International Journal of Research in Medical Sciences
Sane R et al. Int J Res Med Sci. 2024 May;12(5):1588-1593
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20241246

Original Research Article

Efficacy of Ayurved based therapy on global longitudinal strain in ischemic heart disease: a retrospective analysis

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Received: 11 March 2024
Revised: 04 April 2024
Accepted: 06 April 2024

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ABSTRACT

Background: The current study aimed to investigate the efficacy of the Ischemia Reversal program (IRP) as an Ayurveda based therapy to standard anti-ischemic therapy in patients with ischemic heart disease (IHD).
Methods: A retrospective, single centre, observational study was conducted from January 2022 to May 2023. A total of 39 patients diagnosed with ischemic heart disease and global longitudinal strain (GLS) <15, regardless of underlying co-morbidities such as diabetes mellitus, hypertension, obesity, hyperlipidemia, low ejection fraction, history of myocardial infarction were included in this study. The primary endpoint was improvement in GLS from baseline to the 90-day follow-up in various different categories. Secondary endpoints were improvement in EF, abdominal girth, weight and reduction in dependency on allopathic medication from baseline to the 90-day follow-up.
Results: The mean age of the study population was 59.23±9.01 years. Weight (day 1: 67.29±13.16 kg and day 90: 61.39±11.11 kg; p=0.00), body mass index (day 1: 25.75±4.03 and day 90: 23.79±3.50; p=0.00), abdominal girth (day 1: 95.31±10.75 cm and day 90: 85.67±17.02 cm p=0.00), EF (day 1: 40.74±10.30% and day 90: 53.91±11.87%; p=0.00), and GLS (day 1: -10.99±2.72 and day 90: -13.17±3.75; p=0.00) improved at the 90 day follow-up.
Conclusions: The study showed notable improvements in weight, body mass index, abdominal girth, EF, and GLS after 90 days. These results suggest that IRP is beneficial treatment for IHD, but more extensive research is needed to confirm its effectiveness.

Keywords: Ayurveda, Ischemic heart disease, Panchakarma

INTRODUCTION

Ischemic heart disease has increased markedly over the past decade, contributing significantly to mortality rates, especially in developing countries. This escalation imposes a substantial burden on healthcare systems and finances.[1] Current management strategies involve the administration of long-term therapeutic agents such as aspirin/clopidogrel, beta blockers, and angiotensin-converting enzyme inhibitors.

However, the efficacy and safety of prolonged usage of these medications are subject to uncertainty.

Furthermore, challenges such as poor adherence to treatment regimens, and high costs hinder the widespread implementation of these therapies in countries like India. Therefore, there is an imperative to explore novel therapeutic approaches to address the growing burden of ischemic heart disease and enhance patient outcomes.[2]

Ayurveda, an ancient Indian medicinal system, is used to treat and manage various ailments. Its fundamental objective is to establish equilibrium between physiological and structural entities which ultimately promote good health. Any disruption or imbalance, external or internal, can prompt disease development. Thus, Ayurvedic interventions aim to restore this balance through diverse techniques, lifestyle modifications, dietary adjustments, and herbal medicines. The Ischemia Reversal Program (IRP) represents a comprehensive approach by combining *Panchakarma* and allied therapy. Its primary goal is to mitigate the risk of myocardial infarction and enhance exercise tolerance, thereby improving overall quality of life. Earlier studies have revealed IRP treatment to be associated with significant improvement in the Duke Treadmill score and Vo_2 max, indicative of improved cardiovascular function.[3-6] In line with these studies, we sought to evaluate the effect of IRP on ejection fraction (EF) and global longitudinal strain (GLS) and dependency on standard conventional medication.

METHODS

Study design and patient population

This was a retrospective, observational study conducted at Madhavbaug Hospital, Kondhali, and Maharashtra between January 2022 to May 2023.

A total of 39 patients diagnosed with ischemic heart disease and GLS <15, regardless of underlying co-morbidities such as diabetes mellitus, hypertension, obesity, hyperlipidemia, low EF, history of myocardial infarction were included in this study. The exclusion criteria was patients with (i) GLS >15, (ii) seropositive findings, (iii) severe aortic stenosis, (iv) mitral stenosis, and (v) incomplete treatment of 90 days were not included in this study. All patients provided written informed consent. The study was conducted in accordance with the Declaration of Helsinki, Good Clinical Practice, and applicable regulatory requirements.[7,8]

Ischemia reversal program

The study population were given a total of 14 *Panchakarma* treatments twice a day for the period of 7 days. The *Panchakarma* treatment consisted of 3 steps: centripetal oleation, thermal vasodilation and per rectal herbal decoction administration details of which is mentioned in previous published papers.[5]

Centripetal oleation helps to improve cardiac output and vasodilation and reduces inflammation and causes the loss of excessive salts and water by sweating and per rectal herbal decoction administration reduces lipid, water overload and oxidative stress of the body. The study population were prescribed with Tab GHA 2tb twice a day (BD) before meal and ARJ *Kadha* 10 ml BD post meal for 30 days.

GHA is a combination of *Tribulus terrestris*, *Curuma longa*, *Phyllanthus emblica* and ARJ is a combination of *Terminalia arjuna*, *Boerhavia Diffusa*, and *Acorus calamus*. They were also advised a calorie-controlled diet for 90 days. The daily calorie intake of the study patients was 1000 calories daily.

Global longitudinal strain

GE Healthcare Vivid S6 Ultrasound System (Wauwatosa, USA), an echocardiography machine was used for the study according to American Society of Echocardiography guideline. The left ventricular function was measured using ejection fraction (EF) and 2D speckle tracking to determine global longitudinal strain (GLS). The test was carried out upto 24 hours before treatment and at the 90-day follow up as per protocol at our centre. A total of 18 segments was used to calculate the LV global longitudinal peak strain average (GLPS-Avg). The vertical segments were basal, mid, and apical and horizontal segments were anterior, anteroseptal, inferoseptal, posterolateral, inferior, dan anterolateral. Apical long axis (APLAX) was used to view the anterior and inferior segments, Apical 4-chambers (4-Ch) was used to view anterolateral and inferoseptal segments and apical 2-chambers (2-Ch) was used to view anteroseptal and posterolateral segments.

Study endpoints and data collection

The primary endpoint was improvement in GLS from baseline to the 90-day follow-up in various different categories. Secondary endpoints were improvement in EF, abdominal girth, weight and reduction in dependency on allopathic medication from baseline to the 90-day follow-up.

Data for patient demographics, anthropometrics, echocardiographic findings, and medications were collected and analysed from patient medical records.

On day 1 of the IRP, a detailed patient history, anthropometric measurements, and echocardiographic measurements were documented. Details of concomitant standard anti-ischemic medication was also recorded. This activity was repeated on day 90 of the program. Data of day 1 was compared with data of day 90. Data of only those patients who had completed a total of 14 sessions was collected and analysed.

Statistical analysis

Categorical data are expressed as number (percentage) and continuous data are expressed as mean ± standard deviation. Paired t test was used to determine the difference between baseline and follow-up at 90 days. P

value≤0.05 was considered as statistically significant. R Version 3.4.1 software was used to analyse the data.

RESULTS

Demographics of study patients

A total of 39 patients were included in this study. The mean age of the study population was 59.23±9.01 years. There were 29 (74.36%) males in the study population. Weight (day 1: 67.29±13.16 kg and day 90: 61.39±11.11 kg; p=0.00), body mass index (day 1: 25.75±4.03 and day 90: 23.79±3.50; p=0.00), abdominal girth (day 1: 95.31±10.75 cm and day 90: 85.67±17.02 cm p=0.00), EF (day 1: 40.74±10.30% and day 90: 53.91±11.87%; p=0.00), and GLS (day 1: -10.99±2.72 and day 90: -13.17±3.75; p=0.00) improved at the 90 day follow-up. The demographics of the study population are detailed in Table 1. EF and GLS changes at baseline and 90-day follow-up according to underlying comorbidities of the study population are given in Table 2.

Table 1: Demographics of the study population.

Variable	Day 1	Day 90	p value
Age, years	59.46±9.73		
Male,	138 (82.14%)		
Weight, kg	66.81±12.61	61.47±10.98	0.00
Body mass index	25.40±4.21	23.40±3.66	0.00
Abdominal girth, cm	93.30±9.99	87.35±8.86	0.00
EF, %	34.20±7.57	37.30±7.88	0.00
GLS	-10.54±2.96	-12.64±3.31	0.00

All data are expressed as number (percentage) or mean±standard deviation.
p value ≤0.05 was considered statistically significant.
EF-ejection fraction; GLS-global longitudinal strain

Demographic and anthropometric measurements according to age, ejection fraction, and global longitudinal strain of the study population

Weight improved for the 35-60 year age group (day 1: 68.43±14.23 kg and day 90: 62.89±11.53 kg; change: -5.54%) and the 61–75 year age group (day 1: 66.29±11.97 kg and day 90: 59.97±10.50; change: -6.25%) at the 90-day follow-up.

Body mass index improved for the 35-60 year age group (day 1: 26.31±4.30 and day 90: 24.48±4.01; change: -1.83%) and the 61–75 year age group (day 1: 25.22±3.69 and day 90: 23.13±2.79; change: -2.09%) at the 90-day follow-up. Abdominal girth improved for the 35–60 year age group (day 1: 95.89±11.71 cm and day 90: 89.00±11.29 cm; change: -6.89%) and the 61–75 year age group (day 1: 94.75±9.71 cm and day 90: 82.50±20.58 cm; change: -12.25%) at the 90 day follow-up. EF improved for the 35–60 year age group (day 1: 39.47±11.35% and day 90: 45.58±10.65%, change: 6.11%) and the 61–75 year age group (day 1: 41.95±9.02% and day 90: 45.75±12.91; change: 3.80%). GLS improved for the 35-60 year age group (day 1: -11.31±2.78 and day 90: -13.57±3.92; change: -2.26%) and the 61-75 year age group (day 1: -10.69±2.63 and day 90: -12.79±3.53; change: -2.11%) at the 90-day follow-up.

Similar improvements were observed when EF and GLS were measured according to weight, body mass index, abdominal girth, EF and GLS as demonstrated in Table 3.

Table 2: EF and GLS changes at baseline and 90-day follow-up according to underlying comorbidities of the study population.

Diagnosis	EF day 1	EF day 90	Change %	GLS day 1	GLS day 90	Change %
Coronary artery disease (n=31)	-11.37	-13.53	-2.16	41.65	46.58	4.94
Diabetes mellitus (n=20)	-10.78	-12.18	-1.41	38.55	42.65	4.10
Hypertension (n=24)	-11.66	-13.91	-2.25	41.75	45.92	4.17
Ischemic heart disease (n=26)	-11.22	-13.57	-2.35	41.77	47.50	5.73
Percutaneous transluminal coronary angioplasty (n=10)	-11.81	-13.75	-1.94	41.70	49.60	7.90
Chronic heart failure (n=4)	-8.85	-11.20	-2.35	30.50	32.75	2.25
Myocardial infarction (n=15)	-11.84	-13.60	-1.76	43.13	45.67	2.53
Dyslipidemia (n=5)	-11.92	-12.58	-0.66	39.80	44.80	5.00
Obesity (n=6)	-9.98	-13.38	-3.40	37.67	44.33	6.67
Coronary artery bypass graft (n=1)	-9.90	-12.50	-2.60	38.00	51.00	13.00
Low ejection fraction (n=2)	-8.85	-9.45	-0.60	37.50	35.00	-2.50
Single vessel disease (n=6)	-10.53	-12.42	-1.88	39.00	44.83	5.83
Double vessel disease (n=5)	-10.90	-11.50	-0.60	41.40	40.00	-1.40
Triple vessel disease (n=13)	-11.95	-14.92	-2.97	43.92	48.92	5.00

p value ≤0.05 was considered statistically significant.
EF-ejection fraction; GLS-global longitudinal strain

Table 3: Demographic and anthropometric measurements according to age, ejection fraction, and global longitudinal strain of the study population.

Variable	Weight day 1	Weight day 90	Change %	BMI day 1	BMI day 90	Change %	ABG day 1	ABG day 90	Change %	EF day 1	EF day 90	Change %	GLS day 1	GLS day 90	Change %
Age															
35-60	68.43± 14.23	62.89± 11.53	-5.54	26.31 ±4.30	24.48 ±4.01	-1.83	95.89± 11.71	89.00± 11.29	-6.89	39.47± 11.35	45.58± 10.65	4.67	-11.31 +2.78	-13.57 +3.92	-2.26
61–75	66.29± 11.97	59.97± 10.50	-6.25	25.22 ±3.69	23.13 ±2.79	-2.09	94.75± 9.71	82.50± 20.58	-12.25	41.95± 9.02	45.75± 12.91	5.23	-10.69 +2.63	-12.79 +3.53	-2.11
Ejection fraction															
10-30	65.08± 14.49	57.86± 10.75	-7.21	25.24 ±4.94	23.40 ±3.27	-1.84	91.50± 13.50	84.25± 8.54	-7.25	26.88± 2.15	31.38± 9.73	4.50	-7.54± 2.11	-8.60± 3.52	-1.06
31-50	68.66± 12.87	63.60± 11.04	-5.06	26.00 ±3.86	24.27 ±3.59	-1.73	96.00± 9.76	86.04± 20.19	-9.96	41.20± 5.75	47.04± 8.53	5.84	-11.69 ±1.86	-14.28 ±2.74	-2.59
Above 50	64.57± 11.62	56.92± 9.16	-7.65	25.40 ±3.21	22.27 ±2.90	-3.13	97.50± 9.20	86.00± 9.24	-11.50	57.33± 3.59	59.00± 5.29	1.67	-12.68 ±2.64	-14.65 ±2.85	-1.97
GLS															
3-8	68.10± 13.90	60.07± 11.39	-8.03	26.42 ±3.81	23.13 ±3.12	-3.28	94.83± 13.66	84.83± 9.79	-10.00	32.00± 11.03	36.67± 14.06	4.67	-6.50± 1.72	-8.52± 2.22	-2.02
8-12	64.46± 8.21	60.15± 7.80	-4.31	24.94 ±3.23	23.72 ±2.87	-1.22	92.76± 7.34	82.24± 21.97	-10.53	38.06± 8.10	41.59± 9.63	3.53	-10.16 ±1.09	-11.99 ±3.47	-1.84
12-15	70.01± 16.20	63.21± 13.49	-6.80	26.37 ±4.68	24.10 ±4.15	-2.27	98.19± 11.80	89.63± 8.33	-8.56	46.88± 8.33	53.38± 7.94	6.50	-13.56 ±0.90	-16.16 ±1.01	-2.61

All data are expressed as number (percentage) or mean ± standard deviation.
p value ≤0.05 was considered statistically significant.
EF-ejection fraction; GLS-global longitudinal strain

Table 4: Adherence to medication at baseline at 90-day follow-up of the study patients.

Variable	Day 1, %	Day 90, %	Change %
Angiotensin-converting enzyme inhibitors	17.95	15.38	-66.67
Angiotensin receptor blockers	15.38	5.13	-66.67
Angiotensin receptor/neprilysin inhibitor	10.26	20.51	62.50
Anticoagulants	20.51	33.33	62.50
Antiplatelet	58.97	46.15	-21.74
Beta blockers	48.72	15.38	-68.42
Cholesterol lowering medication	20.51	28.21	37.50
Calcium channel blockers	5.13	0.00$	-100
Diuretic	38.46	25.64	-33.33
Vasodilators	12.82	10.26	-20.00

All data are expressed as number (percentage)

DISCUSSION

GLS has demonstrated its superiority as a predictor of cardiac events and all-cause mortality when compared to EF. Recent studies have further established GLS as a robust prognostic marker post-myocardial infarction and cardiac surgery, as well as in patients with cardiomyopathy.[9,10]

Ischemic heart disease or myocardial ischemia often stems from an imbalance between increased myocardial oxygen demand and decreased myocardial perfusion and oxygen delivery. In individuals with stable angina,

physical exertion or emotional stress can lead to a surge in heart rate, blood pressure, or contractile state, thereby elevating myocardial oxygen demand without a proportional increase in oxygen delivery due to narrowed coronary arteries. This imbalance can result in myocardial ischemia. Additionally, disruptions in the oxidant/antioxidant mechanisms can lead to oxidative stress and unchecked vascular injury.[9] It is postulated that *Snehana* may attenuate sympathetic activity thereby reducing vascular tone. *Swedana* prompts perspiration, potentially inducing peripheral vasodilation and systemic vascular resistance reduction. Consequently, afterload diminishes, alleviating cardiac workload and myocardial oxygen demand. Passive heating-induced elevation of body temperature notably enhances cutaneous vascular conductance, maintaining barometric homeostasis. *Basti* correlates with decreased oxidative stress, potentially mitigating myocardial damage.[10]

Recently, a similar study aimed to ascertain the role of the IRP in IHD. The primary endpoint was change in GLS from baseline. The study demonstrated an enhancement in the GLS, with measurements showing -10.26±4.02 on day 1 and -10.99±3.94 on day 7 (p=0.04).[11] Likewise, another similar investigation displayed improvement in the GLS score, with measurements of -10.35±3.11 on day 1 and -11.80±3.48 on day 30 (p=0.0004). A separate study also affirmed the positive effects of the IRP, with GLS measurements of -10.77 on day 1 and -12.13 on day 30 (p=0.00).[12] Consistent with these findings, the present study indicates a significant improvement in GLS from -10.54±2.96 on day 1 to -12.64±3.31 (p=0.00) on day 90.

The current study assessed the impact of Ayurveda based Ischemia Reversal program (IRP) on improvement of ischemic heart disease using the GLS. Study findings revealed significant improvement in the GLS score post IRP improvement. These study findings are in line with other similar recent findings. The current study also sought to study dependency of patients on standard conventional medication. Several earlier studies documented reduced dependency of patients on conventional medication at the end of the IRP in line with the current study findings.[1]

The single arm, single centre design of the study are some limitations of the current study. Also, a larger sample size might have allowed generalization of these study findings to a larger population.

CONCLUSION

This study provides real-world evidence of the effect of Ayurveda based therapy along with diet on myocardial ischemia in known case IHD as assessed by GLS, a high-end diagnostic tool. The IRP appears to be a promising Ayurveda-based therapy for patients with IHD. The study showed notable improvements in weight, body mass index, abdominal girth, EF, and GLS after 90 days. These results suggest that IRP is beneficial treatment for IHD, but more extensive research is needed to confirm its effectiveness.

ACKNOWLEDGEMENTS

Authors would like to thank Miss Pallavi Mohe from the Research Department of Madhavbaug Cardiac Clinics took an all efforts for data collection and data analysis.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Sane R, Ghadigaonkar P, Shelke G, Singh RP, Kulthe N. Efficacy of Ayurved based therapy on global longitudinal strain in ischemic heart disease: a retrospective analysis. Int J Res Med Sci 2024;12:1588-93.