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RESEARCH ARTICLE
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A CASE REPORT ON SINGLE-VESSEL CORONARY ARTERY DISEASE DETECTED WITH A SMARTPHONE-BASED ECG DEVICE.

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Abstract
Background: The electrocardiogram (ECG) is the only easily accessible diagnostic procedure for a patient with chest pain who is suspected of having acute coronary syndrome (ACS).
Case Presentation: We describe a case of a 45-year-old woman with a known history of type 2 diabetes mellitus, who presented with complaints of acute chest pain at a cardiac care unit. Based on the presenting complaints, a gold standard 12-lead ECG (Philips PageWriter ECG) was performed, which showed ST-elevation in leads V1 to V6, suggestive of anterolateral myocardial infarction. She had a smartphone-based ECG the following day, utilising a Spandan smartphone-based ECG device, which showed inversion of the T wave in lead I and J-point elevation in V1 to V6 along with ST-elevation in V3 to V6, II, III, and AVF. These findings were suggestive of inferior STEMI and anteroseptal MI. On the same day, coronary angiography showed a 90% blockage of the left anterior descending (LAD) artery with grade II thrombus and a 60% ostial lesion of the right coronary artery (RCA), suggestive of single-vessel disease of the LAD artery.
Conclusion: This case study highlights the diagnostic utility of a Spandan smartphone-based ECG device in detecting ECG abnormalities indicative of single-vessel CAD, which was later confirmed by a report of coronary angiography.

Keywords: Coronary artery disease, Portable ECG, Acute coronary syndrome, Acute myocardial infarction

Introduction

Coronary artery disease (CAD) is characterized by the accumulation of plaque, which decreases blood flow to the heart muscle [1]. An extensive evaluation of cardiac ischaemia symptoms is necessary for the early diagnosis of coronary atherosclerosis, which is mostly based on risk stratification techniques such as medical history, physical examination, ECG, and serum cardiac marker tests. Rapid decision-making is necessary for the diagnosis of CAD due to its life-threatening nature. [2]

Early and prompt ECG testing should be performed on any patient who exhibits chest pain. Faster performance, patient convenience, and safety are the primary reasons why noninvasive evaluation techniques have been evaluated for CAD prediction [3]. The smartphone-based 12-lead ECG is a simpler, precise, and cost-effective device for the diagnosis of CAD. This case report illustrates the diagnostic capability of Spandan smartphone-based ECG to detect ST-elevation consistent with single-vessel disease (SVD), further confirmed by coronary angiography.

Case presentation

A case of a 45-year-old woman of height 155cm and weight 65 kg admitted to the cardiac care unit of Swami Rama Himalayan University (SRHU) Hospital with chief complaints of acute chest pain. At the time of admission, her baseline blood pressure was 130/90 mmHg. She had a known history of Type 2 diabetes mellitus (T2DM), and her social history revealed she was a nonsmoker. There were no prior cardiac incidents or interventions that had occurred, as the patient stated that she experienced sudden chest pain, which prompted her visit to the hospital.

Based on the presenting complaint, the Philips PageWriter ECG device was used to perform a gold standard 12-lead ECG on February 18, 2024, at 7:16 PM. The results showed ST-segment elevation of leads V1, V2, V3, V4, V5, and V6, which is suggestive of anterolateral ST-elevation myocardial infarction (STEMI). (Figure 1) Based on the findings of the gold standard ECG, the patient was started on medical therapy under close observation. The medication included Pantoprazole, a proton pump inhibitor; low molecular weight heparin; Nitroglycerin, a vasodilator; Injection Morphine; Aspirin, an antiplatelet agent; Clopidogrel, also an antiplatelet agent; Atorvastatin, lipid-lowering therapy; and a sustained release formulation of glyceryl trinitrate, a vasodilator.

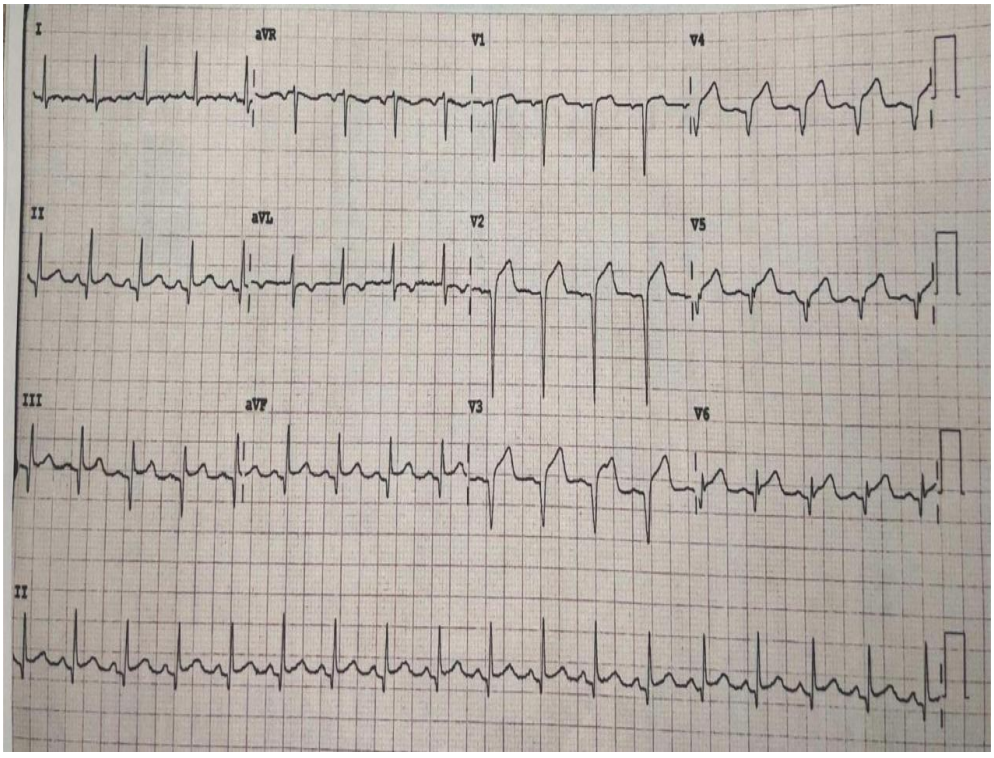

Figure 1: Gold standard 12-lead ECG report.

On the following day (February 19, 2024), at 8:30 AM, a smartphone-based ECG was performed using the Spandan smartphone-based device. The ECG showed J point elevation in leads V1 to V6, ST -elevation in leads V3 to V6, II, III, and AVF. In addition to J point and ST-elevation, T-wave inversion in lead I. These results suggested inferior STEMI and anteroseptal MI (Figure 2).

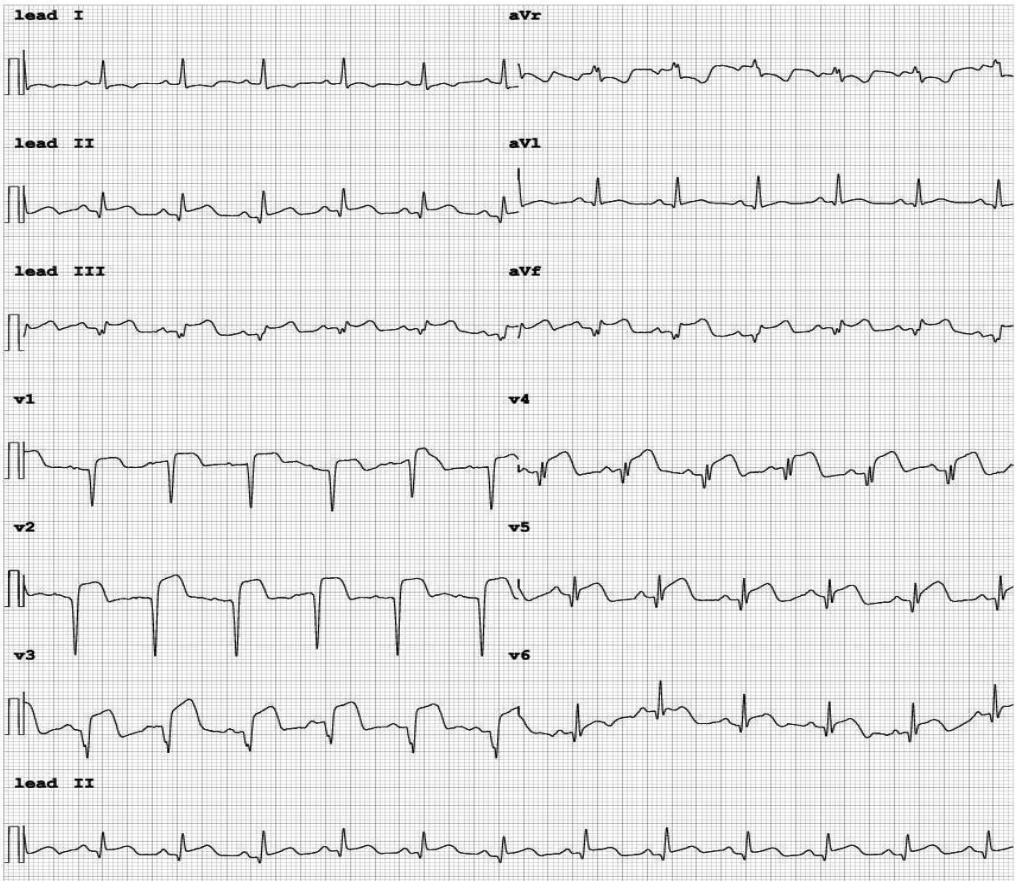

Figure 2: Spandan smartphone-based 12-lead ECG report

To assess the condition's severity even more, coronary angiography was done on the same day, February 19, 2024, at 1:38 PM. The findings of the angiography showed 90% occlusion of the left anterior descending (LAD) artery with grade II thrombus along with 60% ostial lesion of the right coronary artery (RCA). These angiographic findings were suggestive of SVD involving the LAD artery. Based on the angiography report, the cardiologist recommended percutaneous transluminal coronary angioplasty (PTCA) with a stent to the LAD (Figure 3). The case report timeline is presented in Figure 4.

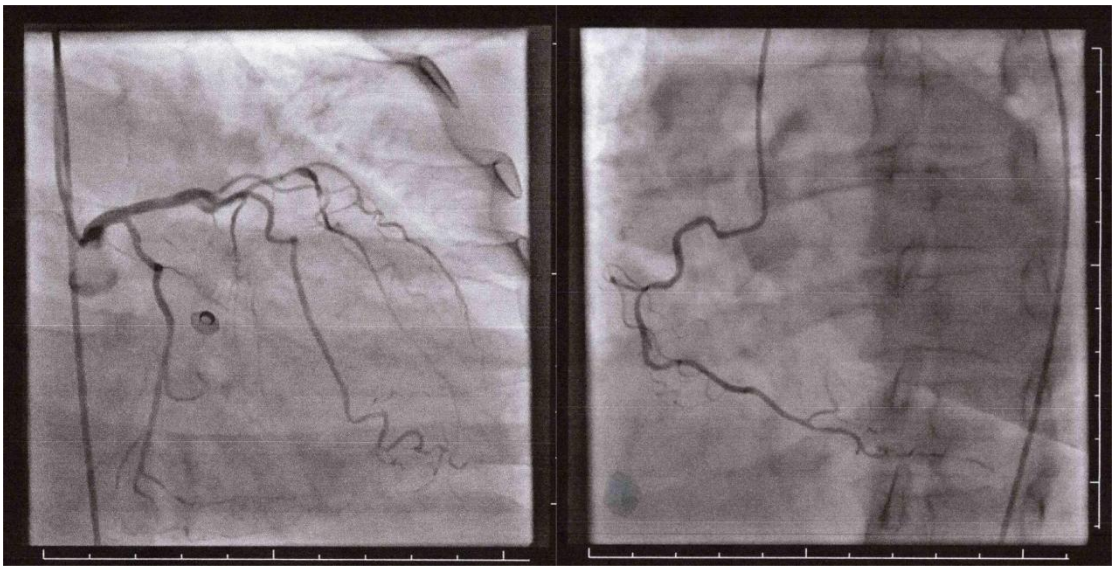

Figure 3: Coronary angiography report.

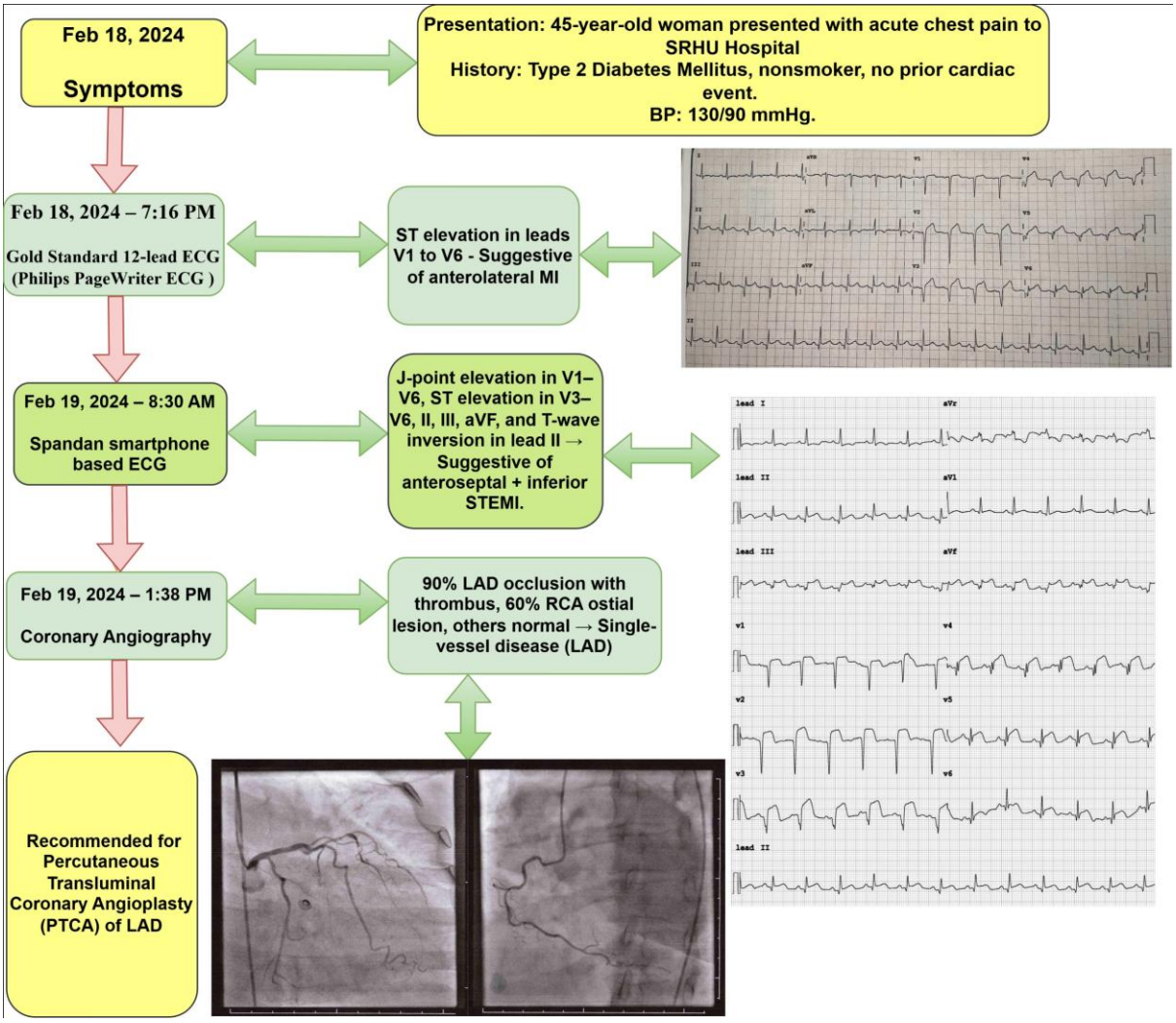

Figure 4: Timeline for the case report presented in compliance with CARE guidelines.

Discussion

Acute coronary syndrome can manifest in a variety of ways, depending on the type of population, age, gender, comorbidities, and the medical facility used for diagnosis and treatment. This case report detailed the diabetic woman's complaint of acute chest pain. Hyperglycemia initiates and exacerbates atherosclerosis by producing advanced glycation end products and reactive oxygen species (ROS). ROS can cause cardiomyopathy and microvascular problems, which can increase the risk of heart failure. Hyperglycemia and insulin resistance can also activate the renin-angiotensin-aldosterone system (RAAS), increasing the risk of cardiovascular disease. [4]

This case report presents the diagnostic performance of the Spandan smartphone-based ECG in the detection of single-vessel CAD. While the gold standard ECG initially identified the ST- elevations in leads V1 to V6, suggestive of anterolateral STEMI. A subsequent ECG was performed using Spandan smartphone-based ECG which showed J point elevation from leads V1 to V6, ST -elevation in leads V3 to V6, and inferior leads (II, III, AVF), along with that Spandan ECG also showed T wave inversion in lead I which was not shown initially by gold standard ECG. This raises the possibility of more extensive changes, including inferior myocardial involvement, which may indicate RCA blockage, as an ECG showing acute ST-Segment elevations in the inferior leads suggests inferior wall infarction due to acute occlusion of the RCA [5]. The findings of the Spandan smartphone were suggestive of anteroseptal MI and inferior STEMI. The same day, coronary angiography was performed, which showed SVD involving 90% occlusion of the LAD artery and also revealed a 60% ostial lesion of the RCA.

The Final diagnosis of this case report was SVD involving LAD. Large-scale research indicates that SVD is more prevalent than Triple Vessel Disease (TVD) and Double Vessel Disease (DVD). In a

study by Chowdhary GS, 42.30% of the study cohort had SVD involvement, which was the most prevalent [4]. Additionally, Revaiah et al. demonstrated that SVD was the most prevalent, occurring in 53% of the patients [6]. Accordingly, Chowdhary GS discovered that the LAD artery was the most often affected, occurring in 38.7% of patients in the extensive research of different kinds of multivessel and SVD [4]. The results were consistent with Revaiah et al.'s investigation, which found that 40% of cases had LAD [6]. Even Mohammad et al. discovered that LAD was the vessel most commonly impacted, appearing in 60.7% of cases [7]. The significance of the LAD lies in the fact that it is one of the three largest coronary arteries. Precordial ST-segment elevation on the ECG is a sign of ischaemia in the LV's anterior wall caused by LAD occlusion. Depending on the degree of cardiac involvement, STEMI brought on by LAD has been linked to poorer clinical outcomes. [4]
The diagnostic concordance between the Spandan ECG and coronary angiography in this case reinforces its utility as a reliable screening and monitoring device. Early detection of ischemic patterns, even when subtle or evolving, can significantly impact clinical decisions and outcomes. For patients with comorbidities such as diabetes, who may present with atypical symptoms or evolving ECG changes, such tools offer timely insights that can guide life-saving interventions.

Conclusion

In conclusion, the study underscores the importance of smartphone-based ECG in diagnosing and assessing MI, providing valuable insights into patient management and risk stratification. Spandan smartphone ECG was able to diagnose ischemic changes following SVD in the LAD in a diabetic woman presenting with chest pain. The diagnosis was later confirmed by coronary angiography, and thus, the use of smartphone-based ECG technology in ACS evaluation. The case supports the use of such devices in standard clinical practice for the early and reliable diagnosis of myocardial infarction.

Ethical approval and Informed consent: This case report's patient was part of a larger clinical trial that was approved by the Swami Rama Himalayan University Institutional Ethics Committee (Approval No: SRHU/HIMS/E-1/2024/07), with CTRI No: CTRI/2024/07/071055. To publish this study, the patient provided written informed consent.

Conflict of interest: The authors declare that there is no conflict of interest regarding the publication of this paper.

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