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Efficacy Of Different Modes Of Cardiac Rehabilitation And It's Benefits: A Literature Review.

VidyaKadam*1, Shivani Patil2, M Premkumar3
1PG student, Srinivas college of physiotherapy,Mangalore.
2PG student, Srinivas college of physiotherapy, Mangalore.
3.Associate Professor, Srinivas college of physiotherapy, Mangalore .
Corresponding author: VidyaKadam
Email: vidyankadam26@gmail.com

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I. Introduction

WHO defines Cardiac rehabilitation (CR) as all activities which provide an optimal social, physical, and mental environment to a patient who is suffering from a cardiac condition to improve his/her maximal functional capacity in society.[1]

Heart disease consists of all type of cardiac condition which includes coronary artery diseases and disturbances in the mechanical and or electrical function of the heart.[2]

The benefits of cardiac rehabilitation depend on which type of cardiac condition is being treated. Over the past three decades, cardiac rehabilitation has been shown to have numerous advantages, including improving emotional well-being, lowering cardiovascular risk, and improving several other outcomes. [3] In research including almost 600,000 Medicare beneficiaries hospitalized for stable ischemic heart disease, revascularization procedures, and acute coronary syndromes, individuals who participated in cardiac rehabilitation programs had lower mortality rates than those who did not. Based on the number of sessions attended (one to 24 sessions vs. 25 sessions or more), patients were compared. Those who attended 25 or more cardiac rehabilitation sessions had mortality rates that were reduced at one year and five years (2.2% vs. 5.3% at one year and 16.3% vs. 24.6% at five years). Additionally, subgroup studies among patients who attended 25 or more sessions revealed that nonwhites, older adults, and women benefited more.[4]

Systematic reviews and meta-analyses which were conducted in 2011 and 2016 have concluded that exercise-based CR decreases hospital admissions as well as cardiovascular mortality by up to 18% to 26%, over 12 months in patients with coronary heart disease.[5]

The study on examining the effect of cardiac rehabilitation on depression was held in 2007 on it concluded that, the rate of depression decreased from 17% at entry into cardiac rehabilitation to 6% after completion. [6] Cardiac rehabilitation also increases functional capacity of patients and improves peak oxygen consumption.[7]

Previous studies have stated that it also improves lipid control and reduces weight as well as helpful in managing the comorbidities. Recent publications have concluded that cardiac rehabilitation overall improves quality of life in patients by reducing hospital admission, reduction in mortality rate. [8]

There are several modes of giving cardiac rehabilitation. Tele, hospital based and home-based cardiac rehabilitation. Tele cardiac rehabilitation (TCR)include tele health solutions for patients who are unable to attend rehabilitation in hospital and it gives opportunity to patients to attend the rehabilitation in home-based settings.[9] Tele rehab uses telecommunication technologies such as smartphone applications, video consultation to provide remote CR services. TCR offers CR digitally via asynchronous remote patient monitoring (RPM) or live video which means the patient is being watched in real time. Patient exercise on their own and receive guidance using phone calls and smartphone applications. [10]

Patients who are not able to attend hospital based CR repeatedly for them Home based CR have been developed.[11] Recently a model of treatment centred on the idea that home rehabilitation for patients with cardiac

disorders following an uncomplicated heart attack it increases more responsibility on patients by which it increases their independence. [12]

There are several factors that affect the hospital based CR. There is a lot of research on patient-level factors that affect adherence, attendance, compliance, enrolment, completion, and drop-out rates in cardiac rehabilitation among the general cardiac population.[13] These elements include the amount of available funds, travel time needed and work commitments.[14]

About half of patients with coronary artery disease do not receive a referral to take part in cardiac rehabilitation. [15] Despite the fact that elderly patients have a higher prevalence of comorbidities and a way of life with less physical activity.[16] The main reason behindnonparticipation is transportation in older patient.[17] A RCT concluded that mobile guided cardiac rehabilitation could be effective and safe to increase physical activity and improve fitness in older patients.[18]

Though there are several publications which states that cardiac rehabilitation is an effective programme to improve patients' overall quality of life. There is a paucity of literature search for exactly which type of method is helpful in improving patients condition also which mode of the treatment is beneficial for patients' recovery henceforth, this literature search is going to be carried out to find out the effective mode/method of cardiac rehabilitation and how helpful that mode is to improve QOL of patients.

II. Review of literature

Efficacy of different types of exercise based cardiac rehabilitation on coronary heart disases: a network meta analysis (2018).[24]

It has been acknowledged that exercise based cardiac rehabilitation (CR) is a crucial part of treating coronary heart disease (CDH). Developing exercise based CR programmes requires evaluating the effectiveness of contemporary alternative treatment modalities. June 6, 2016 study published in MEDLINE, EMBASE, and the Cochrane library. Different varieties of mode of cardiac rehabilitation has been included in this study such as exercise-based CR was classified into center-based CR, home-based CR, tele-based CR, and combined CR for this analysis. Different types of outcome used as the inclusion criteria for the study which include all possible conditions of cardiac rehabilitation. 60 randamised clinical trials concluded for meta analysis. This study concluded that The most recent research indicates that center-based CR is suitable for CHD patients. Home- and tele-based CR should be further studied in future studies because they can reduce time, money, effort, and resources while also perhaps being preferred by patients

Current Insights into Exercise-based Cardiac Rehabilitation in Patients with Coronary Heart Disease and Chronic Heart Failure(2020)[25]

This article stated that community based cardiac rehabilitation provide the better treatment protocol for patients. Cardiac rehabilitation proposed that exercise training is a main component for heart disease in 1993. Review stated that cardiac rehabilitation going to be effective for the patient who having the heart disease. Systematic review and clinical trials were collected to check the modifiable cardiovascular risk factors and shows that reduces the cardiovascular risk factors with Coronary Heart Disease and Chronic Heart Failure. Aim of the Exercise-based Cardiac Rehabilitation studies stated to improve survival. This study concluded that Cardiac rehabilitation is the focused management for the patient of heart disease and involves the increased peak O2 uptake longer term survival of the patient. Cardiac rehabilitation Impacted towards the positive lifestyle changes for the long duration and meet the patient requirements.

Home based cardiac rehabilitation for people with heart failure: a systematic review and meta-analysis (2016)[26]

This study stated that effectiveness of home based cardiac rehabilitation for the heart failure is more effective than the no cardiac rehabilitation program. Randomised controlled trial was performed from the different systematic reviews of cardiac rehabilitation. Form MEDLINE, EMBASE, CINAHL, PsyclNFO and Cochrane Library to December 2015 collected 19 trials with median follow up of 3 months were collected. Results showing that the improvement of vo2 max in home based cardiac rehabilitation compare to the usual care. This study concluded that short term improvements are seen in exercise capacity and health realted quality of life after giving home based cardiac rehabilitation. There is no indication that home based cardiac rehabilitation increases the risk of hospitalisation or mortality, making it appears to be safe. These results support the use of home based cardiac rehabilitation as evidence based substitute for the conventional center based approach of treatment for heart failure.

Virtual reality and video games in cardiac rehabilitation programs. A systematic review (2021).[27]

This ,study conduct an analysis of the data about the use of virtual reality and video games in cardiac rehabilitation the method was done thorough analysis. The Oxford Center for Evidence-Based Medicine was

used to assess the degree of evidence and the level of recommendation, and the Jadad scale was used to rate the methodological quality of the included publications. They adhered to the PRISMA standards statement for systematic reviews. Total 10 numbers articles are included with different study population, conditions with variety of modes and treatment. In the various stages of cardiac rehabilitation, patients with cardiovascular disorders may employ virtual reality and video games as complementary methods of physical exercise. To select the optimum technology systems, target audiences, and clearly defined protocols to evaluate their effects in the short, medium, and long-term assessments, it is also important to conduct research with an adequate level of methodological quality. Rehabilitation implications Virtual reality and video games could be viewed as complimentary methods for cardiovascular disease sufferers to exercise. It helps to boost the motivation and continuity towards the cardiac rehabilitation.

Patient perception when transitioning from classic to remote assisted cardiac rehabilitation (2022)[28]

Cardiac rehabilitation is a customised outpatient programme that combined physical activity with medical education in order to hasten recovery and enhance health status in people with heart disease. This study aimed that assessment of technology and remote monitoring devices in cardiac recovery. The UMFCD cardiology clinical department's patient admission served as a common inclusion criterion for the two study groups. Additionally, individuals with ischemic heart disease were required to meet the inclusion criteria for the second research group as well as those with NYHA stage II or III heart failure. To determine how the patients felt about the technical and medical capabilities of the system, we performed a system usability survey. The survey yielded outstanding preliminary results in the ischemic heart disease group and excellent preliminary results in the heart failure study group. The difficulty Romanian patients have in accessing cardiac rehabilitation has boosted interest in and motivation for this study. The final product is intended to change to meet the demands of patients.

Hybrid cardiac rehabilitation- The state of the science and the way forward (2021).[29]

This study focusing on the hybrid model of the cardiac rehabilitation, including center based and home based cardiac rehabilitation program. They found nine studies were fitted the definition of hydrid protocol. 2-11 week of center based cardiac rehabilitation and the 10 -22 weeks of home based cardiac rehabilitation were conducted, with 3 to 5 workouts a week consisting of either walking or cycling for 25 to 35 mins at 60 to 75 percent of one max heart rate. Outcome measures used as the acceleometer for the heart rate. In these studies, individuals with coronary artery disease (CAD) who received hybrid CR had similar short-term outcomes to those who received traditional CR, as well as higher adherence and lower delivery costs. In patients with CAD, hybrid CR decreased cardiovascular events and improved lipid profiles, exercise ability, and HRQoL compared to conventional treatment. Compared to standard therapy, hybrid CR enhanced physical function, exercise tolerance, and HRQoL in HF patients. Ongoing research may help define the role that technology should play in CR interventions and shed light on the center- and home-based CR mix that produces the best results.

Home based cardiac rehabilitation alone and hybrid with center based cardiac rehabilitation in heart failure: a systematic review and meta analysis (2019)[30]

Heart failure patients' outcomes have been proven to be improved with center-based cardiac rehabilitation (CBCR) (HF). Patients who are unable to engage in CBCR may have more access to home-based cardiac rehabilitation (HBCR). Combining short-term center-based cardiac rehabilitation and home-based cardiac rehabilitation creates hybrid cardiac rehabilitation (CR), which may allow for both flexibility and rigour. Recent data comparing these programmes, however, has not yet been compiled. They performed meta analysis to show the improvement in quality of life for HBCR and usual care, hybrid CR and usual care, and HBCR and CBCR. The randamized controlled were performed from jan 31, 2019 in different 5 standard databased. 31 randomised control trials were took. This study concluded that HBCR and hybrid cardiac rehabilitation increases the capacity of performance and HBCR enhances the quality of life with care but both will improve the patients performance who are not suitable for CBCR.

Tele-rehabilitation and hospital-based cardiac rehabilitation are comparable in increasing patient activation and health literacy: (A pilot study 2019)[31]

The aim of this study was to evaluate health literacy and patient activation in tele rehabilitation which was compared to hospital-based cardiac rehabilitation. It is a non-randomized control trial in which patients with ischaemic heart disease and heart valve disease were included and 12 weeks of cardiac rehabilitation was given. Patient Activation Measure was used as a primary outcome the Health Literacy Questionnaire was used as a secondary outcome. Outcome measures were taken prior to the intervention and at the end of the trial that is after 6 months. Result of this study stated that patient activation increased comparably in hospital-based cardiac rehabilitation and tele-rehabilitation. Patients in tele-rehabilitation significantly outperformed patients in

hospital-based cardiac rehabilitation on the HLQ6 dimension six months following the intervention. In HLQ3 or HLQ9, no significant between-group differences were discovered. Conclusion of the study that patient activation and health literacy in both type of rehabilitation are equally outstanding.

Cost-Utility Analysis of Home-based Telerehabilitation Compared with Centre-based Rehabilitation in Patients with Heart Failure (2018)[23]

This comparative trial was done by Rita Hwang, PhD et. Al. It is a multi-centre, two-arm, non-inferiority, randomised controlled trial with 6 months follow-up. 53 participants 24 were randomised into tele-rehabilitation and 29 in traditional centre-based program. 12 weeks of tele-rehabilitaion exercise intervention was delivered to the patients at home twice weekly. The control group underwent centre based rehabilitation programme which included Aerobic and strength training as well as education of the patient. The rehabilitation was of same frequency and duration as the tele-rehabilitation and was given to 8 group of people in hospital. This study concluded that tele-rehabilitation appears to be less costly and as effective as centre based cardiac rehabilitation.

Effectiveness of Home-Based Mobile Guided Cardiac Rehabilitation as Alternative Strategy for Nonparticipation in Clinic-Based Cardiac Rehabilitation Among Elderly Patients in Europe A Randomized Clinical Trial (2022)[18]

Johan A. Snoek, MD, MSc et al. have done this study to determine whether a guided 6-month MCR programme is a successful treatment for elderly patients. In this study total 4236 patients were included with the recent diagnosis of coronary revascularization, or surgical or percutaneous treatment for valvular disease, or documented coronary artery disease, acute coronary syndrome. 996 patients declined to start cardiac rehabilitation. According to inclusion and exclusion criteria only 179 patients 90 in Randomized to control group and 89 Randomized to MCR were enrolled in the study to participate in the European Study on Effectiveness and Sustainability of Current Cardiac Rehabilitation Programmes in the Elderly trial. From Jan 21 to oct 11 2019 data were analysed. To reach the exercise goals home based cardiac rehabilitation with telemonitoring and coaching was given for 6 months. Control group was not given any treatment. VO2 peak was used as a primary outcome measure and it was taken after 6 months. Result of this study concluded that 6 months of MCR is safe and effective to improve VO2 peak for patients 65 years or older with coronary artery disease or a valvular intervention as compared to the control group.

III. METHODOLOGY

Study design: Literature review

Study setup: Institute of physiotherapy, Srinivas university, Pandeshwar Mangalore.

Study duration: 1 month

Search Engines: Pub med, Google scholar, Cochrane library

Key words: Cardiac rehabilitation, Home based rehabilitation, Centre based rehabilitation, Tele rehabilitation.

FIELD OF RESEARCH	FOCUS	OUTCOME FINDING	AUTHORS/ REFERENCES
Differenttypesofexercisebased cardiacrehabilitationon coronaryheartdisases.	exercise-based CR was classified into center-based CR, home-based CR, tele-based CR, and combined CR	center-based CR is suitable for CHD patients	Xia, T. L et.al.
Current Insights on **Cardiac Rehabilitation in Patients with Coronary Heart Disease and Chronic Heart Failure**	Involves the increased peak O2 uptake longer term survival for heart disease patients.	CR had a long term favourable impact on patients lifestyle and met their needs.	Nichols, S., McGregor, G et.al
Home based cardiac rehabilitation for people with heart failure	Improvement of vo2 max in home based cardiac rehabilitation compare to the usual care	Use of home based cardiac rehabilitation as evidence based substitute for the conventional center based approach of treatment for heart	Zwisler, A. D et.al.

		failure.	
Virtual reality and video games in cardiac rehabilitation programs	patients with cardiovascular disorders may employ virtual reality and video games as complementary methods of physical exercise	Virtual reality and video games could be viewed as complimentary methods for cardiovascular disease sufferers to exercise	García-Bravo, S et.al.
Patient perception when transitioning from classic to remote assisted cardiac rehabilitation.	outstanding preliminary results in the ischemic heart disease group and excellent preliminary results in the heart failure	This Designed product provide the needs and necessities to adapt perception towards the CR.	Busnatu, Ș. S., et.al.
Hybrid cardiac rehabilitation- The state of the science and the way forward	Compared to standard therapy, hybrid CR enhanced physical function, exercise tolerance, and HRQoL in HF patients	Who are not suitable for CBCR, HBCR and hybrid cardiac rehabilitation improve the patients performance.	Heindl, B., Ramirez et.al.
Home based cardiac rehabilitation alone and hybrid with center based cardiac rehabilitation in heart failure	HBCR and hybrid CR increases the capacity of performance and HBCR enhances the QOL with care.	Both will improve the patients performance who are not suitable for CBCR.	Imran, H. M., Baiget.al.
Tele-rehabilitation and hospital-based cardiac rehabilitation are comparable in increasing patient activation and health literacy.	HLQ6 has been improved in tele-rehab. Patient activation are improved and HLQ3 and HLQ9 not much improved in both rehabilitation .	Tele and hospital based CR showed similar improvement in all patints.	Knudsen, M. V., et.al.
Cost-Utility Analysis of Home-based Telerehabilitation Compared with Centre-based Rehabilitation in Patients with Heart Failure	12 weeks of telerehabilitaion exercise intervention was delivered to the patients at home twice weekly and control group underwent CBC programme of Aerobic and strength training and education of the patient	tele-rehabilitation appears to be less costly and as effective as centre based cardiac rehabilitation	Hwang, R et.al.
RCT on **Effectiveness of Home-Based Mobile Guided Cardiac Rehabilitation as Alternative Strategy for Nonparticipation in Clinic-Based Cardiac Rehabilitation Among Elderly Patients in Europe**.	home based cardiac rehabilitation with telemonitoring and coaching was given for 6 monthstoRandamized group .Control group was not given any treatment. VO2 peak was used as a primary outcome measure.	MCR is safe and effective to improve VO2 peak	Snoek, J. A et.al.

Inclusion.criteria:

- All RCT's
- Systematic review and meta analysis
- Pilot study.

Exclusion.criteria:

- Other than RCT's, Systematic review and meta analysis
- Studies that are conducted before 2015

Procedure

Each study has been searched according to the key words on different searche engine. We searched the PubMed(MEDLINE), Cochrane library, Google scholer. Total 3422 articles showed by the search engine. This arcticles were searched in between the duration of one month. After excluding the articles the Article assessed for eligibility was 31. Studies included in synthesis were 10 according to the feasibility and assessment. Before conducting the full text review, titles and abstracts were screened to assess their relevance for inclusion in this study. At the end total 10 articles were used in this study to assess the superior rehabilitation for the cardiac rehabilitation.

IV. Discussion

According to prior Cochrane reviews exercised based CR was classified into centre based CR, home based CR, Tele based CR, and combined for this analysis. We found that CR is beneficial for all type of cardiac conditions including coronary heart disease, hypertension, myocardial infarction, heart failure, post CABG etc. Cardiac rehabilitation not only reduces the cardiovascular risk but also it has been shown improvement in emotional wellbeing, improvement in depression, improving exercise tolerance, increase in peak oxygen consumption. The AHA and American Association also stated importance of the role of CR which include decreasing risk factors for future events, decreasing disability, and improving quality of life post-cardiac event. [19]

Despite the widespread benefits that the CR provides its application is very limited in community due to many obstacles. There are many barriers because of which cardiac rehabilitation is not reaching in the community as a mode of treatment. Shanmugasegaram S. et al, Bakhshayeh S et al and Higgis Ro et al have also stated distance from CR programmes due to travel time, cost of travel and lack of transportation, lack of knowledge are some of the key factors for lack of participation in cardiac rehabilitation programme. [20,21,22]

Rita Hwang, PhD et al have also concluded that telerehabilitation seemed to be cost-saving and as effective as traditional center-based rehabilitation when it was given for 12-week group based video telerehabilitation. Other researchers have also come to the conclusion that home based CR patients maintained better improvement for older patients than hospital-based.[23] Home based and mobile based CR programmes can be applied easily as they avoid many barriers that could affect the participation and completion of the programme. Home based or mobile-based telerehabilitation will be less challenging in aspects of transportation, finance, accessibility of hospital, and time. In some hospitals there are very limited resources of cardiac rehabilitation centre so these programs will enhance active participation as well as completion of rehabilitation.

According to previous studies it has been established that any mode of cardiac rehabilitation would be beneficial for the patient to improve the overall quality of life. All type of cardiac rehabilitation is similarly effective to improve the patient's overall health. Henceforth, patients can choose any mode of cardiac rehabilitation that is most comfortable for them as provided the rehabilitation will have the same beneficial effects in any chosen mode.

Limitations

- To make a high level of evidence this literature review can be further carried out as a systematic review or meta-analysis.
- There is no single comparison RCT study between mobile-based telerehabilitation and hospital-based rehabilitation

Future Recommendations

Execution of cardiac rehabilitation program in the community using comfortable mode and awareness about the mobile based CR is as beneficial and effective as other mode this mode can be used widely.

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