Intensive Cardiac Rehabilitation outcomes in Patients with Heart Failure

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Introduction

- Cardiac Rehabilitation (CR) has been beneficial for patients with Heart Failure (HF) with reduction in morbidity and mortality.

- CR has also shown to improve fitness and psychological outcomes in HF patients.

- Intensive Cardiac rehabilitation (ICR) has proven benefits for patients with cardiovascular disease, However, outcomes of ICR in patients with HF are unknown.

- Donna K Arnett, R.S.B., Michelle A. Albert et al. , *19 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.* Circulation, 2019. **140**: p. 563-595.

- MA., W., *AACVPR Guidelines for cardiac rehabilitation programs & secondary prevention programs.* 2004.

Methods

- Retrospective cohort study of 12950 patients who were offered ICR at 46 ICR centers across USA from January 2016 till December 2020.

- ICR sessions consists of 4-hours two times per week for 9-weeks of lifestyle modification aiming at high fiber low fat diet, peer support, exercise and stress reduction.

Methods

- Patients were divided into two groups: 1400 patients (11%) in HF group and 11550 patients (89%) in non-HF group.

- Primary outcome →

- Change in body mass index (BMI),

- Exercise minutes per week (EMW) and

- Depression scores (CESD).

Methods

- Secondary outcomes →
- Δ Blood pressure,
- Δ Cholesterol,
- Δ Low density lipoprotein,
- Δ High density lipoprotein,
- Δ Triglycerides and
- Δ Health status (SF-36 physical & mental composite scores).

Methods

- CESD → Center for Epidemiological Studies-Depression score is 20 item questionnaire which ranges from 0-60. Higher score is associated with more depression. Patients were enrolled in CR if they met eligible criteria which includes PCI, CABG, NSTEMI/STEMI, angina, heart transplant, valve repair/replacement or HF per American Heart Association (AHA)/AACVPR guidelines.

- SF-36 or Health related quality of life.

→physical composite score (PCS) and mental composite score (MCS).

36 item questionnaire to measure physical by PCS and psychological well-being, social functioning, emotional wellbeing, energy or fatigue, pain and general health perception by MCS. It is scored from 0-100 where high score is associated with better health.

Methods

- ICR consists of 4-hour sessions twice a week over a 9-week period.
- It has half number of exercise sessions when compared to TCR, however it gives more time for non-exercise components including stress management and nutrition (plant-based diet).
- The first hour of ICR is an exercise session similar to TCR, however the second hour is for nutrition counselling, focusing on a plant-based diet, with the rehab center providing meals.
- The third hour is teaching for stress reduction and fourth hour is for group therapy.

Statistical analysis

- Patients with missing values for primary outcomes at enrollment were excluded.

- For the main analysis, subjects were grouped into HF and Non-HF.

- Values are presented as mean ± standard deviation, median with interquartile range, frequencies or percentage.

- We performed a retrospective power size calculation to detect statistical difference among the two groups. Number needed was 127 patients in each group.

Statistical analysis

- T-test and Wilcoxon signed rank test was used to compare variables between two groups.

- Linear regression was used to adjust for difference in baseline variables→
- Age
- Race
- Gender
- BMI
- BP
- HTN/HL/DM
- Smoking
- AACVPR risk category.

Statistical analysis

- A level of significance of P < 0.05 was used for statistical significance.

- Statistical analyses were carried out using Stata statistical package (Stata 15.1).

- Study was approved by hospital IRB.

Results

- HF group consists of older patients
(HF: 68.5 ± 11 years vs non-HF: 66.0 ± 11 years, P<0.01)

- 37% females (vs 44% females in non-HF group) and

- 52% whites (vs 50% whites in non-HF)

- ICR completion rate was higher in non-HF group (non-HF: 74.1% vs HF: 63.8%, P<0.01).

Clinical and demographic characteristics for patients with & without HF enrolled in Intensive Cardiac Rehabilitation (N=12950)

	HF patients (N=1400)	Non-HF patients (N= 11550)	P Value
Age (years)	68.54 ± 10.71	66.04 ± 10.78	<0.01
Female	515 (37%)	5080 (44%)	<0.01
Race/Ethnicity (White)	732 (52%)	5735 (50%)	<0.01
Body Mass Index (kg/m²)	32.32 ± 7.40	31.62 ± 7.15	<0.01
Baseline SBP (mmHg)	123.97 ± 19.50	127.82 ± 17.19	<0.01
Risk Category			<0.01
• **Low**	174 (13%)	3928 (37%)	
• **Medium**	488 (37%)	4742 (44%)	
• **High**	661 (50%)	2060 (19%)	
Risk Factors			
• **Hypertension**	1079 (77%)	8117 (70%)	<0.01
• **Diabetes**	580 (41%)	3388 (29%)	<0.01
• **Hyperlipidemia**	8742 (76%)	1010 (72%)	<0.01
• **Obesity**	732 (52%)	5688 (49%)	0.03
• **Current smoker**	23 (2%)	119 (1%)	<0.04
• **Family hx heart disease**	563 (40%)	4870 (42%)	0.16

	HF patients (N=1400)	Non-HF patients (N= 11550)	P Value
Comorbid conditions			
• **PCI with & without stent**	573 (41%)	4738 (41%)	0.54
• **STEMI/NSTEMI**	3272 (28%)	564 (40%)	<0.01
• **CABG**	331 (24%)	2056 (18%)	<0.01
• **Angina**	250 (18%)	1934 (17%)	0.29
• **Heart Transplant**	5 (0.4%)	13 (0.1%)	0.02
• **Valve repairs/replacements**	144 (10%)	505 (4%)	<0.01
Completed cardiac rehabilitation	893 (63.8%)	8560 (74.1%)	<0.01
Number of sessions	57.90 ± 30.27	63.56 ± 27.98	<0.01
Total Cholesterol (mg/dl)	157.78 ± 55.03	166.78 ± 47.85	<0.01
LDL (mg/dl)	85.13 ± 36.93	91.20 ± 39.76	<0.01
HDL (mg/dl)	45.59 ± 18.06	47.76 ± 14.86	<0.01
Triglycerides (mg/dl)	143.18 ± 107.37	147.93 ± 108.77	0.14

Table for Pre- and Post-Intensive Cardiac Rehabilitation values for patients with & without HF (N= 12950)

	HF patients (N= 1400) 11%	Non-HF patients (N= 11550) 89%	P-value**
BMI (kg/m^2)			
• Pre-CR	32.32 ± 7.40	31.62 ± 7.15	<0.01
• Post-CR	31.27 ± 7.03	30.08 ± 6.77	<0.01
• Change	-1.07 ± 1.81*	-1.47 ± 1.58*	<0.01
SBP (mmHg)			
• Pre-CR	123.97 ± 19.50	129.55 ± 17.83	<0.01
• Post-CR	120.27 ± 17.03	122.50 ± 17.73	<0.01
• Change	-3.68 ± 19.10*	-5.30 ± 20.03*	<0.01
Cholesterol (mg/dl)			
• Pre-CR	157.78 ± 55.03	166.78 ± 47.85	<0.01
• Post-CR	138.52 ± 37.86	143.05 ± 42.60	<0.01
• Change	-18.72 ± 38.43*	-24.66 ± 39.03*	0.04
LDL (mg/dl)			
• Pre-CR	85.13 ± 36.93	91.20 ± 39.76	<0.01
• Post-CR	70.78 ± 31.02	72.80 ± 33.76	<0.01
• Change	-14.36 ± 32.90*	-18.96 ± 33.02*	<0.01
HDL (mg/dl)			
• Pre-CR	45.59 ± 18.06	47.76 ± 14.86	<0.01
• Post-CR	43.04 ± 13.13	45.17 ± 13.33	<0.01
• Change	-2.65 ± 16.83*	-2.88 ± 9.63*	0.55

	HF patients (N= 1400) 11%	Non-HF patients (N= 11550) 89%	P-value**
Triglycerides (mg/dl)			
• Pre-CR	143.18 ± 107.37	147.93 ± 108.77	0.14
• Post-CR	129.98 ± 74.96	130.47 ± 80.67	0.87
• Change	--14.48 ± 94.29*	-17.24 ± 83.77*	0.39
Exercise minutes per week			
• Pre-CR	74.92 ± 119.33	98.70 ± 134.51	<0.01
• Post-CR	186.34 ± 140.75	202.69 ± 135.96	<0.01
• Change	99.84 ± 144.58*	100.17 ± 145.35*	0.95
CESD score			
• Pre-CR	12.97 ± 10.59	11.76 ± 10.43	<0.01
• Post-CR	6.60 ± 7.55	5.75 ± 7.03	<0.01
• Change	-5.48 ± 8.12*	--5.36 ± 8.36*	0.72
SF36PCS			
• Pre-CR	38.38 ± 9.90	45.28 ± 9.70	<0.01
• Post-CR	46.29 ± 9.19	51.55 ± 7.17	<0.01
• Change	6.75 ± 7.33*	5.44 ± 6.74*	<0.01
SF36MCS			
• Pre-CR	48.63 ± 10.16	49.21 ± 9.50	0.03
• Post-CR	54.38 ± 7.31	54.79 ± 6.59	0.11
• Change	4.80 ± 7.60*	5.09 ± 7.76*	0.33

*P value < 0.01 among pre and post ICR

** P value comparing two groups

Limitations

- The study design was observational and non-randomized for which the possibility of residual confounding cannot be excluded despite our efforts using strict inclusion criteria and multi-variate adjustment.

- It is possible that the observed difference was a result of healthier patients more willing to attend ICR compared to those who did not.

- Despite the above weaknesses, this study is helpful in providing the first effect size estimates for the design of future randomized-controlled trials.

Conclusion

- Significant Improvement in ICR outcomes were achieved for both groups.

- Non-HF group has more reduction in BMI while no difference in depression scores or EMW when compared with HF group.

Conclusion

- Despite lower baseline functional status and psychosocial scores of HF patients at baseline compared to non-HF patients, patients with HF were able to achieve similar or better functional and psychosocial outcomes after ICR.

- Future studies should investigate whether ICR offers unique advantages over traditional CR for patients in lower function class such as those with HF.

- CR has Class 1A recommendations for eligible patients and underutilized $\simeq$ 30%.

Questions/Comments

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