Lymphatic Considerations of the Abdomen/Pelvis in the Hospitalized Patient
Hugh Ettlinger, DO, FAAO

“If this be true we must keep them normal all the time or see confused nature in the form of disease, the list through. Thus we strike at the source of life and death when we go to the lymphatics.”

The body’s response to disease
- Local – Inflammation
- Humeral – Immune
- Nervous System – Spinal cord reflexes
- Central – Hypothalamic/pituitary/adrenal axis
Role of lymphatics in inflammation

- Antigen – the lymphatics carry antigen to the lymph nodes where the immune response is initiated. This is particularly important in infections.

Circulatory Considerations

- Inflammation produces a change in capillary permeability which allows a large protein efflux into the interstitium.
- This produces an inflammatory exudate, which can only be drained via the lymphatics.

If we think and use a homely phrase, and say that disease is only too much dirt in the wheels of life, then we will see that nature takes this method to wash out the dirt.

As an application, pneumonia is too much dirt in the wheels of the lungs. If so, we must wash it out; nowhere can we go to a better place for water than to the lymphatics.
Role of lymphatics in inflammation

- Resolution of the Inflammatory process
- The lymphatics are central to the progression and resolution of inflammation
- Impaired or inadequate lymph drainage is implicated in chronic inflammatory diseases, as well as fibroic diseases

Resolution of the inflammatory process

- Many if not most inflammatory mediators are broken down in the systemic circulation. They are brought there by the local lymphatic drainage.
- The progression and ultimate resolution of the inflammatory process with healing will depend on efficient lymphatic drainage.

Resolution of the inflammatory process

- Neutrophils are responsible for the lysozymes that produce most of the tissue damage during inflammation.
- Their removal is critical to resolution of inflammation. They are removed by macrophages which phagocytise them.
- These macrophages are removed from the tissue via lymphatic drainage.

Mechanics of the lymph circulation

- Terminal – drainage of thoracic duct into the subclavian vein.
- Vascular – the movement of lymph through the lymphatic vessels.
- Formation – the movement of extracellular fluid into the initial lymphatic

Thus it behooves us to handle them with care, for by and from them a withered limb, organ or and division of the body receives what we call reconstruction, or is builded anew.

A.T. Still
Philosophy of Osteopathy, p. 105
Mechanics of the lymph circulation

- Terminal – drainage of thoracic duct into the subclavian vein.
- The Respiratory/Circulatory model – J. Gordon Zink, DO

“The cardiogenic aspect of circulation depends on the respirogenic aspect of circulation to complete the circuit. But that is not all; the most important feature is the fact that ‘terminal’ lymphatic drainage into the venous system is also dependent on this effective diaphragmatic respiration when the patient is resting.”


Terminal lymph drainage

- Respiratory/circulatory function
  - J. Gordon Zink
  - 35 – 60% of thoracic duct flow is produced by respiration
    - Pressure changes in the thorax
    - Relation of crus to cysterna chyle
    - Venturi effect
    - Effect on lymph formation


Negative intrathoracic pressures produced by respiratory excursions move venous and lymphatic fluid back to the heart.

Central Lymph

The venturi effect:

The entrance of the thoracic duct at the junction of two central veins reduces the pressure against which lymph must drain.
Central Lymph

- Crura act as pump for cysterna chyle.
- Crura may obstruct flow when tense (goat and boulder parable)

“The treatment of the lymphatic system must always begin by securing ‘terminal drainage’ by way of insuring a good abdominothoracic venous pump. Venous stasis may precede lymph blockage, but it is the lymphatic disturbance that spells disaster to the tissues.”
J. Gordon Zinc, DO The Osteopathic Holistic Approach to Homeostasis, AAO Yearbook, 1970, p. 4

Vascular Lymph Flow

- “The lymph stream is readily checked in many ways. The vessels are pliable and readily compressed.”

Vascular lymph flow

- Lymphangion – a unit with smooth muscle and valves
- Has intrinsic peristaltic action
- Can generate enough pressure to account for all intravascular lymph movement
Vascular lymph flow

- Lymphangion – a unit with smooth muscle and valves
- Has intrinsic peristaltic action
- Can generate enough pressure to account for all intravascular lymph movement
- Can be obstructed with increased tissue tension/somatic dysfunction

- Aukland & Reed. Interstitial-lymphatic Mechanisms in the control of Extracellular fluid volumes Physiol. Reviews 73, 1993

- Mechanical and electrical coupling
- Electrical – spontaneous, rapid, propagates in both directions
- Mechanical – Filling stimulates pacemaker via stretch, slow, unidirectional

Vascular lymph flow
- Lymphangion – a unit with smooth muscle and valves
- Has intrinsic peristaltic action with a pacemaker
- Sympathetic Innervation
  - Alpha receptor dominant
  - Will increase contractility
- Humoral influences


Vascular Lymph Flow
- Lymphangion – a unit with smooth muscle and valves.
- Has intrinsic peristaltic activity with pacemaker.
- Able to account for all movement of lymph through the vessels.

Lymph Formation
- There is a small uphill hydrostatic gradient which must be overcome for extracellular fluid to move into an initial lymphatic.
- This may be the limiting factor in overall lymph flow.
- External forces are necessary for lymph formation.

Vascular Lymph Flow
- Sympathetic Innervation
  - Effect is small enough that researchers suggest the innervation is more to modulate immune function than affect flow.
Circulatory forces (the hydrostatic and osmotic gradients which produce capillary exchange) dissipate almost immediately beyond the edge of the vessel.

These (starling) forces do not account for the movement of fluid through the interstitial matrix (gel) where cellular respiration takes place. By the time fluid reaches the lymphatic, there is actually a small uphill gradient which must be overcome for lymph to form.

There is an interstitial mechanism, which includes tissue movement and fluctuation of extracellular fluid, that functions to promote interstitial interchange and facilitate cellular respiration.

Lymphatics develop in the interstitial space, and in the presence of this interstitial mechanism, and develop and adapt to utilize these forces for the formation of lymph.

Anchoring filaments produce a change in volume with alternating movements in the local interstitial tissue.

Respiratory excursions produce lymph in the lungs.
Peristaltic contractions, as well as movement of the diaphragm forms lymph in the abdomen.

Arterial pulse creates a small fluctuation of fluid in the immediate vicinity of the arterioles. Many lymphatics are found in this area. Pulse has been shown to produce lymph in these vessels.

Lymph Formation
- There is a small uphill hydrostatic gradient which must be overcome for extracellular fluid to move into an initial lymphatic.
- This may be the limiting factor in overall lymph flow.
- External forces are necessary for lymph formation.
- This is where the “lymph pump” is applied.

The definition of the word fluctuation in my concept is that which is in Webster’s dictionary, “the movement of a fluid within a natural or artificial cavity observed by palpation of percussion.”

W.G. Sutherland, TSO p.13

Lymph Pump
- A well designed study demonstrated lymph pump to be vastly more effective increasing lymph flow when done over the area of swelling, ie. Lymph formation, compared to the area of vascular flow.
- McGeown, et.al. The role of External Compression and Movement in Lymph Propulsion in the Sheep Hindlimb J Phys (London) 387, 1987
Lymph Pump
- The effect on lymph flow was rate and amplitude dependent.

Regional Lymph Drainage
- Abdomino/Pelvic peritoneal drainage
- Gastrointestinal Lymph drainage
- Genitourinary Lymph drainage

The Abdomen/Pelvis is a single container, that serves and supports the function of the GI and GU systems. It’s roof is the Diaphragm, floor is the pelvic diaphragm, with significant support from the posterior abdominal wall.

The Diaphragm as a Sponge
- Peritoneal fluid drains upward to the undersurface of the diaphragm
- Stomata
The Diaphragm as a Sponge

- Lacune

- Prelymphatic channels

Drainage of the GI System

- 3 regions, based on development (foregut, midgut, hindgut)
  - Celiac
  - Superior mesenteric
  - Inferior Mesenteric

- All neurovascular structures enter and exit through the mesenteries

Drainage of the GI System

- Celiac
Drainage of the GI System

- Inferior Mesenteric

Vascular lymph flow

- Can be obstructed with increased tissue tension/somatic dysfunction.
- The GI system drains through the roots of the mesenteries

Central Lymph

- Fluid ends up in the Aortic nodes on the posterior wall, then enter the Cyeterna Chyle.
- The GI system accounts for > 50% of all lymph flow

Drainage of the GU System

- Reproductive organs
- Most drain to External and internal iliac nodes, then on to Aortic ascending to Cyeterna Chyle

Drainage of the GU System

- Reproductive organs
- The perineum, as well as cervix and lower uterus have drainage pathways to the inguinal nodes
Drainage of the GU System

- Urinary system
  - The kidneys drain to the hilum, then follow the renal vein where they join the drainage from the upper ureters at the aortic nodes, which eventually end at Cysterna Chyle.

The Diaphragm as a Sponge

- Lymphatic Fluids converging at the Diaphragm
  - Peritoneal
  - Gut tube
  - Posterior body wall
  - Pelvis
  - Lower Extremity

Central Lymph

- Respiration involves coordinated action of the diaphragm, pelvic diaphragm, anterior and posterior abdominal walls.
- Lymph rises to cysterna chyle along the psoas

Clinical Considerations

- Reproductive organs
- Millard used exam of the inguinal nodes as a means of distinguishing PID from appendicitis

Millard

- “I have based my diagnosis… as to the appendix upon the state in which I found the Inguinal nodes”
- “…the almost set type of glandular inguinal enlargement found in Gonorrhea”
Clinical Considerations

- Fibroid Uterus
- PID
- Endometriosis
- Prostatis

Clinical Considerations

- Pyelonephritis
- Nephrolithiasis
- ?Chronic kidney disease

Clinical Considerations

- Cholecystitis
- Hepatitis
- Gastritis/ulcer
- Diverticulitis
- Appendicitis
- POST-OP
- All Acute illnesses
- Chronic illnesses

Clinical Considerations

- Inflammatory Bowel Disease
  - Obstruction of Intestinal lymphatics produces bowel changes strikingly similar to IBD

Clinical Considerations

- Inflammatory Bowel Disease
  - Numerous Authors have theorized that IBD is a consequence of Lymph obstruction and/or dysfunction.
  - The theory is that gut inflammation leads to fibrosis with consequent lymphatic obstruction, which leads to recurrent, more severe inflammation and subsequent bowel damage.
Clinical Considerations

Inflammatory Bowel Disease

Pancreatitis
- In normal functioning, pancreatic lymphatics do not carry pancreatic enzymes or insulin
- During experimental pancreatitis, pancreatic enzymes are found in high concentrations in lymph effluent.

- Obliteration of Pancreatic lymph vessels can lead to fatal necrotic pancreatitis

Pancreatitis
- Lymph drainage has been shown to dramatically reduce the tissue damaging effects of pancreatic enzymes with obstruction of the main pancreatic duct in dogs.

Pancreatitis
- In chronic pancreatitis, there is evidence of fibrosis with obliteration of lymphatics, reducing the capacity of lymph drainage of the pancreas, potentially predisposing to and/or increasing the severity of future attacks

The science of osteopathy is simple. You realize you are a mechanic of the fluids of the body, as well as of the skeletal system.
- W.G. Sutherland, TSO p.127
Without this cautious procedure, your patient had better save his life and money by passing you by as a failure, until you are by knowledge qualified to deal with the lymphatics.

- A.T. Still
  Philosophy of Osteopathy, p 105