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Case Report

CARDIOLOGY AND CARDIOVASCULAR MEDICINE

ISSN: 2572-9292

Case Report on the Utilization of mHealth-Based Smartphone ECG for Early Detection and Management of Atrial Septal Defect

Yogendra Singh[1], CB Pandey[2], Shashank Pandey[3], Nitin Chandola[4*], Deekhsha Agarwal[4]

Abstract

Atrial septal defects (ASDs) constitute congenital cardiac anomalies characterized by abnormal communication between the atria, often necessitating prompt intervention to prevent potential complications. This case report elucidates the utilization of mHealth-based smartphone electrocardiography (ECG) in facilitating the early detection of ASDs, thereby enabling timely intervention and favorable patient outcomes. A 63-year-old individual presented with mild dyspnea and an irregular pulse, prompting evaluation with a mHealth-based smartphone ECG device. Sinus rhythm with ventricular premature complexes (VPCs) was detected, leading to further diagnostic assessment and subsequent diagnosis of an ASD. Prompt consultation with a cardiologist and procedural intervention ensued, resulting in successful ASD closure and favorable post-procedural outcomes. Follow-up assessments confirmed the efficacy of mHealth-based smartphone ECG in facilitating early ASD detection and guiding therapeutic management. This case underscores the potential of mHealth based 12 lead ECG technologies in enhancing cardiac care by expediting diagnostic processes, enabling timely intervention, and improving patient prognosis in cases of cardiac anomalies like ASDs.

Keywords: Atrial septal defects; Electrocardiography; Ventricular premature complexes; Smartphone ECG device; mHealth technologies.

Introduction

Atrial septal defects (ASDs) represent a spectrum of congenital heart anomalies characterized by abnormal communication between the atrial chambers of the heart [1, 2]. Despite being one of the most common congenital heart defects, ASDs often present with subtle or even asymptomatic features, leading to underdiagnosis and potential complications if left untreated [3]. Among these complications, cardiac arrhythmias stand out as a significant concern, underscoring the importance of early detection and intervention in managing ASDs [4]. Traditional diagnostic approaches for ASDs have primarily relied on electrocardiography (ECG), echocardiography, and cardiac catheterization [5]. However, advancements in mobile health (mHealth) technologies have introduced innovative modalities for cardiac assessment, notably mHealth-based smartphone ECG devices [6]. These devices offer a convenient, non-invasive means of capturing and analyzing cardiac rhythms in real-time, thereby facilitating early detection of arrhythmias and structural abnormalities such as ASDs [7, 8]. In recent years, the integration of mHealth-based smartphone ECGs into clinical practice has shown promising results in enhancing the diagnostic accuracy and efficiency of cardiac evaluations. By empowering patients with the ability to

Affiliation:

[1]Consultant Cardiologist, Max Hospitals, Dehradun, Dehradun, India

[2]Cardiology, Lala Lajpat Rai Memorial Medical College, Meerut, India

[3]Research and Development, Sunfox Technologies, Dehradun, India

[4]Pharmacology, Shri Guru Ram Rai University, Dehradun, India

***Corresponding authors:**
Nitin Chandola, Research and Development, Sunfox Technologies, Dehradun, India.

Citation: Yogendra Singh, CB Pandey, Shashank Pandey, Nitin Chandola, Deekhsha Agarwal. Case Report on the Utilization of mHealth-Based Smartphone ECG for Early Detection and Management of Atrial Septal Defect. Cardiology and Cardiovascular Medicine. 8 (2024): 303-306.

Received: June 18, 2024
Accepted: June 20, 2024
Published: July 04, 2024

Singh Y, et al., Cardiol Cardiovasc Med
2024 DOI:10.26502/fccm.92920391

monitor their cardiac health remotely and facilitating timely consultation with healthcare providers, these devices have the potential to revolutionize the management of cardiac conditions, including ASDs [9]. This case report delves into the utilization of mHealth-based smartphone ECG for the early detection and subsequent management of an ASD in a 63-year-old individual presenting with cardiac arrhythmias. Through an in-depth exploration of the clinical course, diagnostic assessment, therapeutic intervention, and follow-up outcomes, this report aims to underscore the pivotal role of mHealth technologies in augmenting cardiac care and improving patient outcomes in cases of ASDs and associated arrhythmias. By elucidating the efficacy and implications of mHealth-based 12 lead smartphone ECG Spandan Pro™ developed by Sunfox Technologies Private Limited, Dehradun, India in this context, this report contributes to the growing body of evidence supporting the integration of innovative technologies in cardiovascular medicine.

Case Report

Patient Information

A 63-year-old individual presented on January 4, 2024, with a chief complaint of mild dyspnea and an irregular pulse of 40/min . Subsequently, on January 31, 2024, the patient was admitted to the hospital due to worsening dyspnea on exertion accompanied by cough. Following admission, the patient's clinical course was documented until discharge on February 2, 2024, with a scheduled follow-up appointment on February 7, 2024.

Presenting Complaints

The initial presentation on January 4, 2024, was characterized by mild dyspnea and an irregular pulse, prompting the patient to seek medical attention [18]. The symptoms escalated by January 31, 2024, with dyspnea on exertion and cough, necessitating hospital admission for further evaluation, particularly focusing on the potential closure of an atrial septal defect (ASD).

Clinical Findings

Upon admission, the patient's vital signs were stable, exhibiting a blood pressure of 110/70 mmHg, oxygen saturation (SpO2) of 98%, and afebrile temperature. Notably, a mHealth-based smartphone ECG device named Spandan Pro ™ ECG machine was employed for cardiac assessment, revealing sinus rhythm along with ventricular premature complexes (VPCs), ventricular couplet, and a ventricular run as shown in the Figure 1.

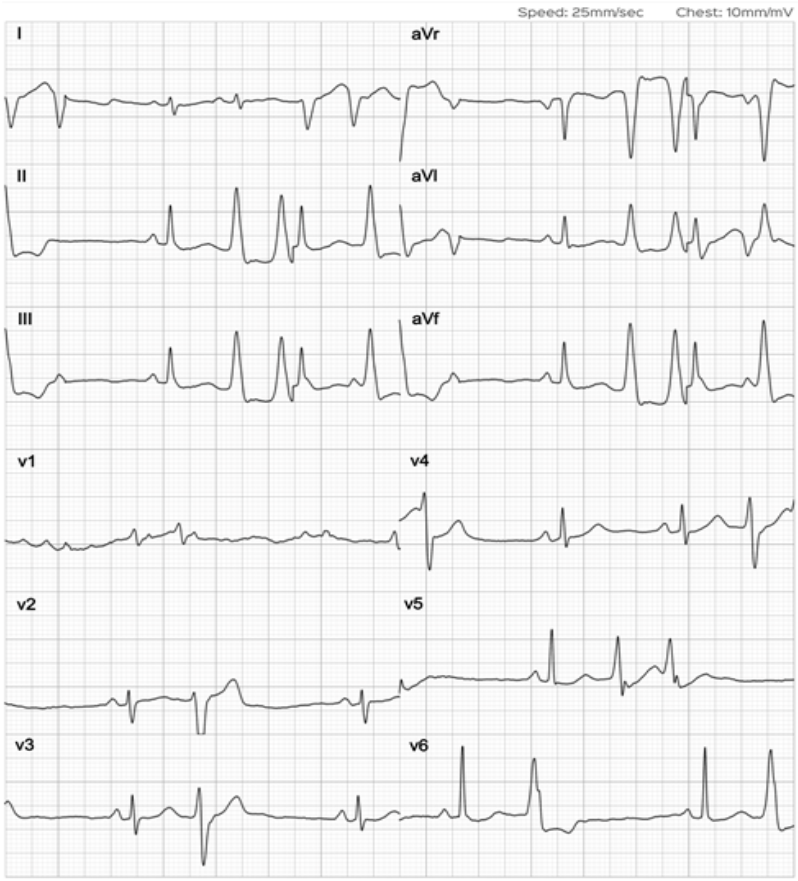

Figure 1: The ECG taken by the patient at home using a Smartphone based ECG device showed the VPCs, Ventricular couplet and ventricular run.

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Diagnostic Assessment

Consultation with a cardiologist, supported by conventional diagnostic measures and the findings from the mHealth-based smartphone ECG, led to the diagnosis of an atrial septal defect (ASD). The utilization of smartphone ECG expedited the diagnostic process, allowing for early detection of the ASD and subsequent intervention.

Therapeutic Intervention

The patient underwent successful Lifetech 20mm ASD closure on January 31, 2024. Throughout the hospitalization period, the patient received a regimen of medication, including Monocef 1gm, Pan 40, Emset 4mg, Dytor plus 20+50, Vasosure 20, and Foracort inhaler 200, tailored to manage their condition effectively.

Follow-up and Outcomes

Upon discharge on February 2, 2024, the patient exhibited stable vital parameters and was prescribed a post-discharge regimen. Subsequent follow-up on February 7, 2024, confirmed the successful closure of the ASD and preserved cardiac function without any detectable anomalies, reaffirming the efficacy of mHealth-based smartphone ECG in facilitating the early detection and management of ASDs.

Discussion

The case presented underscores several key points regarding the diagnosis and management of atrial septal defects (ASDs) utilizing mHealth-based smartphone electrocardiography (ECG) technology. Firstly, the utilization of mHealth-based smartphone ECG played a pivotal role in expediting the diagnostic process [10]. The ability to perform ECG assessments promptly at the point of care facilitated the early detection of cardiac abnormalities, including sinus rhythm with ventricular premature complexes (VPCs), ventricular couplet, and a ventricular run in this case. This highlights the potential of mHealth technologies to enhance the efficiency and accuracy of cardiac evaluations, particularly in cases where timely diagnosis is paramount, such as in patients presenting with symptoms suggestive of ASDs. Furthermore, the integration of smartphone ECG findings with conventional diagnostic measures led to the prompt diagnosis of an ASD in the patient. By providing real-time data on cardiac rhythms, smartphone ECG devices complemented traditional diagnostic modalities, enabling healthcare providers to make informed clinical decisions efficiently. In this case, the early detection of the ASD facilitated timely consultation with a cardiologist and subsequent therapeutic intervention, averting potential complications associated with delayed diagnosis. Therapeutically, the successful closure of the ASD using a Lifetech 20mm ASD closure device further underscores the importance of early detection facilitated by smartphone ECG. Timely intervention following the diagnosis of ASD is crucial in preventing the progression of associated complications, including cardiac arrhythmias and pulmonary hypertension. The implementation of a comprehensive treatment regimen, including medication tailored to manage the patient's condition effectively, highlights the importance of a multidisciplinary approach in the management of cardiac anomalies like ASDs. Moreover, the favorable outcomes observed during the follow-up appointment reinforce the efficacy of mHealth-based smartphone ECG in guiding therapeutic management and monitoring post-procedural outcomes. The confirmation of successful ASD closure and preserved cardiac function without detectable anomalies underscores the utility of smartphone ECG in facilitating comprehensive cardiac care from diagnosis to.

Conclusion

The comprehensive evaluation of the presented case highlights several key conclusions regarding the utilization of mHealth-based smartphone electrocardiography (ECG) in the management of atrial septal defects (ASDs) and associated cardiac arrhythmias. Firstly, the integration of smartphone ECG technology into clinical practice offers a transformative approach to cardiac assessment. By providing real-time data on cardiac rhythms, mHealth-based smartphone ECG devices enable prompt detection of cardiac abnormalities, facilitating early diagnosis and intervention. This is particularly crucial in cases like ASDs, where timely detection can prevent the progression of complications and improve patient outcomes. Secondly, the successful closure of the ASD using a Lifetech 20mm ASD closure device exemplifies the efficacy of early intervention guided by smartphone ECG findings. Timely procedural intervention following the diagnosis of ASD not only mitigates the risk of complications but also ensures optimal therapeutic outcomes for the patient. The favorable post-procedural outcomes observed in this case underscore the importance of integrating smartphone ECG technology into the therapeutic decision-making process.

Furthermore, the multidisciplinary approach employed in the management of the patient, involving collaboration between cardiologists, healthcare providers, and the utilization of innovative technologies like smartphone ECG, emphasizes the importance of a holistic approach to cardiac care. By leveraging the expertise of various healthcare professionals and integrating advanced technologies, comprehensive and patient-centered care can be delivered, ultimately improving clinical outcomes and patient satisfaction. In conclusion, the case highlights the transformative impact of mHealth-based smartphone ECG technology in optimizing the diagnosis, management, and follow-up of cardiac conditions such as ASDs. The successful utilization of smartphone ECG in this case underscores its potential as a valuable tool in cardiovascular medicine, offering promise for enhanced patient outcomes, streamlined clinical workflows, and improved accessibility to cardiac care. However, continued research, education, and integration of these technologies into routine clinical practice are essential to fully realize their benefits and improve cardiovascular health on a broader scale.

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