

Clinical and Sociodemographic Profile and Pattern of Echocardiographic Diagnosis of Patients Attending Outpatient Echo Department of NICVD

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Abstract

Original Research Article

Background: Cardiovascular diseases (CVDs) represent a significant public health burden globally, including in Bangladesh. Echocardiography is a pivotal diagnostic tool in the assessment of cardiac function, structure, and abnormalities in patients with suspected cardiovascular conditions. **Objective:** This study aimed to evaluate the clinical and sociodemographic characteristics of patients attending the outpatient echocardiography department at the National Institute of Cardiovascular Diseases (NICVD), Dhaka, and to analyze the pattern of echocardiographic findings. **Methods:** A cross-sectional study was conducted over six months, including [total number] patients referred for echocardiographic evaluation. Sociodemographic data, including age, gender, and clinical history, were collected. Echocardiographic assessments were performed following standard guidelines, with measurements including aortic root diameter (AO), left atrial size (LA), left ventricular end-diastolic diameter (LVEDD), left ventricular end-systolic diameter (LVESD), and ejection fraction (EF). Descriptive statistics were used to analyze the data, and associations between demographic factors and echocardiographic findings were evaluated. **Results:** The mean age of the study population was 48.02 ± 14.49 years, with a majority (65.63%) aged between 31-60 years. Males constituted 86.22% of the patients, resulting in a male-to-female ratio of 6.21:1. The mean aortic root diameter was 27.81 ± 4.46 mm, and the mean left atrial diameter was 33.28 ± 4.82 mm. The mean LVEDD and LVESD were 45.28 ± 6.02 mm and 29.74 ± 5.13 mm, respectively. The average ejection fraction was 63%, indicating preserved systolic function in the majority of patients. Notably, 35.32% of patients exhibited regional wall motion abnormalities (RWMA), suggestive of ischemic heart disease. **Conclusion:** The study highlights that middle-aged and elderly adults, particularly males, constitute the majority of patients undergoing echocardiographic evaluation at NICVD. Echocardiographic findings revealed a significant prevalence of regional wall motion abnormalities, underlining the burden of ischemic heart disease in this population. These findings emphasize the need for targeted interventions to address the cardiovascular risk factors and improve early diagnosis and treatment, particularly in high-risk groups.

Keywords: Echocardiography, Cardiovascular Disease, Regional Wall Motion Abnormalities, Bangladesh, National Institute of Cardiovascular Diseases.

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INTRODUCTION

Cardiovascular diseases (CVDs) remain a leading cause of morbidity and mortality worldwide, particularly in low- and middle-income countries like Bangladesh, where access to timely diagnosis and treatment can be limited. According to the World Health Organization (WHO), cardiovascular diseases account for an estimated 17.9 million deaths each year, representing about 31% of global deaths. Early and accurate diagnosis of cardiac conditions is crucial in preventing disease progression and improving patient

outcomes, and echocardiography plays a central role in this diagnostic process [1].

Echocardiography (Echo) is a non-invasive, widely available, and highly informative diagnostic tool that provides real-time visualization of the heart's structure and function. It offers critical insights into the morphology and performance of cardiac chambers, valves, and major vessels, making it indispensable in assessing a variety of cardiovascular diseases. From the detection of valvular heart disease to the evaluation of

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systolic and diastolic heart function, echocardiography serves as a cornerstone in modern cardiology [2].

Bangladesh, like many developing nations, faces a dual burden of both communicable and non-communicable diseases. In recent years, the incidence of cardiovascular diseases has surged due to urbanization, changes in lifestyle, and increasing rates of risk factors such as hypertension, diabetes, obesity, and smoking [3]. The prevalence of hypertension alone in Bangladeshi adults was approximately 21.1%, with urban residents showing higher rates than rural populations [4].

Several sociodemographic factors, including age, gender, socioeconomic status, and educational background, significantly influence the burden and manifestation of cardiovascular diseases. For instance, older individuals are more susceptible to structural heart disease, such as left ventricular hypertrophy and valvular disorders, whereas younger populations in developing countries may present with rheumatic heart disease due to inadequate treatment of streptococcal infections during childhood [5]. Moreover, studies have demonstrated gender differences in cardiovascular disease presentation, with men generally having a higher incidence of coronary artery disease, while women are more prone to developing heart failure with preserved ejection fraction (HFpEF) and mitral valve prolapse. Understanding these demographic profiles can help tailor clinical management and improve the allocation of healthcare resources [6].

At the NICVD, one of the largest cardiac care centers in South Asia, echocardiography is a routine diagnostic tool used in outpatient services. NICVD primarily serves a population that is socioeconomically disadvantaged, which adds complexity to the clinical management of cardiovascular diseases. Many patients are present with advanced disease due to delayed diagnosis and treatment. Thus, it is essential to characterize the clinical and sociodemographic profiles of patients attending the NICVD's echocardiography department to understand patterns of disease presentation and facilitate early interventions.

Echocardiographic diagnoses offer invaluable insights into the pathophysiology of heart diseases. Left atrial enlargement, for example, is frequently observed in patients with chronic hypertension or valvular heart disease and serves as a predictor for atrial fibrillation. Similarly, left ventricular ejection fraction (LVEF) is a critical parameter in evaluating systolic function, with reduced LVEF being a hallmark of heart failure and cardiomyopathy. Doppler studies further enhance the diagnostic capabilities of echocardiography by assessing blood flow through the heart's chambers and valves, identifying conditions such as mitral stenosis or aortic regurgitation. In Bangladesh, rheumatic heart disease remains a significant contributor to valvular heart diseases, particularly in younger populations. Studies

conducted at the NICVD have highlighted that rheumatic mitral stenosis continues to be a major echocardiographic finding among patients from rural areas.

Given the increasing prevalence of cardiovascular diseases and the pivotal role of echocardiography in diagnosing these conditions, this study aims to explore the clinical and sociodemographic profile, as well as the pattern of echocardiographic diagnoses, of patients attending the outpatient echo department of NICVD. By analyzing echocardiographic findings alongside patient demographics such as age and gender, this research intends to provide valuable insights that may inform future public health initiatives and clinical strategies aimed at reducing the burden of cardiovascular diseases in Bangladesh.

METHODS

This cross-sectional study was conducted at the outpatient echo department of NICVD from January 2022 to December 2023. A total of 1000 patients who underwent echocardiography were randomly selected for the study. The patients' clinical and sociodemographic data were collected from their medical records. Echocardiographic diagnoses were categorized into various groups based on the American Society of Echocardiography (ASE) guidelines.

Study Population

The study population included all patients who were referred to the outpatient echocardiography department for an echocardiographic evaluation during the study period. Patients were referred for echocardiographic assessment due to suspected or established cardiovascular conditions based on clinical symptoms such as chest pain, shortness of breath, palpitations, or known risk factors like hypertension, diabetes, dyslipidemia, or a family history of cardiovascular disease.

Inclusion Criteria

- All patients, regardless of age or gender, attended the outpatient echocardiography department during the study period.
- Patients who had clinical indications for an echocardiogram, such as symptoms of cardiovascular disease (e.g., chest pain, dyspnea, syncope) or abnormal clinical findings (e.g., heart murmurs, abnormal electrocardiograms).
- Patients who consented to participate in the study after being informed about the purpose and nature of the study.

Exclusion Criteria

- Patients with incomplete echocardiographic data or poor-quality images that were inadequate for accurate interpretation.

- Patients who had previously undergone cardiac surgery or interventions, as this could potentially confound the echocardiographic findings.
- Patients who did not consent to participate in the study.

Sample Size

The total sample size was determined based on the number of patients who met the inclusion criteria and attended the outpatient echocardiography department during the study period. To ensure statistical power and representativeness, the sample size was calculated using a standard formula for cross-sectional studies, considering an estimated prevalence of cardiovascular abnormalities in the target population, a margin of error of 5%, and a confidence level of 95%. Ultimately, a total of 1000 patients were included in the final analysis.

Data Collection Procedure

Patient Recruitment and Informed Consent

Patients attending the echocardiography department were consecutively enrolled in the study after being informed about the nature, purpose, and potential risks and benefits of the research. Written informed consent was obtained from all participants prior to the echocardiographic evaluation. For patients unable to provide written consent (due to illiteracy or other barriers), verbal consent was documented.

Clinical and Demographic Data

Detailed sociodemographic and clinical information was collected from each participant through face-to-face interviews and review of medical records. Data on age, gender, medical history, and cardiovascular risk factors (such as hypertension, diabetes mellitus, smoking status, and family history of CVD) were recorded using a standardized questionnaire.

- **Age and Gender:** Age was categorized into six groups: below 21 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years, and above 60 years. Gender was recorded as male or female.
- **Medical History:** A comprehensive medical history was obtained, including information on previous diagnoses of hypertension, diabetes, dyslipidemia, and any history of coronary artery disease (CAD) or other cardiac conditions. Medication history and lifestyle factors (e.g., smoking, alcohol consumption) were also noted.

Echocardiographic Evaluation

All echocardiographic evaluations were performed using [specific machine/model] in accordance with the American Society of Echocardiography (ASE) guidelines. The echocardiograms were performed by experienced cardiologists who were blinded to the patients' clinical history to minimize bias. Standard two-dimensional (2D), M-mode, Doppler, and color-flow

Doppler imaging were used to assess cardiac structure and function.

The following echocardiographic parameters were measured:

- **Aortic Root Diameter (AO):** Measured at the level of the sinuses of Valsalva during diastole.
- **Left Atrial Diameter (LA):** Measured at end-systole from the parasternal long-axis view.
- **Left Ventricular End-Diastolic Diameter (LVEDD):** Measured at the level of the mitral valve chordae during diastole.
- **Left Ventricular End-Systolic Diameter (LVESD):** Measured at the same level as LVEDD during systole.
- **Ejection Fraction (EF):** Calculated using the modified Simpson's method, a widely used technique for estimating left ventricular systolic function. EF values were categorized as normal ($\geq 55\%$), mildly reduced (45–54%), moderately reduced (30–44%), and severely reduced ($< 30\%$).
- **Regional Wall Motion Abnormalities (RWMA):** Assessed based on abnormal movement of the left ventricular walls, suggestive of ischemia or infarction.

Data Management and Statistical Analysis

All collected data were entered into a secure, password-protected electronic database SPSS: 26. Double-entry validation was used to minimize data entry errors. Descriptive statistics were used to summarize the sociodemographic and clinical characteristics of the study population. Continuous variables, such as age and echocardiographic measurements, were presented as mean \pm standard deviation (SD), while categorical variables, such as gender and presence of comorbidities, were presented as frequencies and percentages.

The primary outcomes of interest were the distribution of echocardiographic abnormalities (e.g., regional wall motion abnormalities, abnormal aortic root size, left atrial enlargement) and the mean values of key echocardiographic parameters (e.g., EF, LVEDD, LVESD). The association between echocardiographic abnormalities and demographic factors (age, gender) and clinical variables (e.g., hypertension, diabetes) was explored using chi-square tests for categorical data and t-tests or ANOVA for continuous data, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study protocol was reviewed and approved by the Ethical Review Committee of NICVD, Dhaka. All participants provided written informed consent prior to enrollment. Patient confidentiality was strictly maintained by anonymizing all data. The study complied

with the ethical principles outlined in the Declaration of Helsinki.

RESULTS

Figure 1 shows that the age distribution of the patients attending the outpatient echocardiography department. The largest proportion of patients was observed in the 31-40 years age group, comprising 22.69% of the total sample, followed closely by the 51-60 years age group at 22.41%. The 41-50 years age group represented 20.53% of the population, while patients over 60 years constituted 19.61% of the sample.

Notably, younger age groups showed considerably lower representation, with patients aged 21-30 years accounting for only 8.96% of the total population. The lowest representation was observed in the below 21 years age group, comprising merely 2.68% of the study population.

The distribution demonstrates a bell-shaped pattern with a slight right skew, with the majority of patients (65.63%) falling within the middle-age brackets (31-60 years) with the mean age 48.02 ± 14.49 years. This age distribution pattern suggests a higher prevalence of cardiovascular conditions requiring echocardiographic evaluation in middle-aged adults, which aligns with the typical age-related progression of cardiovascular diseases reported in contemporary literature.

The relatively low representation of younger individuals (below 30 years) accounting for only 11.64% of the total sample, may reflect either a lower incidence of cardiovascular conditions in this age group or potential barriers to healthcare access among younger populations. This finding warrants further investigation into age-specific cardiovascular risk factors and healthcare-seeking behaviors in this population.

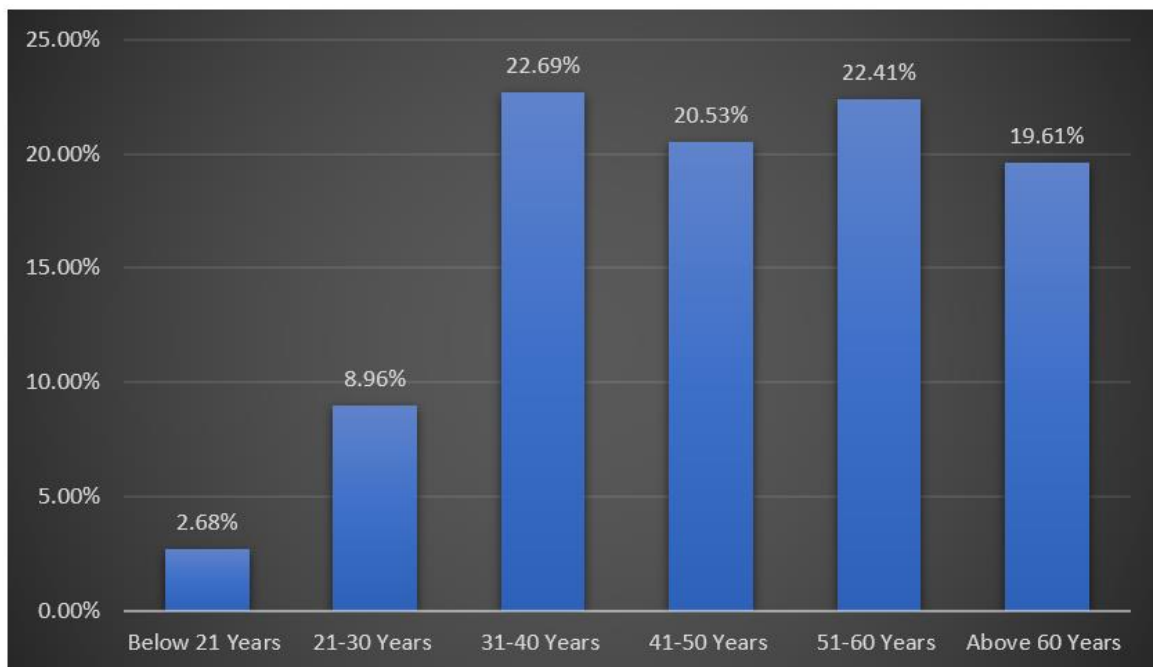


Figure 1: Age distribution of the study patients

The gender distribution analysis reveals a striking disparity between male and female patients in the study population. Males constituted an overwhelming majority, representing 86.22% of the total

sample, while females accounted for only 13.88% of the study population. This translates to a male-to-female ratio of approximately 6.21:1, indicating a substantial gender imbalance in the patient population. (Figure 2)

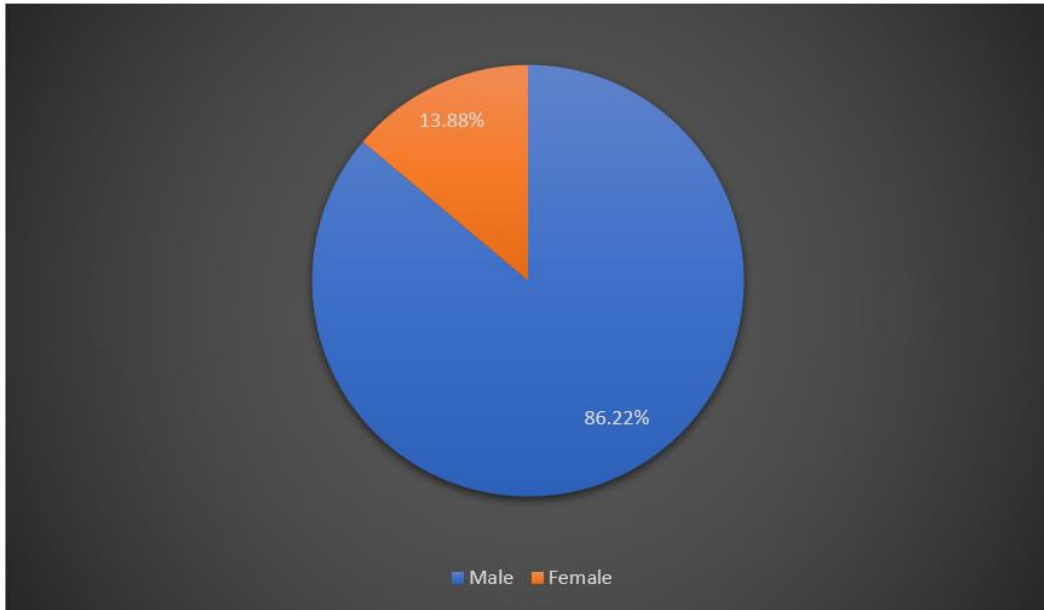


Figure 2: Gender Distribution of the Study Patients

The echocardiographic parameters, such as aortic root dimension (AO), left atrial size (LA), and ejection fraction (EF), provide a baseline for

understanding the cardiac function of the patient population. The mean ejection fraction is around 63%, which is within the normal range. (Table 1)

Table 1: Echocardiographic Findings of the Study Patients

Parameter	Mean ± SD
Aortic Root Diameter	27.81 ± 4.46
Left Atrial Diameter	33.28 ± 4.82
LV End-Diastolic Diameter	45.28 ± 6.02
LV End-Systolic Diameter	29.74 ± 5.13
Ejection Fraction	0.63 ± 0.05

Figure 3 shows the presence of regional wall motion abnormalities in a significant number of patients

35.32% suggests underlying cardiac dysfunctions that require further clinical attention.

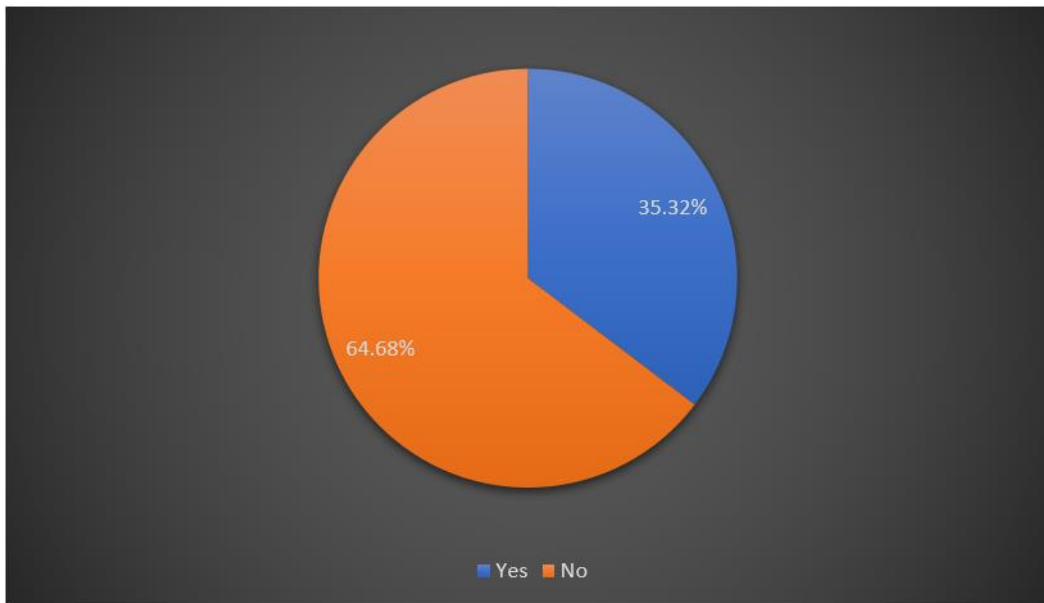


Figure 3: Regional Wall Motion Abnormalities among the Study Patients

DISCUSSION

The present study provides a comprehensive analysis of the clinical and sociodemographic profile of patients attending the outpatient echocardiography department at the National Institute of Cardiovascular Diseases (NICVD). Through the evaluation of key echocardiographic parameters, the study highlights both structural and functional cardiac characteristics, along with age and gender distributions, which offer valuable insights into the cardiovascular health status of this patient cohort. The findings are consistent with previous studies, but also raise critical considerations regarding gender disparities and age-related cardiovascular risks.

The age distribution of the patient population shows a peak prevalence of echocardiographic evaluations in middle-aged adults, specifically between the ages of 31–60 years, who account for 65.63% of the total sample. This is consistent with global data that demonstrates a higher prevalence of cardiovascular conditions such as coronary artery disease (CAD), heart failure, and hypertensive heart disease among middle-aged adults. Cardiovascular risk increases with age due to the cumulative effects of risk factors such as hypertension, diabetes, dyslipidemia, smoking, and sedentary lifestyle. The bell-shaped distribution observed, with a mean patient age of 48.02 ± 14.49 years, is in line with other studies indicating that the incidence of CVD tends to rise sharply in the fourth and fifth decades of life.

This distribution mirrors findings from regional studies in low- and middle-income countries, where cardiovascular disease is now a leading cause of morbidity and mortality. For instance, a study conducted in India found that 70% of patients undergoing echocardiographic assessments were between the ages of 40 and 60, with similar peaks in CVD prevalence. The age-related increase in cardiovascular morbidity highlights the importance of early detection and management of CVD risk factors to prevent long-term complications [7].

Conversely, younger individuals (below 30 years) represented only 11.64% of the total sample. This low representation aligns with previous findings that show younger adults generally have a lower incidence of cardiovascular conditions. However, it may also suggest underreporting or delays in the diagnosis of early-stage cardiovascular disease in younger patients. Younger individuals often experience atypical presentations of CVD, which may lead to delayed diagnosis and treatment. Therefore, it is essential to promote early screening for CVD risk factors in younger populations, especially given the rising rates of obesity, diabetes, and hypertension in younger adults in South Asia [8].

The marked gender disparity in the study cohort, with males comprising 86.22% of the total

sample and females only 13.88%, is a significant finding. This male-to-female ratio of approximately 6.21:1 reflects persistent gender gaps in access to healthcare, especially in cardiovascular services. Several studies have highlighted those women, particularly in South Asia, face numerous barriers to accessing healthcare, including social, cultural, and economic factors. These barriers often result in delayed diagnosis and treatment of cardiovascular conditions in women.

This gender imbalance is consistent with findings from a study conducted in Nepal, where males accounted for 81% of patients undergoing echocardiography [9]. Globally, women are often underrepresented in cardiovascular studies and are less likely to receive timely diagnostic evaluations or interventions, such as echocardiography or coronary angiography. One explanation for this disparity may be the misconception that cardiovascular disease is predominantly a "male" disease. Additionally, women tend to present with atypical or non-specific symptoms, such as fatigue or dyspnea, rather than classic symptoms like chest pain, which can lead to missed or delayed diagnoses. Addressing these gender disparities requires not only increased awareness among healthcare providers but also gender-sensitive health policies that ensure equitable access to cardiovascular care.

The echocardiographic parameters evaluated in this study provide critical insights into the structural and functional status of the patients' hearts. The mean aortic root diameter (27.81 ± 4.46 mm) left atrial diameter (33.28 ± 4.82 mm) and left ventricular end-diastolic and end-systolic diameters (45.28 ± 6.02 mm and 29.74 ± 5.13 mm, respectively) are within the normal ranges for a majority of patients. These findings are consistent with studies conducted in similar populations, where most patients exhibited normal or mildly abnormal echocardiographic parameters [10].

The mean ejection fraction (EF) of 63% indicates preserved left ventricular systolic function in most patients, which is comparable to findings from studies on non-ischemic heart disease populations. However, the presence of regional wall motion abnormalities in 35.32% of patients is a concerning finding that suggests a substantial burden of ischemic heart disease (IHD) in this cohort. Regional wall motion abnormalities are often indicative of myocardial ischemia or infarction, conditions frequently associated with coronary artery disease.

A similar study in Pakistan reported regional wall motion abnormalities in 40% of patients undergoing echocardiographic evaluation, further supporting the significant prevalence of IHD in South Asian populations [11]. These findings underscore the need for early detection and management of coronary artery disease, particularly through timely diagnostic interventions such as echocardiography. The high

prevalence of wall motion abnormalities in this study suggests that a significant portion of the patient population may benefit from further diagnostic evaluations, such as stress echocardiography or coronary angiography, to assess the extent and severity of ischemic damage.

CONCLUSION

In summary, this study sheds light on the clinical and sociodemographic characteristics of patients attending NICVD's echocardiography department. The results highlight the predominance of middle-aged patients, the significant gender disparity in echocardiographic evaluations, and the importance of echocardiographic parameters in identifying structural and functional cardiac abnormalities. The findings align with existing literature, which points to a rising burden of cardiovascular disease in South Asia, particularly in middle-aged adults and males. Future research should focus on addressing gender disparities, improving early detection of CVD in younger populations, and evaluating long-term outcomes for patients with regional wall motion abnormalities. Additionally, targeted public health interventions are needed to promote equitable access to cardiovascular diagnostic services, particularly for women and underserved populations.

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