (65.6)	33 (34.4)	0.017	0.895
Creatinine Category	Mild	33 (55.0)	27 (45.0)		
	Moderate	25 (78.1)	7 (21.9)		
	Severe	24 (61.5)	15 (38.5)		
	High/Very Severe	23 (76.7)	7 (23.3)	7.08	0.069

2. Age and Ejection Fraction

Age category demonstrated a statistically significant association with EF status ($\chi^2 = 14.27$, $p = 0.003$).

Patients aged 50–65 years showed the highest proportion of reduced EF (83.6%), whereas patients aged 65–75 years had a relatively lower prevalence (50.8%).

This suggests that middle-aged CAD patients in this cohort exhibited more severe systolic dysfunction.

3. Gender and EF
Reduced EF was more common among males (69%) compared to females (51.4%), showing a borderline association (χ^2 = 3.75, p = 0.053).

4. Comorbidities and EF
Diabetes mellitus (p = 0.498), hypertension (p = 0.895), hypothyroidism (p = 0.743), and hyperuricemia (p = 0.297) were not significantly associated with reduced EF.
Creatinine category showed a borderline association with EF (χ^2 = 7.08, p = 0.069), suggesting a possible trend toward worse EF in patients with renal dysfunction.

5. Hospital Variables and EF
Hospital stay duration (p = 0.719) and recurrent admission (p = 0.169) were not significantly associated with EF category.

DISCUSSION

The present retrospective study evaluated the clinical profile and determinants of in-hospital mortality and severe left ventricular systolic dysfunction among patients with coronary artery disease (CAD) admitted to a tertiary care centre in Kerala. The findings reveal a high burden of advanced systolic dysfunction, substantial in-hospital mortality, and a strong association between pulmonary comorbidities and adverse outcomes.

Clinical Profile of CAD Patients
In this cohort, the majority of patients were male (78.3%), and most were above 50 years of age. This male predominance is consistent with previously reported CAD registries. Sharma et al., 2014 (10), in a large South Indian ACS cohort, reported 79.5% male predominance, closely mirroring our findings. Similarly, Galon et al., 2010 (11) observed a higher prevalence of CAD among males undergoing cardiac catheterization.

The mean age distribution in our study showed that 59% of patients were aged above 65 years, reflecting the known association between advancing age and coronary atherosclerosis. De Matteis et al., 2022 (12) demonstrated that mortality increased significantly with advancing age among elderly heart failure patients, reinforcing the role of age as a marker of vulnerability in cardiovascular disease.

Diabetes mellitus (67.7%) and hypertension (59.6%) were highly prevalent in our cohort, reflecting the cardiometabolic risk burden typical of Indian populations. Zada et al., 2024 (13) similarly reported high rates of hypertension (65.3%) and diabetes (47.9%) among ACS patients with left main coronary disease. The high prevalence of these risk factors underscores the importance of aggressive preventive strategies in CAD management.

In-Hospital Mortality
The overall in-hospital mortality rate in the present study was 19.9%, which is relatively higher compared to some contemporary cohorts. Sharma et al., 2014 (10) reported 7.9% in-hospital mortality in ACS patients, while Zada et al., 2024 (13) observed a mortality rate of 4.2% among ACS patients with left main disease. Galon et al., 2010 (11) reported 5.6% mortality in CAD patients undergoing PCI. The higher mortality observed in our study may be attributable to the high proportion of patients with severe left ventricular dysfunction (65.2%) and significant comorbidity burden.

Khalili et al., 2022 (14), studying patients with severe left ventricular dysfunction undergoing CABG, reported a mortality rate of 9.5%. Although lower than our findings, their study population included surgical candidates who may have undergone careful preoperative selection. Differences in patient profiles and healthcare settings may explain the variation in mortality rates.

Predictors of Mortality
In our study, chronic obstructive pulmonary disease (COPD) and smoking were significantly associated with in-hospital mortality. Patients with COPD had a mortality rate of 54.5%, and smoking was associated with 60% mortality, both statistically significant.

The impact of non-cardiac comorbidities on cardiac outcomes has been increasingly recognized. De Matteis et al., 2022 (12) reported that infections were strongly associated with in-hospital mortality in acute heart failure patients, emphasizing that non-cardiovascular factors significantly influence short-term outcomes. Similarly, Hailu et al., 2023 (15) demonstrated that comorbid conditions significantly contributed to hospital mortality in cardiovascular admissions in Ethiopia.

COPD likely worsens outcomes through chronic hypoxia, pulmonary hypertension, systemic inflammation, and increased perioperative risk. The combined cardiopulmonary compromise may explain the strong association observed in our study. Smoking, as a modifiable risk factor, not only accelerates atherosclerosis but also impairs endothelial function and increases thrombotic risk, contributing to adverse outcomes.

Interestingly, traditional cardiometabolic risk factors such as diabetes and hypertension were not significantly associated with in-hospital mortality in our cohort.

Similar findings were reported by Khalili et al., 2022 (14), where none of the studied variables remained independent predictors of ICU mortality in multivariate analysis. This suggests that acute clinical status and organ dysfunction may outweigh chronic risk factors in determining short-term outcomes.

Severe Left Ventricular Dysfunction

A striking finding in our study was the high prevalence (65.2%) of severe left ventricular systolic dysfunction (EF <35%). This indicates that a substantial proportion of patients presented with advanced myocardial impairment.

Age category showed a statistically significant association with reduced EF, particularly among patients aged 50–65 years. This is an important observation, suggesting that middle-aged individuals in this population may present with aggressive or delayed-diagnosed CAD. Sharma et al., 2014 (10) noted that ACS occurred nearly a decade earlier in Indian patients compared to Western populations, supporting this trend of earlier and more severe disease manifestation.

Renal dysfunction showed a borderline association with reduced EF in our study. Galon et al., 2010 (11) reported chronic renal failure as a predictor of in-hospital mortality in CAD patients, highlighting the interplay between cardiorenal syndrome and adverse cardiac outcomes.

Gender showed a borderline association with reduced EF, with males demonstrating a higher proportion of severe dysfunction. This may reflect higher exposure to risk factors such as smoking and delayed health-seeking behavior among men.

Clinical Implications

The findings of this study emphasize the importance of identifying high-risk subgroups among CAD patients, particularly those with pulmonary comorbidities. While traditional risk factors remain important in the development of CAD, short-term in-hospital outcomes appear to be more strongly influenced by acute organ dysfunction and associated comorbid conditions.

Early recognition of COPD, aggressive smoking cessation interventions, and optimization of respiratory status may play a crucial role in improving survival among hospitalized CAD patients. Additionally, the high prevalence of severe systolic dysfunction underscores the need for early screening, timely revascularization, and guideline-directed medical therapy.

Strengths and Limitations

This study provides valuable regional data from a tertiary care centre over a five-year period. However, as a retrospective study, it is subject to limitations including potential documentation bias and inability to establish causality. Multivariate regression analysis was not performed, which limits the identification of independent predictors. The relatively small number of smokers and COPD patients may also influence the precision of risk estimates.

Conclusion

In this cohort of CAD patients, severe left ventricular systolic dysfunction was highly prevalent, and in-hospital mortality was substantial. COPD and smoking emerged as significant determinants of mortality, whereas traditional cardiometabolic risk factors were not independently associated with short-term outcomes. These findings highlight the need for comprehensive management strategies that address both cardiac and non-cardiac comorbidities to improve survival among CAD patients.

Conflict of Interest: Nil

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