



Original Research Article (Clinical)

# Efficacy of heart failure reversal treatment in patients with low ejection fraction

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## ABSTRACT

**Background:** Heart failure reversal therapy (HFRT) is designed to enhance cardiorespiratory fitness of chronic heart failure (CHF) patients.

**Objective(s):** The present study was designed to evaluate efficacy of HFRT that uses herbal procedure (*panchakarma*) and allied therapies, in CHF patients with low ejection fraction.

**Methods:** This efficacy study was conducted in CHF patients (aged: 25–65 years, ejection fraction (EF) 10–30%) wherein HFRT (60–75 min) consisting of *snehana* (external oleation), *swedana* (passive heat therapy), *hrudaydhara* (concoction dripping treatment) and *basti* (enema) was administered twice daily for 7 days. During this therapy and next 30 days, patients followed the study *dinacharya* and were prescribed ARJ *kadha* in addition to their conventional treatment. The primary endpoint of this study was evaluation of maximum aerobic capacity uptake (MAC) as assessed by 6 min walk distance (6MWD) using Cahalins equation from baseline, at the end of 7 day treatment, follow-up after 30 days and 90 days. EF was assessed by 2D Echo at baseline and after 30 days of follow-up.

**Results:** Fifty-two CHF patients with 10–30% EF (mean [SD] age: 58.8 [10.8], 85% men) were enrolled in the study. There was a 100% compliance to study therapy. A significant improvement was observed in MAC levels (7.11%,  $p = 0.029$ ), at the end of 7 day therapy as compared to baseline. This improvement was maintained at two follow-up visits. Moreover ejection fraction was observed to be increased by 6.38%,  $p = 0.012$  as compared to baseline at day 7 of the therapy.

**Conclusion:** This 90 day follow up study highlights the benefit of HFRT, as a part of maintenance treatment for CHF patients with reduced ejection fraction.

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## 1. Introduction

The estimate of prevalence and incidence of chronic heart failure (CHF) in India is often unreliable. However, there is a growing burden of CHF with an estimated annual incidence of 0.5–1.8 million [1]. Therefore, immense research work is performed to identify newer therapeutic targets to combat CHF, also guidelines for management of CHF are updated [2–4]. Although conventional medicinal therapy has improved over a decade, the overall survival of CHF patients may be unsatisfactory due to lowered ejection fraction or low aerobic capacity in CHF patients leading to increasing rates of mortality and morbidity. Perhaps complementary and alternative

medicines can be of benefit as an adjuvant therapy for better management of CHF.

In India, Ayurveda is considered as a traditional medical system. Moreover, several studies have shown effectiveness of *panchakarma* therapy to treat various diseases. *Panchakarma* therapy is a 5-step ayurvedic procedure that is known to eliminate harmful toxins from the body thereby providing maximum health benefit to the patient [5]. Heart failure reversal therapy (HFRT) is one of its kind therapy designed to enhance cardiorespiratory fitness of CHF patients. HFRT uses techniques described in *panchakarma* namely *snehana* (massage), *swedana* (fomentation therapy) and *basti* (type of enema) along with *hrudayadhara* (oil dripping therapy) [5–8].

According to Ayurveda, dysfunctional *rasa dhatvagni* is a cause of *Hrudrog* (heart disease). In this study we quantify CHF patients leading to increasing rates of mortality and morbidity as maximum aerobic capacity (MAC). Present scientific study aimed to evaluate

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efficacy of HFRT as an adjuvant therapy in CHF patients with low ejection fraction.

## 2. Methods

### 2.1. Study population

Study participants included patients (both gender, aged 25–65 years) with CHF (New York Heart Association, NYHA Class I–III) and EF > 30 as measured by a two dimensional echocardiogram (2D-ECHO).

Additional inclusion criteria were blood pressure not >150/90 mmHg, hemoglobin levels  $\geq$  10 g/dL and blood glucose levels: fasting not <60 mg/dL and postprandial not >250 mg/dL.

Patients with suspected hypersensitivity to study therapy or unsuitable to receive study therapy (e.g. irritable bowel syndrome, bleeding piles or fistula (grade-I or II piles), 2 nd/3 rd degree hemorrhoids, asthma or chronic obstructive pulmonary disease) or patients with acute heart failure, decompensated heart failure attack (last 3-months), abnormal hepatic/renal/thyroid function test, cancer, physical disability (any form) leading to immobilization or those with participation in another study 30-days prior to screening were excluded. Cardiac patients needing upward dose titration or not on stable dose of SCT (last 3-months) were excluded and so were pregnant or lactating women.

The study was conducted in accordance with the ethical principles in the Declaration of Helsinki, consistent Good Clinical Practices. All patients provided written informed consent to participate in the study.

### 2.2. Study design

This study was conducted from April, 2015 to March, 2016 at Madhavbaug Hospital, Khopoli (Fig. 1).

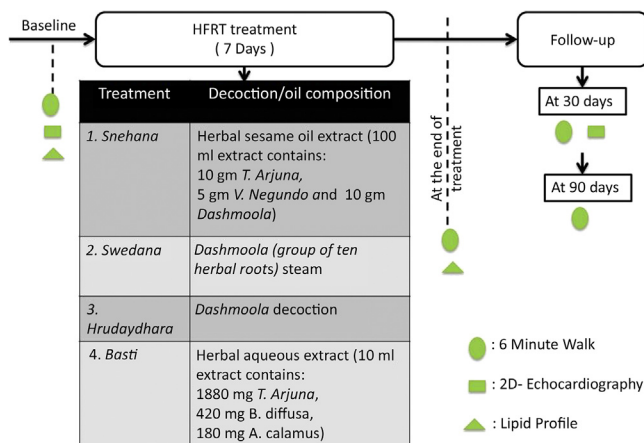


Fig. 1. Study design and therapy.

The enrolled HF patients received HFRT, twice/day for 7 days. During this therapy and next 30 days, patients followed the study dinacharya (Table 1) and were prescribed 10 ml of ARJ kadha, BD (decoction of *Terminalia arjuna*, *Acorus calamus* and *Boerhaavia diffusa* manufactured by Dynamic remedies) in addition to their conventional treatment.

### 2.3. Study therapy

The HFRT is a combination of panchakarma and allied therapies. HFRT uses various decoctions and oils (Fig. 1) and constitutes of a 4-step procedure as described below:

1. *Snehana*/external oleation or massage (~30–35 min): An oil based decoction was used to administer external massage to the HF patients. This massage technique uses centripetal or upward strokes directed towards the heart.
2. *Swedana*/passive heat therapy (~10–20 min): To administer this therapy HF patients were asked to lie in a supine position inside a sudation box and their head was positioned outside the box. *Dashmoola* (group of ten herbs) steam of temperature not more than 40 was then passed steadily for 10–15 min. After the treatment, patients were asked to relax for 3–4 min.
3. *Hrudaydhara*/variation of shirodhara technique (~15 min): During this technique, luke-warm *dashmoola* decoction was allowed to drip at a constant speed from a fixed height on the medial mediastinum region of the HF patients demarked by a *hrudayapatra*.
4. *Basti*/medicated enema (~15 min): A medicated enema was administered to HF using a rectal solution that remains inside the body  $\geq$ 15 min for maximum absorption.

The entire HFRT treatment was performed after a light meal/breakfast and total administration duration was 65–75 min.

### 2.4. Study evaluations

Primary endpoint was improvement from baseline (before HFRT treatment) in MAC as assessed by 6 min walk distance (6MWD) using Cahalins equation, at the end of 7 day treatment, follow-up at 30 days and 90 days.

Secondary endpoints included improvement from baseline, in EF (monitored by 2D Echo, after 30 days of follow-up) and lipid profile (at the end of 7 day treatment).

Patient reported outcomes are not considered as efficacy endpoints in this study.

### 2.5. Statistical methods

#### 2.5.1. Statistical analyses

Statistical analyses were performed using SPSS software version 22 (Chicago, Illinois, USA). The parametric variables are

Table 1  
Study Dinacharya.

Activity	Benefit	Inclusion in daily schedule
Wake up early	Improves health, help to excrete, metabolic wastes.	4:30 am
Medicated abhyang	Daily abhyanga rejuvenates body along with it reduces <i>Shrama</i> (breathlessness on exertion) typical sign of chronic heart failure. It improves quantity of life, quality of sleep, reproducing power of cells.	Twice a day for 7 days then advised for once a day before bath
Exercise	It improves functional capacity, it can improve <i>Koshthagani</i> as well as <i>Dhatwagni</i> including <i>rasdhatwagni</i>	First 7 days walking for 30 min, cycling at speed of 10 km/h and Yoga under supervision of physiotherapist.

References from Ashtanghrudaya Sutrthan 2nd chapter.

depicted as mean (standard deviation) while non-parametric variables are reported as median (range). The mean change in efficacy endpoints between the time-points was analyzed using non-parametric analysis with baseline values as covariates.

**3. Results**

**3.1. Study population**

Out of the 82 screened CHF patients, 52 were enrolled in the present study and received HFRT in addition to their conventional treatment. The study population had mean [SD] age of 53.0 [8.6] years and comprised of 44 (84.6%) men. The baseline demographic and clinical characteristics were comparable among the CHF patients (Table 2). All enrolled patients with CHF completed the 14 sittings of HFRT and the follow-up visits (100% compliance).

**3.2. Efficacy measurements**

The primary efficacy endpoint was analyzed at baseline, at the end of 7 day treatment, follow-up after 30 days and 90 days. Patients with CHF showed significant improvement in MAC<sub>levels</sub> (7.11%,  $p = 0.029$ ), at the end of 7 day treatment as compared to baseline. This improvement was maintained at two follow-up visit (Fig. 2).

Secondary efficacy endpoints namely EF showed significant improvement (6.38%,  $p = 0.012$ ) at 30 day follow-up visit (Median (range): 25.0 (22.0/29.75)) as compared with baseline (23.5 (20.0/26.0)).

The serum lipid levels i.e. HDL-cholesterol and LDL-cholesterol were increased leading to an increase in total cholesterol levels, at the end of treatment as compared with baseline whereas VLDL-cholesterol levels and triglyceride levels were decreased (Table 3).

**3.3. Safety and tolerability**

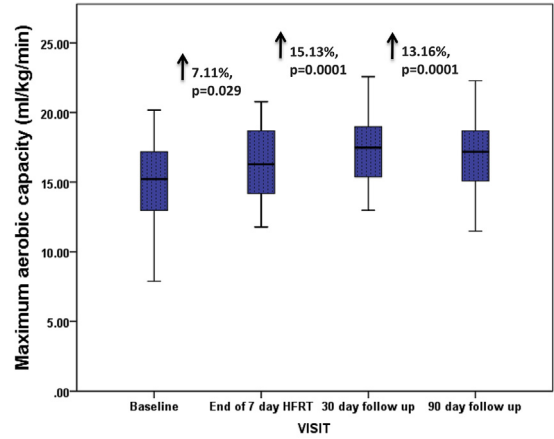
Overall, no TEAEs, abnormal laboratory results or ECG values were reported from baseline to follow-up.

**4. Discussion**

Chronic Heart Failure is inability of heart to pump sufficient amount of oxygenated blood, which is required for normal

**Table 2**  
Baseline and clinical characteristics.

Parameters	Total (N = 52)
Age, years, mean (SD)	58.8 (10.9)
Men, n (%)	44.0 (84.6)
Weight, kg, mean (SD)	62.6 (11.2)
Body mass index, kg/m <sup>2</sup> , mean (SD)	23.7 (3.7)
Medical history	
Diabetes, n (%), yes	25 (48.1)
Hypertension, n (%), yes	19 (36.5)
Intervention	
PTCA	1 (1.9)
CABG	8 (15.4)
Concomitant medicines	
Non-steroidal anti-inflammatory drugs	17 (32.7)
Angiotensin receptor antagonists	12 (23.1)
Vasodilators	10 (19.2)
β-blockers	8 (15.4)
Calcium channel blockers	7 (13.5)
Diuretics	6 (11.5)
ACE inhibitors	4 (7.7)
No record available	16 (30.8)



	Baseline	7 day	30 day	90 day
Maximum Aerobic Capacity (Median (Range))	15.2 (12.9 / 17.2)	16.28 (14.03 / 18.68)	17.5 (15.3 / 19.1)	17.2 (15.1 / 18.8)

**Fig. 2.** Maximum aerobic capacity estimations.

metabolic activity of body. Factors like high blood pressure, uncontrolled diabetes, valvular heart diseases and ischemic heart disease can lead to dysfunction of myocardium which in turn may cause CHF [9]. The CHF is also referred as a disabling disease mainly because patients suffer from fatigue and delayed recovery after exertion due to reduced MAC. Therefore, MAC is considered as a strong predictor of mortality [10].

According to Acharya Charak if agni of an individual is vitiated, the entire metabolic activity in the body is disturbed and the person suffers from disease. Ayurveda uses an umbrella term ‘Hrudrog’ for cardiac problems.

In Ayurveda all causes of heart disease are dysfunctional *rasa dhatvagni* which causes production of poor quality of *rasa dhaatu* which when goes in heart cause various cardiac diseases. This *dhatvagni* or bioenergy can be denoted by metabolic rate. Ratio of metabolic rate at rest and during exercise is denoted as metabolic

**Table 3**  
Lipid profile.

N = 52	Baseline	At the end of 7-day HFRT treatment
Total cholesterol	132.9 114.15/161.075	153.2 138.5/180.8 $p = \mathbf{0.011}$
HDL cholesterol	39.6 33.15/48.8	40.8 34.8/50.8 $p = 0.231$
LDL cholesterol	73.4 58.1/96.2	92.5 75.0/115.7 $p = \mathbf{0.010}$
VLDL cholesterol	20.8 15.8/25.5	19.8 16.7/26.0 $p = 1.00$
Triglycerides	103.8 78.8/127.5	99.0 83.4/130.1 $p = 0.997$

HDL: high density lipoprotein, HFRT: heart failure reversal therapy, LDL: low density lipoprotein, LV: left ventricular, 6-MWD: 6-minute walk distance, VLDL: very low density lipoprotein. Results are reported as median (range). The difference between the parameters at each visit is evaluated using Mann–Whitney U test.  $p$  value < 0.05 is considered significant.

equivalent (Met) value and  $\text{Met} \times 3.5 = \text{MAC}$ . Hence MAC can be correlated with *rasa dhatvagni*, suggesting that reduced MAC may cause *rasa dhatvagni maandya* (reduction in function of *rasa dhatvagni*) which may lead to *Hrudrog*. [11].

This is a first follow-up study to report that 7 day HFRT improves MAC of CHF patients with low ejection fraction ( $<30$ ) and is maintained for 90 days after the therapy.

There is a plethora of literature related to different methods of MAC estimations. However 6MWT is known to be most convenient and affordable test for MAC estimations [12].

Over the years, several equations for MAC estimation based on 6MWT were developed depending upon the population. For heart failure, various MAC equations are proposed namely Lipkin 1986, Cahalin 1996, Faggiano 1997, Roul 1998, Lucas 1999, Opasich 2001 etc. Several studies have highlighted that a good correlation equation between 6 minute walk distance and MAC has low standard error of estimate (SEE) [12–18]. Therefore present study uses improved Cahalin et al., 1996 correlation equation that has lower SEE as compared to other equations.

Our results corroborate with several other studies that highlight, the improved MAC level is prognostic marker for CHF. However, these studies had different interventions such as exercise, etc. A retrospective study, even associated 1 unit (mL/kg/min) increase in MAC with ~15% decrease in risk of mortality [19]. Additionally, the result of current study underlines the improvement in MAC reported by earlier studies with HFRT as an intervention [7,8].

HFRT, as described earlier uses several herbs such as *T. Arjuna*, *Vitex negundo* and/or *B. diffusa* that are reported to increase antioxidant reserves. *A. calamus* possesses hypolipidemic activity. Also, the Dashmoola formulation has anti-inflammatory, analgesic and anti-platelet effect [20–26]. These herbs used in HFRT, provide an additional cardiac conditioning to CHF patients.

In the present study, there is a statistically significant increase in LDL-cholesterol and total cholesterol levels. But this change did not have viable clinical significance as the increased levels of LDL-cholesterol and total cholesterol were within the diagnostic normal range. Moreover, it should be noted that LDL-cholesterol is not harmful unless there is inflammation and a simultaneous increase in HDL-cholesterol levels may indicate less chance of progressive inflammation [27].

Additionally, HFRT is a combination of panchakarma and allied therapies which is known to have a nourishing effect on the body. Therefore, this treatment may have added to nutritive value of *rasa dhatu* as shown by changed serum lipid levels.

However, the present study had a small sample size and was restricted to CHF patients with reduced ejection fraction. Future studies in a larger sample-size and different levels of CHF severity are warranted to establish HFRT as a part of maintenance treatment for patients with CHF.

## 5. Conclusion

HFRT promises significant therapeutic effects with improvement in MAC and no safety concerns. This non-invasive ayurvedic regime can be considered as a good candidate to be included in maintenance treatment of patients with CHF.

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## Conflict of interest

Dr. RM is an employee of Vaidya Sane Ayurvedic Education and Agricultural Trust. Dr. RS received honoraria from Vaidya Sane Ayurvedic Education and Agricultural Trust.

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