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INTEGRATED MANAGEMENT OF FILARIAL LYMPHEDEMA FOR RURAL COMMUNITIES

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ABSTRACT

The Global Alliance for the Elimination of Lymphatic Filariasis (GAELF) has recommended exploring local health traditions of skin care and a low cost treatment paradigm for rural communities has been proposed by Vaqas and Ryan. Our case study incorporates these promising treatments for use in treating filariasis in rural communities. Patients having lymphedema of one or both lower limbs (skin: normal, thickened or with trophic/warty changes) received treatment components from ayurveda, yoga and biomedicine simultaneously: including soap wash, phanta soaking, Indian manual lymph drainage (IMLD), pre- and post-IMLD yoga exercises, and compression using bandages for 194 days, along with diet restrictions and oral herbal medicines indicated for "elephantiasis" in Ayurveda. Entry points when infected were treated with biomedical drugs. The study was conducted in the reverse pharmacology design. 112 patients and 149 lower limbs completed 194 days of treatment during 2003-2006. Significant improvements were observed in the limb circumference measurements and the frequency of acute dermatolymphangio-adenitis, use of preventive antibiotics, and reduction in the number of entry points were also improved. The objective to obtain significant benefit for a common problem using locally available, sustainable and affordable means has been achieved. It has not been our purpose to show that the regimen employed is better than another but the results do pose the question–"Are there components of Ayurvedic medicine that deserve further study?" It is important to understand that the regimen has been delivered mostly at home and that participants we have treated, representing a population suffering from a common problem, have not had access to effective conservative therapy that is culturally acceptable, safe, and efficacious.

Keywords: Ayurveda, integrated medicine, lymphatic filariasis, lymphedema, reverse pharmacology, yoga

The morbidity control agenda of the Global Alliance for the Elimination of Lymphatic Filariasis (GAELF) is in its infancy, and the clinical management trials working group of GAELF has recommended exploring the current practices of skin care in filariasis endemic areas and evaluation of effectiveness of traditional methods for lymphedema treatment (1). Vaqas and Ryan's perspective article discussed the theoretical basis of the current treatment practices and its application for the management of filariasis in resource poor settings (2). In Ayurveda (a widely used traditional Indian system of Medicine), manifestations resembling elephantiasis are described as Shleepada, from the Sanskrit terms Shlee = elephant skin and Paada =

TABLE 1
Number of Patients at Different Stages of Follow up at the Time of Analysis

Grading of filarial lymphedema	14th Day		45th Day		104th Day		194th Day	
	Patients	Limbs	Patients	Limbs	Patients	Limbs	Patients	Limbs
Edema with normal skin	25	36	23	32	15	22	11	16
Edema with thickened skin	82	111	76	103	58	80	41	55
Edema with trophic skin changes	82	101	72	89	60	74	43	53
Edema with trophic skin changes and received *Swedana* (limb heating)	51	74	44	64	32	44	17	25
Total	240	322	215	288	65	220	112	49

foot. There are 68 compound drugs mentioned for filariasis in Ayurveda and because of their anti-inflammatory, analgesic and anti-pyretic properties, they could be used for filarial edema (3). We initially treated a 60 year old female patient with 36 year duration of lower limb filarial lymphedema using yoga exercises, skin care measures using Ayurveda medicines and Indian manual lymph drainage (IMLD) with promising results (4). The gold standard practiced in Europe is too expensive for rural India and to some extent culturally unacceptable. Using one of India's systems of medicine ensures greater compliance of the patients, and we have adapted it to include evidence-based concepts from European practices and locally available, sustainable and low cost procedures.

MATERIALS AND METHODS

240 patients *(Table 1)* having lymphedema of one or both lower limbs (322 limbs) of any duration, with ability to withstand the variety of yoga exercises, were recruited for the integrated treatment over the period October 2003-September 2006 under Institutional Ethics Committee clearance. Their lymphedema was graded according to the International Society of Lymphology Consensus Statement 2003 (5). Patients presenting with acute dermatolymphangioadenitis (ADLA) were excluded. The Ayurvedic doctor (P.E.M.) selected the Ayurvedic herbal medicines used for each patient following a complete Ayurvedic clinical examination, which included determination of body constitution (*shareera*= body *prakruthi*= constitution) and disease in the affected part (*sthaneeya*= local; *vikruthi*= disease) using more than 100 clinical parameters listed in a table as yes/no type questions. Before hospitalization, each patient's management strategy and details were then e-mailed to the second author, who guided this study for his agreement and advice. Patients were admitted in the KPO (Knowledge process outsourcing) hospitals of the Institute of Applied Dermatology for an initial 14 days in order to train the patients and at least one member of the family for this self-help treatment. This was followed by 6 months of treatment at home.

Admission baseline data were recorded to determine indicators of improvement: changes in the limb circumferential measurements and volume of the limb calculated based on the measuring points *(Table 2)* in the same way as the measurements are taken

TABLE 2
Percent Reduction over Baseline Values at Fixed Time Intervals and Quantity Reduced in the Category Grade- Skin Normal

Measuring points	14th Day %	14th Day Qty	45th Day %	45th Day Qty	104th Day %	104th Day Qty	194th Day %	194th Day Qty
Metatarsal	3.5	0.74**	2.2	0.47*	0.2	0.14	1.5	0.34
Mid foot	6.4	1.57**	5.8	1.38**	6.5	1.61**	10.1	2.44**
Ankle	2.9	1.33**	3.1	1.41*	3.2	1.57*	6.7	2.31**
End of calf muscle bulk	10.5	2.78**	10.2	2.64**	13.7	3.43**	15.0	3.59**
Maximum bulk	8.3	2.86**	10.6	3.47**	12.2	4.07**	14.2	4.59**
Patellar region	4.6	1.86**	7.1	2.71**	5.4	2.05**	5.4	1.97**
Mid thigh	4.2	2.28**	4.5	2.48**	5.7	3.18**	6.1	3.25**
Maximum bulk standing	7.0	2.45**	9.4	3.13**	10.4	3.50**	13.3	4.38**
Volume by water displacement	9.4	0.47**	11.2	0.54**	13.2	0.62**	13.7	0.56**
Std error for volume	1.117	0.071	1.570	0.085	1.952	0.104	3.100	0.138

Qty=reduction in circumferential measurements in centimeters at each point; volume is represented in liters; **quantity reduced is significant at $p<0.01$ (based on paired t-test); *significant at $p<0.05$ level

for tailor-made compression garment stitching); frequency of inflammatory episodes and reduction in the use of penicillin injections or consuming antibiotics for prevention of inflammatory episodes; reduction in the number of entry points (intertrigo, folliculitis, eczema, or any other focus of infection); and reduction in the thickness of skin folds by pinching between the index and thumb. The status of the limb and skin was documented with photographs. The foot end of the bed was elevated between 20-30 cms throughout 2 weeks of hospitalization. The steps of treatment, same for all grades of patients, were in the following sequence for an average of 1½ to 2 hours per day.

1. **Skin care measures:** A nurse, assisted by the patient's attendant, gave meticulous soap and water wash every day. The selection of soap for skin care was done after determining the pH using litmus paper (6). Although not routinely available in the market, recommended soaps were in the acidic range. The wash included removal of dirt and deposits between the folds for larger limbs. A syringe was used to spray the boiled and tepid water between the folds. The foul odor of some wounds was treated initially with ringer lactate solution (7). Following the wash, the affected limb was immersed in an ayurvedic skin care *"phanta"* solution (acidic pH) for 20 minutes (8). *Phanta selected were Manjistha, Sariva, Yestimadhu, and Triphala* based on the ayurvedic principles of treatment. Later the water and moisture contents were dried using a cotton towel with special attention to eliminate moisture from the skin folds. Whenever fungal intertrigo was present, colorless castellani's paint was instilled and if it did not respond, clotrimazole 1% cream was applied. Eczema lesions were treated with topical betamethasone dipropionate 0.05% while ulcers, if infected, were treated with

appropriate antibiotics. Unhealthy granulation tissues and slough on the base of the ulcer were treated with *Jatyadi thaila* of Ayurveda (8). Skin care also included regular cleaning and cutting of nails and hair. Patients were strictly advised to use good, well-fitting, cobbler-made footwear.

2. **Pre-IMLD Yoga:** Following the *phanta* soaking, a series of yoga exercises were performed. A yoga therapist coached pre- and post-IMLD yoga exercises with special attention to posture and breathing coordination (9). A CD-ROM containing the complete details of yoga exercises is provided to the patients (10). Manual lymph drainage of central lymph nodes, a mandatory pretreatment procedure as part of CDP (7) was not performed in our patients. Instead, a series of Yoga exercises was done.
3. **Indian Manual Lymph drainage (IMLD):** Immediately following pre-IMLD, yoga patients were subjected to IMLD. Patients lay supine on a massage table and inguinal and popliteal lymph node massage was done as in CDP (7) followed by IMLD part 1 (*Unmardhana* – a type of non-oil massage) (11). IMLD-1 involves applying squeezing pressure using both palm and fingers beginning from the tip of the toes up to the upper border of the lymphedema. Non-oil massage is performed 10 minutes in supine position. Later IMLD part 2 (*Udhwarthana or Vimlpapana* – another ayurvedic technique of massage using oil) (12) was performed. The meaning of *Udhwarthana* is applying oil over the skin and making the movements over the body in *viloma gathi* (the movement in the opposite direction to hair growth) (13) but with more pressure than general massage (abhyanga). This technique includes smearing the selected oil (over 95% of patients presented the clinical features of *Kapha + Vatha*, hence oil selected was *Nalpamaradi thaila*) over the affected limb; then gripping it using both hands, the limb is massaged from distal to proximal ends with maximum pressure in a continuous sliding movement from tip of the toe to the upper border of the lymphedema. A spiral movement is made at the upper border towards the medial side of the thigh along the direction of the great saphenous vein (7). The cycle was repeated for 10 minutes each in supine and prone position. During the distal to proximal movement of non-oil and oil types of massage, the patients gradually breathe out or hold the breath after expiration. The patient takes a sudden and deep inspiration during the time gap between end and beginning of IMLD cycles. A masseur provided IMLD and coached the patient's home caregiver. After the IMLD procedure, the patient was asked to keep the limbs elevated 20-30 cm in the bed for 20 minutes (7).
4. **Compression Bandaging:** 20 minutes after IMLD, clean and dry cotton cloth (not "Elastomull") is wrapped around the limb in order to prevent soiling of the compression bandages. Long stretch compression bandages of size 8 cms and 15 cms manufactured by Dynamic Techno Medicals Aluva, Kerala, were used. Depending on the length and swelling of the limb, the number of the compression bandages used ranged from 2 to 8 per limb. The compression bandage was applied in a figure 8 manner as explained in CDP (7).
5. **Post- IMLD yoga:** Post-IMLD yoga is done wearing the compression bandage and on an empty stomach. The procedures from skin wash to compression bandaging were done in a sequence and the patient asked to take a break and consume food. Therefore, post-IMLD yoga *(Table 1)* is performed in a different session, morning or in the evening.
6. **Ekanga swedana:** The patients having the most severe limbs (warty changes and nodules over the skin) received two types

of treatment. One group (53 patients) received integrated treatment as 1-5 above, and the other group (31 patients) received 1-5 above and additional heating of the limb treatment called *Ekanga Swedana* (14). *Ekanga Swedana* is a special ayurvedic technique wherein steam created from water mixed with certain medicinal herbs is focused and sprayed over the affected areas. Ayurvedic doctor (P.E.M.) performed this procedure after *Vimlpapana*. A medicated steam of *khadira* (acacia catechu) (15) was used as described by Charaka (16). The steam is sprayed until the treated limb showed "beads of sweat" uniformly over the heated part and the patient was unable to tolerate further heat (17). The average time needed for appearance of these features is around 15 to 20 minutes. Patient then rests outside the procedure room at room temperature without using a fan, with foot elevation until the heat in the limb is comparable to other parts of the body and the sweat which appeared on the limb dries on its own (takes 30 to 45 minutes). Later compression bandaging was done as in 4 above followed by post-IMLD. These patients were not given *phanta* soaking care during the days of *ekanga swedana* but were advised to use the warm *phata* as domiciliary procedure.

During the two weeks stay in the hospital, the patient and a family member was trained to perform all these activities so as to carry them out at home. Handouts containing the details of the procedure and treatment were given in their local language. Comprehensive education about the importance of each component of therapy was given to every patient. Patients were strictly advised to stop antibiotics as a preventive measure for inflammatory episodes and diuretic furosemide (Lasix®) was discontinued unless the patient had signs of heart failure.

Domiciliary Therapy

Patients were asked to perform all these procedures every day for six months in the above sequence. In addition, they were advised to take two oral ayurvedic prescriptions for lymphedema and skin care, *Kanchanaraguggulu* (18) and *Mahamanjishtadi kwatha* (19), as recommended in the ayurvedic formulary of India (8).

Diet

Patients were advised to avoid weight gain and to observe restrictions in diet while on oral medications. A list of restricted and allowed dietary constituents was provided. In general, cold water and cool drinks, milk and milk products, black gram (bean), horse gram (bean), cashew nuts, ground nuts, tamarind (date), jaggery (sugar), and brinjal (eggplant) were avoided, and the diet was strictly vegetarian.

Follow Up

Patients were scheduled for follow up at 45th day, 104th day, 194th day from admission. During each follow up, the patients demonstrated all the treatment components that they were doing at home including all the exercises of yoga in order to perfect the procedures. A counselor spent an hour or more to educate patients about the treatment procedures and how entry points can precipitate inflammatory episodes.

Investigations

The patients attending the clinic had chronic lymphedema, mostly long ago treated with diethylcarbamazine (DEC). Therefore, peripheral blood collected at night was examined by fluorescent method to identify microfilariae. It was negative in all patients. Baseline lymphoscintigraphy was done in 4 patients. Indicators of improvement and complete physiotherapy parameters of the affected limb were recorded at baseline, at discharge from the hospital, during every follow up, and at the end of the treatment.

TABLE 3
Percent Reduction over Baseline Values at Fixed Time Intervals and Quantity Reduced in the Category Grade- Skin Thickened

Measuring points	14th Day		45th Day		104th Day		194th Day	
	%	Qty	%	Qty	%	Qty	%	Qty
Metatarsal	6.5	1.56**	4.6	1.12**	5.4	1.31**	4.3	1.06**
Mid foot	11.2	3.32**	10.7	3.20**	13.6	4.21**	14.2	4.38**
Ankle	10.0	4.05**	11.9	4.83**	13.9	5.86**	15.1	6.55**
End of calf muscle bulk	15.6	5.70**	17.2	6.45**	21.3	8.32**	23.4	9.07**
Maximum bulk	12.7	5.67**	9.8	4.71	22.0	10.26**	23.4	11.24**
Patellar region	5.9	2.45**	8.1	3.36**	0.7	-0.47	13.1	5.07**
Mid thigh	4.5	2.45**	5.9	3.18**	9.3	5.02**	8.1	4.40**
Maximum bulk standing	12.1	5.43**	16.7	7.60**	21.6	10.08**	22.8	10.94**
Volume by water displacement	16.5	1.27**	17.9	1.54**	26.1	2.23**	14.3	1.88*
Std error for volume	0.957	0.113	1.642	0.177	2.094	0.277	5.328	0.812

Qty=reduction in circumferential measurements in centimeters at each point; volume is represented in liters; **quantity reduced is significant at p<0.01 (based on paired t-test); *significant at p<0.05 level

Medical Records

Data entry was done in a booklet containing over 30 pages for each patient.

RESULTS

Statistical Analysis

The percent change over baseline outcome measures made at the time of the admission of the patient during the periodic follow up was calculated. According to the treatment protocol, patients had to be reviewed at discharge from the hospital (14th day) and during the follow up. Since the follow up was not at fixed intervals, as patients did not turn up on a regular basis, it was necessary to express the per cent change uniformly for easy comparison. Accordingly, the outcome measures for each patient were interpolated (not extrapolated from any earlier time point) for the 194th day using data recorded for patients during their second, third and fourth follow up visits. Based on the computed values of indicators, percent change over initial value was worked out. The difference in response between the three disease gradings was tested using analysis of variance. Paired t-test was used to test the changes in limb circumference measurement points observed at different time intervals (3). Longitudinal comparison of changes in measurements at fixed time intervals among the disease grades as well as within each disease category separately was performed by following "univariate analysis of variance" for the repeated measures data on those patients who had completed the fourth follow up visit (194th day). In the "univariate approach," linear combinations of the repeated measures were subjected to analysis of variance and the F-statistic was chosen based on validity of the "assumption of sphericity" (i.e., the transformed variables have a constant variance and are not

TABLE 4
Percent Reduction over Baseline Values at Fixed Time Intervals and Quantity Reduced in the Category Grade- Skin with Trophic (Warty) Changes & Received Integrated Treatment

Measuring points	14th Day %	14th Day Qty	45th Day %	45th Day Qty	104th Day %	104th Day Qty	194th Day %	194th Day Qty
Metatarsal	7.3	1.82**	6.0	1.12**	6.0	1.55**	5.3	1.42**
Mid foot	10.1	3.38**	10.0	3.20**	11.1	3.74**	13.7	4.33**
Ankle	12.5	5.95**	14.7	4.83**	16.5	7.94**	16.6	7.46**
End of calf muscle bulk	16.2	7.97**	16.9	6.45**	22.8	11.45**	25.7	13.18**
Maximum bulk	15.2	8.71**	19.4	4.71**	25.3	14.64**	28.2	17.07**
Patellar region	8.9	4.42**	11.1	3.36**	6.3	1.65	14.7	6.90**
Mid thigh	3.5	2.76**	4.6	3.18**	7.2	5.15**	10.8	6.22**
Maximum bulk standing	6.9	8.33**	5.0	11.39**	15.4	14.79**	28.1	17.48**
Volume by water displacement	19.7	2.34**	25.7	1.54**	31.1	3.78**	33.2	4.40**
Std error for volume	0.887	0.183	1.386	0.267	1.902	0.389	2.77	0.616

Qty=reduction in circumferential measurements in centimeters at each point; volume is represented in liters; **quantity reduced is significant at p<0.01 (based on paired t-test); *significant at p<0.05 level

TABLE 5
Percent Reduction over Baseline Values at Fixed Time Intervals and Quantity Reduced in the Category Grade- Skin with Trophic (Warty) Changes But Received *Swedana* (Limb Heating) over Integrated Treatment

Measuring points	14th Day %	14th Day Qty	45th Day %	45th Day Qty	104th Day %	104th Day Qty	194th Day %	194th Day Qty
Metatarsal	8.0	2.31**	8.1	2.43**	7.1	2.19**	7.0	2.18**
Mid foot	10.3	3.47**	10.1	3.46**	11.6	4.11**	11.3	4.06**
Ankle	10.4	4.72**	11.3	5.26**	12.5	5.83**	11.0	5.30**
End of calf muscle bulk	13.7	6.36**	14.5	6.96**	19.1	9.61**	15.1	6.56**
Maximum bulk	14.5	8.46**	18.2	10.89**	21.2	12.80**	20.6	11.36**
Patellar region	13.1	7.26**	16.0	9.23**	19.1	11.07**	15.1	8.70**
Mid thigh	10.0	6.49**	11.5	7.84**	14.6	9.99**	14.2	10.32**
Maximum bulk standing	12.4	7.53**	16.1	10.23**	20.5	12.74**	23.3	12.88**
Volume by water displacement	11.6	1.74**	20.6	2.94**	26.6	3.88**	27.9	3.42**
Std error for volume	5.86	0.061	1.657	0.388	2.059	0.534	2.457	0.483

Qty=reduction in circumferential measurements in centimeters at each point; volume is represented in liters; **quantity reduced is significant at p<0.01 (based on paired t-test); *significant at p<0.05 level

TABLE 6
Clinical Profile of Patients in All Grades (%)

Visit	History of Inflammatory Episodes	Consuming Preventive Antibiotics	Folliculitis	Intertrigo	Other Entry Points
Baseline	88.2	89.1	89.1	89.8	89.4
14th day	-	-	13.7	55.0	38.4
45th day	2.5	0.3	8.3	45.5	31.1
94th day	3.0	1.6	6.6	38.3	25.7
194th day	2.4	2.4	6.8	30.3	20.7

correlated) for testing the significance. Data preparation, computation of number of days between follow ups, and analysis of data were done using the software SPSS.

Percent reductions of measurements over baseline values and corresponding absolute differences (Qty) with statistical significance level for all grades at different stages of follow up are shown in *Tables 2-5* for patients belonging to all categories of grades.

Patients with skin grade trophic changes and receiving integrated treatment were compared to those patients having the same disease grade but receiving additional Ekanga Swedana (limb heating) treatment. At the end of the 14th and 45th day, significant difference was observed at patellar region and mid-thigh for Swedana group. Patients *(Table 1)* who completed treatment course significant reduction were observed for end-of-calf muscle bulk and maximum bulk in favor of only integrated treatment. However, differences between these two groups were non-significant for most parameters during successive follow ups.

Analysis of data on other clinical indicators revealed that the treatment was effective in providing comfort to patients *(Table 6)*.

DISCUSSION

This study was aimed at developing a primary level treatment for morbidity reduction that would be applicable to Indian rural communities where the disease is endemic, biomedical doctors are fewer in number, and population is mostly dependent on services of Ayurveda or other Indian systems of medicine. Our integrated patient care protocol was developed following the case report (4) and the perspective paper (2). Consensus on clinical evaluations (reverse pharmacology design) for studies in traditional medicine was adhered to (20,21). The important components in the protocol included skin care measures, breathing, and movement. These are described in Ayurveda and yoga, not necessarily for lymphedema alone:

Oiling and massaging of the affected limb aimed to improve the health of the skin and to maintain its hygiene (22). Yoga was used for its coordinated breathing and exercises mobilizing muscles and joints (7). Venesection or blood letting therapy *(rakthamokshana)* (23) described in Ayurveda for *shleepada* and many other diseases could promote venous emptying. Instead, compression therapy with compression garments of biomedicine replaced this invasive procedure

The patients were recruited over time and, therefore, *Table 1* shows different numbers for each follow up date. The volume reduction observed in all 322 limbs was gradual and progressive. *Table 7* and the graph shows the trend for 149 limbs that have completed 194 days. The univariate analysis

TABLE 7
Summary ANOVA of Repeated Measures for Different Disease Categories

Measuring Points	Grade: Skin Normal	Grade: Skin Thickened	Grade: Skin Trophic (warty)	Grade: Skin Trophic (warty) + received limb heating *(Swedana)*
Metatarsal	0.76	20.19**	23.58**	21.40**
Mid foot	10.20**	181.27**	139.55**	68.09**
Ankle	10.32**	387.98**	440.60**	169.16**
End of calf muscle bulk	27.63**	684.83**	1258.06**	218.65**
Maximum bulk	47.47**	’4336.67	2306.75**	547.25**
Patellar region	’22.05*	205.50**	384.91**	364.00**
Mid thigh	’35.34	200.51**	312.07**	489.89**
Maximum bulk standing	36.33**	1096.47**	2440.92**	593.04**
Volume by water displacement	0.72**	43.73**	133.38**	’205.4*

Mean sum of square (unadjusted) used for variance of different sized groups except where noted by “ ’ ” which used mean sum of square corresponding to the Greenhouse-Geisser adjusted F-statistic.
**=p<0.01; *=p<0.05

of variance of repeated measures for the measuring points at fixed time periods viz., baseline, 14th day, 45th day, 104th day, and 194th day, revealed that overall changes in measurements were significant for all parameters. However, the changes over time were not uniform across disease categories as indicated by the significant interaction effect. Subsequently, the changes were tested separately for each disease category and results are summarized in *Table 7*. Except for Maximum bulk in Grade, skin thickened and mid-thigh in Grade, and skin normal, the changes in measurements at the fixed time intervals were found to be significant for all parameters in the disease categories. It should be noted here that only in three instances was the assumption of sphericity found to be valid. However, the inference was the same irrespective of the text statistic except for four instances as indicated in *Table 7*. The pattern of change in different disease grades was further elucidated on comparison of mean values at different time intervals. The salient features observed were for all measuring points, the volume reduction followed a gradual and progress trend except for patients with grades of thickened skin and those patients who received additional limb heating *(Swedana)*. Although *Swedana* patients showed progressive reduction over the time interval, the response was different from the original integrated treatment. The patients receiving *Swedana* had steep decrease in volume at the level of mid thigh. This may be because several of them had debulking treatment earlier resulting in scar tissue below the patellar level. Hence they had large measurements for mid thigh at baseline. Volume reduction in Maximal bulk level for patients with skin thickened grade showed an increasing trend at 104th day (not more than the baseline) and later followed the same trend as other measuring points and grades. After discharge from the hospital, patients carried out the same

treatment protocol in village/domiciliary setting, including daily compression bandaging. Therefore, the hospital treatment may not be necessary, and with proper education and support, the treatment could be conducted entirely outside the hospital.

Additional *Swedana* (limb heating) treatment was not found superior to original integrated treatment. However, *Swedana* may have a role in the treatment of patients where response is poor or showing the worst skin damage.

In our experience, treating lymphatic filariasis at "research level" costs Rs4,867/- to Rs20,500/- for six months ($115.9 to $488) depending on the size and number of the limbs affected by the disease. Most of these costs come from the use of compression garments Rs3500/- to Rs16, 000/- ($83.4 to $381) for six months. The ayurvedic component in the treatment cost was $32.5

GAELF utilizes the services of doctors and allied health professionals trained in biomedicine, and patient education by a team of workers is the key to the management of lymphedema. This has to be culturally acceptable because touching and massaging is required for lymphedema management. Doctors of biomedicine have little or no orientation in the practice of such a regimen in rural communities. Ayurveda doctors also do not know much about lymphedema *(Shleepada)*. Yet, Ayurveda practitioners can contribute to lymphatic filariasis "morbidity control" because their curriculum teaches culturally acceptable and therapeutic actions/procedures adopted in our protocol. Endemic areas of filariasis in India have an adequate and sustainable distribution of ayurvedic doctors, Yoga teachers, and allied health professionals trained to give massage who can provide/teach this self-help procedure at home. Therefore, Ayurveda doctors and paramedical workers as active members of a team could be in the forefront for global elimination and morbidity reduction of India's multi-million cases of lymphedema who mostly live in rural and tribal areas because traditional Indian systems of medicine achieves the best patient compliance in these communities.

Full details on Ayurvedic methods employed and discussion based on the references in traditional literature are available as a Supplemental Appendix on the official web site of International Society of Lymphology (http://www.u.arizona.edu/~witte/ISL.htm).

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REFERENCES

1. Addiss, DG, C Mackenzie: LF disease–clinical management. Am. J. Trop. Med. Hyg. 71 (5 suppl) (2004), 12-15.
2. Vaqas, B, TJ Ryan: Lymphoedema: Pathophysiology and management in resource-poor settings - relevance for lymphatic filariasis control programmes. Filaria J. 2 (2003), 4 (www.filariajournal.com)
3. Ryan, TJ, SR Narahari, PE Mahadevan, et al: Proc of the National Seminar on evidence

based and integrated medicine for lymphatic filariasis, HIV/AIDS and other chronic dermatoses. IAD, Kasaragod, S. India, 2005.
4. Narahari SR, TJ Ryan, PE Mahadevan, et al: Role of Indian system of medicine in the management of filarial lymphoedema. Lymphology 37(suppl) (2004), 673-677.
5. International Consensus Statement of International Society of Lymphology released at the 19th International Congress of Lymphology, Freiberg, Germany, 2003. (www.u.arizona.edu/~witte/2003consensus.pdf)
6. Tyebkhan, G: A study on the pH of commonly used soaps/cleansers available in Indian market. Indian J. Dermatol. Venereol. Leprol. 67 (2001), 290-291.
7. Földi, M, E Földi, S Kubic: *Textbook of Lymphology*. Elsevier, Germany, 2003.
8. The Ayurvedic Formulary of India Part I: Department of AYUSH, Government of India, 1967.
9. Vivekananda: *Complete Illustrated Book of Yoga*. Crown Publishers Inc, New York.
10. Yoga exercises in Shleepada-IAD-Ryan regimen [CD-ROM]: Institute of Applied Dermatology, Kasaragod, India, 2005.
11. Astanga Hrudaya Sutra Stana, Chapter 2, Verse 11.5.
12. Astanga Hrudaya Sutra Stana, Chapter 2, Verse 14.
13. Haridas Shridhara Kasture's translation of Chakrapani's commentary on, Charaka Samhitha Sutra Stana Chapter 5 verse 93,94 In: *Ayurvedeya Panchakarma Vignan*, Baidyanatha Ayurveda Bhavana Ltd.
14. Charaka Sutra Stana, Chapter 14, Verse 66.
15. Sushrutha Chikithsa Stana, Chapter 9, Verse 70.
16. Charaka Sutra Stana, Chapter 14, Verse 43.
17. Astanga Hrudaya Sutra Stana, Chapter 17, Verse 15.
18. Sharngadhara Samhitha, Madhyama Khanda, Chapter 7, Verse 95-98.
19. Sharngadhara Samhitha, Madhyama Khanda, Chapter 2, Verse 137-141.
20. General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine: Who, Geneva, 2000.
21. Narahari, Sr, KS Prasanna: A Methodology for Clinical Evaluation of Existing Practice, Using Traditional Herbal Medicinal Formulations. Current Science, 76 (1999), 467-468.
22. Astanga Hrudaya Sutra Stana, Chapter 2, Verse 7.
23. Astanga Hrudaya Uttara Stana, Chapter 29, Verse 18-22.

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