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Review Article

Home-based care in post-discharge arrhythmia management: a review

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ABSTRACT

Arrhythmia, particularly atrial fibrillation (AF), is a common heart rhythm abnormality with risk factors including age, high blood pressure, alcohol consumption, congenital heart disease, and lung disease. Proper management is critical to prevent complications, enhance quality of life, enable early detection, and reduce healthcare costs. Multidisciplinary patient care and routine follow-up are essential for improving adherence, reducing hospital readmissions, and boosting survival rates. Home-based care has proven to be as effective as clinical settings in reducing mortality and rehospitalization rates. However, challenges such as cost, accessibility, safety, cost, and regulatory issues persist. A comprehensive workbook, including care pathways, dietary guidelines, exercise recommendations, and follow-up procedures, is essential for supporting home care providers and enhancing patient outcomes. A thorough literature review was conducted across multiple databases, including PubMed, Google Scholar, Scopus, and Web of Science, to identify studies related to arrhythmia and home-based post-discharge care. Data from these studies were analyzed and summarized in this review article and highlighted the importance of incorporating home-based care into post-discharge arrhythmia management.

Keywords: Atrial fibrillation, Rehospitalization, Workbook, Dietary guidelines, Follow-up procedures, Care-pathways

INTRODUCTION

Abnormalities in heart rhythm, known as arrhythmias, are associated with both increased mortality and morbidity.[1] According to the Pan-arrhythmia observational study, the distribution of arrhythmia classifications among patients is as follows: bradyarrhythmia (15%), atrial fibrillation (AF) (15%), other supraventricular tachyarrhythmias (10%), and ventricular tachycardia/fibrillation (4.5%).[2] The AF is the most common type of treated arrhythmia, with various risk factors contributing to its development.[3] These risk factors include age, high blood pressure, alcohol consumption, congenital heart disease, and lung disease.[4]

Arrhythmias are broadly categorized based on heart rate into two types: bradyarrhythmia's and tachyarrhythmias. Bradyarrhythmia is characterized by a heart rate of fewer than 60 beats per minute, while tachyarrhythmia refers to a rate exceeding 100 beats per minute.[1] Both conditions can reduce cardiac output, potentially leading to hypertension and even death. Bradyarrhythmia typically results from reduced spontaneous depolarization in the sinoatrial node, slowed conduction through the heart's conduction system, or increased parasympathetic tone. In contrast, tachyarrhythmias arise from accelerated rhythms, either above or below the atrioventricular node.[5]

Addressing arrhythmia is crucial for preventing several health complications, improving quality of life, enabling early detection, and facilitating personalized treatment plans. Effective management is key not only for individuals' health but also for public health outcomes, as it helps reduce the burden of related conditions and

healthcare costs. For individuals suspected of having arrhythmia, the initial step in diagnosis typically involves an electrocardiogram. Based on the diagnosis, treatment strategies may include anticoagulants, medications for rhythm and rate control, and, if necessary, interventional cardiac procedures.[4]

Enhancing patient adherence, reducing hospital readmissions, and increasing survival rates can all be achieved through multidisciplinary patient management and routine follow-up. When it comes to lowering mortality and preventing rehospitalization, home-based programs are as effective as those in clinical settings.[6] Home care includes services provided by certified medical professionals or services that individuals can receive at home after surgery. To reduce hospital readmissions, these services are offered to adults, elderly patients, and children who require assistance after being discharged from the hospital or those who wish to maintain their independence at home.[7] Home-based and digital care has become essential tools in the post-COVID-19 age.[8] Since unplanned hospital admissions can lead to complications, increased morbidity, additional stress for patients and caregivers, and higher costs for payers and providers, the primary goal of home health care is to help patients care for themselves or receive support from their families.[9]

The significance of home-based care for patients with post-discharge arrhythmia is emphasized in this review article. Effective management techniques are discussed followed by epidemiology, etiology, prognosis, diagnosis, therapy, and post-discharge risk related to arrhythmia. The article highlights the need for a comprehensive workbook that contains care pathways and crucial information related to home-based care, such as dietary guidelines, exercise recommendations, and follow-up procedures. Additionally, the workbook provides valuable skills and information for members of the cardiovascular care team to enhance patient outcomes.

METHODS

The methodology section of this study outlines the approach used to gather and analyze data related to arrhythmia care, particularly post-discharge, and home-based care in India. A comprehensive literature review was conducted across databases such as PubMed, Google Scholar, Scopus, and Web of Science to ensure broad topic coverage. Relevant studies were identified using keywords like ‘arrhythmia,’ ‘prevalence,’ ‘home-based care,’ ‘challenges,’ and ‘post-discharge care.’ Data from selected studies were extracted and summarized in a review article, focusing on the arrhythmia clinical care pathway incorporating home-based care post-discharge.

EPIDEMIOLOGY OF ARRHYTHMIA

India faces serious concerns related to arrhythmias and heart failure, with ventricular tachyarrhythmias being a major cause of avoidable deaths.[10] While Asians have a lower prevalence of stroke and mortality compared to Western populations, their prognosis is comparable. Each Asian country reports approximately 40 sudden cardiac death incidents per 100,000 people annually, with myocardial infarction and ventricular fibrillation being common causes.[11] In India, heart failure is the leading cause of cardiac arrhythmia, accounting for 58% of cases, followed by bradyarrhythmia and AF (15% each).[2]

However, data collection in India faces challenges, including under-registration of deaths, lack of uniform coding, limited emergency services, and infrequent physician visits.[12] Despite the availability of Western prevalence data, India lacks sufficient local data, which is essential for creating evidence-based national evidence-based policies and guidelines.[13]

ETIOLOGY AND PROGNOSIS OF ARRHYTHMIA IN INDIA

Arrhythmias are common complications of acute myocardial infarction in India, with ventricular premature contractions being the most frequent type.[14] Studies show that arrhythmias occur more often in males and patients over 60 years old, with anterior wall infarcts being more common than inferior wall infarcts.[14,15] Ventricular tachyarrhythmias are a significant cause of preventable death and are often associated with underlying coronary artery disease (CAD).[10] Among acute coronary syndromes, ST-elevation myocardial infarction is associated with an increased risk of arrhythmia.[16] Patients with acute myocardial infarction patients who experience arrhythmias tend to have a worse prognosis and more extensive myocardial damage, which underscores the need for improved detection and treatment methods in India.[10,16]

DIAGNOSIS OF ARRHYTHMIA

Arrhythmias present diagnostic challenges due to their varied patient presentations and the differing management approaches, which are influenced by clinical history, physical examination, and electrocardiogram findings.[1] Sodium, calcium, potassium levels, respiratory rate, and blood pressure can all be useful for the early diagnosis of cardiac arrhythmias.[17] Several techniques for arrhythmia detection, ranging from simple statistical metrics-based methods to more complex machine-learning techniques, such as neural networks, support vector machines, and Bayesian classifiers. Among these machine-learning approaches, neural networks and support vector machines tend to perform better.[18] In Indian patients, wearable patch monitors can achieve good patient compliance and a high diagnostic yield for clinically significant arrhythmias.[19]

Machine learning techniques have shown promise in arrhythmia classification. One study classified five different types of arrhythmia beats with an overall accuracy of 98.49% using discrete wavelet transform, independent component analysis, and support vector machine.[20] Additionally, an internet of things-based

system utilizing fuzzy logic-based neural network classifiers has been developed for cardiac arrhythmia monitoring and diagnosis. This system offers lower cost and better accuracy than conventional approaches. [21] These advancements are helping India diagnose arrhythmias more quickly and efficiently.

TREATMENT OF ARRHYTHMIA

Arrhythmia treatment involves antiarrhythmic drugs (Table 1), with class I drugs blocking sodium channels, class II drugs blocking sympathetic activity, class III drugs blocking delayed rectifier potassium channels, and class IV drugs blocking slow inward calcium currents at the atrioventricular node. Management strategies also include implantable devices such as electronic pacemakers, cardioverter defibrillators, and catheter ablation.[22] Post-discharge ECG Holter monitoring of AF patients is a valuable tool for identifying deviations in rhythm/rate control, allowing for adjustments in therapeutic management. It may also help identify individuals with labile heart rates.[23] Understanding arrhythmogenesis and conducting epidemiological studies are crucial for the development of new treatments. Addressing risk factors is essential, as some cases may require medication or invasive procedures (Figure 1).[22]

Table 1: Classification of antiarrhythmic drugs.[22]

Class	Drugs
I: Sodium channel blockers	Disopyramide, procainamide, quinidine, propafenone
II: Beta-blockers	Metoprolol, propranolol, bisoprolol
III: Potassium channel blockers	Amiodarone
IV: Calcium channel blockers	Diltiazem, verapamil

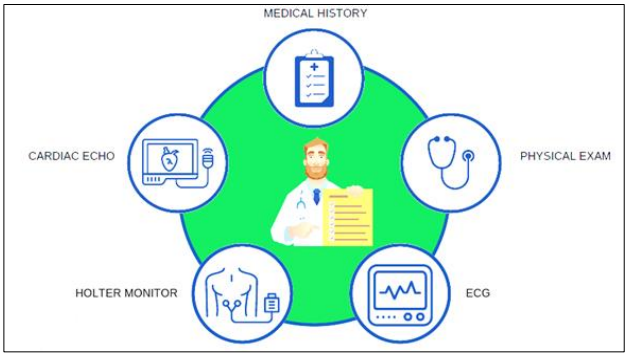

Figure 1: Diagnosis of arrhythmia.

India's limited reimbursement and insurance coverage necessitate the use of high-yield diagnostic tools, especially for arrhythmia diagnosis. Proper patient selection can improve outcomes, yield higher diagnostics accuracy, and reduce medical resource usage. External loop recorders, a cost-effective new technology, could replace Holter monitors in patients with symptom frequency of less than three times a week.[24]

POST-DISCHARGE ARRHYTHMIA RISK AND CARE

Post-discharge arrhythmia (AF) after open-heart surgery is common in valvular procedures and can cause rehospitalization and impact hospital resources. Patients taking beta-blockers have less frequent events, which can be predicted by simple variables observed in the early stages after surgery.[25] Its incidence was high among patients with post-operative AF (POAF), with over half experiencing post-discharge AF after 30 days post-coronary artery bypass graft hospital discharge.[26] The incidence rate of POAF recurrence in patients at high risk of stroke is 28.3% post-discharge, with 61-100% identified through implanted continuous monitoring within two years. Approximately 40%-93% of episodes were asymptomatic. Monitoring for POAF recurrence identifies early asymptomatic recurrences, potentially benefiting anticoagulation for stroke prevention.[27]

Home-based arrhythmia management offers benefits such as early diagnosis, cost reduction, hospital readmissions, stroke, and mortality.[28] Remote monitoring and telemedicine are used to ensure patient surveillance, reducing hospital visits and infection risk.[29] Home monitoring systems improve early detection of ventricular arrhythmia and inappropriate shock, optimizing medical treatment and device programming with low healthcare resource utilization.[30] The implantable cardio monitoring and mHealth technologies can enable remote detection and management of arrhythmias, including comorbidity and lifestyle management.[31,32] Also, the home-based nurse intervention may improve confidence and self-esteem, and reduce early hospital readmissions.[33]

HOME-BASED POST-DISCHARGE ARRHYTHMIA CARE COMPONENTS

Home-based therapy for AF, incorporating education on modifiable risk factors and innovative heart rate monitoring methods, can potentially reduce costs and hospitalizations.[28] A home-based medication management service provided by a pharmacist can improve care continuity and address medication discrepancies post-hospital discharge.[34] Telephone-based monitoring and documenting of arrhythmias after hospital discharge have been demonstrated to improve survival rates among sudden death survivors.[35]

Diet

Home-based management of arrhythmias, especially AF, can be improved through dietary interventions and lifestyle modifications. A whole-food plant-based diet rich in whole grains, legumes, fruits, and vegetables can reduce risk factors associated with AF including hypertension, CAD, inflammation, obesity, and diabetes.[36] Consuming

omega-3 fatty acids like fish and nuts can reduce ventricular arrhythmias and sudden cardiac death.[37] Maintaining electrolyte balance is crucial for arrhythmia management.[38] Fish oil can prevent ventricular fibrillation after coronary artery occlusion and reperfusion.[39] Specific micronutrients can improve insulin resistance and left ventricular function.[40]

Exercise

Telephonically monitored home exercise programs are safe and effective in detecting new arrhythmias or conduction disturbances in patients following coronary bypass surgery.[41] The tele-rehabilitation in coronary heart disease (TRiCH) study demonstrated that home-based exercise interventions, supported by telemonitoring guidance, are as effective as center-based programs in maintaining exercise capacity and physical activity levels in patients with CAD. [42] Additionally, a pilot, single-center, real-world evidence study evaluating the effectiveness of the LYFE application in patients with CAD, revealed a remarkable 90% adherence to regular exercise.[43] Furthermore, an interim, prospective, single-center cohort study reported that combining the LYFE app with the standard of care significantly improved physical exercise adherence in patients with CAD. [44]

Telehealth

Telehealth has proven to be an effective method for monitoring postoperative status and detecting complications in cardiac surgery patients following discharge.[45] One study utilized a combination of three survey tools namely, the medication understanding and self-efficacy tool, functioning self-efficacy scale, and arrhythmia-specific questionnaire for patients with tachycardia and arrhythmias. These were complemented by monitoring devices such as loop recorders, Kardia-TM, pacemakers, and cardioverter defibrillators-ICDs. Through telephone and video consultations, the study aimed to identify arrhythmia changes in arrhythmias and assess patient reactions to enhance self-efficacy behaviors.[46] Another study demonstrated no significant difference between telemedicine and in-person consultations in detecting new cases of AF or ventricular tachyarrhythmias.[47] Furthermore, the LYFE application provided comprehensive and proactive monitoring, including auto-scheduled lab tests and remote teleconsultations with cardiologists.[44,48] This intervention demonstrated the potential of telehealth in improving patient care for those at risk of arrhythmias. Additionally, home-based telecardiology service has been successfully utilized for follow-up care with patients who were discharged early, including those with arrhythmias.[49]

Patient's education

Education provided by emergency department nurses plays a crucial role in improving outcomes for AF patient's post-discharge.[50] It enhances patients understanding of AF, reduces complications, and lowers both short-term hospital admissions for heart failure and mid-term all-cause admissions.[51] These findings suggest that patient education is a key factor in improving post-discharge outcomes for AF patients. The LYFE application incorporates an educational module designed for both patients and caregivers, offering detailed information about heart conditions. This content is supported by real-world evidence, prospective studies, and randomized controlled trials. Such an approach significantly enhances outcomes in CR by improving the understanding of both patients and their caregiver.[43,44,48,52]

Thus, it offers potential benefits in terms of patient outcome, quality of life, and healthcare resource utilization, particularly for older patients and those with chronic AF.

CHALLENGES OF HOME-BASED CARE

India is facing a demographic transition due to an aging population and an increase in chronic diseases, leading to demand for home healthcare services. However, home healthcare delivery in India is under-researched, with concerns about accessibility, availability, providers, regulatory issues, care standards, costs, safety, and grievance redressal mechanisms.[53] Other challenges include interdisciplinary collaboration, volunteer involvement, training enhancement, service expansion, and improving community support.[54]

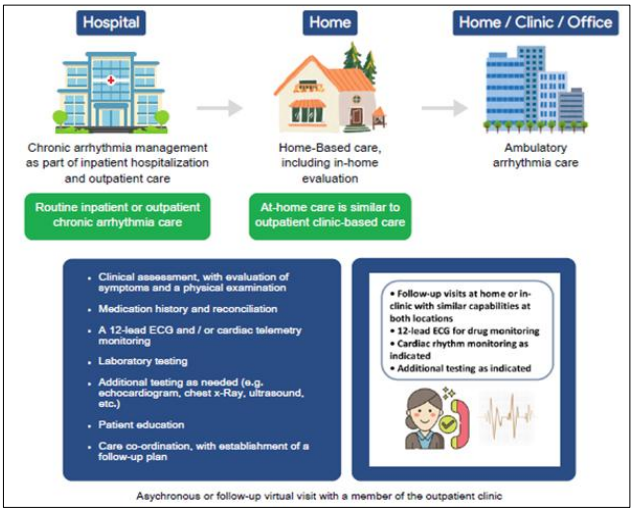

Figure 2: Arrhythmia clinical care pathway incorporating home-based care.

ARRHYTHMIA CLINICAL CARE PATHWAY INCORPORATING HOME-BASED CARE

Chronic arrhythmia management involves comprehensive care in both inpatient and outpatient settings. Home care mirrors this approach, offering clinical assessments, diagnostic tools, laboratory testing, and patient education. It includes physical examinations, medication history, and

reconciliation, as well as echocardiograms or chest X-rays as needed. Patient education is crucial to understand of their condition and treatment options. Coordination of care is emphasized, with follow-up visits planned, including asynchronous or virtual consultations with outpatient clinic members, ensuring continuous and effective management of chronic arrhythmias (Figure 2).

CONCLUSION

This review emphasizes the importance of home-based care post-discharge arrhythmia management. However, challenges such as accessibility, availability, regulatory issues, and costs make it essential to develop a new approach to address these concerns. A workbook with a care pathway has been designed to empower healthcare team members to deliver exceptional, patient-centered care in home settings, facilitating seamless transitions from traditional hospital care and innovative home-based solutions.

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