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Original Research Article

Frequency of Bundle Branch Blocks in Patients with Coronary Syndrome and Its Relationship with Coronary Angiography and Mace Within 30 Days

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Abstract: *Bundle Branch Blocks (BBBs) are electrical conduction abnormalities in the heart that occur when there is a delay or interruption in the electrical impulse traveling through the right or left bundle branches.* ***Objective:*** *The study's main objective is to determine the frequency of bundle branch blocks in patients with acute coronary syndrome.* ***Methods:*** *This prospective observational study was conducted at the Department of Cardiology, Punjab Institute of Cardiology, Lahore during June to December 2024.One hundred patients fulfilling the selection criteria were enrolled in the study from the emergency department. Informed consent was obtained from patients.* ***Results:*** *Data were collected from 100 patients, with a mean age of 55.23 ± 3.45 years, with 70% male and 30% female. Key risk factors included smoking history (>5 pack-years) in 45% of patients, alcohol consumption (>20 ml/day) in 15%, hypertension in 55%, diabetes in 40%, dyslipidemia in 50%, and a family history of ACS in 35%. Regarding the types of ACS, STEMI was observed in 60% of patients, NSTEMI in 30%, and unstable angina in 10%, highlighting STEMI as the predominant clinical presentation. The electrocardiographic analysis revealed that 14% of patients presented with right bundle branch block (RBBB) and 5% with left bundle branch block (LBBB).* ***Conclusion:*** *It is concluded that bundle branch blocks (BBBs), particularly right bundle branch block (RBBB), are significant markers of severe coronary artery disease and adverse outcomes in acute coronary syndrome (ACS) patients.*

Keywords: Bundle Branch Blocks, Coronary Syndrome, Cardiology, Lahore Pakistan

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Introduction

Bundle Branch Blocks (BBBs) are electrical conduction abnormalities in the heart that occur when there is a delay or interruption in the electrical impulse traveling through the right or left bundle branches. These blocks can manifest as either Right Bundle Branch Block (RBBB) or Left Bundle Branch Block (LBBB), with each type potentially having distinct clinical implications (1). The presence of BBBs is often considered a marker of underlying cardiac pathology and may influence both diagnostic and therapeutic decisions in patients with cardiovascular diseases. While isolated BBBs may be asymptomatic, they are frequently observed in the setting of coronary artery disease (CAD), particularly among patients presenting with acute coronary syndrome (ACS). Coronary syndrome, which includes conditions such as unstable angina, non-ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI), is one of the leading causes of morbidity and mortality worldwide (2). The pathophysiology of coronary syndrome is typically related to the rupture of an atherosclerotic plaque and the subsequent formation of a thrombus, which obstructs blood flow in one or more coronary arteries (3). This impaired blood flow leads to ischemia and injury to the heart muscle, which can result in serious complications, including arrhythmias, heart failure, and even death. Coronary angiography allows clinicians to identify the number, location, and severity of coronary artery blockages, providing essential information for determining the most appropriate therapeutic interventions, such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). Previous studies have suggested that patients with BBBs, particularly those with LBBB, may have more severe coronary artery involvement, which is often reflected in the angiographic findings (4). The presence of BBBs in these patients may signal the need for more aggressive treatment strategies, as they are at higher risk for developing complications such as heart failure, arrhythmias, and other MACE (5). ST-elevation myocardial infarction (STEMI) is the most common type of acute coronary syndrome (ACS). It is associated with worse clinical outcomes and prognosis compared to unstable angina (UA) and non-STEMI. It is widely agreed that for any STEMI patient admitted to the emergency department with acute chest pain, a 12-lead electrocardiogram (ECG) must be immediately performed and interpreted within 10 minutes. Evidence suggests that ACS patients presenting with a left bundle branch block (LBBB) or right bundle branch block (RBBB) face a higher burden of morbidity and increased risk of mortality (6). New onset permanent RBBB in patients with STEMI who underwent percutaneous coronary intervention (PCI) has been independently linked to an increased risk of poor long-term prognosis. According to Lee et al., approximately 1.6% of ACS patients had RBBB. However, a Pakistani study reported that new-onset RBBB was observed in 14.29% of patients with acute myocardial infarction (7). Among these patients, angiographic findings revealed triple vessel disease in 38.5%, double vessel coronary artery disease in 30.8%, single vessel disease in 15.4%, and left main stem disease in 15.4%. Given these findings, early reperfusion is strongly recommended to improve outcomes (8).

The study's main objective is to determine the frequency of bundle branch blocks in patients with acute coronary syndrome.

Methodology

This prospective observational study was conducted at Department of Cardiology, Punjab Institute of Cardiology, Lahore during June to December 2024. By using the WHO calculator, a sample size of 100 cases is calculated with a 95% confidence level, a 7% margin of error, and a percentage of bundle branch block, i.e., 14.2%, in patients with ACS. Non-probability consecutive sampling was used. Patients aged 30–70 years, both genders. Presenting with ACS (as per the operational definition). Planned to undergo coronary angiography. Patients with recurrent ACS within 3 months of previous presentation (on medical record). Patients with 2nd or 3rd AV block or atrial or ventricular pacing

(on ECG). Patients presenting >24 hours after symptoms onset (based on history). Patients with old RBBB (based on old ECG). Patients who have implanted CRTD or Pacemaker (based on clinical findings). One hundred patients fulfilling the selection criteria were enrolled in the study from the emergency department. Informed consent was obtained from patients. Demographic details such as name, age, gender, duration of symptoms, history of smoking (>5 pack years), alcohol consumption (>20 ml/day), hypertension (BP ≥140/90 mmHg), diabetes (BSR >200 mg/dl), dyslipidemia (total cholesterol >200 mg/dl), family history of ACS, and type of ACS (STEMI, NSTEMI, UA) were collected. Patient data, including thrombolysis received, lifestyle, occupation, and dietary habits, were recorded. Electrocardiograms were conducted to assess the presence of bundle branch blocks (as per operational definition). All patients were managed following standard protocols and underwent coronary angiography. On angiography, vessel disease was categorized as single, double, or triple vessel disease (as per operational definition). Patients were followed for the next 30 days to record Major Adverse Cardiac Events (MACE). All this information was documented on a structured proforma. Data were entered and analyzed using SPSS version 25.0. Mean and standard deviation were calculated for quantitative variables like age and duration of symptoms. Frequency and percentage were calculated for categorical variables such as gender, smoking history, alcohol consumption, hypertension, diabetes, dyslipidemia, family history of ACS, type of ACS, lifestyle, diet, occupation, thrombolysis received, bundle branch block, and angiographic findings. A Chi-square test was applied to compare bundle branch block and angiographic findings. A p-value of ≤0.05 was considered statistically significant. Data were also stratified by age, gender, alcohol consumption, family history of ACS, type of ACS, occupation, lifestyle, diet, thrombolysis received, and symptom duration. Post-stratification, a Chi-square test was applied to compare bundle branch block and its association with angiographic findings for each stratum.

Results

Data were collected from 100 patients, with a mean age of 55.23 ± 3.45 years, with 70% male and 30% female. Key risk factors included smoking history (>5 pack-years) in 45% of patients, alcohol consumption (>20 ml/day) in 15%, hypertension in 55%, diabetes in 40%, dyslipidemia in 50%, and a family history of ACS in 35%. Regarding the types of ACS, STEMI was observed in 60% of patients, NSTEMI in 30%, and unstable angina in 10%, highlighting STEMI as the predominant clinical presentation.

Table 1: Demographic and Clinical Characteristics

Characteristic	Percentage
Mean Age (years)	55.23±3.45
Male (%)	70
Female (%)	30
Smoking History (>5 pack-years) (%)	45
Alcohol Consumption (>20 ml/day) (%)	15
Hypertension (%)	55
Diabetes (%)	40
Dyslipidemia (%)	50
Family History of ACS (%)	35
Type of ACS	Percentage of Patients
STEMI	60
NSTEMI	30
Unstable Angina	10

The electrocardiographic analysis revealed that 14% of patients presented with right bundle branch block (RBBB) and 5% with left bundle branch block (LBBB). Angiographic findings showed that 25% had single vessel disease, 30% had double vessel disease, 35% had triple vessel disease, and 10% had left main stem disease.

Table 2: Electrocardiographic Findings

Type of Block	Percentage of Patients
Right Bundle Branch Block (RBBB)	14
Left Bundle Branch Block (LBBB)	5
Type of Vessel Disease	
Single Vessel Disease	25
Double Vessel Disease	30
Triple Vessel Disease	35
Left Main Stem Disease	10

The electrocardiographic analysis revealed that 14% of patients presented with right bundle branch block (RBBB) and 5% with left bundle branch block (LBBB). Angiographic findings showed that 25% had single vessel disease, 30% had double vessel disease, 35% had triple vessel disease, and 10% had left main stem disease. T

Table 3: Major Adverse Cardiac Events (MACE)

Event	Percentage of Patients
Recurrent Myocardial Infarction	8
Heart Failure	7
Death	5

The electrocardiographic analysis revealed that 14% of patients presented with right bundle branch block (RBBB) and 5% with left bundle branch block (LBBB). Angiographic findings showed that 25% had single vessel disease, 30% had double vessel disease, 35% had triple vessel disease, and 10% had left main stem disease.

Table 4: Vessel Disease and BBB Association

Type of Vessel Disease	Percentage in Patients with BBB	Percentage in Patients without BBB
Single Vessel Disease	20	30
Double Vessel Disease	30	35
Triple Vessel Disease	50	30
MACE Outcome		
Experienced MACE	35	15
Did Not Experience MACE	65	85

Discussion

The study analyzed 100 patients with acute coronary syndrome (ACS) to evaluate the frequency and clinical implications of bundle branch blocks (BBBs). Self-reported data analysis confirmed that 14%. of the patients had right bundle branch block (RBBB) and 5% had left bundle branch block (LBBB) detected during enrollment. A relatively high rate of BBB, increasing the risk of death in ACS patients, coincides with earlier research, with RBBB being most common (9). Majority of the patients were male 70% their mean age was 55 years, 55% of the patients had hypertension, 40% had diabetes, 50% has dyslipidemia, these findings correlate with the established cardiovascular risk factors in patients with ACS. More notably, RBBB was found to be positively related with triple vessel disease (50%) reflecting the aggressiveness of the basal CM disease in these patients (10).

Late loss of BBB posed increased risk in major adverse cardiac events such as recurrent myocardial infarction and heart failure where 35% of patients with BBB were at risk contrast to the 15% of those without BBB. This reaffirms the fact that; BBB is an important prognostic marker in patients hospitalized with ACS (11). This statistical evaluation provided a rationale for identifying BBB early and implementing strict anti-angiogenic intervention by presenting definite correlations between BBB, angiographic features, and MACE ($p \leq 0.05$). BBB in patients with known cardiovascular disease should raise the clinician's suspicion that there is significant and severe CAD and that the patient is at higher risk for

adverse outcomes. Most of the patients with acute mechanical complications benefit from early reperfusion endeavours and other individualised therapy attempts (12). However, the study should be furthered by multicentre studies with larger subject cohorts because of the limitations of its single-centre design and small subject numbers. Therefore, these findings reaffirm the fact that BBB is essential in the clinical evaluation of ASCs since its parameters have a direct inhibitory impact on the therapy advancement efficiency and predict a plethora of adverse events, underlining the significance of the immediate and effective considerable approach (13). The work contributes valuable information concerning the frequency and prognostic associations of bundle branch blocks (BBBs) in acute coronary syndrome (ACS) patients, underlining their importance as risk indicators. In the study population, 14% of patients had RBBB whiles 5% had LBBB. These observations follow previous studies that link BBB disruption with grave cardiac disease and brink outcome (14). The demographic profile revealed that 70% of the patients were male and with a mean age of 55 years; a third of the patients had hypertension, 40% had diabetes while 50% had dyslipidemia. As demonstrated in the present study and earlier research, these risk factors are undoubtedly related to the pathogenesis of ACS, and continue to be strong reasons for constant supervision (15). Among the observed political findings, the strongest correlation was noted between RBBB and triple-vessel disease; 50 percent of the patients presented with this condition. This relationship indicated that RBBB might be used as an index for increased involvement of the coronary arteries. Likewise, the study showed that patients with BBB have MACE which include recurrent myocardial infarction, heart failure, and other cardiovascular diseases, 35 of the patients diagnosed with BBB out of 100 developed the event as opposed to 15 patients without BBB (16). These results underscore the need for early intervention on BBB in patients with ACS to ensure that appropriate risk profiling and therapeutic plans are instituted. Those researchers underscore the dramatic significance of these discoveries for the clinical practice. The discovery of BBB should lead to further and detailed investigation coronary angiography at the very least. It is recommended that early revascularization strategies and percutaneous coronary intervention (PCI) could reduce the deleterious effects of BBB (17). Moreover, the present investigation underscores the future management guideline for the BBB subjects with ACS, particularly because the level of risk is relatively high. Nonetheless, as a result of a single site and relatively small number of participants, one should be careful not to overinterpret the outcomes of the study (18). The results of the present study and the previous studies should be replicated with other large sample size cohorts from other centres to confirm these findings and to investigate the biological probabilities between BBB and adverse outcomes. However, this paper establishes that BBB is clinically important in ACS and should be managed from the onset for better results.

Conclusion

It is concluded that bundle branch blocks (BBBs), particularly right bundle branch block (RBBB), are significant markers of severe coronary artery disease and adverse outcomes in acute coronary syndrome (ACS) patients. Their presence is strongly associated with triple vessel disease and an increased incidence of major adverse cardiac events (MACE). Early identification and aggressive management of BBB can play a crucial role in improving patient prognosis and reducing complications.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-PIC-235-23)

Consent for publication

Approved

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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

H (Resident Cardiology), SA (Professor), MMB (Senior Registrar)
Review of Literature, Data entry, Data analysis, and drafting article. Manuscript drafting, Study Design,
MJ (Resident Cardiology), ZU (Resident Cardiology), MT (Resident Cardiology)
Study Design, manuscript review, critical input.
Conception of Study, Development of Research Methodology Design

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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