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Cardiology

Chronic Coronary Syndrome: A Cross-Sectional Study in a Tertiary Care Setting

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Abstract **Original Research Article**

Background: Chronic Coronary Syndrome (CCS) is a prevalent cardiovascular condition characterized by stable yet progressive coronary artery disease. Understanding its clinical presentation, comorbidities, and diagnostic outcomes is crucial for effective management. This study aims to assess the demographic and clinical characteristics of CCS patients and evaluate the role of the Exercise Tolerance Test (ETT) in their diagnosis. ***Methods:*** This cross-sectional study was conducted at the Department of Cardiology, Mymensingh Medical College Hospital, Bangladesh, from June 2022 to July 2023. A total of 220 patients diagnosed with CCS were included. Data on demographics, comorbidities, and ETT results were collected and analyzed. Statistical associations between comorbidities, age, sex, and ETT outcomes were evaluated. ***Results:*** The study population had a mean age of 42.5 ± 12.1 years, with a male predominance (70%). Hypertension (28.18%) and diabetes mellitus (9.55%) were the most common comorbidities. ETT was positive in 60% of patients, with a higher positivity rate observed in hypertensive patients (61.29%, p=0.012) and those aged 30–69 years. Females had a significantly higher ETT positivity rate (86.36%, p<0.001) compared to males (48.70%). ***Conclusion:*** CCS patients present with diverse clinical characteristics, with hypertension being the most frequent comorbidity. ETT serves as a useful diagnostic tool in risk stratification, particularly in hypertensive and female patients. Further studies are needed to assess long-term outcomes and optimize management strategies for CCS in resource-limited settings.

Keywords: Chronic Coronary Syndrome, Exercise Tolerance Test, Hypertension, Diabetes Mellitus, Cardiovascular Risk Factors.

INTRODUCTION

Chronic coronary syndrome (CCS) encompasses a broad variety of clinical syndromes that result from stable atherosclerotic coronary artery disease (CAD), involving an imbalance in myocardial oxygen supply and demand [1]. Unlike the acute and abrupt presentation of cardiac events in acute coronary syndrome (ACS), CCS usually presents along with stable angina or with ischemic symptoms precipitated by stress or exertion [2]. It is still a leading cause of morbidity and mortality worldwide and is linked with a high burden on healthcare systems [3, 4]. It is still difficult to detect early and stratify risk, despite advances in diagnostic and therapeutic modalities, particularly in resource-limited regions like Bangladesh [5].

Coronary artery disease is a leading cause of death in the world and is increasingly becoming common in South Asian countries because of the growing prevalence of risk factors such as hypertension, diabetes mellitus, dyslipidemia, smoking, and lack of physical activity [6]. CCS imposes a high burden in Bangladesh, with cardiovascular diseases being a leading cause of hospitalization. Lack of regular screening, late presentation, and limited access to advanced diagnostic modalities are the causes of delayed treatment and

adverse outcomes in such patients [3]. Selection of high-risk patients and optimization of their therapy remain crucial in the prevention of adverse cardiovascular events [7].

Diagnosis of CCS relies on a combination of clinical assessment, electrocardiography (ECG), exercise tolerance testing (ETT), and imaging modalities such as coronary computed tomography angiography (CCTA) or invasive coronary angiography [8]. Of these, ETT is a still commonly used, inexpensive, and non-invasive tool for the evaluation of myocardial ischemia in patients with suspected CCS [9]. ETT helps in the assessment of functional capacity, detection of ischemic changes, and risk stratification of cardiovascular disease. Its diagnostic utility, however, is contingent on patient factors, comorbidities, and multivessel disease [10]. Despite its drawbacks, ETT remains an important screening tool in resource-poor environments where access to advanced imaging is restricted [11].

A number of studies have investigated the epidemiology, risk factors, and diagnostic methods for CCS but with limited data available in Bangladesh [12, 13]. In view of the country's distinct sociodemographic and healthcare profile, it is crucial to determine the clinical profile, comorbidities, and diagnostic findings of CCS patients in order to devise suitable management strategies [14]. Improved insight into the relationship between conventional cardiovascular risk factors and ETT findings could help in optimizing diagnostic pathways and enhancing early intervention plans [15].

This study aimed to evaluate the demographic profile, clinical presentation, comorbidities, and results of ETT in CCS patients in a Bangladeshi tertiary care hospital. By examining the correlation between risk factors and test outcomes, this study aims to contribute significant evidence to the burden of CCS and its diagnostic complexity in a resource-poor setting. The findings from this study might help clinicians maximize risk stratification, patient results, and better health resource deployment in the handling of CCS successfully.

METHODOLOGY & MATERIALS

This cross-sectional study was conducted at the Department of Cardiology, Mymensingh Medical College Hospital, Mymensingh, Bangladesh, from June 2022 to July 2023. There were 220 patients diagnosed with CCS. All patient age groups and both genders of patients with CCS-suggestive symptoms and patients who had undergone an Exercise Tolerance Test (ETT) were recruited. Exclusion factors were patients with acute coronary syndrome, history of revascularization, severe valvular heart disease, or incomplete medical records.

Data were obtained on case record forms structured to collect demographic, clinical presentation, comorbid illness such as hypertension and diabetes mellitus, and ETT data. The ETT was conducted using the Bruce protocol, and the findings from the test were labeled as positive or negative based on changes in ST segments and clinical manifestations. Laboratory investigations and imaging studies were reviewed where applicable to augment the diagnostic process.

Descriptive statistics were used to summarize the data, where categorical variables were expressed as percentages and frequencies. The association between comorbidities and ETT outcomes was established by using the chi-square test, where p-value <0.05 was statistically significant. Statistical analysis was done using SPSS version 25. Informed consent was obtained from all participants before being included in the study. Confidentiality of the patient was maintained at all times throughout the study.

RESULTS

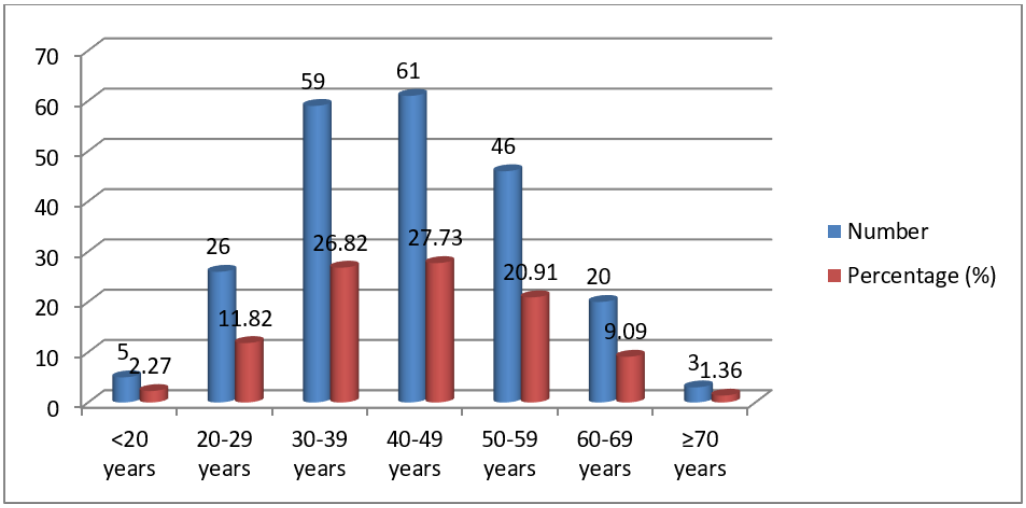

Figure 1: Age Distribution of our Study Participants (N = 220)

Figure 1 details the age distribution of the 220 CCS patients, revealing a significant concentration in the 30-39 year (26.82%) and 40-49 year (27.73%) age brackets, with 11.82% in the 20-29 year group and 20.91% in the 50-59 year group, and a mean age of 42.5 ± 12.1 years.

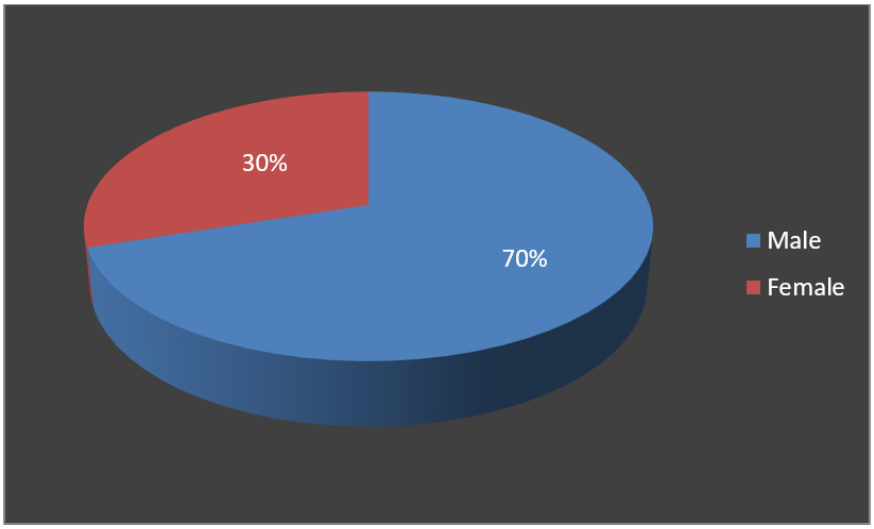

Figure 2: Sex Distribution of our Study Participants (N = 220)

Figure 2 illustrates the sex distribution of the study population, revealing a significant male predominance with 154 males (70%) compared to 66 females (30%). This translates to a male to female ratio of approximately 2.3:1 in the 220 Chronic Coronary Syndrome patients studied.

Table I: Clinical Presentation and Comorbidities (N = 220)

Comorbidity	N	Percentage (%)
Chronic Coronary Syndrome (CCS)	220	100
Hypertension (HTN)	62	28.18
Diabetes Mellitus (DM)	21	9.55
Chest Pain	13	5.91
Chest Pain in Central Region	22	10
Exertional Chest Pain	2	0.91
Shortness of Breath (SOB)	6	2.73

Table I summarizes the clinical presentation and comorbidities identified in the 220 Chronic Coronary Syndrome (CCS) patients. Hypertension emerged as the most prevalent comorbidity, affecting 28.18% of the cohort, followed by Diabetes Mellitus at 9.55%. Chest pain, particularly in the central region (10%), was a common presenting symptom, while exertional chest pain and shortness of breath were less frequent.

Table II: Exercise Tolerance Test (ETT) Results (N = 220)

Test Result	N	Percentage (%)
Positive	132	60.00
Negative	88	40.00
Total	220	100

Table II presents the Exercise Tolerance Test (ETT) results for the 220 patients. A majority of the patients, 132 individuals (60%), exhibited a positive ETT, while 88 patients (40%) had a negative result.

Table III: Association between Comorbidities and ETT Test Results (N = 220)

Comorbidity	Positive	Negative	Total	p value
Hypertension (HTN)	38 (61.29%)	24 (38.71%)	62 (100%)	0.012
Diabetes Mellitus (DM)	11 (52.38%)	10 (47.62%)	21 (100%)	0.760
Chest Pain	9 (69.23%)	4 (30.77%)	13 (100%)	0.055
Shortness of Breath (SOB)	4 (66.67%)	2 (33.33%)	6 (100%)	0.269

Table III illustrates the relationship between comorbidities and ETT outcomes. Hypertension was the most common comorbidity, with 61.29% of hypertensive patients having a positive ETT (p = 0.012), indicating a significant association with ischemic changes. Among diabetic patients, 52.38% had a positive ETT, but the association was not statistically significant (p = 0.760). Chest pain was associated with a 69.23% positive ETT rate (p = 0.055), while shortness of breath showed a 66.67% positive ETT rate (p = 0.269), though neither reached statistical significance.

Table IV: Age Distribution and ETT Test Results (N = 220)

Age Group	Positive	Negative	Total	p value
<20 years	2 (40%)	3 (60%)	5 (100%)	0.549
20-29 years	7 (26.92%)	19 (73.08%)	26 (100%)	<0.001
30-39 years	41 (69.49%)	18 (30.51%)	59 (100%)	0.006
40-49 years	33 (54.10%)	28 (45.90%)	61 (100%)	<0.001
50-59 years	33 (71.74%)	13 (28.26%)	46 (100%)	<0.001
60-69 years	15 (75%)	5 (25%)	20 (100%)	0.002
≥70 years	1 (33.33%)	2 (66.67%)	3 (100%)	0.461
Total	132 (60.00%)	88 (40.00%)	220 (100%)	

Table IV presents the ETT outcomes across different age groups. The highest positive ETT rates were observed in the 60–69 years (75%), 50–59 years (71.74%), and 30–39 years (69.49%) age groups, with statistically significant associations (p < 0.05). Conversely, younger patients, particularly those <20 years (40%) and ≥70 years (33.33%), had lower positive ETT rates, with no significant association (p = 0.549 and p = 0.461, respectively). These findings suggest a higher prevalence of ischemic changes in middle-aged and older adults.

Table V: Sex Distribution and ETT Test Results (N = 220)

Sex	Positive	Negative	Total	p value
Male	75 (48.70%)	79 (51.30%)	154 (100%)	0.649
Female	57 (86.36%)	9 (13.64%)	66 (100%)	<0.001
Total	132 (60.00%)	88 (40.00%)	220 (100%)	

Table V shows the ETT outcomes by sex. Females had a significantly higher positive ETT rate (86.36%) compared to males (48.70%) (p < 0.001), indicating a strong association between female sex and positive ETT findings. In contrast, males had a nearly equal distribution of positive (48.70%) and negative (51.30%) ETT results (p = 0.649).

DISCUSSION

Our study provides an in-depth evaluation of Chronic Coronary Syndrome (CCS) in a tertiary care setting, focusing on clinical presentation, comorbidities, and Exercise Tolerance Test (ETT) outcomes. The findings reveal important patterns in CCS prevalence and diagnostic evaluation, with notable demographic and clinical associations.

The age distribution according to our study indicates that CCS most frequently occurs in middle-aged individuals, with highest prevalence in the 40–49 (27.73%) and 30–39 (26.82%) age groups. Jesmin *et al.*, previously identified that coronary syndromes tend to present earlier in Bangladesh than [16]. The mean age (42.5 ± 12.1 years) in our study was relatively younger than in overseas research, where CCS is mostly presented in elderly subjects, as highlighted by Shah *et al.*, [17]. These findings support early preventive interventions, especially in the South Asian population, with earlier onset of cardiovascular risk factors.

The present study reported high prevalence of male (70%) among CCS patients. Huda *et al.*, and Khandaker *et al.*, also indicated high incidences of coronary syndromes in males as observed in universal trends [18, 19]. However, our ETT data revealed a remarkable sex difference whereby females developed much higher positivity (86.36%) compared to males (48.70%, p < 0.001). Islam *et al.*, also observed similar sex-based discrepancies in CCS diagnosis, which highlights the need for gender-based diagnostic criteria and therapeutic interventions [20].

Of the comorbidities, hypertension was highest (28.18%), followed by diabetes mellitus (9.55%). Latif *et al.*, and Li *et al.*, also pointed out that hypertension has a close relationship with CCS, high blood pressure is a key risk factor in ischemic heart disease [21, 22]. The current study also supports the same, as there was an increased positivity rate in ETT in patients with hypertension (61.29%, p = 0.012), supporting the close association of hypertension with myocardial ischemia. Prevalence of diabetes in our cohort was lower than what was previously established in some studies, such as Shah

et al., but still shows that patients with diabetes have a high ETT positivity rate (52.38%) [17]. This suggests a need for careful monitoring of diabetes-associated cardiovascular risks.

In diagnostic evaluation, 60% of our patients had a positive ETT, consistent with reports by Panuccio *et al.,* who emphasized ETT as an effective first-line assessment tool for ischemia in CCS patients [23]. According to our analysis by age groups, positivity rates were highest in the 60–69 (75%) and 50–59 (71.74%) age groups, with significant differences between groups. Goldsmith *et al.,* earlier reported that age is an important determinant of ischemic burden and diagnostic yield in ETT [24]. Patients younger than 20 and 20–29 years in our study had a lower rate of positivity, which could be due to early disease or a lower total ischemic burden.

The current study suggests the value of non-invasive diagnostic techniques like ETT for quantifying ischemic burden. Later imaging studies with imaging modalities such as coronary computed tomography angiography (CCTA) or fractional flow reserve (FFR) may add additional insight into CCS risk stratification, as suggested by Zeb *et al.,* [25]. Our study highlights the importance of early detection and control of risk factors in CCS, particularly in hypertensive patients and females with high ETT positivity. Since CCS presentation in our series is comparatively young, such interventions to alter lifestyle and perform early screening are necessary.

Limitations of the study

Our study has some limitations. Firstly, it was conducted in one tertiary center, and therefore this may limit generalizability to the broader populations. Secondly, the study relied on Exercise Tolerance Test (ETT) as the first choice diagnostic tool, and while useful, is less sensitive and specific compared to highly advanced imaging studies like coronary computed tomography angiography (CCTA) or fractional flow reserve (FFR). Third, long-term patient outcome and the impact of different treatment approaches, e.g., medical therapy versus invasive interventions, were not assessed. Lastly, assumed confounding factors, e.g., drug use, lifestyle practices, and genetic factors, were not systematically studied. Large multicenter studies with a more extensive diagnostic evaluation protocol are needed in the future to validate and expand our findings.

CONCLUSION

This study provides valuable insights into the clinical characteristics, comorbidities, and diagnostic evaluation of patients with Chronic Coronary Syndrome (CCS) in a tertiary care setting. Hypertension was the most prevalent comorbidity, highlighting its significant role in CCS. The Exercise Tolerance Test (ETT) was positive in 60% of patients, with a higher positivity rate observed among hypertensive patients and females, suggesting potential differences in disease presentation across demographic groups. Age also influenced ETT outcomes, with the highest positivity rates found in patients aged 30–69 years. These findings emphasize the importance of comprehensive risk assessment and early diagnosis, particularly in high-risk groups. Further research is needed to explore long-term outcomes and refine diagnostic approaches for CCS in resource-limited healthcare settings.

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Conflicts of interest: There are no conflicts of interest.

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