

Spectrum of Cardiovascular Diseases and Associated Comorbidities in Hospitalized Patients: A Retrospective Study

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Abstract: Background: Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide. The spectrum of cardiovascular diseases and their associated comorbidities varies across regions depending on demographic characteristics, lifestyle factors, and stages of epidemiological transition. Understanding the distribution of cardiovascular diseases and associated risk factors is essential for improving preventive strategies and clinical management. **Objectives** To evaluate the spectrum of cardiovascular diseases and assess the burden of comorbid conditions among patients attending a tertiary care center in Kerala. **Methods** A retrospective observational study was conducted using medical records of patients diagnosed with cardiovascular diseases at a tertiary care hospital in Kerala between 2014 and 2016. A total of 302 patients were included in the study. Demographic details, cardiovascular diagnoses, and associated comorbidities were collected from hospital records. A comorbidity score was calculated based on the presence of coexisting diseases. Data were analyzed using descriptive statistics, and associations between variables were assessed using the Chi-square test. **Results** Among the 302 patients, the majority were male (68.9%), and most belonged to the >60 years age group (62.6%). Coronary artery disease (58.9%) was the most common cardiovascular condition, followed by heart failure (33.4%) and dilated cardiomyopathy (13.9%). The most prevalent comorbidities were diabetes mellitus (60.9%) and hypertension (55%). A significant association was observed between diabetes mellitus and coronary artery disease ($\chi^2 = 43.623$, $p < 0.001$) as well as between hypertension and coronary artery disease ($\chi^2 = 16.275$, $p < 0.001$). Increasing age was significantly associated with higher comorbidity scores ($\chi^2 = 71.126$, $p < 0.001$). Coronary artery disease was significantly more common among male patients (69.2%), while rheumatic heart disease was more prevalent among females (15.1%). **Conclusion** The study demonstrates that coronary artery disease is the predominant cardiovascular condition, with a high burden of metabolic comorbidities such as diabetes and hypertension. Advancing age is associated with increased comorbidity burden, highlighting the need for comprehensive risk assessment and management strategies. Early detection and effective control of modifiable risk factors may play a crucial role in reducing the burden of cardiovascular diseases.

Keywords: Cardiovascular diseases, coronary artery disease, comorbidity burden, diabetes mellitus, hypertension, retrospective study.

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of morbidity and mortality worldwide, accounting for a substantial proportion of global deaths and disability. According to global estimates, cardiovascular diseases contribute significantly to the burden of non-communicable diseases and remain a major public health challenge across both developed and developing countries (Khairy et al., 2010; World Health Organization, 2016) [1,2].

The spectrum of cardiovascular diseases varies across regions and populations, depending on demographic characteristics, lifestyle factors, socioeconomic conditions, and stages of epidemiological transition. In low- and middle-income countries, infectious and inflammatory cardiovascular conditions such as rheumatic heart disease and congenital heart diseases remain common, while in developed regions ischemic

heart disease, hypertensive heart disease, and heart failure predominate (Yadeta et al., 2017) [3].

Studies from developing regions have highlighted considerable heterogeneity in the distribution of cardiovascular diseases. For example, a large cross-sectional study conducted in Ethiopia across six referral hospitals reported that valvular heart disease was the most common cardiovascular condition, accounting for 40.5% of cases, with the majority being chronic rheumatic heart disease (Yadeta et al., 2017) [3]. Similarly, echocardiographic registry data from Somalia demonstrated that hypertensive heart disease and valvular heart disease were the most frequent cardiovascular conditions, reflecting the growing burden of non-communicable diseases in resource-limited settings (Alici and Genç, 2021) [4].

Another important aspect influencing cardiovascular outcomes is the presence of multiple comorbid

conditions. Patients with cardiovascular diseases frequently present with additional chronic illnesses such as diabetes mellitus, hypertension, renal disease, and chronic pulmonary disorders, which can significantly affect disease progression, treatment outcomes, and healthcare utilization. An analysis of the US Nationwide Inpatient Sample demonstrated that different comorbidity profiles among heart failure patients were associated with increased mortality, longer hospital stay, and higher healthcare costs (Lee et al., 2014) [5].

Population-based studies have also demonstrated that the burden of comorbidities among cardiovascular patients has been increasing over time, particularly among elderly individuals. In a nationwide cohort study in the Netherlands involving over 2 million hospital admissions, comorbid conditions were present in approximately 38% of patients with cardiovascular diseases, with the prevalence increasing significantly among patients aged ≥ 75 years (Buddeke et al., 2017) [6].

Furthermore, cardiovascular diseases frequently coexist with other chronic respiratory conditions. For instance, a study conducted among patients hospitalized for acute exacerbation of chronic obstructive pulmonary disease (AECOPD) demonstrated a high prevalence of cardiovascular diseases such as pulmonary hypertension, arrhythmias, ischemic heart disease, and heart failure, which significantly influenced clinical outcomes and mortality (El-Shabrawy and Eldamanhory, 2017) [7].

Despite the growing burden of cardiovascular diseases and their associated comorbidities, regional data describing the pattern and distribution of cardiovascular diseases remain limited in many settings, particularly in developing countries. Understanding the local spectrum of cardiovascular diseases and associated comorbid conditions is essential for identifying high-risk groups, improving preventive strategies, and optimizing clinical management.

Therefore, the present study was undertaken to analyze the spectrum of cardiovascular diseases and evaluate the burden of comorbid conditions among patients attending cardiac clinics, with particular emphasis on identifying major risk factors such as diabetes mellitus and hypertension associated with coronary artery disease.

Aim

To analyze the spectrum of cardiovascular diseases and associated comorbidities among hospitalized patients.

Rationale of the Study

Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide, accounting for a significant proportion of hospital admissions and healthcare burden. The prevalence of cardiovascular diseases has been steadily increasing due to population aging, urbanization, sedentary lifestyles, and the rising

prevalence of metabolic risk factors such as diabetes mellitus, hypertension, dyslipidemia, and chronic kidney disease.

Patients with cardiovascular diseases frequently present with multiple comorbid conditions, which complicate disease progression, influence treatment outcomes, and increase the risk of adverse cardiovascular events. The presence of comorbidities such as diabetes and hypertension is well known to accelerate atherosclerosis and coronary artery disease, thereby worsening clinical outcomes. Understanding the pattern and burden of comorbidities among cardiovascular patients is therefore essential for effective clinical management and risk stratification.

Despite the growing burden of cardiovascular diseases in developing countries, there is limited regional data describing the distribution of cardiovascular conditions and their associated comorbidities in hospital-based populations. Evaluating these patterns can help identify high-risk groups, improve preventive strategies, and guide clinical decision-making.

Therefore, the present study was undertaken to analyze the demographic profile, disease spectrum, and comorbidity burden among patients with cardiovascular diseases and to examine the association of major risk factors such as diabetes and hypertension with coronary artery disease. Such information can contribute to improved risk assessment, targeted interventions, and better management of cardiovascular patients.

MATERIALS AND METHODS

Study Design

This study was designed as a retrospective observational cross-sectional study conducted to evaluate the spectrum of cardiovascular diseases and associated comorbidities among patients attending a tertiary care center. Retrospective studies utilize previously recorded clinical data to examine disease patterns and associated risk factors among patients.

Study Setting

The study was conducted at a tertiary care referral hospital in Kerala, India, which provides specialized cardiology services to patients from both urban and rural areas. The hospital functions as a major referral center with outpatient cardiac clinics, inpatient cardiology wards, and diagnostic facilities including electrocardiography, echocardiography, and laboratory services.

Study Period

The study included patient records from January 2016 to December 2018, covering a three-year period.

Study Population

The study population consisted of patients diagnosed with cardiovascular diseases who attended the

cardiology outpatient department or were admitted to the cardiology ward during the study period.

A total of 302 patient records that fulfilled the inclusion criteria were included in the final analysis.

Inclusion Criteria

Patients were included in the study if they met the following criteria:

- Patients aged ≥ 18 years
- Patients diagnosed with cardiovascular diseases such as:
 - Coronary artery disease
 - Heart failure
 - Dilated cardiomyopathy
 - Rheumatic heart disease
 - Congenital heart disease
- Patients whose complete medical records were available in the hospital database.

Exclusion Criteria

The following records were excluded:

- Incomplete or missing medical records
- Patients with uncertain or provisional cardiovascular diagnosis
- Patients with repeated admissions where complete clinical details were unavailable

Data Source

Data were collected from hospital medical records and electronic patient databases maintained in the cardiology department. Information was extracted from:

- Outpatient case sheets
- Inpatient medical records
- Echocardiography reports
- Laboratory investigation reports
- Discharge summaries

Data Collection Procedure

A structured data extraction form was used to collect relevant clinical information from the medical records. The collected variables included:

1. Demographic Variables

- Age
- Gender

2. Clinical Diagnosis

The spectrum of cardiovascular diseases recorded included:

- Coronary artery disease (CAD)
- Heart failure
- Dilated cardiomyopathy
- Rheumatic heart disease
- Congenital heart disease

3. Comorbidities

Information on the presence of associated comorbid conditions was collected, including:

- Diabetes mellitus
- Hypertension
- Chronic renal failure
- Dyslipidemia
- Atrial fibrillation
- Chronic obstructive pulmonary disease
- Hypothyroidism
- Pulmonary hypertension

4. Comorbidity Score

A **comorbidity score** was calculated to represent the cumulative burden of coexisting diseases.

- Score 0 – No comorbidity
- Score 1 – One comorbid condition
- Score 2 – Two comorbid conditions
- Score 3 – Three comorbid conditions
- Score ≥ 4 – Four or more comorbid conditions

This scoring system was used to evaluate the relationship between age and overall comorbidity burden.

Outcome Measures

The primary outcomes assessed in the study included:

1. Distribution of different cardiovascular diseases
2. Prevalence of comorbid conditions
3. Association between major risk factors (diabetes and hypertension) and coronary artery disease
4. Association between age and comorbidity burden
5. Gender differences in cardiovascular diseases

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software.

The following statistical methods were used:

- Descriptive statistics were used to summarize demographic characteristics and disease distribution.
- Continuous variables were expressed as frequencies and percentages.
- Associations between categorical variables were assessed using the Chi-square (χ^2) test.
- A p-value < 0.05 was considered statistically significant.

Ethical Considerations

The study utilized retrospective data obtained from hospital records, and patient confidentiality was maintained throughout the study. Personal identifiers were removed during data extraction to ensure privacy. Ethical approval was obtained from the institutional ethics committee of the tertiary care center prior to the commencement of the study.

RESULTS

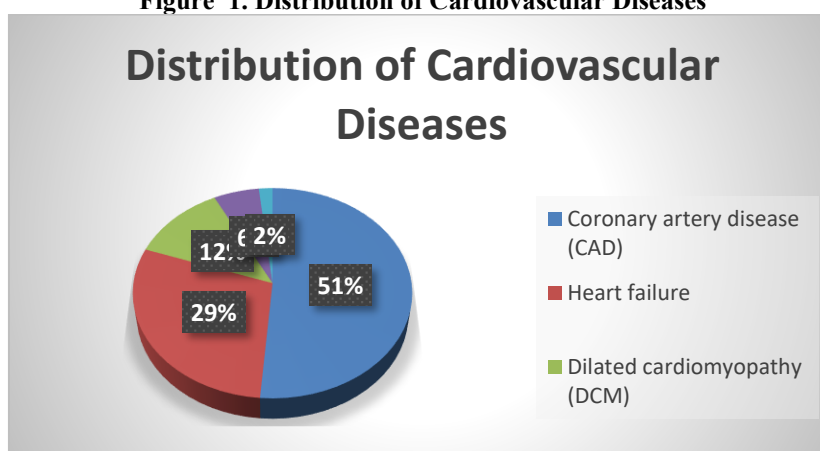
A total of 302 patients with cardiovascular diseases were included in the study. The demographic characteristics, disease spectrum, comorbidities, and their associations with coronary artery disease were analyzed.

Table 1. Demographic Characteristics of Study Participants (n = 302)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	208	68.9
	Female	93	30.8
Age group	<40 years	17	5.6
	40–60 years	96	31.8
	>60 years	189	62.6

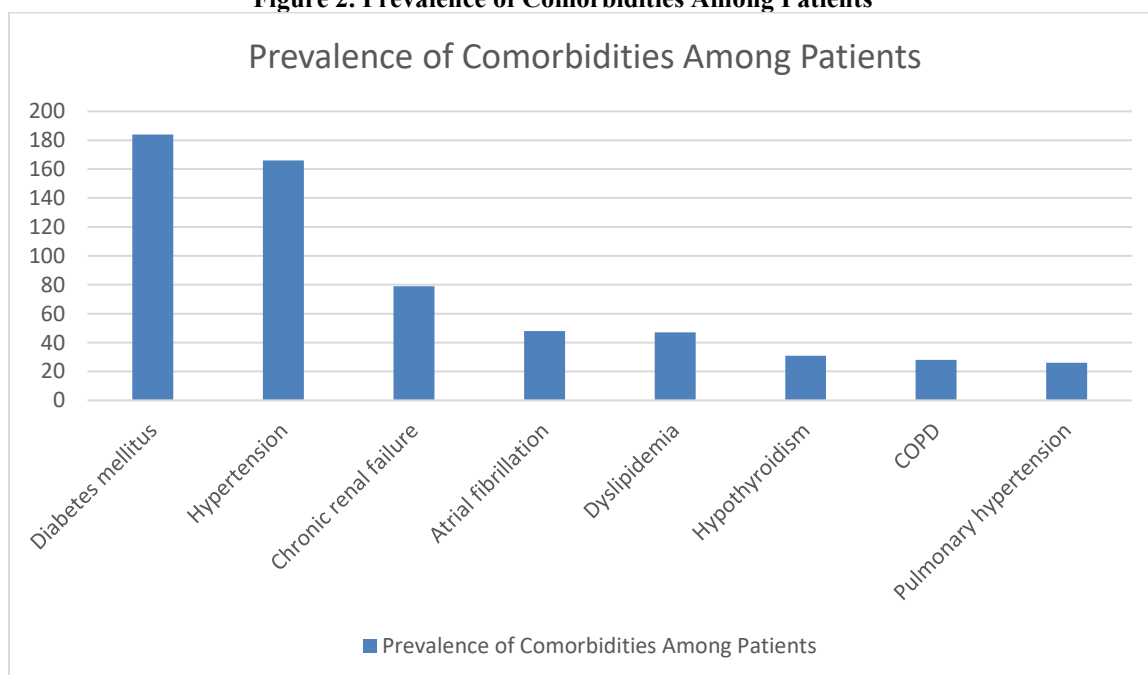
The majority of patients were male (68.9%), while females accounted for 30.8% of the study population. Most patients belonged to the >60 years age group (62.6%), followed by the 40–60 years group (31.8%). Only 5.6% of patients were younger than 40 years, indicating that cardiovascular diseases were more prevalent among older individuals.(Table 1)

Figure 1. Distribution of Cardiovascular Diseases



Coronary artery disease was the most common cardiovascular condition, present in 58.9% of patients. Heart failure was observed in 33.4%, followed by dilated cardiomyopathy (13.9%). Rheumatic heart disease and congenital heart disease were less frequent, accounting for 6.6% and 2% respectively.(Figure 1)

Figure 2. Prevalence of Comorbidities Among Patients



Among the comorbid conditions, diabetes mellitus (60.9%) and hypertension (55%) were the most prevalent. Chronic renal failure was present in 26.2% of patients, while atrial fibrillation and dyslipidemia were observed in 15.9% and 15.6%

respectively. Other comorbidities such as hypothyroidism, COPD, and pulmonary hypertension were present in smaller proportions. (Figure 2)

Table 2. Association Between Diabetes Mellitus and Coronary Artery Disease

Diabetes Mellitus	CAD Absent n (%)	CAD Present n (%)	χ^2 value	p value
No	76 (64.4%)	42 (35.6%)		
Yes	48 (26.1%)	136 (73.9%)	43.623	<0.001

A statistically significant association was observed between diabetes mellitus and coronary artery disease ($\chi^2 = 43.623$, $p < 0.001$). CAD was present in 73.9% of diabetic patients, compared with 35.6% of non-diabetic patients, indicating that diabetes is a major risk factor for CAD in this population. (Table 2)

Table 3. Association Between Hypertension and Coronary Artery Disease

Hypertension	CAD Absent n (%)	CAD Present n (%)	χ^2 value	p value
No	73 (53.7%)	63 (46.3%)		
Yes	51 (30.7%)	115 (69.3%)	16.275	<0.001

A significant association was found between hypertension and coronary artery disease ($\chi^2 = 16.275$, $p < 0.001$). CAD was more prevalent among hypertensive patients (69.3%) compared to those without hypertension (46.3%). (Table 3)

Table 4. Association Between Age Group and Comorbidity Score

Age Group	0 n (%)	1 n (%)	2 n (%)	3 n (%)	4 n (%)	χ^2 value	p value
<40 years	15 (88.2)	1 (5.9)	1 (5.9)	0 (0)	0 (0)		
40–60 years	18 (18.8)	30 (31.3)	31 (32.3)	14 (14.6)	3 (3.1)		
>60 years	26 (13.8)	31 (16.4)	61 (32.3)	51 (27.0)	20 (10.6)	71.126	<0.001

There was a statistically significant association between age group and comorbidity burden ($\chi^2 = 71.126$, $p < 0.001$). Patients aged >60 years had higher comorbidity scores, indicating increased disease burden with advancing age.

The comorbidity score reflects the cumulative burden of co-existing diseases. Higher scores indicate the presence of multiple comorbid conditions and greater clinical complexity. (Table 4)

Table 5. Association Between Gender and Coronary Artery Disease

Gender	CAD Absent n (%)	CAD Present n (%)	χ^2 value	p value
Male	64 (30.8%)	144 (69.2%)		
Female	60 (64.5%)	33 (35.5%)	30.212	<0.001

A significant association was found between gender and coronary artery disease ($\chi^2 = 30.212$, $p < 0.001$). CAD was significantly more prevalent among male patients (69.2%) compared to female patients (35.5%). (Table 5)

Table 6. Association Between Gender and Rheumatic Heart Disease

Gender	RHD Absent n (%)	RHD Present n (%)	χ^2 value	p value
Male	202 (97.1%)	6 (2.9%)		
Female	79 (84.9%)	14 (15.1%)	15.343	<0.001

A statistically significant association was observed between gender and rheumatic heart disease ($\chi^2 = 15.343$, $p < 0.001$). RHD was more common among female patients (15.1%) compared to male patients (2.9%). (Table 6)

DISCUSSION

The present study evaluated the spectrum of cardiovascular diseases and associated comorbidities among 302 patients. The findings demonstrate that coronary artery disease (58.9%) was the most common cardiovascular condition, followed by heart failure (33.4%) and dilated cardiomyopathy (13.9%). Additionally, diabetes mellitus (60.9%) and hypertension (55%) were the most prevalent comorbidities, and both showed significant associations with coronary artery disease.

Demographic profile

In the present study, male patients constituted 68.9% of the study population, while females accounted for 30.8%. These findings are consistent with the known epidemiological pattern where cardiovascular diseases are more common among males, particularly ischemic heart disease.

However, in contrast to our findings, Yadeta et al. (2017) [3] reported a higher proportion of female patients (58.5%) in their large cross-sectional study involving 6275 cardiovascular patients in Ethiopia. The difference may be attributed to regional variations in disease

distribution and the higher prevalence of rheumatic heart disease among women in certain populations.

Similarly, in the present study, the majority of patients were older than 60 years (62.6%), indicating that cardiovascular diseases are more common among elderly individuals. This finding is consistent with the study by Buddeke et al. (2017) [6], who analyzed 2.3 million hospital admissions for cardiovascular disease and reported that comorbidities and cardiovascular events were significantly more prevalent among patients aged ≥ 75 years.

Spectrum of cardiovascular diseases

The present study found that coronary artery disease was the most common cardiovascular condition (58.9%). This finding reflects the increasing burden of ischemic heart disease associated with urbanization, lifestyle changes, and the rising prevalence of metabolic risk factors.

In contrast, Yadeta et al. (2017) [3] reported that valvular heart disease was the most common cardiovascular condition (40.5%), with 86% of these cases attributed to chronic rheumatic heart disease. This difference likely reflects variations in epidemiological transition between regions, where rheumatic heart disease still contributes significantly to cardiovascular disease burden in certain low-income settings.

Similarly, Alici and Genç (2021) [4] conducted an echocardiographic registry study involving 1140 patients in Somalia and reported that hypertensive heart disease (39.8%) was the most common cardiovascular condition, followed by valvular heart disease (34.6%) and heart failure with reduced ejection fraction (30.8%). These findings highlight the regional variability in the distribution of cardiovascular diseases.

Comorbidity burden

The present study demonstrated a high prevalence of comorbidities, particularly diabetes mellitus (60.9%) and hypertension (55%). These findings are consistent with the increasing global burden of metabolic risk factors contributing to cardiovascular disease.

Previous studies have also highlighted the importance of comorbid conditions in cardiovascular patients. Buddeke et al. (2017) [6] reported that 38% of patients hospitalized for cardiovascular diseases had at least one comorbid condition, with higher prevalence observed in patients with heart failure (54%) and peripheral arterial disease (46%).

Furthermore, Lee et al. (2014) [5] analyzed 192,327 hospitalizations for heart failure in the United States and identified distinct comorbidity profiles, including a lifestyle profile characterized by diabetes, hypertension, obesity, and chronic pulmonary disorders. This profile was associated with 12% higher healthcare costs and

longer hospital stays, highlighting the clinical impact of multiple comorbidities.

Association of diabetes and hypertension with coronary artery disease

In the present study, diabetes mellitus showed a strong association with coronary artery disease ($\chi^2 = 43.623$, $p < 0.001$). CAD was present in 73.9% of diabetic patients, compared with 35.6% of non-diabetic patients.

Similarly, hypertension was also significantly associated with coronary artery disease ($\chi^2 = 16.275$, $p < 0.001$), with 69.3% of hypertensive patients having CAD compared with 46.3% among non-hypertensive patients. These findings are consistent with well-established evidence that diabetes and hypertension are major modifiable risk factors for coronary artery disease.

Age and comorbidity burden

The present study also demonstrated that comorbidity burden increased significantly with age ($\chi^2 = 71.126$, $p < 0.001$). Patients aged > 60 years had higher comorbidity scores, indicating greater clinical complexity among elderly patients.

Similar findings were reported by Buddeke et al. (2017) [6], who observed that the prevalence of comorbid conditions increased significantly among older cardiovascular patients, particularly among those aged ≥ 75 years.

Gender differences in cardiovascular diseases

The present study demonstrated that coronary artery disease was significantly more common among male patients (69.2%) compared to females (35.5%), which aligns with the established epidemiology of ischemic heart disease.

Conversely, rheumatic heart disease was significantly more common among female patients (15.1%) compared with males (2.9%) in the present study. Similar gender patterns have been reported in studies conducted in developing regions where rheumatic heart disease remains prevalent.

Cardiovascular diseases and associated conditions

Several studies have also demonstrated strong links between cardiovascular diseases and other chronic conditions. For example, El-Shabrawy and Eldamanhory (2017) [7] reported that among 252 patients hospitalized for COPD exacerbations, cardiovascular diseases such as pulmonary hypertension (64.8%), systemic hypertension (37.3%), arrhythmias (31.5%), ischemic heart disease (27.8%), and heart failure (21.3%) were frequently observed and significantly influenced clinical outcomes. Overall, the findings of the present study are consistent with global trends demonstrating an increasing burden of coronary artery disease and metabolic risk factors, particularly diabetes and hypertension. At the same time, the distribution of cardiovascular diseases varies across

regions due to differences in socioeconomic conditions, lifestyle patterns, and healthcare access.

These findings highlight the importance of early detection and effective management of modifiable cardiovascular risk factors to reduce the growing burden of cardiovascular diseases.

CONCLUSION

The present study evaluated the demographic profile, disease spectrum, and comorbidity burden among patients with cardiovascular diseases. Cardiovascular diseases were more common among male patients and individuals older than 60 years. Coronary artery disease was the most prevalent condition, followed by heart failure and dilated cardiomyopathy.

A high prevalence of comorbidities was observed, particularly diabetes mellitus and hypertension, both of which showed a significant association with coronary artery disease. Increasing age was also significantly associated with a higher comorbidity burden, indicating that elderly patients are more likely to present with multiple coexisting conditions.

Additionally, coronary artery disease was more common among males, while rheumatic heart disease was more frequent among females. These findings highlight the importance of early identification and management of modifiable risk factors, particularly diabetes and hypertension, to reduce the burden and adverse outcomes of cardiovascular diseases.

CONFLICT OF INTEREST: Nil

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