

ORIGINAL RESEARCH ARTICLE

ELECTROCARDIOGRAPHY PATTERNS IN PATIENTS WITH PROXIMAL LEFT ANTERIOR DESCENDING CORONARY ARTERY STENOSIS

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ABSTRACT

Background: Stenosis of proximal left anterior descending coronary artery presents with diverse electrocardiographic patterns. This study aimed to determine different types of ECG changes and their frequency in patients with proximal left anterior descending coronary artery stenosis.

Methods: This descriptive cross-sectional study was conducted at the Department of Cardiology, College of Medical Sciences, Bharatpur from 1st June 2023 to 30 October 2023. Patients who underwent coronary angiography and had proximal left coronary artery stenosis were included in the study. Total 80 such patients were evaluated. Electrocardiographic changes in these patients was noted. Proximal left anterior descending coronary artery stenosis was independent variable and ECG changes were dependent variables. The ECG changes were ST elevations in leads I, aVL and precordial leads V1-V6, ST elevations in V1-V6, De Winter's T-wave pattern, acute LBBB and Wellen's Syndrome. Frequency of varying electrocardiographic changes in proximal left anterior descending coronary artery stenosis was evaluated.

Results: Electrocardiographic analysis of proximal left anterior descending artery revealed diverse patterns. 37.5% (n=25) had ST elevations in leads I, aVL and V1-V6. 25% (n=20) had ST elevations in V1-V6. De Winter's T-wave pattern was seen in 16.25% (n=13) patients. Left bundle branch block was present in 15% (n=12). A Wellen's Syndrome was present in 12.5% (n=10).

Conclusions: Proximal LAD artery stenosis reveals significant diversity in ECG patterns.

INTRODUCTION

Different kinds of ECG changes in proximal left coronary artery (LAD) include ST segment elevations, left bundle branch block (LBBB) pattern, Wellen's syndrome and de Winter's T wave pattern.¹ De Winters syndrome include tall and symmetrical T waves in precordial leads and Wellen's syndrome ECG changes refers biphasic T waves or deeply inverted T waves in antero-septal leads.² Sgarbossa criteria used to determine Acute Myocardial infarction in patient with LBBB is defined as an ECG consisting of ST-segment elevation of 1 mm or more concordant with the QRS complex (i.e., positive complex) in any lead (score of 5), ST-segment depression of 1 mm or more in lead V1, V2 or V3 (score of 3) and ST-segment elevation of 5 mm or more discordant with the QRS complex in any lead (score of 2) and score of more or equal to 3 indicates acute myocardial infarction.³

Proximal part of LAD stenosis usually causes infarction over large area myocardium and is associated with high incidence of morbidity and mortality.⁴ The de Winter ECG pattern can precede extensive ST elevation myocardial infarction.⁵ These

patients with acute LBBB fulfilling Sgarbossa criteria, Wellen's syndrome, de Winter's T wave pattern and ST segment elevation in precordial leads should be revascularized as early as possible to prevent fatal consequences.⁶ Different ECG patterns can guide us to predict proximal LAD stenosis and can form the objective basis to start treatment at the earliest to prevent mortality and morbidity.^{7, 8} This study was aimed to study the ECG patterns among patients with proximal LAD stenosis detected in coronary angiography.

METHODS

This descriptive cross-sectional study was conducted at Department of Cardiology, Collage of Medical Sciences from 1st June 2023 to 30th October 2023. Ethical clearance was obtained from Institutional Review Committee of College of Medical Sciences. Non-probability purposive sampling technique was used to select total 80 patients including males and females of all ages who meets the inclusion criteria. These patients underwent coronary angiography for recommended indications and found to have proximal LAD stenosis were evaluated for ECG changes in the study.

All patients underwent coronary angiography at cardiac catheterization lab of College of Medical Sciences and only those patients with stenosis of proximal LAD coronary artery were included in the study. Patients with multi-vessel coronary artery disease and history of previous per-cutaneous coronary intervention and coronary artery bypass surgery were excluded from the study. ECGs of the patients with proximal LAD coronary artery stenosis were evaluated. Diverse nature of ECG patterns in proximal LAD stenosis revealed ST segment elevation in antero-lateral leads (V1 to V6, I and aVL), ST segment elevation in precordial leads (v1 to v6), acute LBBB defined by Sgarbossa criteria, de winters syndrome (tall T waves in precordial leads) and Wellen's syndrome (Biphasic or inverted T waves in leads v1-v4).

Data was entered in excel sheet and analysed using SPSS version 16.0. descriptive statistics with frequency and percentage of different ECG changes (as dependent variables) in proximal LAD stenosis was calculated. The value was described as mean $\pm$ SD (standard deviation), frequency and percentages.

RESULTS

Mean age of the study population was 52.35 years with 60% males and 40% females (Table 1).

Table 1: Demographic profile of cases under study n=80

Variables	n (%)
Age (mean)	52.35 Years
Males	48 (60%)
Females	32(40%)

Electrocardiographic analysis of proximal left anterior descending artery revealed diverse patterns. 37.5% (n=25) had ST elevations in leads I, aVL and precordial leads V1-V6. 25% (n=20) had ST elevations in V1-V6. De Winter's T-wave pattern was seen in 16.25% (n=13) patients. Left bundle branch block was present in 15% (n=12). Wellen's Syndrome was present in 12.5% (n=10) (Table 2).

Table 2: ECG patterns in patients with proximal LAD stenosis

n=80

ECG patterns	Frequency %
ST elevations in leads I-aVL and V1-V6	25(37.5%)
ST elevations in leads V1-V6	20(25%)
de Winter's T waves pattern	13(16.25%)
Acute LBBB	12(15%)
Wellen's syndrome	10(12.5%)

DISCUSSION

Various patterns of ECG are seen among patients with proximal LAD stenosis. de Winter's T waves pattern is atypical ECG changes with proximal LAD stenosis. It can precede as early ischemic changes before extensive antero-lateral myocardial infarction and mandates urgent revascularization. About 2% of patients with acute subtotal or total occlusion of the proximal

LAD artery have the de Winter ECG pattern instead of ST-segment elevation and was first described as acute subtotal or total proximal LAD occlusion in 2008 in the New England Journal of Medicine.¹ In our study around 16% of patients presented as such ECG pattern. A long debated de Winters pattern as a sign of proximal LAD was found to have positive predictive value of 95.2%[confidence interval 95%: 76.2-9.9%] by Sclarvosky et al.⁹ and positive predictive value of 100%[confidence interval 95%: 51.7-100%] by Misumida et al.¹⁰ which tries to clarify the debate and support our finding of presence of this sign in 16% [13 patients] in our study.

An ECG is the most important and economical tool for initial diagnostic evaluation of acute myocardial infarction. Utilization of ECG as a diagnostic tool with extreme degree of vigilance aids in timely diagnosis and management of acute coronary syndromes.¹¹ There was a pattern of ST elevation in I,aVL (66.7%) in LCX occlusion in a study¹² which along with ST-elevation in v1-v6 is seen in 25% patient in our study. In another study¹³ a significantly higher (p<0.001) involvement of lateral leads (Lead-I, aVL) when compared to the distal branches. Our study also show 25(37.5%) patients having ST-changes in lateral leads (Lead-I, aVL), however there was involvement of the precordial leads also in our study. Proximal LAD occlusion involving precordial leads was found in 20(25%) in our study, similar findings of significantly higher magnitude of ST-elevation in V2-V5 leads was shown in a study.¹⁴ A team of scientists from Tel Aviv Israel reported the ST segment elevation in non-consecutive leads like V2 and aVL revealed stenosis of first diagonal branch of LAD in coronary angiography.¹⁵ A proximal LAD occlusion may result in a new RBBB, which is often accompanied by LAFB¹⁶, as shown by a group of scientists, a significant number of patient 58%(n=98 out of 170) showed RBBB pattern and 30%(n=26 out of 170) showing LBBB¹⁷. Whereas our study shows 15% (n=12) of patient with proximal LAD occlusion had new onset Left bundle branch block.

In another study¹⁸ showing electrocardiographic changes in proximal-LAD, 4/32(12.5%) patients showed left bundle branch block which was similar to our study 12/80(15%). A dilemma always remains to identify the LBBB pattern as old or new to correlate it with acute myocardial infarction, for this Sgarbossa criteria is used to identify the acute LBBB. In a study by a group of researchers showed that the new LBBB(n=131) among the total(n=3903) and no new LBBB(n=3772) had LAD as a culprit artery in 24.4%(n=32) patient,¹⁹ vs 15%(n=12) in ours. Another group of researcher from New York City reported high incidence of mortality and morbidity including ventricular fibrillation and sudden cardiac arrest among the patients with acute LBBB.²⁰ Wellen's syndrome, mostly destined to a massive anterior wall myocardial infarction was found to be present in 12.5%(n=10) patients in our study. This was the least involved pattern and a similar results was found in a study where out of 120 patients presenting with ACS, 18(15%) patients fulfilled wellen's syndrome criteria and among them those involving the Proximal LAD artery were as low as 4 patients where none of them fulfilled STEMI.²¹ In our study, this pattern was prevalent in 12.5%(n=10) patients and the idea of early intervention in these patients is supportable. Presence of ischemic ECG changes in anterior

wall myocardial infarction is associated with LAD occlusion in majority of the cases.²³

This study was a single centered study with limited sample size. In addition, the coronary angiography was performed by single doctor. This may have affected the final result.

CONCLUSION

We concluded that there is a diversity of Electrocardiographic

patterns in patients presenting with acute anterior wall myocardial infarction and these patients have proximal LAD artery stenosis. Early diagnosis and pharmacological or mechanical reperfusion is mandatory in order to prevent high mortality associated with these subsets of ECG changes.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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