



How Does Yoga Work in Lymphedema?

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Abstract

Lymphedema occurs when lymph vessel function is greatly impaired. The major cause of lymphedema is Lymphatic Filariasis and affects millions in developing countries. We used pranayama and yoga exercises as part of the integrative treatment for 2,239 patients affected by lower extremity lymphedema. Our studies showed that the lymph drainage achieved in these patients was plausibly because of breathing, movements coordinated with breathing and stimulation of autonomic system. Yoga offers a self-care management tool for lymphedema albeit there is lack of evidence that breathing actually achieves lymphatic drainage.

Introduction

The lymphatic system represents an accessory route through which fluid can flow from interstitial spaces into the blood. It drains those cells, proteins and large particulate matter which are not removed by blood capillaries [1]. Lymphedema occurs when lymph vessel function is greatly impaired due to blockade, gross dilatation or loss. The pathogenesis of the major cause of lymphedema, filariasis, involves a parasite that lives in the lymphatic collecting ducts near their lymph node termination and causes considerable dilatation. The mechanism is unknown. It was described by Sir Patrick Mason, the pioneer in the field of tropical diseases. Many others have noted such dilation and Young and Kinmonth showed such dilatation using Lymphangiography [2]. Lymphoscintigraphy is now the most common tool demonstrating not just filled lymphatics but also that there is a failure of flow. The original investigation was a combined Indian and USA laboratory approach [3].

We used breathing exercises (*pranayama*) and yoga coordinated with breathing as part of the integrative treatment for 2,239 patients affected by lower extremity lymphedema. The objective outcome measures showed highly significant changes (Figure 1) [4].

Indirect evidence: Vaqas and Ryan [5] wrote that there was a potential for the use of yoga and breathing as a way to empty the great veins of the thorax into the heart and promote central lymphatic drainage through the thoracic duct.

Breathing was known to be important for the cardiovascular system



Figure 1: Changes seen in lymphedematous limb after two months of integrative treatment. Patient had hammertoe deformity of left toe, outer rotation of right hip joint due to the compensatory movement. After two months these deformities reduced with volume reduction and skin changes. Yoga was an important component of treatment along with ayurvedic skin care treatments and compression therapy.

[6], and control of venous pressure [7] and by inference therefore for the lymphatic system. We hypothesized that the central lymph drainage could be achieved by using breathing exercises [5]. Lymph drains in to the venous system when intra-thoracic pressure decreases in inspiration, whereas expiration allows flow of lymph from extremities. We used yoga to replace central Manual Lymphatic Drainage (MLD) during the treatment of lower extremity lymphedema. MLD has long been used in Europe but there is no access to lymphedema therapists in rural India [8]. According to the current practice of lymphedema treatment central Manual LD is a prerequisite for achieving the peripheral LD [9]. The introduction of Fold's decongestive therapy and manual lymphatic drainage (MLD) showed how over filled lymphatic's in the limbs could be emptied by body movements (both active and passive) and using massage [9]. It also showed that peripheral lymphatic's cannot flow efficiently into overfilled central lymphatics. Thus attempts to do so by massaging a lymphedematous leg diverts lymph into the lymphatics of the scrotum [10] and is a well-known complication of intermittent pressure pumps used without first treating the central drainage system.

Controlled breathing along with contraction of rectus abdominus, diaphragm and inter costal muscles as in *Bhastrika*, creates pressure differences in both the abdomen and thoracic region. This pressure differences should allow lymph to drain towards the thorax. In *Ujjayi*, *anulomaviloma*, *suryabhedana*, *rechaka-kumbhaka* [11] the inhalation is prolonged. The strokes of continued exhalation in *Bhastrika* are aimed at completely emptying the thoracic cavity. If at the same time forceful movements over the abdomen from diaphragmatic and abdominal muscles cause maximum lymphatic emptying, this might allow unimpeded peripheral drainage. During artificial respiration, using 'tank respirator' expiration is caused when positive pressure develops around the body, negative pressure causes inspiration. Positive pressure inside the lungs impedes the flow of blood into chest and heart from peripheral veins [1]. Deep, slow, methodical breathing, as in *Ujjayi* and *rechaka kumbhaka* induces intra-thoracic pressure changes. Wen et

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Received May 17, 2013; Accepted July 29, 2013; Published August 02, 2013

Citation: Narahari SR, Ryan TJ, Aggithaya MG (2013) How Does Yoga Work in Lymphedema? J Yoga Phys Ther 3: 135. doi:10.4172/2157-7595.1000135

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al. [12] monitored the micro lymphatic pressure by using the servo-nulling technique at the forefoot skin in 24 healthy volunteers and in 27 patients with primary lymphedema. They recorded two patterns of pressure fluctuation: rhythmic low-amplitude (mean value 3.7 mm Hg) waves with a frequency identical to respiration (respiratory movements of the thorax recorded simultaneously by a photo cell) and spontaneous no rhythmic, low-frequency waves with higher amplitude (mean value 5.5 mm Hg) [12].

Our studies used indirect evidence such as volume reduction, improvement in QoL and gait corrections achieved by strengthening weakened muscles as indicators of lymph drainage (LD). We did not use any specific investigations to prove that LD had actually been achieved.

Literature search

To support our arguments we also searched literature. PubMed search using MeSH terms yoga AND lymphedema revealed 10 papers, six of them were from our institute whereas remaining four didn't describe the effect of yoga on LD. Another search using respiration OR breathing AND lymphedema revealed 10 more papers. Among them one paper discussed on LD and other was a case report. Remaining eight was not relevant to this review. In addition we examined the classical papers and previous narrative reviews [13] that didn't appear in PubMed.

Possible mechanisms

Peripheral LD is normally achieved by contraction of the lymphatic vessel wall, contraction of skeletal muscles, active and passive body movements, pulsation of arteries adjacent to lymphatics, fluctuations of central venous pressure, gastrointestinal peristalsis, respiration and compression of tissues as in compression therapy. Intrinsic forces of LD, or the active lymph pump, are the result of coordinated contractions of lymphangions, the morpho-functional units of the lymphatic vessels.

There are many disputed or unknown issues regarding the physiology of lymph transport in humans [14,15]. The lymphedema sufferer loses the capacity for the lymphatics to contract [16]. But some contractility can exist even in the most dilated as a response to stretching the smooth muscle fibres found in the wall of the collecting lymphatics [2], yoga can be used to stimulate the sympathetic nervous system [17]. Which is one of the controlling factors of the lymphatic vessel contractility? The difficulty is that all studies showing the effect of breathing have occurred in animals or fit humans. Studies of patients with severe lymphedema are lacking. We do not think it would be possible to determine what happens to skin lymph flow using lymphoscintigraphy. Recently measuring human lymphatic pumping using indocyanine green fluorescence lymphography was shown as an accurate as well as a safe, easy, and economical method. Indocyanine green lymphography is a convenient evaluation method that uses safe nonradioactive dye, which allows qualitative assessment of lymphedema condition in real time. 0.2 ml of indocyanine green is injected subcutaneously into the bilateral lower extremities at the first web space of the foot and the lateral border of the Achilles tendon. 12 to 18 hours after the injection, circumferential fluorescent images of LD channels could be obtained using an infrared camera system [18]. Increased density of lymph vessels in the skin is one way of indirectly assessing the improved lymphatic drainage in the absence of tumours [19].

The control of breathing affects the emptying of the great veins entering the heart in the upper chest. It is at this level of the venous system that the contents of the lymphatic system empty through the

thoracic duct into the blood vascular system. Any failure of emptying of the lymph vessels results in overload and consequent lymphedema. At this level, the effect of failure to empty is whole body lymphedema. But more local failure of veins to empty or lymphatic system to flow normally results in local overload of the drainage system and local lymphedema. This was first described in the 19th Century by central European clinicians and was reviewed by Ryan [20]. Hanzawa reported a case of whole body lymphedema resolving after relieving the obstruction in the thoracic duct [15]. Osteopaths have also believed in the importance of lymph flow and made a study of flow through the thoracic duct using abdominal and thoracic pump techniques in the dog [21]. It has been frequently confirmed [22]. Calnan and Kountz [23] were among many who in the last century showed an effect of venous obstruction on the function of lymphatics. Drake et al. used inflatable cuffs to increase venous pressure in the veins of the neck and portal vein in sheep and studied the effects of lymph drainage. Scrotal swelling drains through the abdominal lymphatics and once the lymphatics had returned to normal the scrotal swelling completely resolved [2]. We are not aware of any well controlled study that avoids surgery of the *scrotal swelling* by the use of conservative interventions such as breathing, elevation of the lower parts of the body, gentle compression and body movements. We do note however that prior to surgery, preparative maneuvers frequently reduce the swelling.

Conclusion

There is no evidence that breathing facilitates the lymphatic drainage in much dilated human truncal lymphatics. We could assume such over filled and dilated truncal collecting lymphatics are a major impediment to peripheral lymph flow. If breathing does empty these central lymphatics, it could be the important maneuver necessary to promote impaired lymphatic flow. This means yoga offers a self-care management tool for lymphedema [16]. However it is possible that deep breathing through autonomic effects [17] promotes lymphatic clearance by some other mechanism, e.g. opening up peripheral lymphatico-venous shunts? We also have to show that breathing empties central lymphatics. To do the latter we have to be certain that we have no impediment to flow from the inoculation site of indocyanine green during lymphography. We conclude that Indian Systems of Medicine have through our recent activities succeeded in the management of lymphedema. This should be hailed as one of the important advances of our time. After all there are at least 20 million persons whose quality of life is dismal and who now may have hope of an affordable sustainable and locally available therapy. If our questions lead to scientific proof of mechanisms and there is an increased utilization of yoga then the numbers benefiting could approach a billion because chronic oedema has multiple causes crying out for self-help interventions.

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Citation: Narahari SR, Ryan TJ, Aggithaya MG (2013) How Does Yoga Work in Lymphedema? J Yoga Phys Ther 3: 135. doi:[10.4172/2157-7595.1000135](https://doi.org/10.4172/2157-7595.1000135)

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