

Spectrum of Electrocardiography Changes in a Cardiac Hospital in Nepal

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Abstract



Background

Electrocardiography (ECG) remains one of the most widely used, inexpensive, and essential diagnostic tools in cardiovascular medicine. The pattern of ECG abnormalities in Nepalese patients provides important epidemiological and clinical insights for early diagnosis and management of cardiovascular diseases. The objective of this study is to evaluate the spectrum of ECG findings among patients undergoing ECG evaluation in a tertiary cardiac center in Nepal.

Methods

An analytical cross-sectional study was conducted using ECG data from 110 patients. Demographic characteristics, ECG abnormalities, and final diagnoses were analyzed. Statistical analysis was performed using descriptive statistics and chi-square testing where appropriate.

Results

Among 110 patients, 63 (57.3%) were males and 47 (42.7%) were females. The mean age was 56.8 ± 15.9 years. Normal ECG was observed in 36 patients (32.7%). The most common abnormalities included ischemic changes 28 (25.5%), old myocardial infarction 14 (12.7%), arrhythmias including atrial fibrillation and PSVT 9 (8.2%), bundle branch block 8 (7.3%), sinus tachycardia 6 (5.5%), and sinus bradycardia 5 (4.5%). Ischemic ECG abnormalities were significantly more common in older age groups ($p < 0.05$).

Conclusions

Abnormal ECG findings were common, with ischemic heart disease-related changes being the predominant abnormality. Early ECG screening may facilitate timely diagnosis and management of cardiovascular diseases in Nepal.

Keywords: Electrocardiography; ischemia; myocardial infarction; arrhythmia; Nepal.

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Introduction

Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide and are rapidly increasing in South Asian countries including Nepal. Electrocardiography (ECG) is a simple, rapid, non-invasive, and cost-effective tool widely used for the diagnosis of ischemic heart disease, arrhythmias, conduction disturbances, electrolyte abnormalities, and structural cardiac disorders [1-4]. The burden of hypertension, diabetes mellitus, smoking, obesity, and sedentary lifestyle has significantly increased in Nepal over recent years, contributing to a rising prevalence of coronary artery disease and cardiac arrhythmias [5-8]. Despite the growing burden of cardiovascular diseases, there are limited published Nepalese data describing the spectrum of ECG abnormalities among patients presenting for cardiac evaluation. This study aimed to analyze the pattern of ECG findings among patients undergoing ECG examination at a tertiary cardiac center in Nepal.

Methods

This analytical cross-sectional study was conducted at a tertiary cardiac care center in Nepal to determine the spectrum of electrocardiographic (ECG) findings among adult patients undergoing routine ECG evaluation. The study utilized retrospectively collected ECG records and corresponding demographic information available in the hospital database. Since the study involved the analysis of existing records without direct patient contact or intervention, patient confidentiality was maintained throughout the study by anonymizing all identifiable information prior to analysis.

A total of 110 ECG records were included in the study. The study population comprised adult patients (aged ≥ 18 years) who underwent a standard resting 12-lead electrocardiogram during the study period for any clinical indication, including routine cardiovascular assessment, evaluation of cardiac symptoms, or follow-up of known cardiovascular disease. ECG records were included if they contained complete demographic information and interpretable ECG tracings. Records with incomplete clinical

or demographic information, duplicated entries, technically inadequate recordings, or poor-quality ECG tracings that prevented accurate interpretation were excluded from the analysis.

Standard 12-lead ECGs were performed by trained ECG technicians following institutional protocols using calibrated ECG machines. All ECG recordings were obtained with the patient in the supine position after an adequate period of rest. The ECGs were recorded at a paper speed of 25 mm/second and a calibration of 10 mm/mV. ECG interpretation was performed by experienced physicians/cardiologists according to established standard diagnostic criteria. Data were extracted from the ECG records using a structured data collection form. Demographic variables included age and sex. Age was recorded as a continuous variable and further categorized into predefined age groups for descriptive and comparative analyses. The ECG findings were classified into mutually exclusive diagnostic categories based on the principal abnormality identified. These categories included normal ECG, ischemic changes, old myocardial infarction, arrhythmias, bundle branch block, bradyarrhythmias or tachyarrhythmias, paced rhythms, and other ECG abnormalities. Ischemic changes included ST-segment depression, ST-segment elevation suggestive of myocardial ischemia, and T-wave inversion consistent with ischemic heart disease. Arrhythmias comprised atrial fibrillation, atrial flutter, supraventricular tachycardia, ventricular arrhythmias, and other rhythm disturbances. Bundle branch block included both right and left bundle branch block, while bradyarrhythmias and tachyarrhythmias included sinus bradycardia, sinus tachycardia, and other clinically significant conduction abnormalities. ECG findings not fitting into these predefined categories were grouped under other abnormalities.

The collected data were entered into Microsoft Excel and subsequently exported to the Statistical Package for the Social Sciences (SPSS) version XX (IBM Corp., Armonk, NY, USA) for statistical analysis. Data cleaning and validation were performed before

analysis to ensure completeness and consistency. Continuous variables were summarized using mean and standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. The prevalence of different ECG abnormalities was calculated as proportions of the total study population. The association between age group and the presence of ischemic ECG abnormalities was evaluated using the Chi-square test. Statistical significance was assessed using a two-tailed test, and a p-value of less than 0.05 was considered statistically significant.

Approval to conduct the study was obtained from the concerned institutional authority before data collection. As the study involved retrospective analysis of anonymized ECG records without direct patient interaction, informed consent was waived in accordance with institutional policies. All data were handled confidentially, and patient identifiers were removed prior to analysis to ensure privacy and confidentiality.

Results

Among the 110 study participants, males comprised the majority of the study population, accounting for 63 (57.3%) patients, while females constituted 47 (42.7%). The participants ranged in age from 25 to 90 years, with a mean age of 56.8 ± 15.9 years, indicating that the study predominantly included middle-aged and older adults. Normal ECG findings were observed in 36 (32.7%) patients, whereas 74 (67.3%) patients demonstrated one or more ECG abnormalities, suggesting a high burden of electrocardiographic abnormalities among individuals evaluated at the tertiary cardiac care center. Among the specific ECG diagnoses, ischemic changes were the most frequently observed abnormality, identified in 28 (25.5%) patients. This was followed by old myocardial infarction in 14 (12.7%) patients and arrhythmias in 9 (8.2%). Bundle branch block (right or left) was present in 8 (7.3%) patients, while sinus tachycardia and sinus bradycardia were observed in 6 (5.5%) and 5 (4.5%) patients, respectively. Paced rhythm was identified

in 3 (2.7%) patients, and other ECG abnormalities accounted for only 1 (0.9%) case. These findings indicate that ischemic heart disease-related ECG abnormalities constituted the largest proportion of abnormal ECG findings in the study population (Table 1).

Table 1. Demographic Characteristics and Electrocardiographic Findings of the Study Participants (n = 110)

Variable	Frequency (%)
Sex	
Male	63(57.3)
Female	47(42.7)
Age (years)	
Mean $\pm$ SD	56.8 ± 15.9
Range	25–90
Overall ECG Findings	
Normal ECG	36(32.7)
Abnormal ECG	74(67.3)
ECG Diagnosis	
Normal ECG	36(32.7)
Ischemic changes	28(25.5)
Old myocardial infarction	14(12.7)
Arrhythmias	9(8.2)
Right/Left bundle branch block (RBBB/LBBB)	8(7.3)
Sinus tachycardia	6(5.5)
Sinus bradycardia	5(4.5)
Paced rhythm	3(2.7)
Other abnormalities	1(0.9)

Table 2 presents the associations between selected clinical characteristics and ECG findings. Patients aged more than 60 years were significantly more likely to have abnormal ECG findings than younger patients ($\chi^2 = 7.41$, $p = 0.006$). Male sex was significantly associated with ischemic ECG changes ($\chi^2 = 4.92$, $p = 0.026$). Elderly patients also showed a significantly higher prevalence of conduction abnormalities, including right bundle branch block (RBBB), left bundle branch block (LBBB), and atrioventricular (AV) block ($\chi^2 = 5.33$, $p = 0.021$). Similarly, atrial fibrillation was significantly more common among elderly patients ($\chi^2 = 6.11$, $p = 0.013$). In contrast, normal ECG findings were significantly

more frequent among younger patients aged less than 40 years ($\chi^2 = 8.02$, $p = 0.004$). No statistically significant association was observed between sex and the overall occurrence of arrhythmias ($\chi^2 = 1.82$, $p = 0.17$).

Table 2. Association between Demographic Characteristics and Electrocardiographic Findings among the Study Participants

Clinical Observation	χ^2	P-value
Age >60 years vs Abnormal ECG findings	7.4	0.006
Male sex vs Ischemic ECG changes	4.9	0.026
Elderly age vs Conduction abnormalities (RBBB/LBBB/AV block)	5.3	0.021
Elderly age vs Atrial fibrillation	6.1	0.013
Normal ECG among younger patients (<40 years)	8	0.004
Sex vs Arrhythmias overall	1.8	0.17

Discussion

This study demonstrated that abnormal ECG findings are highly prevalent among patients presenting for cardiac evaluation in Nepal. Ischemic ECG abnormalities and old myocardial infarction patterns were the predominant findings, indicating the growing burden of coronary artery disease. Normal ECG findings were observed in approximately one-third of patients, which is comparable to studies from South Asia and other developing countries [7,8]. Ischemic changes constituted approximately one-fourth of all ECG abnormalities, reflecting the increasing prevalence of cardiovascular risk factors such as hypertension, diabetes mellitus, smoking, dyslipidemia, and obesity in Nepalese populations [9]. Old myocardial infarction patterns, particularly anteroseptal wall myocardial infarction, were commonly observed in this study. Similar ECG distributions have been described in international literature evaluating coronary artery disease and myocardial infarction patterns [10-12]. Bundle

branch blocks and arrhythmias including atrial fibrillation were also frequently encountered. Atrial fibrillation is associated with increased risks of stroke, heart failure, and mortality, especially among elderly patients [13]. Early recognition of conduction abnormalities and arrhythmias through ECG screening can therefore facilitate prompt management and improve cardiovascular outcomes [14-15]. The study highlights the importance of routine ECG screening, particularly in elderly populations and individuals with cardiovascular risk factors.

Limitations

Being a single-center study with a relatively small sample size, its findings may not be generalizable to the broader Nepalese population. Additionally, the absence of echocardiographic and detailed clinical correlation limited the interpretation of the underlying causes and clinical significance of the observed ECG abnormalities.

Conclusions

Abnormal ECG findings are common among patients undergoing ECG evaluation in Nepal. Ischemic heart disease-related ECG abnormalities were the predominant findings. Early ECG screening and prompt cardiovascular risk assessment may help reduce cardiovascular morbidity and mortality.

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Authors' Contributions

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Data Curation: SL, AD, LKC

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Investigation: SL, AD, LKC

Methodology: SL, AD, LKC

Writing-Original Draft: SL, AD, LKC

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