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Prevalence and Impact of Diabetes and Hypertension in Chronic Coronary Syndrome Patients

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Abstract

Introduction: *Coronary artery disease (CAD) is a major cause of morbidity and mortality worldwide. Chronic coronary syndrome (CCS) is defined by the different evolutionary stages of CAD. Diabetes mellitus (DM) and hypertension (HTN) are key risk factors for CCS, significantly influencing disease progression and patient outcomes. Therefore, this study aimed to evaluate the prevalence of DM and HTN in CCS patients and examine their impact on metabolic parameters.*

Methods: *This prospective observational study was conducted in the Department of Cardiology, Mymensingh Medical College Hospital, Mymensingh, Bangladesh, from June 2023 to July 2024. In this study, we included 200 patients with chronic coronary syndrome who attended the cardiology department of our study institution within the study period.*

Result: *The majority of patients (30%) were aged 41-50 years, followed by 23% in the 51-60 years group. Only 2.5% were aged ≤20 years. The male-to-female ratio was 1.56:1, with 61% of patients being male. The mean age was 42.5 ± 11.3 years, and the mean BMI was 28.27 ± 3.24 kg/m². Among the patients, 24% had type 2 DM, while 6% had type 1 DM. Patients with both DM and HTN exhibited the highest BMI (26.7 ± 4.0 kg/m²) compared to those without either condition (24.6 ± 3.4 kg/m²; $p < 0.05$). Systolic blood pressure (CSP) was also significantly higher in the DM + HTN group (145.7 ± 25.6 mmHg) versus the "Neither" group (126.9 ± 20.8 mmHg; $p < 0.05$). Diastolic pressure (CDP) was highest in the DM group (77.1 ± 12.0 mmHg; $p < 0.05$). Total cholesterol (TC) levels were elevated in patients with DM (183.4 ± 42.0 mg/dl; $p = 0.02$), while the highest HDL levels were observed in the "Neither" group (42.5 ± 16.8 mg/dl; $p < 0.05$). Although triglyceride levels were highest in the DM + HTN group (176.3 ± 120.8 mg/dl), the difference was not statistically significant ($p = 0.06$). LDL levels did not differ significantly across groups ($p = 0.08$).*

Conclusion: *The findings of this study show that CCS patients with both DM and HTN had worse metabolic and hemodynamic profiles, including higher BMI, blood pressure, and lipid abnormalities, compared to those without these conditions. Diabetes, particularly when combined with hypertension, is associated with more severe cardiovascular risk factors.*

Keywords: *Diabetes, Hypertension, Impact, Chronic Coronary Syndrome.*

1. INTRODUCTION

Coronary artery disease (CAD) remains a leading cause of illness and death worldwide. Chronic coronary syndrome (CCS) refers to the various stages of CAD, excluding cases characterized by acute coronary syndrome (ACS). [1] While CCS is considered a more stable form of coronary heart disease, this stability is only relative, when there is always a risk of it progressing to ACS, which can result in serious cardiovascular events. [2] According to 2016 data from the American College of Cardiology (ACC), the incidence of CCS is approximately twice that of myocardial infarction and is projected to affect 18% of adults by 2030. [3] CCS is a major public health concern, characterized by the long-term presence of stable atherosclerotic plaques that restrict blood flow to the heart. It affects millions of people worldwide and is a leading cause of morbidity and mortality. Among the various risk factors contributing to CCS, diabetes, and hypertension play a critical role in accelerating disease progression and increasing the likelihood of adverse cardiovascular events.

Diabetes is a well-known and widespread risk factor for cardiac morbidity and mortality, making it a significant comorbidity in patients with ischemic heart disease (IHD). However, there is limited understanding of how diabetes affects health status outcomes following acute coronary syndrome (ACS). Evaluating the impact of diabetes on health outcomes in cardiovascular patients is crucial for improving patient care and management. [4] The global prevalence of diabetes has been rising rapidly and is estimated to have doubled since 1980, from 4.7% to 8.5% among adults. [5] This unfavorable trend has been observed across a broad range of high and low-income countries. [6] Today, diabetes is the seventh cause of death worldwide. [7] Among patients at high risk for cardiovascular disease, diabetes independently increases the risk of death and cardiovascular events, including heart failure, by approximately 30 to 40%. [8 ,9]

Hypertension is also a well-known risk factor for cardiovascular events and a common cause of heart failure. [10, 11] Hypertension has been attributed to be responsible for 13% of global deaths. [12] With the projection of a 30% increase in the worldwide prevalence of this condition by the year 2025 and for its pivotal role in the rising global burden of cardiovascular disease. [13]

The impact of diabetes mellitus (DM) and hypertension on outcomes in patients with acute coronary syndrome (ACS) undergoing percutaneous coronary intervention (PCI) has been extensively studied. Research indicates that hypertension does not significantly affect short- or long-term mortality in patients with ST-elevation myocardial infarction (STEMI) treated with PCI. [14, 15] However, in patients with unstable angina (UA) undergoing coronary stenting, hypertension is the only independent predictor of long-term mortality. [16] Additionally, insulin-treated diabetes mellitus (ITDM) is a strong predictor of long-term mortality compared to patients without diabetes or those with non-insulin-treated diabetes. [17] For ACS patients with both DM and hypertension, the combined presence of these conditions is associated with a higher risk of mortality than having either condition alone. [18] Several studies have described the prognostic impact of a history of HTN and a history of DM, mostly in patients with an acute MI. [19,20] The characteristics, treatment, and outcome in hypertensive patients with and without DM in the full spectrum of ACS are less well known, although addressed in a few papers. [21]

However, the impact of diabetes, hypertension, and also the combined effect of diabetes and hypertension on long-term outcomes in patients with CCS remains obscure. Therefore, in this study, we aimed to evaluate the prevalence of DM and HTN and examine their impact on metabolic parameters in chronic coronary syndrome patients of our tertiary care center.

2. METHODOLOGY & MATERIALS

This cross-sectional study was conducted in the Department of Cardiology, Mymensingh Medical College Hospital, Mymensingh, Bangladesh, from June 2023 to July 2024. In this study, we included 200 patients with chronic coronary syndrome who attended the cardiology department of our study institution within the study period.

These are the following criteria to be eligible for enrollment as our study participants: a) Patients aged above 18 years; b) Patients with chronic coronary syndrome; c) Patients with DM & HTN were included in the study **And** a) Patients receiving steroid medications; b) Patients with any history of acute illness (e.g., renal or pancreatic diseases, asthma, COPD etc.); c) Patients who were unwilling to participate were excluded from our study.

Data Collection: Informed written consent was taken from the patients. Every patient who underwent an Exercise tolerance test (ETT) and had a positive test result was diagnosed with chronic coronary syndrome case. Data on body habitus, baseline biochemical data, and hemodynamic data on cardiac catheterization were all collected for analysis. The measurements of body parameters included body height, body weight, and body mass index (BMI). The baseline biochemical data like CSP, CDP, creatinine, total cholesterol, high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol (LDL-C), and serum triglyceride level of every patient was collected.

Statistical Analysis: All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation; qualitative data was expressed as frequency distribution and percentage. The data were analyzed using the chi-square (X^2) test, and t-test. A p-value <0.05 was considered as significant. Statistical analysis was performed using SPSS 22 (Statistical Package for Social Sciences) for Windows version 10.

3. RESULTS

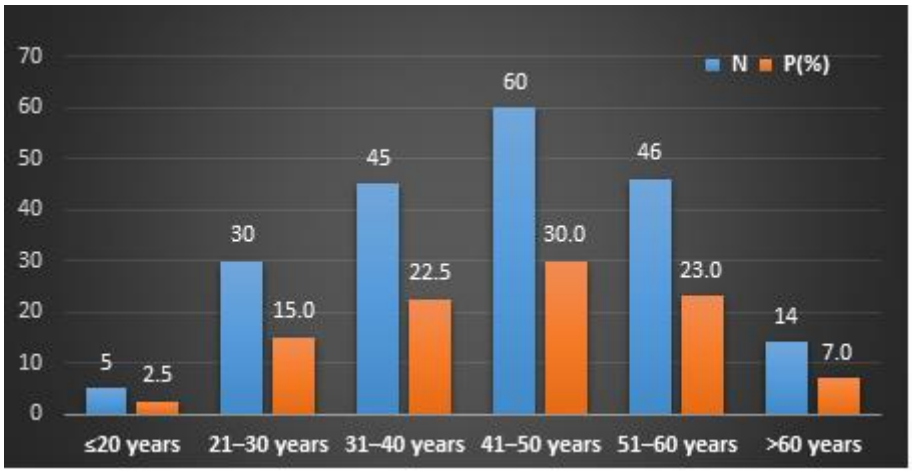

Figure 1. *Age distribution of our study patients (n=200)*

Figure 1 shows that the majority (30%) of our patients were in the age group of 41-50 years, followed by 23% of them aged 51-60 years, 22.5% of them aged 31-40 years, 15% & 7% of patients were in the 21-30 & >60 years age group respectively. Only a small percentage (2.5%) of patients were aged 20 years or younger.

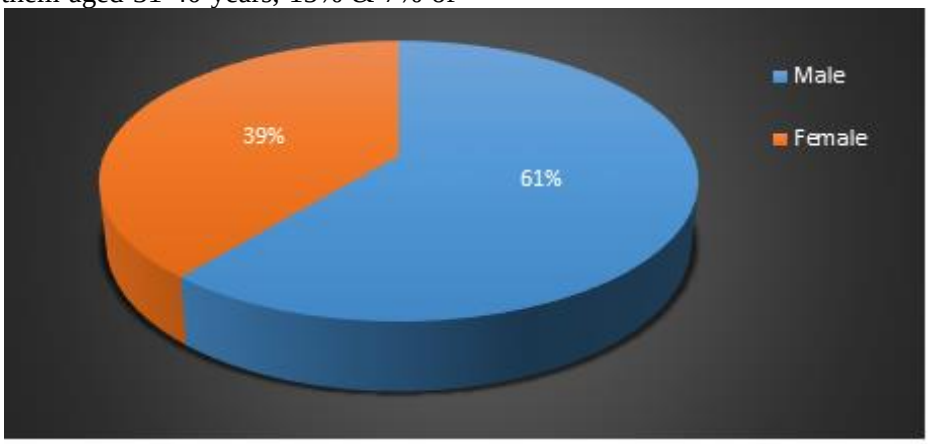

Figure 2. *Gender distribution of our study patients (n=200)*

The pie chart shows that most of our study patients 122 (61%) were male and 78 (39%) were female. The male and female ratio was 1.56:1 in our study.

Table 1. *Baseline characteristics of study subjects*

Baseline	N=200	P(%)
Mean age (years)	42.5±11.3	
BMI(kg/m^2)	28.27±3.24	
DM		

Type 1	12	6.0
Type 2	48	24.0
DM duration		
<8 yrs	32	16.0
8-10 yrs	18	9.0
>10 yrs	10	5.0
Systolic blood pressure (mm Hg)		
≥ 140	126	63.0
<140	74	37.0
Diastolic blood pressure (mm Hg)		
≥ 80	122	61.0
<80	78	39.0
Mean FBG (mmol/L)	11.1±3.4	
Mean 2-h value (mmol/L)	16.21±2.52	
Mean HbA1c (%)	7.89±1.34	
Triglycerides (mg/dL)	189.85±56.04	
Total cholesterol (mg/dL)		
<203	92	46.0
≥ 203	108	54.0
HDL (mg/dL)		
<44	105	52.5
≥ 44	95	47.5
LDL (mg/dL)		
<124	88	44.0
≥ 124	112	56.0

Table 1 shows the baseline parameters of our patients. We found the mean age 42.5±11.3 years. The majority (24%) had type 2 DM and 6% had type 1 diabetes. Among all patients, 16% had diabetes less than 8 years, followed by 9% of patients whose DM duration was 8-10 years & 5% had DM more than 10 years. The mean BMI was 28.27±3.24 kg /m^2. We found the mean FBG was 11.1±3.4 mmol/L, the mean 2-h value was 16.21±2.52 mmol/L, the mean HbA1c was 7.89±1.34 and the mean triglyceride was 189.85±56.04 mg/dL. The majority (54%) had TC more than 203 mg/dL, 52.5% had HDL less than 44 mg/dL & 56% had LDL more than 124 mg/dL.

Table 2. *Metabolic parameters by Diabetes and Hypertension status in our study patients*

Baseline	DM=40	HTN=90	DM+HTN=40	Neither=30	P-value
BMI (kg/m^2)	25.8 ± 4.5	26.2 ± 4.1	26.7 ± 4.0	24.6 ± 3.4	<0.05
Weight (kg)	67.5 ± 13.2	68.5 ± 13.0	68.6 ± 13.8	66.3 ± 11.7	0.08
CSP	130.0 ± 20.0	141.9 ± 21.6	145.7 ± 25.6	126.9 ± 20.8	<0.05
CDP	70.3 ± 11.4	77.1 ± 12.0	73.6 ± 12.8	71.4 ± 13.2	<0.05
Cholesterol (mg/dl)	171.2 ± 40.4	183.4 ± 42.0	180.1 ± 48.0	181.7 ± 45.2	0.02
HDL (mg/dl)	35.8 ± 13.4	40.8 ± 15.4	38.1 ± 14.4	42.5 ± 16.8	<0.05
TG (mg/dl)	154.8 ± 103.0	155.1 ± 96.2	176.3 ± 120.8	148.9 ± 108.9	0.06
LDL (mg/dl)	102.8 ± 36.7	111.9 ± 37.2	107.2 ± 39.7	111.8 ± 40.7	0.08
Serum creatinine (mg/dl)	1.8 ± 2.0	1.6 ± 1.7	2.4 ± 2.6	1.3 ± 1.4	<0.05
Uric acid (mg/dl)	6.7 ± 2.1	6.3 ± 2.1	7.4 ± 2.0	6.4 ± 2.1	0.07

BMI: body mass index, Central SP: central aortic systolic pressure, Central DP: central aortic diastolic pressure, HDL: high-density lipoprotein cholesterol, LDL: low-density lipoprotein cholesterol, TG: triglyceride

Table 2 shows that individuals with both DM and HTN had the highest BMI (26.7 ± 4.0 kg/m²), while those without either condition had the lowest (24.6 ± 3.4 kg/m²). The differences between the groups were statistically significant ($p < 0.05$). CSP was significantly higher in the DM + HTN group (145.7 ± 25.6 mmHg) compared to other groups, with the lowest value in the "Neither" group (126.9 ± 20.8 mmHg, $p < 0.05$). The DM group had the highest diastolic pressure (77.1 ± 12.0 mmHg), while the lowest was seen in the "Neither" group (71.4 ± 13.2 mmHg, $p < 0.05$). TC was slightly higher in those with DM (183.4 ± 42.0 mg/dl) compared to other groups, with a significant p-value of 0.02. The "Neither" group had the highest HDL levels (42.5

± 16.8 mg/dl), while the baseline group had the lowest (35.8 ± 13.4 mg/dl), with a statistically significant difference ($p < 0.05$). The DM + HTN group had the highest triglyceride levels (176.3 ± 120.8 mg/dl), though the difference across groups was not statistically significant ($p = 0.06$). There were no significant differences in LDL levels between the groups ($p = 0.08$).

4. DISCUSSION

This study highlights the significant association between diabetes mellitus (DM), hypertension (HTN), and adverse metabolic and cardiovascular profiles in patients with chronic coronary syndrome (CCS). Our findings demonstrate that patients with both DM and HTN exhibit more severe risk factors, including higher body mass index (BMI), blood pressure levels, and lipid abnormalities, which may contribute to their increased cardiovascular risk and poorer long-term outcomes.

The age distribution in our study indicates that CCS predominantly affects middle-aged individuals, with the majority of patients (30%) falling within the 41-50-year age group. This aligns with previous research suggesting that the prevalence of cardiovascular disease increases with age due to prolonged exposure to risk factors such as DM and HTN. Interestingly, only a small proportion (2.5%) of our cohort was aged 20 years or younger, reinforcing the notion that CCS is rare in younger populations. Lingman et al found that patients with either HTN or DM were older than patients without either of these diagnoses. [22]

Our data also revealed a male predominance (61%), with a male-to-female ratio of 1.56:1. This is consistent with prior studies reporting a higher prevalence of CCS in men, likely due to a combination of biological, hormonal, and behavioral factors. [23-25] Conversely, Lingman et al had a female predominance in their study. [22] However, it is essential to recognize that cardiovascular disease in women is often underdiagnosed and undertreated, which may partially explain the lower representation of female patients in our study.

In the present study, the prevalence of diabetes was 20%, the prevalence of hypertension was 45%, 20% of patients had both hypertension and diabetes, and only 15% of patients had neither of these conditions.

Mak KH et al found the prevalence of diabetes was 29%, much higher than in the general population in which the estimated prevalence is approximately 8-10%. [26-28] Lingman et al reported that a history of HTN was present in 974 (42%), while DM was present in 446 (19%) of the 2329 patients.[22] Lin et al . found that out of 1234 patients, 359 patients in the control group had neither DM nor hypertension, 178 patients had DM alone, 382 patients had hypertension alone, and 315 patients had both DM and hypertension. [24]

The baseline characteristics of our patients underscore the metabolic burden associated with DM and HTN. Patients with both conditions had the highest BMI (26.7 ± 4.0 kg/m²), significantly greater than those without either condition (24.6 ± 3.4 kg/m²; $p < 0.05$). Lin et al found that patients with hypertension alone and patients with both DM and hypertension had higher BMI values compared with the other two groups ($P < 0.01$). [24]

Blood pressure measurements also differed significantly across groups. Patients with both DM and HTN had the highest CSP (145.7 ± 25.6 mmHg) compared to those without either condition (126.9 ± 20.8 mmHg; $p < 0.05$). This finding is particularly concerning, as elevated blood pressure in the setting of CCS is a strong predictor of future cardiovascular events. CDP was also highest in the DM group (77.1 ± 12.0 mmHg). These results highlight the need for aggressive blood pressure management in patients with DM and HTN to mitigate their elevated cardiovascular risk. Lin et al found that patients with both DM and hypertension had the highest central systolic pressure (CSP) compared with the other groups ($P < 0.01$), whereas patients with hypertension alone had the highest central diastolic pressure (CDP) compared with the other groups ($P < 0.01$). [24]

Our study found that total cholesterol (TC) levels were significantly higher in patients with DM (183.4 ± 42.0 mg/dl; $p = 0.02$). Additionally, the DM + HTN group exhibited the highest triglyceride levels (176.3 ± 120.8 mg/dl), although the difference across groups did not reach statistical significance ($p = 0.06$).

Interestingly, HDL levels were highest in the "Neither" group (42.5 ± 16.8 mg/dl) and lowest in the baseline group (35.8 ± 13.4 mg/dl; $p < 0.05$). This finding is consistent with previous studies indicating that patients with DM and HTN often exhibit reduced HDL cholesterol, which further exacerbates cardiovascular risk. Lin et al reported that patients with DM alone had

the lowest cholesterol and HDL-C levels (P = 0.03 and P < 0.01, respectively), while patients with both DM and hypertension had the poorest renal function (P < 0.01). [24] Although LDL levels did not differ significantly between groups (p = 0.08) in this study, elevated LDL cholesterol remains a critical target for intervention in CCS patients to prevent further cardiovascular events. Previous studies have shown similar findings, particularly in younger hypertensive patients, who face an elevated risk of cardiovascular morbidity and poorer outcomes following an acute coronary event. [29-31]

In this cross-sectional study of Chronic Coronary Syndrome (CCS) patients, we found that a history of diabetes mellitus (DM), hypertension (HTN), or both conditions was associated with poor metabolic outcomes compared to patients without these risk factors. Notably, DM emerged as the most significant independent risk factor for long-term mortality, with an additive impact from HTN. Our findings align with previous research indicating that both DM & HTN have a heightened risk of cardiovascular mortality.

5. Limitations of the Study

Our study was a single-center study. We took a small sample size due to the short study period. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

6. Conclusion and Recommendations

In this study, we found that CCS patients with both DM and HTN had worse metabolic and hemodynamic profiles, including higher BMI, blood pressure, and lipid abnormalities, compared to those without these conditions. Diabetes, particularly when combined with hypertension, is associated with more severe cardiovascular risk factors. This study suggests that diabetes mellitus and hypertension have a significant impact on poor long-term outcomes in patients with Chronic Coronary Syndrome. Patients with a history of both conditions face a higher mortality risk compared to those without these comorbidities. In particular, diabetes may strongly be associated with increased mortality, while the impact of hypertension on mortality may appear to increase after two years of follow-up. These findings highlight the critical need for comprehensive management of DM and HTN in CCS patients to mitigate long-term cardiovascular risks and improve patient outcomes.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

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Conflict of Interest: None declared

Ethical Approval: This study was approved by the ethical review committee

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