

DOES BREATHING HAVE AN INFLUENCE ON LYMPHATIC DRAINAGE?

Changes are caused to the intra-thoracic and intra-abdominal cavity pressures as we breathe, even when we breathe superficially, but especially with deep abdominal breathing. As the tidal volume increases, the diaphragmatic excursion will increase, causing a greater change in pressure in the thoracic and abdominal cavities, which is particularly pronounced with increased respiratory rate. Within these cavities are the great veins and larger collecting lymphatic trunks, both of which are capacitance vessels. Variation in intra-thoracic pressure can facilitate variation in venous return, not only from the trunkal area, but from the head and limbs as well as through the jugular/subclavian veins. The thoracic duct drains near the junction of the left jugular/subclavian vein, while the right lymphatic duct drains similarly into the right jugular/subclavian vein.

While we are certain about the impact of the phases of respiration on venous return, there is a great deal of uncertainty about the lymphatic system which is similarly structured and located. Associated with this is a reticence to ascribe any benefits to breathing in terms of its impact on lymphatic drainage.

Given the slow, rhythmical action of the larger lymphatic collectors, and their structural features and location within the thoracic and abdominal cavities, is breathing likely to have an impact on lymphatic clearance from those areas and, thus, from the limbs? NP

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Many patients who have had surgery and/or radiotherapy treatment for their breast cancer have a loss of muscle strength, pain on movement, and are often told to reduce their activity levels. Is this likely to be reducing the opportunity for lymph clearance from the affected tissues?

GC: In my opinion, this would certainly reduce lymphatic clearance. However, as a practitioner, if I had a patient with a decreased range of movement and a resultant loss of muscle strength, I would not tell them to reduce their activity levels. My treatment plans would be to try and return them to normal activity levels by addressing their shoulder mobility and increasing muscle power:

AL: There is generally a decrease in isometric muscle strength at six months post surgery. After one and two years, there is evidence of a decrease in strength of the flexors, adductors, and internal rotators of the shoulder. There is generally no change in gripping force. However, there is no evidence to suggest a relation between lymph circulation and modification of muscle force.

TR: Pain from trauma is relieved initially by immobility but, as we know from sports medicine, early controlled mobilisation is also helpful in reducing swelling and, one may suppose, involves the lymphatic system. It is often facilitated by warm baths of water or wax, but never do the patients just lie in the water or wax without moving. Studies of clearance and nodal uptake show that lymphoedematous tissues clear less well than healthy tissues. They do not show that there is no response to movement.

Given that variation in intra-abdominal and intra-thoracic pressure changes venous return rates, what influence do you believe these might have on lymphatic drainage, especially through the thoracic duct?

GC: As far as I am aware, there have been several studies (Browse et al, 1971; 1974) looking at exercise and deep breathing and their relationship with improving the emptying of the lymphatic trunks into the venous system and enhancing emptying of the thoracic duct, so I feel that it has a positive effect on lymphatic drainage.

AL: The influence of breathing on the thoracic duct has not been demonstrated. My colleagues and I have investigated this influence, and also the influence of osteopathic manipulations by means of lymphoscintigraphy, but we did not measure any influence of these techniques on the thoracic duct flow (unpublished work).

TR: Tests on animals have shown an effect on promoting flow through the thoracic duct in healthy animals (Dery et al, 2000; Drake et al, 1998). The question is whether these effects exist in humans with abnormal lymphoedematous states. This has not been demonstrated because opening up the chest to examine it would be unethical. There are many human studies on breathing and cardiac function, and also on venous pressure. In animals, it is high venous pressure that tends to inhibit lymph flow in the thoracic duct. Lowering venous pressure by breathing is well understood.

Could it be possible to optimally coordinate variations in tissue pressures in the limbs (through exercise or isotonic/isometric movement) and the respiratory cycle to improve lymphatic drainage?

GC: I am sure that it would be possible, however, I am not sure how much of a difference it would make. It has always been my opinion that it is better to teach patients the most straightforward exercises, since it can be difficult at the best of times, to get them to comply. I tend to teach exercise in functional patterns

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of movement and, at times, incorporate breathing patterns, but it depends on the patient. I have also recommended exercise for relaxation purposes.

AL: This has not been investigated. However, a major difficulty is in finding a way to accurately and consistently measure pressure in the tissues during muscle contractions.

TR: It is possible and the Ayurvedic system of management of lymphoedema does this all the time. Studies of 250 plus patients in a unit in Kerala, with which I am associated, use Indian Ayurvedic movement posture and massage simultaneously. All movements require that the body is positioned so that the thoracic girdle does not sag, and the pelvic brim is not thrust forward due to a backward tilt. You either lie down or sit up straight. Breathing is mostly expiratory, as in chanting, and every breath coincides with movements of the tissues. It seems to me common sense, even if currently unproven, not to try and empty the tissues by movements against impediments such as filled central lymphatics or constrictions and compressions due to bony protrusions.

A number of studies have shown that activity and exercise can help in the resolution of lymphoedema. Given that this should add additional load to a compromised lymphatic system, why does the lymphoedema often not worsen, or even improve? Is this likely to be related to the deeper respiratory excursions, or some other factor?

GC: I have not been aware in my patient group that the worsening or improvement to lymphoedema has been related to the effect of respiration. I have assumed that it is related to activity levels before surgery and the way they are increased. Patients who were active

before surgery and who resume their activities post-op do well, and those patients that I have tried to encourage to increase their activity levels do well if they undertake a slow build up of activity. At times, patients report a slight increase in oedema after exercise, and I normally advise them to reduce the level a little and build up again. I have had a few patients who have been very active (marathon runners) and, although at risk of lymphoedema, have had no signs of oedema until they decreased their activity levels. I would certainly be an advocate of exercise as an important way of managing lymphoedema. Certainly for patients with lower-limb chronic oedema — particularly older people who are in the community — the effects of immobility and decreased exercise is a huge problem and a difficult one to address.

AL: The muscle activity increases the deep lymph flow and has less effect on the superficial flow. Oedema is generally superficial. Muscle activity is very efficient when the limb is wrapped (Leduc et al, 1989). Muscle activity is more efficient when the limb is bandaged. The bandage helps the superficial oedema, therefore combined treatment is necessary.

TR: It is the difference between 'exercise' and 'movement'. Exercise, as used to increase cardiac output, raises venous pressure. In some cases of lymphoedema, where there is mechanical obstruction due to scarring, or to the iliac vein as it passes over the pelvic brim, there is good reason why vigorous exercise might significantly increase venous pressure and further obstruct sometimes greatly dilated lymphatics.

If controlled or patterned breathing is likely to be of benefit in managing lymphoedemas, do you think it might work best for the arms or the legs?

GC: I have always felt that it is of benefit to all groups of patients, whether it be upper limb, lower limb, trunk or genital oedema, and I think that it is important to teach all patient groups.

AL: Our scintigraphic investigation showed that 'abdominal breathing' has no effect on lower-limb lymph circulation.

TR: It mostly improves central drainage of dilated core lymphatics. Unless these are emptied, both arms and legs will remain undrained.

Given your knowledge of the structural and functional relationships of the lymphatic collectors with their surrounding structures, what breathing pattern (if any) do you think might promote optimal movement of lymph through these vessels, both within the limbs and the abdominal and thoracic cavities?

GC: I have always believed that diaphragmatic/abdominal breathing promotes the optimal movement of lymph and teach this to my patients, often with a degree of resistance applied by hand.

AL: My team have investigated the influence of abdominal breathing on intestine lymphatics in patients with Klippel-Trenaunay syndrome. We have measured an increase of proteinaemia. But, the investigation was only performed on two patients. I have no experience of the influence of breathing on upper-limb lymph flow.

TR: Peripheral and core lymphatics need a combination of influences from posture, movement and central emptying. Some of this is the transmission of movement from the trunk of both diaphragmatic and costal movements, both inspiratory and expiratory. Venous emptying probably best results from deep inspiration and prolonged expiration, as in chanting.

CG: I don't see pneumatic compression as having much of a role in lymphoedema management.

AL: ...It may be that thoracic breathing could have an influence on upper-limb lymph flow.

TR: Lymphoedema patients tend to be immobile and never take a deep breath.

What would you see as the definitive study which would establish a particular breathing pattern's role in lymphoedema management?

GC: To be honest, I think that it would be a really complicated study with far too many variables, and I am not sure, with so many other areas of lymphoedema management needing research, that this would be the most valuable use of research money. However, my background is as a therapist and not as a researcher, so maybe I am not best placed to answer this question.

AL: Limb (upper and lower) scintigraphy carried out during different breathing techniques on patients with lymphoedema compared with a control group may provide an insight.

TR: The new technologies (computed tomography [CT] scans, lymphosyntigraphy, magnetic resonance imaging [MRI]) which reveal both what is happening in the chest and in the periphery, need to be recruited and used in healthy and lymphoedematous subjects.

Do you think attention to our breathing patterns could make other lymphoedema treatments more effective? An example of this would be breathing out when a pneumatic compression pump on the leg is in its compression cycle.

GC: I am not sure if it would make treatments more effective. I feel that teaching diaphragmatic breathing is important and that time should be spent on this. I personally do not think that pneumatic compression has a role in lymphoedema management and a study by Boris et al (1998) showed an increased risk of genital oedema associated with use of pneumatic

compression. However, it may be of some use for dependent/venous oedema and in a palliative care setting in conjunction with MLD and careful monitoring. I cannot envisage how patients could coordinate their breathing to the pump's cycle. It would be too long and complicated and would produce insubstantial results.

AL: To date, there have been no investigations in this area that would lead me to draw conclusions either way. However, intermittent pneumatic compression (IPC) is part of the International Society of Lymphology (ISL) Consensus Document for the treatment of lymphoedema (ISL, 2003).

TR: Yes I do! It is unwise to use a pneumatic device on the lower limb without first emptying core lymphatics. It makes genital oedema worse. Genital lymphatics drain to the back of the abdominal wall, which is massaged effectively by yoga exercises and diaphragmatic breathing. Not to make some attempt to promote emptying of this region before emptying oedematous legs seems to me a certain way to divert leg lymph into the genitalia.

Do you think our breathing patterns at rest and during/after exercise have any influence on lymphatic drainage?

GC: From a practitioner's point of view, I always try to encourage patients to perform diaphragmatic breathing before and after exercise, and intermittently when at rest. I have always felt that post-exercise is the time when the lymphatic system is under more pressure, so advise patients to spend time then for simple lymphatic drainage (SLD) and deep breathing. However, I think that it is valuable for patients who are not active, as well as those who are, to perform deep breathing on a regular basis.

AL: It may be that thoracic breathing could have an influence on upper-limb lymph flow, but our investigation on lower-limb lymph flow has demonstrated that breathing had no influence. Investigation is needed to confirm the effects of breathing on upper-limb lymph flow.

TR: Yes, for all the reasons mentioned earlier: Lymphoedema patients tend to be immobile and never take a deep breath. In my clinic in Tanzania, I take students on to a balcony to look down on the waiting rooms. Even though the limbs are covered, it is possible to pick out patients with lymphoedema because over the course of 15 minutes they often do not move, even a little. If you tell them about breathing and they notice you watching them, they waggle their toes and take a deep breath.

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