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Review Article

Significance and Outcomes of Cardiac Rehabilitation in Patients with Atrial Fibrillation: A Systematic Review

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ABSTRACT

A trial fibrillation (AF) is the most common arrhythmia, affecting around 2% of the western world and showing a rising trend with age. Not only does it hamper the quality of life (QoL) of patients, but it is also a huge global healthcare burden. The aim of this systematic review is to provide conclusive evidence that cardiac rehabilitation (CR) implementation in patients with symptomatic AF or who have been treated for AF can aid in improving their overall cardio-metabolic profile and help them enhance their QoL. For this purpose, databases such as Pubmed, Pubmed Central (PMC), and the Cochrane Library were screened for relevant articles published between January 1, 2013 and February 22, 2023. After application of appropriate filters and quality assessment of the articles, a total of 10 articles were included in this review, which consisted of four randomised control trials (RCTs), three cohort studies, one narrative review, one systematic review, and one systematic review and meta-analysis.

From this review, it was concluded that cardiac rehabilitation, which is an intensive, demanding intervention comprising parts of fitness training, education, psychosocial treatment, and a behaviour designed to improve the physical and

emotional elements of persons with heart disease, can be successfully implemented in AF sufferers by improving their exercise capacity, QoL, and helping them cope better with the condition.

Keywords: Cardiac rehabilitation; Cardiovascular rehabilitation; Cardiac recuperation; Cardiac rehabilitation program; Atrial fibrillation.

INTRODUCTION AND BACKGROUND

With a prevalence of 2% in industrialised countries, atrial fibrillation (AF) is the most common cardiac arrhythmia, and its prevalence rates have shown a significant increase with advancing age.[1–7] It is a long-term, progressive condition that fluctuates between flare-ups and remissions.[2] Due to symptoms of dread about triggering AF episodes, the arrhythmia significantly affects daily living and leads to a more sedentary lifestyle.[3] Obesity, diabetes, hypertension, and cardiovascular disease are all made more likely by this sedentary behaviour .[3] Age, sex, and lack of activity, together with the previously mentioned ailments, all contribute to the likelihood of developing AF and may play a role in its continuation.[3,8,9] By having an impact on the atrial myocardium's hemodynamic, electrophysiological, and metabolic properties, risk factors for AF influence how the left atrium (LA) looks and works.[10] Inadequate care also contributes to the condition's progression and associated consequences.[10] AF causes disabling and unpredictable symptoms, worsening of quality of life (QoL), and higher mortality,[11] with an increase in the mortality risk factor of 1.5 for men and two for women.[1]

AF is a highly diverse illness that falls into five diagnostic groups described in Table 1.[4] In addition to palpitations, exhaustion, shortness of breath, dizziness, and syncope (fainting), patients with AF may also feel depression, anxiety, and a decreased ability to exercise.[4,6] Compared to paroxysmal AF, persistent and permanent AF are linked to higher patient morbidity and mortality .[11]

Table 1: Categories of AF. Modified from Smart et al.[4]

Category	Feature
First diagnosed AF	First episode of AF in the patient.
Paroxysmal AF	Within 48 hours, the beat typically transforms on its own to a sinus (normal) rhythm.
Persistent AF	More than seven-day duration of an AF episode or necessitates cardioversion.
Long- standing persistent AF	AF lasts longer than a year.
Permanent AF	Accepted by the patient (and doctor), with no rhythm control techniques being utilized.

Worldwide data supports patterns of increasing AF-related healthcare utilisation and glaring correlations with all-cause mortality, stroke, and heart failure (HF).[1,7,10,12,13] The comorbidities that arise in AF patients are a result of both the increased risk of HF and the neurological aftereffects of strokes brought on by AF.[1] With the advent of anticoagulant therapies, stroke-associated mortality has decreased; nonetheless, the morbidity and mortality of AF-related events have remained a challenge.[1]

The main goals of current AF care include rate and rhythm regulation, stroke risk mitigation, and lowering related morbidity and mortality.[4,8] However, rate control treatments, such as anticoagulation and heart rate control, cannot reduce exertional dyspnea brought on by AF.[8] Even with the availability of medication and electrophysiological therapies, deaths

and functional limitations brought on by dyspnea, heart failure, and reduced activity are nevertheless frequent[1]. Research has revealed that despite treatment effectiveness, the majority of patients receive inadequate education, which increases anxiety and the impression of symptoms.[1,5] Hence, a common and significant issue for individuals with AF getting standard medical therapy is a lack of good health-related QoL.[4] It has been demonstrated that catheter ablation, an invasive treatment to eradicate AF symptoms, improves patients' QoL, but impaired physical function frequently persists.[5] For patient outcomes to improve, more thorough standards of treatment are essential.[1]

Evidence indicates that AF may be controlled in addition to medical treatment by altering lifestyle choices.[4] Nutrition, exercise, and risk factor management can all be utilised to temporarily and possibly permanently alter the underlying causes of AF.[2,13] According to a recent meta-analysis on the health benefits of physical activity for AF patients, exercise improved frequency control, reduced the chance of AF relapse after ablation, and improved quality of life for patients with all forms of AF.[3,14] A substantial decrease in the burden of AF was achieved with effective weight loss and improved physical activity.[13]

Cardiac rehabilitation has proven to be beneficial for people with a number of cardiac conditions, including ischemic heart disease, heart failure, post-myocardial infarction, and people with AF.[1,5,8] Recent meta-analyses have demonstrated that cardiac rehabilitation boosts physical fitness and enhances certain aspects of health-related quality of life (HR- QoL) in individuals with AF.[7,15,16] Exercise may benefit AF sufferers' health through a variety of mechanisms, including atrial re-modelling, changes in autonomic regulation that have an anti-arrhythmic effect, lowered blood pressure, decreased body weight, and decreased cholesterol.[3,4,8]

Physical activity as an adjunctive therapy for those with paroxysmal or chronic AF has gained more attention.[3] A recent study compared the load of AF to a passive control group and found that exercise with high intensity reduced the burden.[17] This systematic review aims to study the significance and consequences of cardiac rehabilitation in patients suffering from atrial fibrillation.

REVIEW

Methods:

This systematic review aims at studying the effects and consequences of cardiac rehabilitation in patients recently treated for or those having recurrent episodes of atrial fibrillation. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 standards.[18] were followed for conducting this systematic review.

Search Strategy:

Databases such as PubMed, Google Scholar, and the Cochrane Library were used to conduct a complete literature search. With the help of the BOOLEAN operators "AND" and "OR," the terms "Cardiovascular rehabilitation," "Cardiac rehabilitation programme," "Cardiac recuperation," and "Atrial fibrillation" were combined to create the search. To reduce the number of publication results, a mesh strategy was employed. A complete search of the above-mentioned databases with appropriate filters and the resultant number of articles are presented in Table 2.

Eligibility Criteria:

The studies chosen for this systematic review are in accordance with the participants, interventions, and outcomes as follows:

Participants: adults and elderly populations (>= 18 years), of all sexes and racial backgrounds, who have received treatment for atrial fibrillation or are afflicted with it. Intervention: Commencing cardiac rehabilitation in the above-mentioned participants Outcomes: clinical improvement in the cardiac capacity of the patients and decrease in the recurrence of atrial fibrillation episodes.

Inclusion and Exclusion Criteria:

Additionally, the following inclusion and exclusion criteria were added: papers that were taken into consideration had to be entirely written in English; free full-text articles published within the previous ten years; randomised control trials (RCTs); non-randomised control trials; case series and case reports; cohort studies; case control studies; systematic reviews; literature reviews; and meta-analyses. This systematic review did not include any animal research.

Table 2: Databases used for the literature search

Database	Search Strategy	Filters Applied	Number of articles
PubMed	Cardiac rehabilitation OR Cardiovascular rehabilitation OR Cardiac recuperation OR Cardiac rehabilitation program OR ("Cardiac Rehabilitation/instrumentation"[Mesh] OR "Cardiac Rehabilitation/methods"[Mesh] OR "Cardiac Rehabilitation/statistics and numerical data"[Mesh]) AND Atrial fibrillation OR "Atrial Fibrillation/rehabilitation"[Mesh]	2013-2023; Free full text articles; Adult and elderly population (>=18 yrs); Only English language papers.	130
Google Scholar	allintitle: Cardiac rehabilitation and atrial fibrillation	2013-2023	25
The Cochrane Library	Cardiac rehabilitation AND Atrial fibrillation	2013-2023	1

RESULTS

A total of 156 articles were found from the aforementioned databases within the last ten years (January 1, 2013, to February 22, 2022) by employing the proper search techniques and filters. After duplicates and irrelevant records were

eliminated from the screened articles, the quality of the articles was evaluated using tools such as AMSTAR 2 (for systematic reviews and meta-analyses),[19] the Jadad scale (for RCTs and non-RCTs),[20] SANRA (for narrative review articles),[21] the JBI quality appraisal checklist (for case series and case reports),[22] and the Newcastle-Ottawa checklist (for case control and cohort studies).[23] The PRISMA chart, which is displayed in Figure 1, provides an overview of the screening procedure, whereas Table 3 lists the studies that were approved for inclusion in this systematic review.

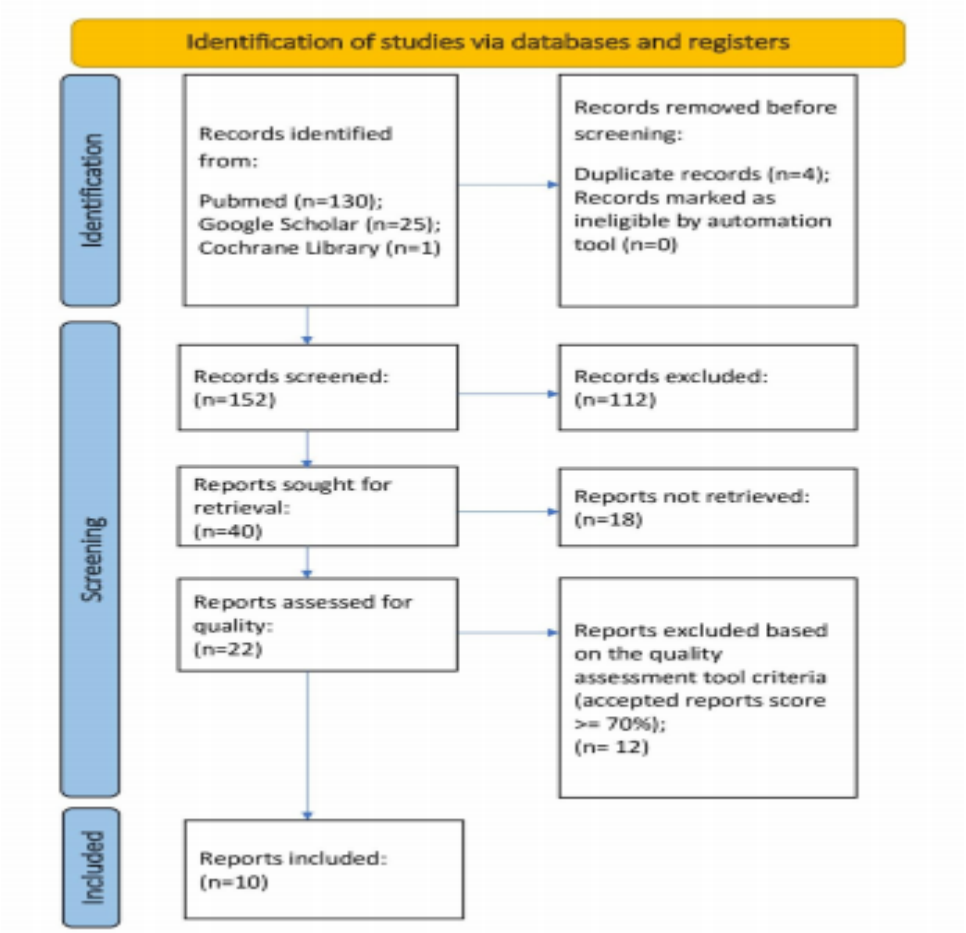

Figure 1: PRISMA Flowchart for the screening process

Table 3: Included studies with quality assessment scores

Author	Publication Year	Type of Study	Quality Assessment tool used	Score
Robaye et al [1]	2020	Review article	SANRA	11
Risom et al [5]	2016	Randomized Control Trial (RCT)	Jadad Scale	7
Smart et al [4]	2018	Systematic Review and Meta-analysis	AMSTAR 2	14
Tanaka et al [8]	2021	Retrospective Cohort	SANRA	10
Reed et al [11]	2022	Randomized Control Trial (RCT)	Jadad Scale	7
Younis et al [9]	2018	Prospective Cohort	Newcastle Ottawa Scale	8
Hamazaki et al	2021	Retrospective Cohort	Newcastle Ottawa Scale	8
Skielboe et al [3]	2017	Randomized Control Trial (RCT)	Jadad Scale	6
Risom et al [6]	2018	Randomized Control Trial (RCT)	Jadad Scale	7
Risom et al [7]	2017	Systematic Review	AMSTAR 2	13

DISCUSSION

Atrial fibrillation(AF), as an entity in itself, is linked to a variety of complications, as diagrammatically represented in Figure 2. Given the well-documented advantages in other clinical contexts, cardiac rehabilitation appears to be a goal that is attainable for patients with AF.[1]

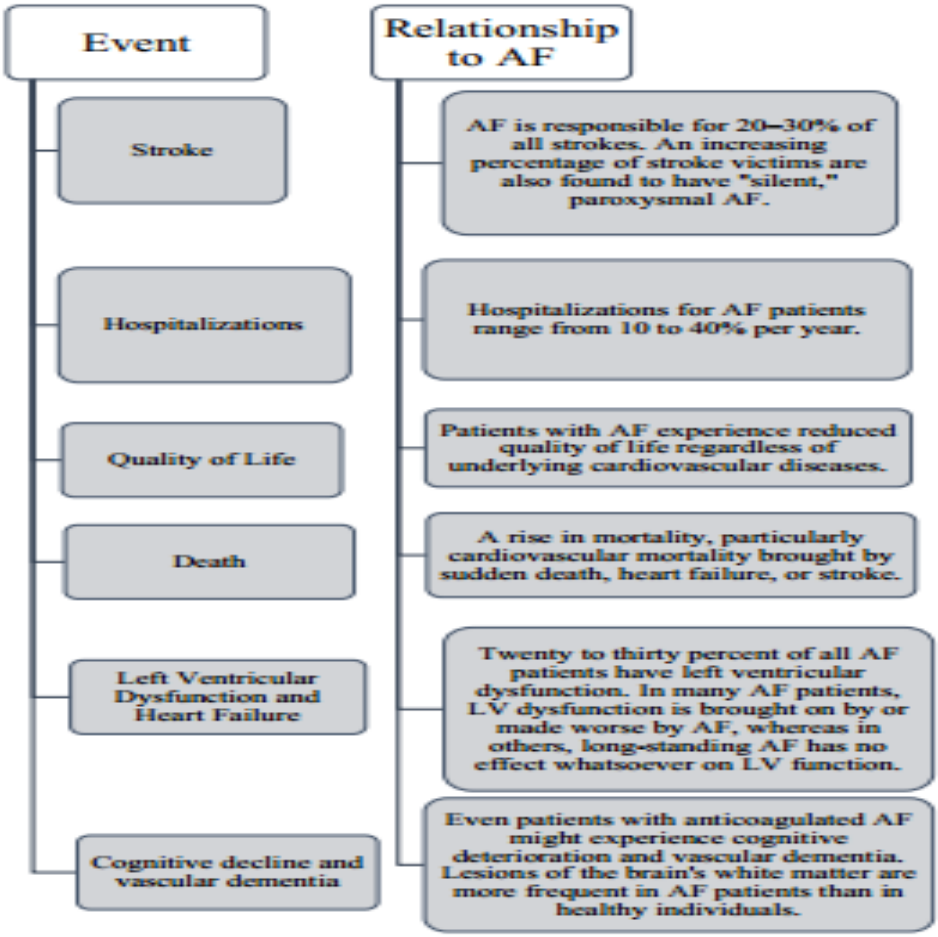

Figure 2: Complications associated with AF. Modified from Robaye et al.[1]

Cardiac rehabilitation (CR) is a thorough, complicated intervention that consists of elements of fitness training, education, psychosocial management, and a behaviour programmed to improve the physical and emotional aspects of people with heart disease.[25] Heart failure, post-myocardial infarction, and revascularization patients may benefit from cardiac rehabilitation due to potential decreases in mortality, hospital stays, and medical expenses, as well as improvements in exercise tolerance and health-related quality of life (HR-QoL).[25] It's also intriguing to wonder how patients with AF's physical limitations on their hearts change over time.[1] According to a 2016 study by Magnani et al, adults with AF who were 70 years of age or older (n = 2753) aged physically more quickly overall than their non-AF colleagues.[26] When clinical confounding factors, such as left ventricular ejection fraction (LVEF), were adjusted in a different study by Hamazaki et al, physical function was still significantly enhanced independent of the rhythm status.[24] Moreover, in elderly heart failure (HF) patients with sinus rhythm or AF, improved physical function following five months of CR was

linked to a lower risk of unfavourable clinical outcomes.[24]

Patients with persistent AF or those receiving cardiac radiofrequency ablation have been a part of the majority of interventional exercise trials up to this point. It has been demonstrated that cardiovascular exercise increases resting heart rate and, to a certain extent, lessens the requirement for medical treatment in these people.[3] Exercise, when combined with a change in lifestyle after radiofrequency ablation, has enhanced sinus rhythm maintenance over the long term.[3] Improvements in physical fitness were linked to fewer AF symptoms and arrhythmias on the electrocardiogram (ECG), according to a study by Pathak et al [27]. In the study by Skielboe et al, it was not significantly demonstrated that high-intensity (HI) exercise was superior to low-intensity (LI) exercise in reducing the burden of AF, but if exercise was continued for longer than 12 weeks, a positive effect on AF burden may be more pronounced due to the gradual onset of a favourable cardiac risk profile, weight loss, and increased exercise capacity.[3]

According to a new meta-regression analysis in AF patients, exercise sessions lasting at least 60 minutes could considerably improve the six-minute walking test (6MWT);[28] however, the patients in the high-intensity interval training (HIIT) group of a clinical trial performed by Reed et al showed a substantial improvement after only a 23-minute programme.[11]
Another analysis given by Smart et al. showed that LVEF was significantly increased by exercise-based CR versus control participants.[4] This is crucial for those who have AF, as they greatly benefit from enhanced systolic function.[4]

The primary clinical result of CR, regardless of the diagnosis, is physical capability, which also serves as a standalone predictor of cardiovascular events and overall mortality.[5] The CopenHeartRFA study used the peak rate of oxygen consumption (VO2 peak) as a gauge of exercise capacity since VO2 was selected as the primary outcome by the specialists in the field and considered to be the most accurate measurement method due to its accessibility and low cost.[5] The study found that the primary outcome considerably improved in the CR group as compared to conventional treatment, indicating a short-term impact on physical capacity after four months.[5] In comparison to standard therapy, this trial demonstrated no discernible difference between the CR group and the control group in terms of major adverse events or self-reported AF symptoms.[5] This is consistent with research that shows exercising has a number of physical health advantages and appears safe for those with AF.[29] Although a lot of studies point towards the importance of CR in patients with AF, some claim that the available evidence is insufficient to evaluate the effect of exercise-based cardiac rehabilitation on the key outcomes of death and major adverse events.[7] However, the pooled estimates from these studies showed moderate to-low-quality evidence that exercise training resulted in short-term gains in exercise capacity, evaluated at the conclusion of the intervention.[7]

In a prospective randomised study by Osbak et al, 49 patients with permanent AF were divided into cardiac rehabilitation and control groups in an effort to determine whether or not patients with permanent AF would benefit from rehabilitation in terms of symptom management, quality of life, cardiac output, and levels of natriuretic peptides.[1,30] The maximal power produced during a stress test, the distance covered during a 6MWT, the cardiac output determined by echocardiography, the quality of life, and the levels of natriuretic peptides were the focus of the study.[1,30] The maximal power during the stress test and 6MWT, as well as a considerable drop-in resting heart rate, all demonstrated significant improvements for the rehabilitation group.[1,30] In the rehabilitation group, the quality of life (QoL), as measured by the Minnesota Living

with Heart Failure Questionnaire (MLHF-Q) score,[31] also increased.[1] Robaye et al reported that CR also lessened the frequency and intensity of AF-related symptoms. The rehabilitation group also noted a tendency towards fewer hospitalisations on a yearly basis and no significant adverse effects.[1] Over time after CR, a decline in the Atrial Fibrillation Severity Scale symptom scores was seen.[11]

Exercise tolerance improvement in HF and AF patients is highly correlated with heart rate recovery (HRR).[8] Prior research has indicated that parasympathetic reactivation is primarily responsible for the early HRR following exercise, with sympathetic withdrawal becoming significant later in the recovery process.[8] To avoid developing future AF episodes, the heart's parasympathetic and sympathetic systems must function in harmony.[3] While parasympathetic activity, such as in the recovery phase after exercise, frequently causes AF episodes in athletes, most other AF patients experience relatively high sympathetic activity, which renders the atrium more prone to AF.[3] Frequent physical activity carried out with CR on a non-elite level shifts the autonomic balance in favour of a stronger parasympathetic tone, and this result is thought to improve rhythm control and reduce AF episodes.[3,8] This is further supported by a few studies that found a substantial reduction in resting heart rate in the CR group.[1,11]

Adherence to CR is difficult, and surveys across multiple nations have revealed that only about 30% of eligible patients maintain their involvement in such programmes.[5] Psychosocial consultations had a higher rate of adherence (84%) than the physical exercise programme (51%), and it was discovered that overall adherence was 44%, which is greater than in prior surveys but still has room for growth.[5] Sleep is another variable that is disturbed in patients with AF. It is a basic action connected to morbidity and healing.[6] Most heart disease patients have poor sleep quality, and patients with AF in particular have poor sleep quality in 50% to 55% of cases.[6] AF is linked to an increase in sympathetic activity, which can lead to disturbed sleep.[6] Furthermore, it was discovered that regardless of the type of AF, patients with higher levels of symptoms and those who scored poorly on anxiety and sadness had lower sleep quality compared to those with high ratings.[6]
However, no distinction in the quality of sleep between the cardiac rehabilitation and normal care groups was seen in the study by Risom et al.[6]

LIMITATIONS

This systematic review encounters some limitations. Firstly, most of the studies included in this review deal with a smaller group of patients with AF. Secondly, only the free full-text articles available in English that were published in the last 10 years were used in this review, increasing the risk of selection bias. Thirdly, this systematic review doesn't take into consideration patients with AF who are also suffering from other debilitating conditions such as diabetes mellitus (DM), hypertension (HTN), kidney diseases, etc., or what role CR plays in these groups of patients. Fourthly, this review doesn't focus on the dietary aspect of the CR. Lastly, AF in patients younger than 18 years of age is not taken into consideration in this review.

CONCLUSION

This systematic review, to a great extent, evidently justifies the importance of CR in patients who have been treated for or have had ongoing symptoms of AF. CR is a comprehensive, challenging intervention that includes components of fitness training, education, psychosocial management, and a behaviour tailored to enhance the physical and emotional aspects of

people with heart disease. CR enhances the overall cardio-metabolic profile of AF patients by improving their exercise capacity, fitness levels, and resting heart rate. This improvement is the result of the tilt towards the parasympathetic tone of the heart, which leads to an anti- arrhythmic effect. Also, exercise-based CR improves the health of AF sufferers via atrial remodelling, lowering body weight, blood pressure, and blood cholesterol levels. This systematic review also points out that psychosocial consultation as a part of CR is important to maintain the adherence of CR in patients with AF. Potential areas of investigation for future studies are: effects of CR in a larger group of patients with AF after removal of the confounding bias; clinical trials focusing on diet-based interventional CR in AF sufferers; and the role of CR in patients having symptomatic AF along with other co-morbidities such as DM, HTN, chronic kidney disease (CKD), and/or obstructive sleep apnea (OSA).

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