

ISSN Print: 2708-2709
ISSN Online: 2708-2717

Journal of Diabetes, Metabolism and Endocrinology
https://jdmeonline.com/

Research Article

In Hospital Outcomes Of Patients With Acute Coronary Syndrome And Conduction Abnormalities In Assam, India.

Romar Dabu[1], Maitreyee Bhattacharyya[2], Narang Naku[3], Tabang Nyitan[4]*.

[1]Assistant Professor, Department of Cardiology, Tomo Riba Institute of Health and Medical Sciences (TRIHMS), Naharlagun, Arunachal Pradesh, India.

[2]Assistant Professor, Department of Cardiology, Gauhati Medical College and Hospital, Guwahati, Assam, India.

[3]Assistant Professor, Department of General Surgery, Tomo Riba Institute of Health and Medical Sciences (TRIHMS), Naharlagun, Arunachal Pradesh, India.

[4]Assistant Professor, Department of Cardiothoracic and Vascular Surgery, Tomo Riba Institute of Health and Medical Sciences (TRIHMS), Naharlagun, Arunachal Pradesh, India..

***Corresponding Author**
Dr. Tabang Nyitan.
Email: tabang1990@gmail.com

Article History
Received: 15.10.2026
Accepted: 13.11.2026
Published: 18.11.2026

Doi: 10.61336/jdme.07/04/27

Abstract: ***Background:*** Electrical conduction abnormalities may complicate acute coronary syndrome (ACS) and vary according to the site of myocardial infarction. This study assessed the frequency, types and clinical correlates of conduction abnormalities among patients hospitalized with ACS. ***Methods:*** A single-centre observational case-control study was conducted in the Department of Cardiology, Gauhati Medical College and Hospital, Guwahati, Assam, India, between June 2017 and December 2018. A total of 1,001 patients with ACS were evaluated, including 300 with conduction abnormalities and 701 without conduction abnormalities. Clinical characteristics, cardiovascular risk factors and ACS presentations were compared between groups using descriptive statistics, crude odds ratios (ORs), 95% confidence intervals (CIs) and Fisher exact tests. ***Results:*** Conduction abnormalities were observed in 300 of 1,001 patients (30.0%). Complete atrioventricular block was the most frequent abnormality (115/300, 38.3%), followed by sinus bradycardia (73/300, 24.3%) and first-degree atrioventricular block (64/300, 21.3%). Inferior-wall myocardial infarction occurred in 168/300 patients (56.0%) with conduction abnormalities and 144/701 (20.5%) without them. Smoking was more common in patients with conduction abnormalities (51.3% vs 28.2%; OR 2.68, 95% CI 2.03–3.54), as was alcohol use (OR 3.03, 95% CI 1.57–5.83). Hypertension was less frequent in this group (OR 0.64, 95% CI 0.45–0.92). ***Conclusion:*** Conduction abnormalities were frequent among patients hospitalized with ACS, particularly those presenting with inferior-wall myocardial infarction. Complete atrioventricular block, sinus bradycardia and first-degree atrioventricular block accounted for most abnormalities. Smoking and alcohol use were more frequently observed among affected patients, although these associations were unadjusted.

Keywords: Acute coronary syndrome; atrioventricular block; bundle branch block; bradycardia; inferior myocardial infarction; risk factors; India.

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INTRODUCTION

Acute coronary syndrome (ACS) encompasses a range of clinical presentations resulting from acute myocardial ischemia. Electrocardiography is central to its diagnosis and also facilitates the recognition of rhythm and conduction abnormalities that may alter clinical management. Early identification of these abnormalities is important because certain forms of atrioventricular or intraventricular block are associated with hemodynamic compromise and increased mortality [1–4].

Electrical disturbances during acute coronary ischemia arise through more than one mechanism. Ischemia affecting the atrioventricular node may produce varying grades of atrioventricular block, whereas septal myocardial injury may affect the His-Purkinje system. Sinus bradycardia may also occur, particularly in inferior infarction where vagal activation and nodal ischemia are plausible contributors. The resulting clinical phenotypes range from a transient slow heart rate to high-grade block associated with major infarct burden or circulatory compromise [5–8].

Published studies have repeatedly identified the importance of infarct location, but reported frequencies differ because patient selection, definitions, time of electrocardiographic assessment and reperfusion strategies vary. Studies focused narrowly on high-degree atrioventricular block cannot be directly compared with cohorts that also count sinus bradycardia and first-degree block [8–11]. A regional dataset encompassing several conduction phenotypes may therefore be useful for describing their practical distribution without equating all phenotypes with the same prognostic implication.

The present study aimed to determine the frequency and clinical spectrum of conduction abnormalities in patients hospitalized with ACS and to examine their relationship with demographic characteristics, cardiovascular risk factors and infarct location at a tertiary-care hospital in Assam, India.

MATERIALS AND METHODS

Study design and setting

A single-centre observational case-control study was conducted in the Department of Cardiology, Gauhati Medical College and Hospital, Guwahati, Assam, India, from June 2017 to December 2018. The study included 1,001 patients admitted with ACS. Patients with conduction abnormalities constituted the study group (n=300), while those without conduction abnormalities constituted the control group (n=701). The patients were followed during their hospital admission.

Participants and diagnostic assessment

Patients admitted with a diagnosis of ACS were assessed for atrioventricular and intraventricular conduction disturbances. Conduction abnormalities included first-degree, second-degree and complete atrioventricular block; right or left bundle branch block; alternating bundle branch block; bifascicular block; and trifascicular block. Sinus bradycardia was also recorded among the observed conduction phenotypes. Patients with pre-existing conduction abnormalities attributable to degenerative heart disease, previous acute coronary events, valvular heart disease, cardiomyopathy, congenital heart disease, paced rhythm, pulmonary hypertension or other non-ACS causes were excluded.

Detailed clinical history was obtained, including presenting symptoms, age, sex, cardiovascular risk factors, medical history and family history. Physical examination included pulse rate, blood pressure and systemic examination. Investigations comprised complete blood counts, blood glucose, glycated hemoglobin, lipid profile, electrolytes, renal and liver function tests, thyroid function tests, troponin T, creatine kinase–MB, 12-lead electrocardiography and two-dimensional echocardiography. Left ventricular function and regional wall motion abnormalities were evaluated using a Siemens ACUSON CV 70 echocardiography system. Coronary angiography was performed using a Philips Allura Xper system when clinically indicated.

Definitions and variables

Patients were classified according to the presence or absence of the documented conduction abnormalities. ACS presentations included anterior-wall, inferior-wall, lateral-wall and posterior-wall myocardial infarction, non-ST-segment elevation myocardial infarction (NSTEMI) and unstable angina. The cardiovascular risk factors assessed were smoking, alcohol consumption, hypertension, diabetes mellitus, dyslipidemia, chronic kidney disease, cerebrovascular disease and previous ACS. Standard clinical criteria used during the study period were applied for hypertension, diabetes mellitus and dyslipidemia.

Statistical analysis

Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized as mean ± standard deviation. Between-group differences in categorical variables were examined using two-sided Fisher exact tests. Crude ORs with 95% CIs were calculated for cardiovascular risk-factor comparisons. A p value <0.05 was considered statistically significant. As the comparisons were unadjusted, associations were not interpreted as independent predictors.

RESULTS

Study population

A total of 1,001 patients with ACS were included, of whom 300 (30.0%) had conduction abnormalities and 701 (70.0%) did not. The mean age was 59.61 ± 11.60 years in the study group and 57.48 ± 10.96 years in the control group. Men accounted for 243 patients (81.0%) in the study group and 592 (84.5%) in the control group. The largest age category was 51–60 years in both groups (34.7% and 37.5%, respectively). The mean pulse rate was 53.66 ± 23.68 beats/minute in the conduction-abnormality group and 84.81 ± 20.11 beats/minute in controls (Table 1).

Table 1. Selected baseline characteristics

Variable	Conduction abnormality (n=300)	No abnormality (n=701)
Age, mean±SD (years)	59.61±11.60	57.48±10.96
Male sex, n (%)	243 (81.0)	592 (84.5)
Female sex, n (%)	57 (19.0)	109 (15.5)
Pulse, mean±SD (beats/min)	53.66±23.68	84.81±20.11
LVEF, mean±SD (%)	38.6±10.66	44.5±6.78
Haemoglobin, mean±SD (g/dL)	12.46±1.43	12.61±1.42
HbA1c, mean±SD (%)	5.68±1.10	5.83±2.27

Values are expressed as mean ± standard deviation or number (percentage), as appropriate. LVEF, left ventricular ejection fraction; HbA1c, glycated hemoglobin.

Types of conduction abnormalities

Complete atrioventricular block was the most common abnormality, affecting 115 of 300 patients (38.3%), followed by sinus bradycardia in 73 (24.3%) and first-degree atrioventricular block in 64 (21.3%). Second-degree atrioventricular block was identified in 14 patients (4.7%), bifascicular block and right bundle branch block in 12 patients each (4.0% each), and left

bundle branch block in 10 patients (3.3%). The distribution of conduction disturbances is presented in Table 2 and Figure 1.

Table 2. Recorded conduction phenotypes among cases

Phenotype	Patients, n	Percentage of 300
Complete (third-degree) atrioventricular block	115	38.3
Sinus bradycardia	73	24.3
First-degree atrioventricular block	64	21.3
Second-degree atrioventricular block	14	4.7
Bifascicular block	12	4.0
Right bundle branch block	12	4.0
Left bundle branch block	10	3.3
Total	300	100.0

Percentages were calculated using the 300 patients with conduction abnormalities as the denominator. Values may not sum exactly to 100% because of rounding.

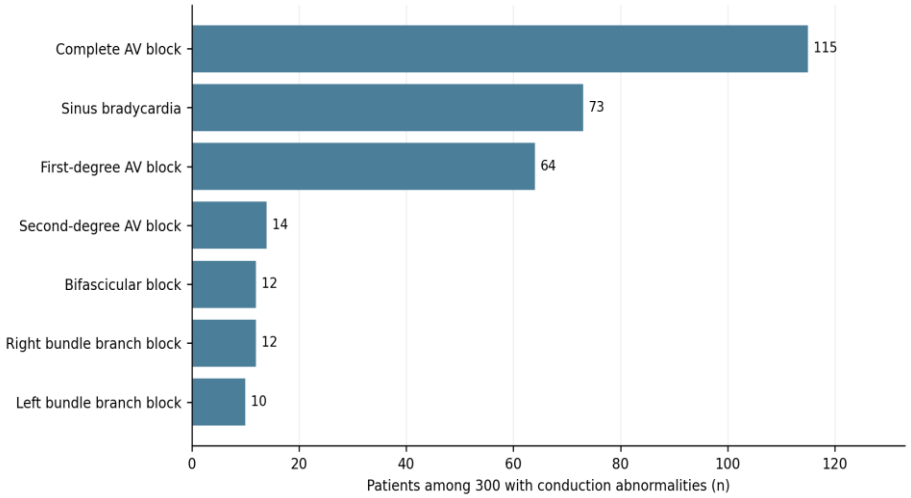

Figure 1. Distribution of the seven reported conduction phenotypes among 300 ACS cases with abnormalities.

Distribution by acute coronary syndrome subtype

Inferior-wall myocardial infarction was the most frequent ACS presentation among patients with conduction abnormalities, occurring in 168 patients (56.0%), followed by anterior-wall myocardial infarction in 79 (26.3%) and NSTEMI in 37 (12.3%). In contrast, anterior-wall myocardial infarction was more common among controls (349/701, 49.8%), followed by NSTEMI (154/701, 22.0%) and inferior-wall myocardial infarction (144/701, 20.5%). The distribution across ACS presentations is shown in Table 3.

Table 3. ACS categories by conduction-abnormality status

Recorded ACS category	Cases (n=300), n (%)	Controls (n=701), n (%)
Anterior-wall MI	79 (26.3)	349 (49.8)
Inferior-wall MI	168 (56.0)	144 (20.5)
Lateral-wall MI	2 (0.7)	5 (0.7)
Posterior-wall MI	0 (0.0)	3 (0.4)
NSTEMI	37 (12.3)	154 (22.0)
Unstable angina	14 (4.7)	47 (6.7)

MI, myocardial infarction; NSTEMI, non-ST-segment elevation myocardial infarction. The individual ACS-category counts in the control group total 702, although the recorded control-group denominator is 701; these totals require confirmation against the study register.

Cardiovascular risk-factor correlates

Smoking was reported by 154 patients (51.3%) with conduction abnormalities and 198 controls (28.2%), corresponding to a crude OR of 2.68 (95% CI 2.03–3.54; p<0.001). Alcohol use was reported by 21 patients (7.0%) in the study group and 17 controls (2.4%; OR 3.03, 95% CI 1.57–5.83; p=0.001). Hypertension was recorded in 46 cases (15.3%) and 154 controls (22.0%; OR 0.64, 95% CI 0.45–0.92; p=0.016). Diabetes mellitus occurred in 43 cases (14.3%) and 125 controls (17.8%), without a statistically significant difference. The remaining risk-factor comparisons are presented in Table 4.

Table 4. Recorded risk factors and unadjusted associations with case classification

Characteristic	Cases n (%)	Controls n (%)	Crude OR (95% CI)	Fisher p
Smoking	154 (51.3)	198 (28.2)	2.68 (2.03–3.54)	<0.001
Hypertension	46 (15.3)	154 (22.0)	0.64 (0.45–0.92)	0.016
Diabetes mellitus	43 (14.3)	125 (17.8)	0.77 (0.53–1.12)	0.196
Chronic kidney disease	1 (0.3)	16 (2.3)	0.14 (0.02–1.08)	0.031
Alcohol use	21 (7.0)	17 (2.4)	3.03 (1.57–5.83)	0.001
Prior cerebrovascular accident	2 (0.7)	10 (1.4)	0.46 (0.10–2.10)	0.526
Prior ACS event	2 (0.7)	16 (2.3)	0.29 (0.07–1.25)	0.116

OR, odds ratio; CI, confidence interval; ACS, acute coronary syndrome. Odds ratios are unadjusted; p values were obtained using two-sided Fisher exact tests.

DISCUSSION

Conduction abnormalities were observed in 30.0% of patients hospitalized with ACS in the present study. Complete atrioventricular block was the most frequent form, followed by sinus bradycardia and first-degree atrioventricular block. The distribution of these abnormalities is clinically relevant because sinus bradycardia, nodal atrioventricular block and intraventricular block arise through different mechanisms and have different prognostic implications. Escosteguy et al. and Gang et al. also demonstrated the clinical significance of conduction disturbances in acute myocardial infarction, although their study populations and diagnostic categories differed [5,8].

Inferior-wall myocardial infarction accounted for more than half of ACS presentations among patients with conduction abnormalities. This finding is consistent with the vulnerability of the sinoatrial and atrioventricular nodal regions to right coronary artery ischemia and autonomic influences. Hreybe and Saba observed a greater prevalence of complete heart block in inferior and posterior infarction than in anterior or lateral infarction [6]. Similar associations between infarct location and advanced atrioventricular block have been described by Meine et al., Gang et al. and the HORIZONS-AMI investigators [7–9]. However, coronary artery involvement and individual conduction patterns could not be examined simultaneously in the present analysis.

Complete atrioventricular block represented 38.3% of the 300 patients with conduction abnormalities and 11.5% of all 1,001 ACS admissions. Its frequency was higher than that reported in several studies restricted to particular myocardial infarction populations [10,13]. Differences in patient selection, ACS spectrum, timing of electrocardiographic assessment and inclusion of milder bradyarrhythmias may contribute to these variations. The high proportion of complete atrioventricular block emphasizes the importance of early rhythm assessment and close monitoring in ACS.

Smoking and alcohol consumption were more frequently reported among patients with conduction abnormalities. Smoking is a well-established cardiovascular risk factor, but the present unadjusted association does not distinguish a direct relation to conduction-system ischemia from an association mediated by infarct presentation or overall disease severity. The alcohol comparison involved relatively small numbers and should be interpreted cautiously. Hypertension was more frequent in the control group, a finding that may reflect differences in clinical characteristics or case mix rather than a protective effect.

Men constituted more than four-fifths of both groups, consistent with the marked male predominance reported in several myocardial infarction cohorts. Nonetheless, no strong sex difference was evident in the distribution of patients with and without conduction abnormalities. Recognition of the specific conduction phenotype remains important, as advanced atrioventricular block and bundle branch block may require more intensive monitoring and intervention than isolated sinus bradycardia or first-degree block [1,2,4].

Strengths and limitations

This study was limited by its single-centre observational design, potential selection bias, absence of standardized information on the timing or persistence of conduction disturbances and lack of adjustment for infarct severity and other potential confounders. Sinus bradycardia and high-grade atrioventricular block were included within a broad composite category, limiting comparison with studies that assessed advanced conduction block alone. Minor inconsistencies in ACS subtype tabulation also restrict interpretation of selected subgroup counts. The frequency reported here represents the proportion observed among hospitalized patients rather than the rate of newly developed abnormalities.

CONCLUSION

Conduction abnormalities were identified in 30.0% of patients admitted with ACS. Complete atrioventricular block was the most frequent abnormality, followed by sinus bradycardia and first-degree atrioventricular block. Inferior-wall myocardial infarction predominated among affected patients, while smoking and alcohol consumption were more frequently recorded. These findings highlight the importance of electrocardiographic assessment and early recognition of conduction disturbances in ACS.

ETHICAL CONSIDERATIONS

Informed consent was obtained from the patients enrolled in the study.

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