Your Lymphatic System in Health & Disease

Professor Neil Piller,
Director, Lymphoedema Research Unit
Flinders Medical Centre

Dr Vaughan Keeley,
Consultant in Palliative Medicine, Lymphoedema Clinic,
Derby Hospitals NHS Foundation Trust, UK
Your Lymphatic System in Health and Disease
About me

- **Professor in area of Lymphology**, Dept Surgery, School Medicine, Flinders University
- **Director, Lymphoedema Research Unit**, Dept. Surgery, Flinders University, Adelaide, South Australia
- **Coordinator** Year 2 HPS, Year 1 Electives, and Advanced studies in the MD Program, School of Medicine,
- **Director** International Lymphoedema Framework (UK)
- **Executive Member** International Society of Lymphology (USA)
- **Executive Board member** International Union Phlebologie
- **President** 22nd Internat. Society of Lymphology Congress
- **Australasian Editor** “Lymphatic Research and Biology” (USA)
- **Clinical Sciences Editor** “Journal of Lymphoedema” (UK)
- **Editor** International Journal of “Lymphology” (USA)
- **Editor** “American Journal of Phlebology” (USA)
- **Advisory Editor** “US- Chinese Journal Oncology/Lymphology”
Remember?
Well – things are better now!
We must pay more attention to the lymphatic system

- All men and women who have surgery and or radiotherapy are at risk of developing LO
- 5 to-30% develop clinically manifest lymphoedema (arm, leg or breast generally)
- Some people are born with a poorly functioning lymphatic system and this influences risk.
- Early Advice can reduce Lymphoedema risk
- Early signs of Lymphoedema can be detected
- Early intervention can reduce the severity of Lymphoedema and patient/health system costs
More reasons!

- The lymph system is a sewer – it must flow!
- Good lymph flow needed for cell health
- Slow lymph flow means more fat deposits
- Reduced lymph flow means more infections
- The lymphatics “master-mind” all immune responses
Overview of the System Drainage
Think Holistically! Fluid from the legs must drain into an area near the left shoulder!
Organisation of the superficial lymphatic system

Skin

Muscle
Functioning of the lymphatic system

KEY POINT

Accumulated fluids must be helped to enter and move along lymph vessels
Lymph Collectors

- Beat about 6-10 times/min
- Beat rate varies with load
- Most above our muscles
- Constrained by fibrous tissues
- Constrained by external pressure
The problems of fibrosis preventing pulsation
Lymph Nodes

- Lymph contents changed
- 30% lymph taken up into the veins
- Important for body defence against bacteria

What happens when we massage these nodes?
The parts of the Lymphatic System

General drainage areas are called Lymphatic Territories

Each Lymphatic Territory separated by boundaries called Watersheds
Territories and Watersheds
Trunk and legs
Factors which may damage the lymphatic system: Surgery
Factors which may damage the lymphatic system: Radiotherapy

Reduces potential for lymph capillary regeneration

Reduces ability of lymph collectors to pulsate

Reduces lymph flow through area
Factors which may slow lymph flow: Being overweight
Lymphoedema – Where the changes occur – near the surface of the body.
Lymphoedema and Oedema

Key differences

Making the lymphatic system work better can help both
About Lymphoedema
Pre disposition to BCRL
(Stanton, Mortimer, Modi et al, 2011)

- A simple “stopcock” mechanism does not always explain LO
- Lymph flow greater in those with LO
- Lymph flow higher in contra lateral limb
- BCRL more prominent in those with higher lymph flow!
- Lymph pressures lower in those with LO
Development of Lymphoedema

Three major stages

- Fluid
- Fatty/fluid
- Fibrous/fatty
Detecting lymphoedema
Lymphoedemas (primary and secondary)

With earlier detection and recognition we hope these pictures are ones of the past.
Early Detection can make a difference

- Treatments are much simpler
- We are dealing mostly with fluid
- Patients can manage with good information
Detecting Local area Fluid

- Pitting
  - Can (but most often don’t) test each territory
  - Pressure ideally applied for at least 30 s

- Three types (free, osmotically + physically trapped)
Detecting Local area fluids
Di-Electric Constants:

Fluid levels in specific area (lymphatic territory) at varying depths depending on head
Detecting whole limb fluids: BioImpedance (BIS)

Fluid means current problems
Early assessment with BIS

BIS out of normal range

Self-report

Volume


8 months
**Stemmer Sign – Detecting Fibre**

Positive Stemmer Sign – Skin fold cannot be picked up

A rough indication of fibre/fatty tissue buildup
Evolution of Indurometry

Mechanical Indurometer

Electronic Indurometer

Visco-elastic Indurometer
Treating Lymphoedema
Lymphoedema
A problem of balance

Load

Transport Capacity/Flow
Factors which contribute to Lymph Load

- The skin (as a barrier)
- Hypertension (high blood pressure)
- Strength of small blood vessels
- Infection of wounds, cuts and scratches
- Weight and fats in diet
- Venous system issues
Factors which determine Lymph Flow

- **Load** (greater load = greater flow)
- **Activity** in skeletal muscles
- **Pulsation** frequency of lymph collectors
- **Pressure** in chest and abdominal areas
- **External pressure** (variation) on vessels
Minimising the problem external pressure of Clothing
Normal under Bra Pressures
(the force it takes to remove pressure from the skin at indicated sites)

Under bra strap pressure
245 gm +/- 134 gm

Anterior chest wall
105 gm +/- 89 gm

Side panel pressure 270 gm +/- 145 gm

Under wire pressure 300 gm +/- 125 gm
Just Deep Breathing can help!

Coordinated arm exercise & deep breathing + rest breaks

Figure 1.

- **a.** starting position: person starts taking a deep breath in whilst moving the arms slowly & gently outwards.
- **b.** when the arms reach full extension the breath is held in. All the arm muscles are then tightened.
- **c.** the arm muscles are relaxed and the arms move back to the starting position whilst the breath is exhaled out.

Variation in intrathoracic and tissue pressures

Aqua Therapy

- All forms of water based activity and exercise
  - Helps vary tissue pressures
  - Provides graded external compression
  - Can control temperature
  - Support for body and tissues
Exercise and activity is generally discouraged in lymphoedema patients

But Exercise is GOOD!
Exercise and activity is great but …

Avoid carrying heavy objects for a long time
Before any treatment a good assessment can help identify areas of fibrotic tissue
Scanning and Hand held Laser and light
All forms of lymphatic massage can help

What follows are some of the research findings from our group
Massage and any form of tissue movement will vary tissue pressure and help uptake and movement of lymph
Know how to help lymphatic Drainage

Proximal sites must be cleared first

It should be part of a patient’s routine
Hand held massage units
(person or machine based)
Compression compliments
Massage
**Garments** - Choose the right type and ensure the right pressure, gradient, elasticity and no tourniquet effect

- Reduce outflow from vascular system
- Encourage uptake into lymphatics
- Work better with mild exercise

External pressure effect
Garments – new ideas about donning and doffing and donning devices/times one garment or two?
Wobblers and Vibrating pads
Kinesio/lymph taping

Piller Lymphoedema Research Unit
Intermittent Compression Pumps
Electrical stimulation of Smooth Muscle
Be aware that simple events may slow lymph flow

- Bloating
- Constipation
- Intra abdominal adiposity
- Shallow Breathing
- External pressure in wrong place
The Fat Connection

When lymph flow is slow

Fat deposits!
Irrespective of the reason for it, increased subcutaneous fat deposits reduce lymph transport and add to load.
Slow lymph flow in these babies limbs?
Slow lymph flow from Abdominal apron?
Treatment Summary

- Intensive phase – from a professional
- Maintenance phase – patient takes control
- Explore the treatment options and see what is likely to work for you
- For Patients, ensure your therapist knows what you want
  - ? Reduction in size
  - ? Improvement in how limb feels
  - ? Better ability to undertake activities of life
SUMMARY: The Lymphatic System

- It’s a sewerage system for our body
- Nearby blood vessels affect it
- It’s easily damaged
- Most problems are close to the surface
- It’s a lazy system
- We can make it work harder/better
- We can detect lymphoedema early
- Early advice can reduce
  - the risk of lymphoedema
  - lymphoedema severity
Some think there is no way out; but there is and its Early Detection, Education, Advice and Action!
Good Web sites

- Australasian Lymphology Association (AUS)
  - www.lymphoedema.org.au
  - Information about practitioners

- National Lymphoedema Network (USA)
  - www.lymphnet.org
  - Guidelines for patients – exercise, flying etc

- International Lymphoedema Framework (UK)
  - www.lympho.org
  - Best practice documents
  - Templates for practice