



Original Research Article

Effect of Ayurveda Management on Liver Cirrhosis with Ascites-A Retrospective Cohort Study



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ABSTRACT

Liver cirrhosis with ascites is a challenging medical condition. Ayurveda Clinical experiences suggest of a favourable role but lacks evidence. In a Retrospective cohort study, hospital records of patients with liver cirrhosis and ascites diagnosed through medical ultrasonography, treated at in patient division, department of *Kayachikitsa*, Medical Research Facility of KLE Ayurveda Hospital Belagavi were screened. Records with *Nitya virechana* procedure, minimum of 7 days of admission, proper documentation and meeting the other inclusion and exclusion criteria were selected for the study. Assessment were abdominal girth measurements at umbilicus, Xiphisternum to umbilicus measurement, Umbilicus to pubic symphysis measurement, weight, clinical global impression (CGI) scales (Severity, improvement and efficacy index), hemoglobin, liver function tests, Prothrombin time, INR and renal function tests. Fifty five case records met the methodological criteria of the study. Patients were suffering from stage 3, decompensated cirrhosis and Child-Turcotte-Pugh Score was in class C. Analysis of 15 days of interventions was carried out. Assessments were carried out at base line, 7th, 9th, 11th and 15th day of treatment. Interventions included *nitya virechana*, oral medicaments, diet, salt and fluid restrictions. Ayurveda interventions resulted in significant improvement ($p < 0.001$) at all time points in various parameters of abdominal measurements, weight, CGI scales, hemoglobin, liver function tests, prothrombin time, INR and renal function tests. Study showed complex Ayurveda interventions through *nitya virechana*, oral medications, diet, fluid and salt restrictions improve the clinical profile, liver function, renal function, prothrombin time, INR parameters in patients of ascites with decompensated cirrhosis and warrants further studies. © 2021 The Authors. Published by Elsevier B.V. on behalf of Institute of Transdisciplinary Health Sciences and Technology and World Ayurveda Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Liver cirrhosis is the end stage of many chronic liver diseases. It has compensatory and decompensatory phases. Compensated phase lasts for several years [1]. Decompensated cirrhosis leads to major complications including jaundice, variceal hemorrhage, ascites, or encephalopathy [2]. Ascites is the most common presentation. 50% of compensated cirrhosis develops ascites in 10 years of time [3] Ascites treatment requires hospitalization, can lead to life threatening complications and need liver transplantation. The development of ascites marks the onset of worsened prognosis and increased mortality. Cirrhosis within first year of diagnosis causes

death in 15% and 40% will die in first 60 months [4]. 10 yrs mortality is 34–66% [5]. Alcohol consumption, viral hepatitis B & C, metabolic syndrome related to obesity are the most common causes of cirrhosis. Liver cirrhosis is responsible for 1,70,000 deaths yearly in Europe [6]. Liver diseases frequency is increasing and huge increase in the liver disease burden is expected [3]. Health care costs of liver cirrhosis in United states is between 12 and 23 billion dollars annually [7]. Hepatic cirrhosis incidence in India could be high due to high prevalence of Hepatitis B & C, fatty liver disease and even increasing trends of alcohol intake. Cost of hepatic cirrhosis on quality of life, loss of productivity, medical expenses are high [8]. Treatments to stop progression from compensated to decompensated stage are being tried [9]. Liver transplantation is the only treatment in the end stage liver disease. Liver transplantation has high costs, high mortality and has paucity of organ donors.

In Ayurveda Ascites can be correlated to *Jalodara*. All *Udara* diseases (morbid abdominal disorder) ends up into *Jalodara* stage

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[10]. Ayurveda management protocol mainly aims in improving the *Jatharagni* (metabolism) and stimulating the hepatic function. *Jalodara* management includes *nitya virechana* (C.Chi.13.61), *teekshna* (strong, penetrating) drugs, *kshara* (alkali), *gomutra* (Cow's urine), fluid restriction, milk, buttermilk, diet, oral medicaments and *rasayana* (rejuvenative) drugs etc (C.Chi.13). *Nitya virechana* is a variant of *virechana* procedure in which preoperative procedures like *snehapana* (Internal oleation therapy), *swedana* (sudation therapy) are not carried out. *Virechana* is done in lesser intensity and more frequency. However there is scarcity in evidences of Ayurveda management of liver cirrhosis with ascites. A retrospective study in which case records of a tertiary care Ayurveda teaching hospital known for successful management liver cirrhosis with ascites were reviewed. Attempt was made to analyze the hospital data, treatment algorithms, details of *virechana* procedure, prescription patterns, dietary considerations, clinical outcomes and biological assessments.

2. Materials & methods

2.1. Settings

Setting of the current study was a 300 bed tertiary care KLE Ayurveda hospital, Belagavi situated in North Karnataka, India. Hospital caters to 7.38 lakhs of urban population directly and also to patients of 10 districts of Karnataka and Maharashtra.

2.2. Patient cohort

All patients receiving care for liver cirrhosis with ascites were included. Cases were identified retrospectively by evaluating manually and/or computer searches of hospital and laboratory databases from 2014 to 31 October 2020. Searches were carried out on specific terms like *Kamala*, *Udara*, *Jalodara*, Alcoholic liver disease, Cirrhosis and Ascites. Sonologically confirmed case of liver cirrhosis with ascites and records of patients treated in patient section, department of Kayachikitsa for a minimum of 7 days were included.

Initial screening revealed 255 case records. Cases with adequate recording of abdominal measurements, interventions (with *virechana*), vitals monitoring, observations etc. were included. Patients with concomitant illness like diabetes mellitus, hypertension, cardiovascular disorders were excluded ($n = 65$). Institutional ethics committee approval was obtained for the study. (Reference no BMK/20/BRT/01 dated 25.11.2020).

2.3. Clinical and demographic data

Details of Socio demographic information along with the detailed case history, treatment history, habits, systemic and abdominal examinations, investigations, treatments administered, day to day observations, vitals examination, fluid input and output charts and adequate clinical notes were noted. Assessments noted were.

1. Abdominal measurements at umbilicus, 1 inch above and below the umbilicus, Xiphi sternum to umbilicus and umbilicus to pubic symphysis.
2. Body Weight.
3. Blood parameters including haemoglobin, total bilirubin, indirect bilirubin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total protein, albumin, globulin, Albumin globulin (AG) ratio, alkaline phosphatase, prothrombin time & INR (International normalized ratio), serum creatinine and blood urea.
4. Clinical global impression scale (CGI) (Severity, improvement, efficacy index) [11].

2.4. Ayurveda management details

In all patients *Nitya virechan* (Daily therapeutic purgation) was planned as it is the prime Ayurvedic intervention in ascites. Other oral medications used were mild purgative, diuretic, blood purifier and hepatoprotective. These includes herbo-mineral formulations, decoctions, water extracts of herbs, diet and life style management. *Virechana* dosage was planned to obtain *avara shuddhi* of (3–6 *vega*) and for *Sroto* and *purisha shodhana* (cleansing). On starting days (1–3 days) only *purisha shuddhi* and later (>4 days) *samyak virechan laxanas* were observed. *Shodhan* of *purisha*, *pitta* and *kapha* was noticed and *vata antiki* was seen. After *virechan*, assessment was done on the basis of symptoms like *hridaya shuddhi* (feeling of clearness in chest), clarity in mind, senses and intellect, *laghutva* (body lightness), increase in thirst and appetite. Pattern of increment was decided by number of *vega* produced due to *virechana*. Dose producing 3–6 *vega* (purgation) with no signs of *vata vrudhi*, debility, dehydrative symptoms was retained for the next day. During the course, *virechan* dose was increased whenever there was decrease in *virechan vega* less than 3. *Virechan* dosage was decreased if patients develops more than 6 *vega*, weakness, *vata vrudhi*. As the *virechan* days increased, *virechan* effect was decreased and to retain *shodhan* effect dose escalations were done. Data showed, 8 patients had abdominal pain after continuous *haritaki churna* intervention for 3–4 days, hence one day rest was advised and again *virechan* was initiated by assessing the *roga bala* etc. factors. Average number of *nitya virechan* was 10.47 in patients with 15 days of hospital stay. Oral medications were administered post lunch and dinner (Table 4).

In Ascites diet plays an important role and diet restrictions were advised. Fluid restriction was up to 1.5 L per day. It included 500 ml milk per day, boiled rice water ad linitum, green gram soup measures 100 ml twice a day and medicinal decoctions and juices which was approximately 20–100 ml twice a day. Complete salt restricted diet was administered. Post *Nitya virechana* (purgation) diet was *Peya* (boiled rice water) during day time and at night *Khichadi* (Dish of rice and legumes) was prescribed in all patients. In 23.63% of patients white part of one whole egg twice a day was prescribed as per serum albumin results. Slow walking was advised not producing exertion or *vata vrudhi*. Patients were advised to maintain psychologically relaxed state by do deep breathing exercise, music etc.

Conventional medication (diuretics- Spironolactone and furosemide) was continued in the initial days. Tapering and discontinuation was advised based on reduction of pedal edema, abdominal girth and increased urine out put. Tapering was observed in 96.3% of patients and it was discontinued in 80% of patients.

2.5. Statistical methods

Statistical analysis was carried using IBM SPSS version 25 (IBM Corporation, Chicago, Illinois, United States). Descriptive data is expressed in mean, standard deviation and percentages. Pre and post assessment was done with paired sample t test. Values are reported as mean \pm standard deviation. All tests were considered statistically significant at $p < 0.05$.

3. Results

Total records extracted during the period of 7 years 10 months were 255. Two hundred records had incomplete documentation, lack of/vague/incomplete documentation of laboratory and sonological reports at the time of admission and discharge, lack of abdominal girth measurements, inadequate documentation of intervention, inadequate documentation of observations on day to

Table 1
Profile of patients and interventions.

S.No	Clinical Profile	Number and percentage (%)
1	Age (yrs)	47.03 ± 10.47
2	Sex	
	Male	52 (94.54%)
	Female	3 (5.4%)
3	Alcohol History in Years	7.76 ± 5.72
4	Duration of illness (In Months)	3.57 ± 4.52
5	Weight (Kgs)	63.99 ± 10.78
6	Virechana drug-	
	Haritaki	46
	Trivrita Leha	6
	Goarka	1
	Milk	2
7	Virechan First dose	
	Haritaki churna (In gms)	14.23 ± 5.26
	Trivrut lehya (In gms)	15.83 ± 2.04
	Milk (In ml)	1500 ± 0
	Goarka (In ml)	50 ± 0
8	Virechan Mean dose	
	Haritaki churna (In gms)	16.75 ± 4.73
	Trivrut lehya (In gms)	19.69 ± 2.83
	Milk (In ml)	1500
	Goarka (In ml)	37.69 ± 9.49
9	Anupana first dose (In ml)	
	Milk	58.33 ± 19.46
	Goarka	30.71 ± 12.22
	Hot water	48 ± 7.74
10	Anupana mean dose (in mL)	
	Milk	55.83 ± 22.34
	Goarka	34.19 ± 10.75
	Hot water	49.85 ± 10.92
11	Mean number of Virechana in patients	10.47 ± 3.23
12	Mean number of virechana vega in patients	4.94 ± 1.32
13	Mean Duration of patient stay (days)	13.21 ± 2.99

day basis etc. 55 patient's data met the inclusion criteria. *Virechana* was the first preferred panchakarma procedure in patients fit for *shodhan* procedures. Treatments were planned according to *roga, rogi bala* (strength of disease and patient) and special precautions were taken to prevent increase of *vata* and decrease of patient's strength. Hence patients did not suffer from any dehydration symptoms and had no disturbance to their daily functioning. Most of the patients had laboratory and sonological data at baseline but data at the end of treatment were limited. This could be due to satisfactory clinical improvements, leading to treatment discontinuation to avoid financial burden to patients by physicians, reluctance by patients to repeat the investigations, and even due to poorer economic conditions of the patients. In many records clinical improvements could not be substantiated with sonological and blood parameter changes and remains major lacuna in creating evidences (Fig. 1).

3.1. Patient characteristics

Patients characteristics: mean age (47 years), mean duration of the illness (3.5 months), male (94.5 %), and females (5.4 %), mean weight (64 kilograms). Alcohol history was found in all male patients. Mean abdominal girth at 1 inch above umbilicus was 91.9 cms, at umbilicus was 91.9 cms, and mean abdominal girth below 1 inch of umbilicus was 89.9 cms. Mean measurement from Xiphi sternum to umbilicus was 22.6 cms and mean umbilicus to pubic symphysis measurement was 14.8 centimeters. Mean clinical global impression scale - severity was 5.5. Mean duration of hospital stay was 13.2 days. Number of case records with 7 days admission were 5, with 9 days stay were 9, 11 days admission was 1 and 15 days admission were 40.

All patients were sonologically diagnosed with ascites due to liver cirrhosis. Ascites fluid was mild to moderate. Alcoholic liver

disease (ALD) was in 94% and Non ALD was in 5.4%. Mean alcohol history in patients were 8 years. Hospital records did not show patients with any serious complications such as hepatic encephalopathy, gastro intestinal bleeding, hepato renal syndrome etc. at the time of admission and even during the course of intervention. Other baseline characteristics were mean systolic blood pressure (129 mm of Hg), mean diastolic blood pressure (78 mm of Hg), and mean pulse rate (76 beats per minute) were in normative limits.

In blood variables at baseline (n = 55) mean hemoglobin was 9.77 gm %. Mean erythrocyte sedimentation rate (ESR) was 59.41 mm in 1st hour, mean total bilirubin was 5.29 mg/dl, mean direct bilirubin 2.28 mg/dl and mean indirect bilirubin was 3.0 mg/dl mean AST was 89.76 and mean ALT was 45.61 mg/dl. Mean total protein was 6.19 mg/dl, mean serum albumin was 2.57 mg/dl, mean globulin was 3.49 mg/dl and mean A/G ratio was 0.75. Mean alkaline phosphatase was 139.08 IU/L, mean serum sodium levels were 142.2 mEq/L, mean serum potassium was 3.52 mmol/L. Mean serum creatinine levels were 1.48 mg/dl while mean blood urea was 40.43 mg/dl. On evaluation of PT INR at baseline average prothrombine time was 14.80 s while its control was 13.72 s. Mean INR levels was 1.25. These baseline parameters are indicators of hepatic insufficiency (jaundice), portal hypertension (Ascites), deranged renal functions and are diagnostic of decompensated liver cirrhosis [12] (Table 1).

3.2. Results-Effect of interventions

3.2.1. Abdominal girth

Gradual reductions in different mean abdominal girths were observed at different time points. **Abdominal girth above 1 inch of umbilicus** is decreased as follows 7th day 2.2 cms, 9th day 2.82 cms, 11th day 5.44 cms and by 15th day it was reduced up to

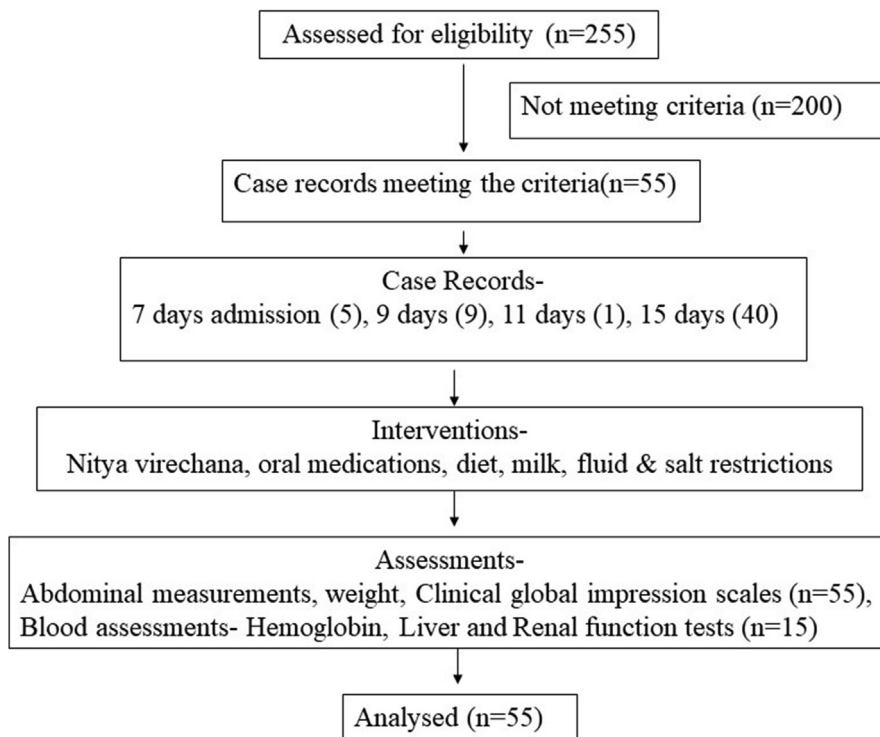


Fig. 1. Study flow chart.

6.5 cms from the baseline. **Abdominal girth at umbilicus** showed reductions as follows 7th day 2.56 cms, 9th day 3.37 cms, 11th day 4.74 cms and on 15th day it was reduced by 6.06 cms from baseline. **Abdominal girth below 1 inch of umbilicus** decrease at 7th day by 2.17 cms, 9th day 3.02 cms, 11th day 3.98 cms and by 15th day it was dropped by 5.46 cms. **Abdominal Girth from Xiphi sternum to umbilicus decreased** on 7th day by 2.07 cms, 9th day 2.43 cms, 11th day 3.06 cms and on 15th day it was 4.00 cms. **From Umbilicus to Pubic Symphysis** decline of 0.99 cms on 7th day, 1.15 cms on 9th day, 1.34 cms on 11th day and 1.69 cms decline is seen on 15th day from baseline (Table 2, Section A) (Fig. 2, Fig. 3).

3.2.2. Blood pressure and pulse

Interventions produced significant changes in Systolic blood pressure but not on diastolic blood pressure and pulse. Systolic blood pressure showed significant change at 7th, 9th and 15th day.

There was a significant decrease compare to base line but were in the normative ranges (Table 2, Section A).

3.2.3. Body weight

There was gradual decrease observed in body weight. From baseline it reduced by 1.7 kg on 7th day, 2.1 kg on 9th day, 2.7 kg on 11th day and by 15th day it was reduced by 4.9 kg (Table 2, Section A) (Fig. 3).

3.2.4. Blood parameters

Ayurveda intervention produced significant increase in haemoglobin levels. Significant reduction in elevated liver function tests including total bilirubin, indirect bilirubin, AST, ALT, total protein, albumin, globulin, alkaline phosphatase, prothrombin time and INR values were observed. Interventions produced normalcy in few parameters like total protein, globulin and alkaline phosphatase. Renal functions including serum creatinine (p = 0.04) and

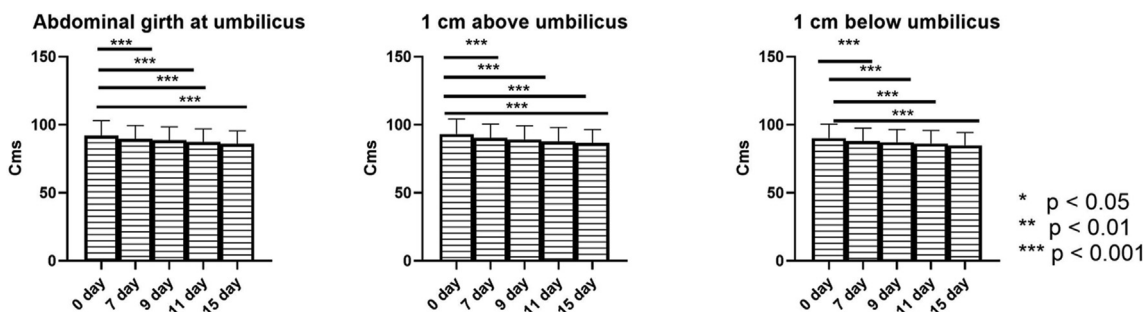


Fig. 2. Effect of interventions on Abdominal Girth.

Table 2
Effect on abdominal measurements, weight & clinical global impression scales by Section A-Ayurveda interventions. Section B- Nitya virechan, Guduchyadi yoga, diet, lifestyle.

S.No	Parameters	0th day (n = 55)	7th day (n = 55)	9th day (n = 50)	11th day (n = 41)	15th day (n = 40)	0-7 (n = 55)	0-9th day (n = 50)	0-11th day (n = 41)	0-15 (n = 40)	7-15 (n = 40)
Section A- Effect of Ayurveda interventions on Abdominal measurements, weight & Clinical global impression scales.											
1.	Number of virechana	0	4.3 ± 1.3	6.1 ± 2.1	8.5 ± 2.2	10.1 ± 3.1	<0.001	<0.001	<0.001	<0.001	<0.001
2.	Systolic Blood Pressure (mm of Hg)	129.04 ± 10.61	127.66 ± 9.61	126.4 ± 9.55	126.1 ± 11.19	128.84 ± 10.56	0.03	0.01	0.07	0.004	0.09
3.	Diastolic Blood Pressure (mm of Hg)	77.87 ± 6.28	76.83 ± 6.22	76.95 ± 4.98	76.93 ± 5.52	76.52 ± 6.35	0.07	0.30	0.64	0.14	0.16
4.	Pulse (Beats/Min)	75.79 ± 6.94	76.35 ± 6.05	75.5 ± 6.13	75.06 ± 5.81	75.42 ± 5.62	0.36	0.63	0.63	0.95	0.18
5.	Abdominal Girth- 1 cms above Umbilicus (in cms)	93.19 ± 11.00	90.36 ± 10.15	89.23 ± 10.03	87.74 ± 10.30	86.68 ± 9.94	<0.001	<0.001	<0.001	<0.001	<0.001
6.	Abdominal Girth- At Umbilicus (in cms)	92.11 ± 11.05	89.55 ± 9.90	88.73 ± 9.74	87.37 ± 9.66	86.05 ± 9.50	<0.001	<0.001	<0.001	<0.001	0.002
7.	Abdominal Girth- 1 cms below Umbilicus(in cms)	90.22 ± 10.18	88.05 ± 9.45	87.20 ± 9.38	86.24 ± 9.58	84.76 ± 9.52	<0.001	<0.001	<0.001	<0.001	<0.001
8.	Xiphisternum to Umbilicus	22.90 ± 3.96	20.82 ± 3.55	20.46 ± 3.40	19.83 ± 3.61	18.89 ± 4.06	<0.001	<0.001	<0.001	<0.001	<0.001
9.	Umbilicus to Pubic symphysis	14.90 ± 3.15	13.91 ± 2.39	13.75 ± 2.34	13.56 ± 1.38	13.21 ± 1.51	<0.001	<0.001	<0.001	<0.001	0.002
10.	Weight (Kgs)	63.99 ± 10.78	62.26 ± 10.46	61.85 ± 10.25	61.26 ± 10.27	59.03 ± 8.73	<0.001	<0.001	<0.001	<0.001	<0.001
11.	CGI-Severity	5.56 ± 1.04	4.00 ± 0.79	3.47 ± 0.69	3.03 ± 0.60	3.00 ± 0.74	<0.001	<0.001	<0.001	<0.001	<0.001
12.	CGI-Global Improvement	-	3.0 ± 0.20	2.70 ± 0.46	2.29 ± 0.52	2.05 ± 0.40	-	<0.001 ^a	<0.001 ^b	-	<0.001
13.	CGI-Efficacy Index	-	5.51 ± 1.79	4.44 ± 1.40	2.9 ± 1.84	2.68 ± 2.02	-	0.01 ^a	<0.001 ^b	-	<0.001
Section B-Effect of Nitya virechan,Guduchyadi yoga, diet, lifestyle on abdominal measurements, weight & Clinical global impression scales. [n = 30 (0th, 7th day), 28 (9th day), 25(11th day), 22 (15th day),30 (0-7th day),28 (0-9th day), 25 (0-11th day), 22(0-15th day, 7-15th day)].											
1.	Number of virechana	0	4.3 ± 1.3	6.1 ± 2.1	8.5 ± 2.2	10.1 ± 3.1	<0.001	<0.001	<0.001	<0.001	<0.001
2.	Systolic Blood Pressure (mm of Hg)	131.4 ± 8.91	129.33 ± 7.93	128.42 ± 7.60	129.57 ± 8.78	130.53 ± 8.39	0.03	0.009	0.14	0.02	0.12
3.	Diastolic Blood Pressure (mm of Hg)	78.40 ± 6.2	77.33 ± 6.11	77.64 ± 4.90	77.89 ± 5.79	77.06 ± 6.71	0.15	0.23	0.23	0.03	0.13
4.	Pulse (Beats/Min)	75.46 ± 6.12	76.13 ± 4.85	75.53 ± 5.54	74.68 ± 5.17	74.93 ± 5.48	0.46	0.53	0.77	1	0.47
5.	Abdominal Girth- 1 cms above Umbilicus (in cms)	91.93 ± 10.42	89.98 ± 10.21	90.0 ± 10.24	88.65 ± 9.56	86.46 ± 9.16	<0.001	<0.001	<0.001	<0.001	<0.001
6.	Abdominal Girth- At Umbilicus (in cms)	91.93 ± 10.42	89.98 ± 10.21	90 ± 10.24	88.65 ± 9.56	86.46 ± 9.16	<0.001	<0.001	<0.001	<0.001	0.002
7.	Abdominal Girth- 1 cms below Umbilicus(in cms)	90.36 ± 9.84	88.71 ± 9.80	88.58 ± 9.88	87.60 ± 9.69	85.1 ± 9.49	<0.001	<0.001	<0.001	<0.001	<0.001
8.	Xiphisternum to Umbilicus	22.11 ± 4.03	20.35 ± 3.52	20.33 ± 3.48	19.78 ± 3.77	18.53 ± 4.06	<0.001	<0.001	<0.001	<0.001	0.001
9.	Umbilicus to Pubic symphysis	14.64 ± 3.47	14.0 ± 2.74	13.88 ± 2.70	13.44 ± 1.50	13.35 ± 1.54	0.001	0.001	0.001	0.002	0.02
10.	Weight (Kgs)	66.34 ± 10.69	64.65 ± 10.56	65.0 ± 9.89	63.50 ± 10.97	60.54 ± 7.91	<0.001	<0.001	<0.001	<0.001	<0.001
11.	CGI-Severity	5.46 ± 0.93	3.80 ± 0.71	3.39 ± 0.62	3.05 ± 0.52	2.86 ± 0.74	<0.001	<0.001	<0.001	<0.001	<0.001
12.	CGI-Global Improvement	-	3.03 ± 0.18	2.78 ± 0.41	2.42 ± 0.5	2.06 ± 0.45	-	<0.006 ^a	<0.001 ^b	-	<0.001
13.	CGI-Efficacy Index	-	5.29 ± 1.53	4.85 ± 0.76	2.26 ± 1.91	2.60 ± 2.02	-	0.32 ^a	<0.001 ^b	-	<0.001

^a Assessment between 7-9th day.
^b Assessment between 7 and 11th day.

blood urea (p = 0.03) levels showed significant decrease as a result of interventions. However they were still in the pathological range (Table 3, Section A).

3.2.5. Clinical Global impression scale

At baseline mean CGI severity of illness scale was 5.56 which was reduced on 7th day by 1.56, 9th day by 2.08, 11th day by 2.53 and by 15th day it decreased by 2.56 compared to baseline. CGI-Global improvement scale showed that mean improvement was 3 on 7th day, on 9th day it was improved by 0.29, on 11th day 0.70 and on 15th day mean improvement was by 0.94. CGI-Efficacy index scale showed, mean score was 5.51 on 7th day which improved by 1.06 on 9th day, 3.34 on 11th day and improvement by 2.82 was seen on 15th day (Table 2, Section A) (Fig. 4).

3.2.6. Effect of Nitya virechana, Guduchyadi yoga, diet and life style on parameters

Intervention (n = 32) showed improvement similar to cumulative assessments (n = 55). Significant reductions in abdominal measurements such as at umbilicus, and 1 inch above and below the umbilicus. Xiphi sternum to umbilicus and umbilicus to pubic symphysis measurements, body weight, systolic and diastolic blood pressures, pulse and Clinical global impression scale (CGI) (Severity, improvement, efficacy index) (Table 2, Section B). Blood variables (n = 10) assessment indicated that intervention produced significant increase in hemoglobin levels, Significant decrease in elevated liver function tests like total bilirubin, indirect bilirubin, AST, ALT, total protein, albumin, globulin, Alkaline phosphatase, prothrombin time and INR values were observed. Interventions produced

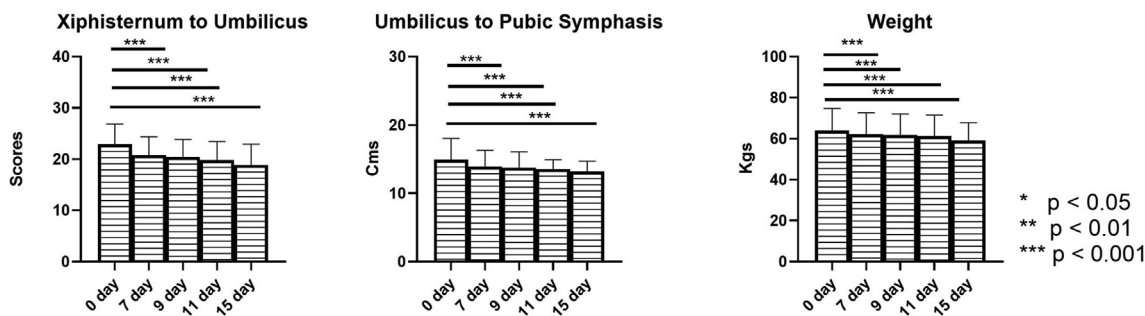


Fig. 3. Effect of interventions on Abdominal measurements and weigh.

normalcy in few parameters like Globulin and Alkaline phosphatase. Renal functions like serum creatinine and blood urea levels showed trends of decrease but were non significant and were in the pathological range. Improvements in most of the parameters were similar to the cumulative sample (Table 2, Section B and Table 3, Section B).

4. Discussion

The present study has shown that complex intervention with *Nitya Virechana*, oral medicaments, diet, fluid and salt restriction proved to be efficacious in the management of decompensated cirrhosis with ascites. It has shown reduction in abdominal girth measurements, body weight, clinical global impression scales of severity, improvement and efficacy index. Improvement was also observed in blood variables, liver function tests, prothrombin time, INR values and renal function tests.

All the patients were sonologically diagnosed case of liver cirrhosis with mild to moderate ascites. Patients had stage 3, decompensated cirrhosis [13] and Child-Turcotte-Pugh Score (CTP) [14] score (calculated through serum bilirubin, serum albumin, prothrombin time, severity of ascites, and grade of encephalopathy) was 10 and was in class C. In Class C, 1 year survival is observed in 45% and 2 year survival is observed in 38% cases [17]. Majority (94%) were due to chronic Alcoholic liver disease. Patients were suffering from these symptoms since 3.5 months. More number of patients were between 45 and 50 years of age. All male patients (94.54%) had chronic alcoholic liver disease. Mean alcohol consumption history was 7.76 years.

Administration of *Nitya Virechan* (daily mild purgatives) with either *haritaki churna* (fine powder of terminalia chebula retz.), *Trivruta leha* (compound formulation of operculina turpethum Linn), *Goarka* (distilled product of cow's urine) or milk can lead to fluid loss. These drugs works as osmotic and stool wetting agents. It

Table 3 Effect on Haemoglobin, Liver and Renal function tests by Section A- Ayurveda interventions. Section B- Nitya virechan, Guduchyadi yoga, diet, lifestyle.

S.No	Parameter (n = 15)	Base line	15th day	P value
Section A- Effect of Ayurveda interventions on Haemoglobin, Liver and Renal function tests				
1.	Hemoglobulin (g/dL)	9.54 ± 2.03	10.16 ± 2.04	<0.001
2.	Bilirubin- Total (mg/dL)	4.78 ± 4.31	3.04 ± 2.3	0.006
3.	Bilirubin- Direct (mg/dL)	1.59 ± 0.94	1.43 ± 1.38	0.64
4.	Bilirubin-Indirect (mg/dL)	2.58 ± 1.89	1.58 ± 1.27	<0.001
5.	AST (IU/L)	99.53 ± 68.52	61.92 ± 37.67	0.002
6.	ALT (IU/L)	45.61 ± 32.36	35.04 ± 16.47	0.01
7.	Total Protein (g/dL)	6.09 ± 1.34	6.51 ± 0.89	0.02
8.	Albumin (g/dL)	2.66 ± 0.59	3.16 ± 0.45	<0.001
9.	Globulin (g/dL)	3.41 ± 0.89	3.53 ± 0.83	0.03
10.	albumin/globulin ratio	0.6 ± 0.14	0.71 ± 0.19	0.06
11.	Alkaline phosphatase (IU/L)	130.08 ± 61.65	104.33 ± 35.68	0.008
12.	Prothrombine time (Seconds)	15.10 ± 2.81	13.91 ± 2.31	0.01
13.	INR (International normalized ratio)	1.25 ± 0.26	1.16 ± 0.18	0.01
14.	Serum creatinine (mg/dL)	1.48 ± 0.80	1.33 ± 0.56	0.04
15.	Blood Urea (mg/dL)	37.07 ± 17.98	31.54 ± 13.41	0.04
Section B- Effect of Nitya virechan, Guduchyadi yoga, diet, lifestyle on Haemoglobin, Liver and Renal function tests (n = 10)				
1.	Hemoglobulin (g/dL)	9.62 ± 1.79	10.21 ± 1.77	<0.001
2.	Bilirubin- Total (mg/dL)	4.97 ± 4.62	3.13 ± 2.64	0.012
3.	Bilirubin- Direct (mg/dL)	1.64 ± 1.01	1.51 ± 1.47	0.75
4.	Bilirubin-Indirect (mg/dL)	2.63 ± 2.02	1.58 ± 1.36	<0.001
5.	AST (IU/L)	100.33 ± 71.50	62.33 ± 39.32	0.003
6.	ALT (IU/L)	46.37 ± 35.46	34.87 ± 17.86	0.03
7.	Total Protein (g/dL)	6.5 ± 1.01	6.68 ± 0.85	0.10
8.	Albumin (g/dL)	2.7 ± 0.57	3.21 ± 0.41	<0.001
9.	Globulin (g/dL)	3.46 ± 0.99	3.58 ± 0.92	0.03
10.	albumin/globulin ratio	0.58 ± 0.14	0.68 ± 0.19	0.15
11.	Alkaline phosphatase (IU/L)	132.75 ± 70.14	106.62 ± 39.35	0.04
12.	Prothrombine time (Seconds)	14.25 ± 2.05	13.25 ± 1.75	0.03
13.	INR (International normalized ratio)	1.22 ± 0.26	1.15 ± 0.18	0.04
14.	Serum creatinine (mg/dL)	1.58 ± 0.88	1.42 ± 0.58	0.13
15.	Blood Urea (mg/dL)	35.33 ± 21.31	31.50 ± 17.61	0.29

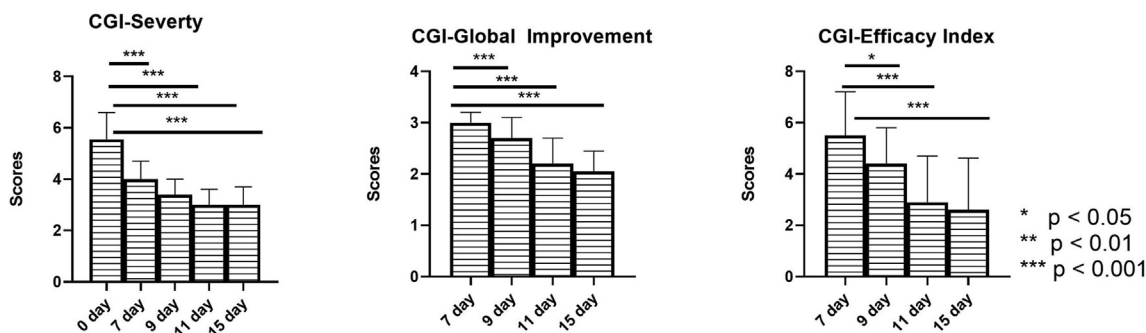


Fig. 4. Change in Clinical Global impression scales-Severity, Global improvement, Efficacy index.

increases water content in gut by changing the fluid dynamics of mucosal cells. These drugs may change the fluid dynamics leading to impairment in water and electrolytes absorption of villous cells inhibiting Na⁺, K⁺ + ATPase [15], resulting into draining of peritoneal fluid into gut through process of osmosis [16]. *Virechan* drugs are *ushna* (hot), *tikshna* (piercing quality), *sukshma* (reach up to minute part), *vyavayi* (spreads all over body), *vikashi* (flowing capacity) *sara* (flowing), *anu* (reaching to cellular level) & *vicchina* (scrapping and excising) and *dosha sanngatahara* (dismantling compactness of dosha) in nature (C.S.K.1.5). By this qualities,

virechan drugs may have moved the peritoneal fluid to the intestines and then evacuation through rectal route. *Haritaki* (*Terminalia chebula* retz.) contains anthraquinones [17] which is mild and gentle laxative in nature. Anthraquinones metabolize the active aglycones which by impairing epithelial cells, deploys its lenitive action leading to the modification in intestinal absorption, secretion and motility [18]. *Trivrtta* (*operculina turpethum* Linn) contains Resin glycosides [19] which has aperient property of the purified resin glycoside fraction. It attributes to NF-κB activation in the colon resulting in increment of COX-2-mediated secretion of

Table 4
Oral medications used in the study.

S.No	Oral medications	Frequency of use	Action
1.	<i>Guduchi swarasa</i> (<i>Tinospora cordifolia</i> Miers) 50 ml with <i>Katuki churna</i> (<i>Pichrorhiza kurroa</i> Royle Benth.) 5 gms. 50 ml twice a day.	58%	Rasayan effect on liver
2.	Decoction of <i>Guduchi</i> , <i>triphala</i> (compound formulation of <i>Terminalia chebula</i> Retz., <i>Terminalia bellerica</i> Roxb., <i>Emblica officinalis</i> Gaertn.), <i>nimba</i> (<i>Azadirachta indica</i> A. Juss.), <i>haridra</i> , (<i>Curcuma longa</i> L.), <i>vasa</i> (<i>Adhatoda vasica</i> NEES) <i>kwatha</i> .50 ml twice a day.	58%	Rasayan effect on liver, <i>rakta pittahara</i>
3.	Tab Amlycure DS. 1 tab twice a day.	25.45%	Rasayan effect on liver
4.	<i>Kalamegha</i> strong syrup (15 ml twice a day)	25.45%	Rasayan effect on liver
5.	<i>Punarnava mandoor</i> . 1 tab twice a day.	21.81%	Rasayan effect on kidney
6.	<i>Patolakaturohinyadi kashay</i> (15 ml twice a day)	20%	Rasayan effect on liver, <i>rakta pittahara</i>
7.	<i>Mutrala kadha</i> (A Preparation of KLE Ayurveda Pharmacy Belagavi, Karnataka) (50 ml twice a day)	20%	Rasayan effect on kidney
8.	<i>Arogyavardhini Rasa</i> . 1 tab twice a day.	18.18%	Rasayan effect on liver
9.	Decoction of <i>Guduchi</i> (<i>Tinospora cordifolia</i> Miers), <i>Nimba patra</i> (<i>Azadirachta indica</i> A. Juss.), <i>Bhringaraj</i> (<i>Eclipta alba</i> Hassk.), <i>Bhumyamalaki</i> (<i>Phyllanthus. niruri</i> Linn.) 50 ml twice a day.	14.54%	Rasayan effect on liver, <i>rakta pittahara</i>
10.	<i>Kalamegha</i> strong and <i>Kumaryasava</i> (15 ml twice a day)	12.72%	Rasayan effect on liver
11.	<i>Yakrutaplihanataka Rasa</i> . 1 tab twice a day.	10.9%	Rasayan effect on liver
12.	<i>Kalamega</i> strong along with <i>Patolakaturohinyadi kashay</i> (15 ml twice a day)	9.09%	Rasayan effect on liver
13.	<i>Bruhadyadi Kashaya</i> (15 ml twice a day)	7.27%	Rasayan effect on kidney
14.	Decoction of <i>Guduchi</i> (<i>Tinospora cordifolia</i> Miers), <i>Brahmi</i> (<i>Bacopa Monnieri</i> Linn.), <i>Bhringaraj</i> (<i>Eclipta alba</i> Hassk.), <i>Bhumyamalaki</i> (<i>Phyllanthus. niruri</i> Linn.). 50 ml twice a day.	3.63%	Rasayan effect on liver, <i>rakta pittahara</i> , nootropic effect
15.	<i>Punarnavasava</i> (15 ml twice a day)	3.63%	Rasayan effect on kidney, <i>rakta pittahara</i>
16.	<i>Punarnavashtak kashay</i> (15 ml twice a day)	3.63%	Rasayan effect on kidney, <i>rakta pittahara</i>
17.	<i>Kokilaksham kashay</i> (15 ml twice a day)	3.63%	Rasayan effect on kidney, <i>rakta pittahara</i>
18.	<i>Kalamegha</i> strong, <i>Kumaryasava</i> and <i>Rohitakarishhta</i> (15 ml twice a day)	3.63%	Rasayan effect on liver, <i>rakta pittahara</i>
19.	Decoction of <i>Guduchi</i> (<i>Tinospora cordifolia</i> Miers), <i>Punaranva</i> (<i>Boerhavia diffusa</i> Linn.) <i>Bhringaraj</i> (<i>Eclipta alba</i> Hassk.), <i>Bhumyamalaki</i> (<i>Phyllanthus. niruri</i> Linn.). 50 ml twice a day.	1.81%	Rasayan effect on liver and kidney, <i>rakta pittahara</i>
20.	<i>Katakakhadiradi kashay</i> (15 ml twice a day)	1.18%	Rasayan effect on kidney
21.	<i>Sootshekhar rasa</i> . 1 tab twice a day.	1%	Rasayan effect on liver
22.	Tablet <i>Redema</i> . 1 tab twice a day.	1%	Rasayan effect on liver, <i>rakta pittahara</i>
23.	<i>Tapyadi loha</i> . 1 tab twice a day.	1%	Rasayan effect on liver

PEG2 which further decreases AQP3 expression leading to purgative action by absorbing water from intestine to the blood vessel [20]. Cow's Milk has various qualities including *guru* (heavy), *sara* (spreading and flowing), *prithvi*, *jala mahabhuta* dominance, mild laxative, *rasayana* (regenerative), *jeevana* (nutritive), *balya* (strength promoting). *Goarka* has purgative action because of its *ushna* (hot), *tikshna* (penetrating), *sara* (spreading and flowing) and *bhedana* (piercing) properties. Frequently used oral formulation was *G. yoga* and *Guduchyadi kwatha*. These formulations were derived from the clinical experiences of the departmental faculty. Other oral formulations were also used. These formulations and their ingredients can potentiate the *rasayana* effect on liver, kidney and nootropic, hepatotropic action, *rakta pittahara* (bleeding and clotting indices), anti anaemic, correcting hypoproteinaemia and diuretic effects. These drugs are *tikta* (bitter) in *rasa*, *laghu* (light), *dravashoshaka* (drying up fluid content), *kapha hara*, *rasayana* (rejuvenation quality) in nature. Various studies have reported *Punarnava* (*Boerhavia diffusa* Linn.) to be effective in improving the urine formation, hepatoprotective and anti-inflammatory in both in vivo and in vitro studies [21,22]. *Nimba* (*Azadirachta indica* A. Juss.) leaf extract has hepatoprotective [23] effect as it contains phytochemicals such as Azadirachtin, Nimbidin, Nimbin, Nimbinin. *Guduchi* (*Tinospora cordifolia* Miers.) [24] has anti-inflammatory, immunomodulatory, hepatoprotective, antioxidant and antidiabetic effects. *Bhringaraj* (*Eclipta alba* Hassk.) [25] has shown hepatoprotective effect. *Bhumyamalaki* (*P. niruri* Linn) [26] in animal model has shown to decrease hepatomegaly, visceral fat weight, serum total cholesterol, low-density lipoprotein, free fatty acids (FFAs), Alanine aminotransferases, aspartate aminotransferases, insulin concentration, homeostatic model assessment of insulin resistance (HOMA-IR), hepatic content of cholesterol, triglyceride, malondialdehyde, prevented fibrosis, and has anti NAFLD effect. Fluid and salt restriction is recommended in Ascites as it is a condition of increase of *Apa mahabhuta*, *kleda* and *mala*. Dietary items such as milk has *balya*, *jeevaniya*, *rasayana*, and is indicated in *kshina* (debilitated individuals). Green gram soup and egg white also have *balya* and *jeevaniya* effect. Through these actions improvement in hemoglobin, total proteins and globulins could have been produced.

Comprehensive clinical assessment was through clinical global impression Scale. This intervention shown significant ($p < 0.001$) improvements in severity of illness, global improvement and efficacy index. This may happened due to clinical improvement in the manifestations of liver cirrhosis with ascites, decrease in the abdominal fluid, effect of drugs like immunomodulatory, anti-inflammatory, hepatoprotective, anti-anemic, diuretic, *rasayana* effects. Improvement in clinical manifestations can help in improving the quality of life and decrease the risk of complications like spontaneous bacterial peritonitis (SBP).

Similarly a prospective study [27] with a complex polyherbal regimen inclusive of purgation with *P. kurroa*, piper longum Linn administration, *punaranvadi kwath*, compound powder, diet and life style modifications for 24 weeks showed improvement in liver child-pugh grade scores and clinical manifestations of liver cirrhosis with ascites. A case report [28] of sonologically diagnosed ascites with *nitya virechan* (therapeutic purgation daily) intervention with *Abhayadi modaka*, cow's urine *Sharapunkha Swarasa*, *Punarnava Kwatha*, *Arogya vardhini* and restricted diet for 3 months showed improvement in ascites, decrease in abdominal girth and clinical improvements. Another case report [29] of liver cirrhosis with ascites with intervention in the form of *nitya virechana* (*hingu triguna taila* with milk for 10 days), *punaranvadi Kashaya*, *panchakola churna*, *gomutra haritaki*, diet, *vardhamana pippali* regimen for 60 days showed decrease in ascites and no recurrence of ascites after 1 year of observation. The present study shows the evidences

for use of different *virechana*, *anupana*, oral medications and diet in decompensated cirrhosis.

Study has many merits. Treatment regimen being practiced in the clinical scenario were analyzed and hence has a strong external validity. Thorough evaluation of Ayurveda physicians' thought process, Ayurvedic assessment of the patient, critically analyzing the treatment algorithm, whole system approach, integrating Ayurveda treatment modalities (*virechana*, oral medication and diet). Assessments with abdominal measurements, weight, clinical global impression scales, liver function tests, renal function tests, prothrombin time and INR values are the notable components of the study. Study has several limitations including retrospective cohort study. Lack of histopathological assessments through liver biopsy is a lacuna and these would have given better biological action of interventions. Limited study duration (15 days) is relatively shorter period for this disease condition.

5. Conclusion

Complex Ayurvedic treatment regimen consisting of *Nitya virechana*, Ayurveda medicaments, diet, salt and fluid restrictions have shown beneficial effect in the management of decompensated stage of liver cirrhosis with ascites. Study gives leads in the Ayurvedic patient assessments, treatment principles, treatment algorithms, customization, medications and diets in liver cirrhosis with ascites. Proper documentation of all the observations, correlating the clinical changes with the appropriate biological investigations, maintaining the long term follow up records, recording the ayurveda interpretations etc needs to be strongly advocated to the Ayurvedic clinicians.

Conflict of interest

None.

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Nil.

Author Contributions

B R Tubaki: Conceptualization, Methodology, Writing - Original draft preparation, Writing- Reviewing and Editing, Statistical analysis. Saish Gawas: Supervision, Data curation, Writing - Reviewing and Editing. Himani Negi: Supervision, Visualization, Data collection, Writing - Reviewing and Editing.

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