

Chapter 9

LYMPH CIRCULATION

About 1.5 to 3 liters of lymph per day circulate through the thoracic duct. The total circulation of lymph, including tissue lymph that passes through veno-lymphatic anastomosis (in the lymph nodes for example) has yet to be precisely measured.

Body functions that promote circulation of lymph, or "lymphokinesis," are called lymphokinetic functions.

Lymphatic circulation is often divided into two parts:

- The superficial lymphatic circulation, just under the dermo-epidermal junction. This is a very significant part of the total lymph circulation; for instance, in the limbs, superficial lymph circulation accounts for about 70 percent of all lymph flow. This circulation is not directly stimulated by exercise.
- The deep circulation of the muscles, below the fascia, and the very deep circulation of the viscera, which is stimulated by muscle contractions.

The superficial and deep systems appear anatomically distinct from one another. Connections between the two systems have been determined, especially under pathological conditions.

Body functions that promote circulation of lymph are called lymphokinetic functions.

ACTIVE LYMPH PUMP: THE LYMPHANGIONS

The muscular units of the lymphangions contract in humans at an overall pulse rate of about 5-8/min. at rest (Olszewski, 1979; 1980). This rate may be higher during exercise.

Lymph diastolic pressure can range between 0 and 1 mmHg, while contractions produce waves of 3-5 mmHg.

The rhythmic contractions of the muscular units forming the lymph collectors are central to the lymph circulation. These tiny muscular structures form part of the lymphangions or "little hearts" of the lymph (Mislin H., 1961). They consist of 2 or 3 layers of spiral muscles and produce peristaltic waves of contractions mediated by the autonomic nervous system. Lymphangions have a natural automotoricity (lymphangiomotoricity), a sort of peristalsis not correlated to the heart rhythm (Smith R.O., 1949; Rusznyak L., Földi M., Szabo G., 1967).

The factors that effectively boost lymph circulation are very few. "...[T]he spontaneous contractility of the lymphatic is the cardinal force propelling lymph forward."

*Olszewski W.L., Engeset A.
1980; Wang G.Y., Zhong S.Z.,
1985.*

When stimulated, the action of these tiny muscles can increase the flow through the lymphatic system by some twenty to thirty times. This rate of maximally stimulated lymph flow is called the "maximum transport capacity" (MTC).

A multitude of stimuli can influence the contractions of lymphangions: mechanical (amount of fluid entering the lymphatic vessels, pressure, stretch, etc.), caloric (increased temperature increases frequency of contractions), ionic (calcium, sodium, potassium, etc.) (Cotton K.D. et al, 1997), chemical (dopamine, prostaglandins, ATP, G-Proteins, Substance P, etc.), hormonal (epinephrine, norepinephrine, etc.), pharmacological (acetylcholine, caffeine, nicotine, procaine, etc.), and neuro-electric (from the splanchnic nerve, sympathetic lumbar trunks, etc.). The effect of an agent on the lymphatic system does not necessarily correspond to its influence on the blood system.

PASSIVE LYMPH PUMP: FACTORS RELATED TO EXTERNAL STRETCH RECEPTORS

- *Respiration*

The movements of inhalation and exhalation of the diaphragm and the thoracic cage, and the negative pressure of the thorax central venous pressure, have been documented as having a strong influence on the flow of lymph in the thoracic duct (Riemenschneider P.A., Shields J.W., 1981; Shields J.W., 1980).

The negative intrathoracic pressure during inspiration creates a "respiratory pump" which helps to discharge lymph into the central veins. The volume of lymph that is "pumped" into the large veins depends on the depth of inspiration and the overall breathing rate. That is why it is useful to ask the patient/client at different times during the session or during exercises to breathe deeply, as during the initial relaxation and "deep abdomen" work. Laughter can similarly stimulate lymph drainage.

- *Skeletal muscle contractions*
- *Peristalsis of the visceral smooth muscles*
- *Contractions of adjacent arteries*
- *Active or passive mobility of limbs*
- *External compression*, e.g. the external pressure used in Lymph Drainage Therapy or the pressure of water during swimming, or the external counterpressure exerted by bandages

Exercise stimulates many of these factors. During exercise, drainage of the skeletal muscles (deep lymphatic circulation) increases by 5 to 15 times (Guyton A.C., 1985). The drainage of the skin (superficial lymphatic circulation) is not directly affected by exercise, so LDT is particularly helpful for stimulating the superficial circulation.

PASSIVE LYMPH PUMP: OTHER FACTORS INHERENT IN THE LYMPH SYSTEM

Other factors inherent in the lymph system having an indirect effect on lymph circulation:

- Anchoring filaments (help efficient absorption of interstitial fluid)
- Valves (prevent backflow)