STATE OF THE RESEARCH AND PHYSICAL TREATMENT OF LYMPHEDEMA LEDUC METHOD

OBJECTIVES

Attendees will understand and be able to explain to physicians and patients:

• Research in the field of manual lymph drainage, Leduc method, including results offered by the newest imaging techniques.
• Research in the field of multi-component bandaging and compression garments.
• Research about compression devices.

PHYSICAL TREATMENT OF LYMPHEDEMA LEDUC METHOD

The physical treatment of lymphedema, Leduc method, includes:

• MANUAL LYMPH DRAINAGE
• MULTI-COMPONENT BANDAGING
• COMPRESSION DEVICES & GARMENTS

LYMPHEDEMA CONCERNED

BY

MANUAL LYMPH DRAINAGE

IS CONFINED BETWEEN

THE SKIN AND THE SUPERFICIAL FASCIA

(Superficial lymph system)

LYMPH CONTAINS PROTEINS.

ANTI-LYMPHEDEMA TREATMENTS MUST ALLOW PROTEINS REABSORPTION.
AS LONG AS THE PROTEINS STAGNATE IN THE INTERSTITIAL SPACES, THE ONCOTIC PRESSURE REMAINS HIGH AND LYMPHEDEMA PERSISTS.

EVALUATION of the TWO MANEUVERS of MANUAL LYMPH DRAINAGE - LEDUC METHOD.

PROTEINS FLOW WITHIN THE LYMPHATIC SYSTEM WAS OBSERVED IN THE L.Es of 7 HEALTHY SUBJECTS & 1 SUBJECT WITH LYMPHEDEMA (25 y.o. average)
Method: LYMPHOSCINTIGRAPHY using NANOCOLL (nanocolloid) LABELED with Tc 99m
GAMMA CAMERA RECORDED RADIOACTIVITY (Frames recorded every 5 seconds)

RESULTS

CALL UP ENHANCES THE LYMPHATIC FLOW WHEN APPLIED IN THE PROXIMITY OF THE LYMPHEDEMA.
REABSORPTION MANEUVER INCREASES SIGNIFICANTLY THE COLLOIDAL PROTEINS REABSORPTION.

IN VIVO EXPERIMENTS (ANIMAL) HAVE SHOWN THAT IF THERE ARE LYMPH NODES BETWEEN THE TREATED SITE AND THE LYMPEDEMATOUS AREA THE CALL UP MANEUVER WILL NOT ENHANCE THE FLOW OF LABELED COLLOIDAL PROTEINS.

DURING L.E.s LYMPH DRAINAGE THERE IS NO NECESSITY TO DRAIN THE THORACIC DUCT PROXIMALLY.
THE LYMPHATIC SYSTEM WHICH DRAINS 2.4L TO 3.0L/24 HOURS CAN INCREASE ITS ACTIVITY X 10.
SUBCLAVICULAR AREA DRAINAGE
DOES NOT HAVE
A GLOBAL EFFECT.

ABDOMINAL MASSAGE
WHICH DOES NOT ENHANCE
I.E. VENOUS OR LYMPHATIC DRAINAGE
IS NEVER PERFORMED
BEFORE OR AFTER
MANUAL LYMPH DRAINAGE.

MANUAL LYMPH DRAINAGE
MANEUVERS
MUST BE EXTREMELY GENTLE.

O. ELISKA, M. ELISKA
Lymphedema Morphology of the Lymphatics after Manual Massage

"THE AIM OF OUR STUDY IS TO DESCRIBE THE ULTRASTRUCTURE CHANGES OF LYMPHATICS OF THE LEG IN HUMAN BEING AND DOG AFTER MANUAL MASSAGE BY PRESSURES OF 70-100 mmHg."

IN PATIENTS WITH LYMPHEDEMA
AND LONG-LASTING POST TRAUMATIC EDEMA,
THE DAMAGE TO LYMPHATICS IS LARGER THAN IN NORMAL INDIVIDUALS.
ALTERATION APPEARED IN THE FORM OF LOCAL DESTRUCTION AND DESQUAMATION OF ENDOTHELIAL CELLS.
Impact of Manual Lymphatic Drainage on Hemodynamic Parameters in Patients with Heart Failure and Lower Limb Edema.
O. Leduc et al Lymphology, 44 (2011) 13-20

• "The aim of this study was to determine if we may continue the treatment of lower limb lymphedema using manual lymphatic drainage in patients with heart failure. We evaluated hemodynamic parameters using echography during manual lymph drainage in patients with cardiac disease and obtained circumferential measurements of the edematous limb before and after treatment."

Manual Lymphatic Drainage(MLD) treatment significantly decreased the volume of the limbs as expected. The heart rate also decreased following MLD in contrast with all other hemodynamic parameters which were not affected by MLD. The findings suggest that there is no contraindication to use MLD in patients with heart failure and lower limb edema.” The results apply to upper limb lymphedema the volume of fluid mobilized being less significant.

MANUAL LYMPH DRAINAGE VISUALIZED BY LYMPHO-FLUOROSCOPY
JP Belgrado, Universite Libre de Bruxelles, Belgium
Belgrado, JP; Giacalone G; Bourgeois P; Bracale P; N. Roh, Jj Moraine

• "Subcutaneous injection of Indocyanine green and the observation of its diffusion under the skin by a specific camera, seems to be an interesting new way of imaging in the study of lymphedema.
• Objectives: To verify the efficiency of the “A. Leduc technique of manual lymph drainage” on resorption of edema and acceleration of the lymphatic flow inside the collectors.
To verify the possibility of mapping the functional lymphatic superficial network of patients with lymphedema in order to indicate the best way to treat.”

Results: During the passive stage (rest), we have repeatedly observed contractions of lymphangions and a slow diffusion of the tracer inside the lymphatic collectors.
During the manual lymphatic drainage, we visualized systematically an increase of the lymph flow mapping progressively the functional lymphatic network of the edema, even areas of dermal backflow.”

Conclusions: Dynamic lympho-fluoroscopy completes the arsenal of imaging tools in lymphology. It might help to verify the efficiency of manual lymphatic drainage. It allows a mapping of the functional superficial lymphatic network.”
NOTE OF THE SPEAKER

CONSIDER THAT SCIENCE IS IN PERMANENT EVOLUTION

AND

NEW CONCEPTS MAY APPEAR AND DESERVE ATTENTION WHEN SUPPORTED BY FUNDAMENTAL RESEARCH

Feb 6, 2014

MANUAL LYMPH DRAINAGE BY ITSELF CAN BE SUFFICIENT TO ADDRESS THE SYMPTOMS OF LYMPHEDEMA. IMPROVEMENT CAN BE MAINTAINED OVER YEARS IF PRECAUTIONS ARE RESPECTED.

Feb 6, 2014

PRECAUTIONS

HEAT IN VARIOUS FORM: • SUNBATHING • WARM COMPRESSES • JACUZZI • BURNS • COOKING ACTIVITIES

HYPERACTIVITY: • Intense sports activities

TIGHT CLOTHES, RINGS / Affected side

SKIN ABRASIONS: • PRICKLY PLANTS • PET CLAWS • SEWING • COOKING ACTIVITIES • MANICURE

AIR TRAVEL, BLOOD PRESSURE READING, INJECTIONS

Feb 6, 2014

MULTI-COMPONENT BANDAGING

MULTI-COMPONENT BANDAGING AS DESCRIBED IN LEDUC METHOD IS A TREATMENT IN ITS OWN RIGHT. IT IS IMPLEMENTED TO GET A SIGNIFICANT DECREASE IN VOLUME OF THE LYMPHEDEMATOUS AREA IN A SHORT TIME.

Feb 6, 2014

BANDAGES USED TO PERFORM A MULTI-COMPONENT BANDAGING ARE APPLIED IN THREE LAYERS

1- Cotton stockinette to protect the skin
2- Foam bandaging to get an even distribution of the pressure applied by the short stretch bandages.
3- Short stretch bandages.

The global bandage is rigid but must allow gross mobility like squatting for the lower extremity, reaching and bringing objects towards oneself for the upper extremity.

Feb 6, 2014
Prof. A. Leduc, Prof. O. Leduc et al have conducted several experiments to show the function of the multi-component bandaging (MCB).

In their initial study, they analyzed the effect of muscular contractions on the lymphatic flow in a limb with and without MCB.

Experiments

Goal: To evaluate the effect of muscular contraction on an experimental upper extremity lymphedema.

Limb 1) Without MCB
2) With MCB.

Method:

Lymphoscintigraphy

Using colloidal proteins labeled with Tc 99m.

Gamma camera (Frames recorded every 5 sec.)

Radioactivity was recorded at the level of the upper arm and in the axilla as well as on injection site before, during, and after the experiments.

Subject was sitting.

U.E. positioned in abduction.

The experimental lymphedema was created by subcutaneous injection of colloidal proteins labeled with Tc 99m performed at the level of the forearm.

3 stages for each experiment:

1- Rest for 20 minutes after injection.
2- 10 minutes exercise: squeezing a manometer (20 contractions per minute)
3- Rest for 20 minutes.
POPULATION:

THE FIRST EXPERIMENT, WITHOUT MCB, WAS PERFORMED ON 6 HEALTHY SUBJECTS.

THE SECOND EXPERIMENT WITH MCB WAS PERFORMED ON 10 HEALTHY SUBJECTS.

RESULTS

1ST EXPERIMENT:

NO SIGNIFICANT DIFFERENCE BETWEEN THE PHYSIOLOGICAL REABSORPTION OF THE EXPERIMENTAL LYMPHEDEMA AND REABSORPTION AND TRANSPORT OF COLLOIDS DURING THE MUSCULAR CONTRACTION.

2ND EXPERIMENT

THE FOLLOWING GRAPH SHOWS THE EVOLUTION OF THE RADIOACTIVITY IN THE AXILLA DURING THE EXPERIMENT.

X-AXIS: TIME IN MINUTE

Y-AXIS: ISOPTIC ACTIVITY RECORDED IN THE AXILLA. COUNT PER MINUTE.

RESULTS (CONTINUED)

THE INCREASE IN THE QUANTITY OF LABELED COLLOIDS IN THE NODES OF THE AXILLA, WAS STATISTICALLY SIGNIFICANT. AN INCREASE IN RADIOACTIVITY WAS RECORDED AT 6 MIN AND 40 SECONDS AFTER THE BEGINNING OF THE EXERCISE. THIS INCREASE IN RADIOACTIVITY WAS SIGNIFICANT DURING ALL THE DURATION OF THE EXERCISE AND AFTER THE EXERCISE.

CONCLUSION

REPEATED MUSCULAR CONTRACTIONS DO NOT SIGNIFICANTLY IMPROVE THE REABSORPTION OF COLLOIDS.

MUSCULAR CONTRACTIONS IN A LIMB WITH MCB GENERATE A SIGNIFICANT INCREASE IN THE COLLOIDS REABSORPTION AND TRANSPORT.

AFTER APPLYING THIS TYPE OF BANDAGE, IT IS RECOMMENDED THAT THE PATIENT KEEPS A NORMAL ACTIVITY AND CERTAINLY DOES NOT IMMOBILIZE THE AFFECTED LIMB.

RECENT RESEARCH

2005

- The Leduc team decided to record the effect of muscular contraction under multi-layered bandaging applied to 5 subjects (38 to 74 y.o.) hospitalized in a CCU.
- Each subject was treated for a congestive heart failure and was wearing a Swan-Ganz catheter.
- Several parameters were recorded: heart rate, cardiac output, systolic and diastolic blood pressures, mean blood pressure, right atrial pressure, pulmonary wedge pressure, cardiac index, pulmonary vascular resistances...

Note: Pulmonary Vascular Resistance: the difference between the mean pulmonary arterial pressure and the left atrial filling pressure divided by the cardiac output.

Concomitant multi-layered bandaging (MLB) applied to the lower extremity and muscle contractions induce significant increase in right atrial pressure of patients suffering from severe heart failure.

The significant rise in Pulmonary Wedge Pressure (PWP) and Pulmonary Arterial Diastolic Pressure indicates enhanced left ventricular preload. In some cases, PWP reached the level of pulmonary edema (PWP >25mmHg).

MLB and muscular contractions were responsible for Increase in left ventricular afterload.

This experiment was limited by the low number of subjects (n=5)

Nevertheless, it disclosed a significant effect from MLB and muscle contractions on transient deterioration of right and left ventricular functions both with a rise in preload and afterload.

It is recommended to limit the use of MLB in patients suffering from severe heart failure. The limitation is more relevant in patients suffering from lower limb lymphedema.
ELASTIC BANDAGES VERSUS MLB.

In 1992 A. Leduc et al published a study on the effect of different bandages on the pressure developed at the interface limb/bandage.

Feb 6, 2014

RESULTS:
EXPRESSED ON GRAPHS.
ON X-AXIS: PRESSURE MEASURED AT THE INTERFACE LIMB BANDAGE
ON Y-AXIS: PRESSURE IN THE SIMULATED LIMB.

SEEN GRAPH AT THE PRESENTATION

Feb 6, 2014

RESULTS (CONTINUED)
WHEN AN ELASTIC BANDAGE WAS APPLIED TO THE SIMULATED LIMB, THE PRESSURE AT THE INTERFACE BANDAGE/LIMB INCREASED AND PLATEAUED IN SPITE OF THE ELEVATION OF PRESSURE IN THE SIMULATED LIMB.

WHEN A MLB WAS APPLIED TO THE SIMULATED LIMB, THE PRESSURE DEVELOPED AT THE INTERFACE MLB/LIMB INCREASED SIGNIFICANTLY WITH THE INCREASE OF TENSION IN THE SIMULATED LIMB.

PRECAUTIONS RELATED TO MULTI-LAYERED BANDAGING
1- DO NOT PULL ON THE BANDAGES WHILE APPLYING THEM.
2- TELL THE PATIENT TO REMOVE HER/HIS MULTI-LAYERED BANDAGING IF SHE/HE EXPERIENCES PAIN OR SEVERE DISCOMFORT.
3- EXPLAIN CLEARLY TO THE PATIENT THAT SHE/HE MUST NOT RE-APPLY HER/HIS BANDAGING HER/HIMSELF OR WITH THE ASSISTANCE OF A FAMILY MEMBER IF THE MULTI-LAYERED BANDAGING UNRAVELS.

February 6, 2014

...They used a simulated limb: a cylinder
In which the pressure of a limb was reproduced.

They increased the pressure in the simulated limb in order to simulate a muscular contraction.

They tested the variations of pressure applied by different bandages on a simulated limb “contracting” progressively.
INTERMITTENT SEQUENTIAL PNEUMATIC THERAPY

ISPT

RESULTS:

I.S.P.T. DOES NOT ENHANCE
THE PROTEINS REABSORPTION
BY THE LYMPHATIC SYSTEM.

Decongestive lymphatic therapy for patients with breast carcinoma-associated lymphedema. A randomized, prospective study of a role of adjunctive intermittent pneumatic compression. A. Szuba, MD R. Achalu, MD S. G. Rockson, MD Cancer Vol. 95, Issue 11, Pages 2260-2267

- "When IPC is used adjunctively with other, established elements of DLT (decongestive lymphedema therapy), it provides an enhancement of the therapeutic response. IPC is well tolerated and remarkably free of complications."
- Study was made on a cohort of 27 patients randomly assigned either to DLT alone or to DLT coupled with daily IPC.

CARDIAC DISEASES AND INTERMITTENT PNEUMATIC COMPRESSION.


Coronary Care Unit, University Hospital Saint Pierre, Brussels (Belgium).

Department of Physical Therapy and Rehabilitation. University of Brussels.

Pressotherapy, (80 mmHg x 20 min.) applied to L.E.s in 11 pts (68 y.o. avg)

with uncomplicated MI (n=6) or chronic ischemic heart failure(n=5).

Right Auricular Pressure , Mean Pulmonary Arterial Pressure, Pulmonary Wedge Pressure, were measured prior, during , after pressotherapy.

After pressotherapy, 3 variables raised in all the patients specifically in patients with CHF.

After pressotherapy variables returned nearly to initial values.
NOTE:

PULMONARY WEDGE PRESSURE (PWP)
IS THE INTRAVASCULAR PRESSURE
AS MEASURED BY A SWAN-GANZ CATHETER
INTRODUCED INTO THE PULMONARY ARTERY;
IT PERMITS INDIRECT MEASUREMENT
OF THE MEAN LEFT ATRIAL PRESSURE.

Electromyostimulation combined with intermittent pneumatic compression. J.P. Belgrado et al

- The author wanted to verify whether electromyostimulation or intermittent pneumatic compression coupled with electromyostimulation enhances the reabsorption of injected labeled proteins.

Protocol:
- Injection,
- 20 minute – rest period,
- electromyostimulation, (EMS) x 20 min.
- 20 minute – rest period
- EMS + compression device Rx x 20 min.
- 20 minute – rest period

Results: “No statistical significance has been revealed in the comparison of the different phases of the protocol.”
Electromyostimulation combined with intermittent pneumatic compression. J.P. Belgrado et al. 
*EJLRP Vol. XV No.45, 2005.*

- Intermittent Pneumatic Compression, even combined with Electromyostimulation, does not enhance the reabsorption of proteins injected in the subcutaneous tissues.

**Pressures**

<table>
<thead>
<tr>
<th>Arterial</th>
<th>Venous</th>
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</thead>
<tbody>
<tr>
<td>Hydrostatic Pressure</td>
<td>+30mmHg</td>
</tr>
<tr>
<td>Oncotic pressure</td>
<td>-25mmHg</td>
</tr>
<tr>
<td>Tissue Pressure</td>
<td>-2mmHg</td>
</tr>
<tr>
<td>Osmotic pressure</td>
<td>+4mmHg</td>
</tr>
</tbody>
</table>

**WITH A COMPRESSION GARMENT:**

<table>
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</tr>
</tbody>
</table>

The Law of Laplace

Some clinical applications.


“The law of Laplace states that the tension in the wall of a container necessary to contain a given pressure on the contents is inversely proportional to the curvature of the wall, or, in other words, directly proportional to the radius of curvature at any point.

It has wide applicability in things ranging from steam boilers to blood capillaries.

The application of the law may have significance in low back pain and the support of the trunk, in elastic support to control edema, and in emptying the bladder.”
Guyton & Associates* demonstrated that the interstitial fluid pressure is normally lower than atmospheric pressure. With the development of edema, this pressure rises and is a little above atmospheric pressure by the time the edema is clinically apparent.

The edema fluid, unlike normal fluid in the interstitial spaces, is movable, as indicated by the phenomenon of pitting and its accumulation in dependent areas.

It usually is not difficult to move the edema fluid out of a limb but new fluid will accumulate in the tissue spaces unless their volume is restricted by external support.

This support is commonly supplied by elasticized bandages, sleeves or stockings.

The Law of Laplace:

\[ T = \frac{P - \rho g h}{R} \]

\( T \) is the tension of the envelope, \( P \) is the transmural pressure, \( \rho \) is the density of the fluid, \( g \) is the acceleration due to gravity, \( h \) is the height of the fluid column, and \( R \) is the radius of the cylinder.

Some clinical applications:


In the case of a cylinder of infinite length, like in blood vessels, the law of Laplace expresses the tension of the envelope, \( T \), the transmural pressure, \( P \), and the radius of the cylinder, \( R \), as follows:

\[ T = \frac{P - \rho g h}{R} \]

CONTRAINDICATIONS to PHYSICAL TREATMENT of LYMPHEDEMA:

1. DERMATOMYOLYPHANGIOADENITIS – DLA – (also termed cellulitis/lymphangiatis) and Erysipelas are contraindications to the physical treatment of lymphedema. The symptoms of these complications are: redness, increase of skin temperature and acute pain. Observation of these symptoms is a contraindication to any form of PHYSICAL TREATMENT of lymphedema, and a reason to refer immediately the patient to his/her physician.

2. The existence of a CARDIAC CONDITION in a patient is a contraindication for implementing a COMPRESSION DEVICE TREATMENT and MULTI-LAYERED BANDAGING or is a requirement for getting a written clearance from the prescribing physician. In wrapping a limb with an elasticized bandage (fig. 4) the circumferential contour will have an effect on the amount of compression exerted at a given point, since the tension in a given turn of bandage, Will be essentially constant.

Regions with a sharper curvature, such as bumps and ridges, will be subjected to more pressure. This may make the bandage more effective if these prominences are due to edema, but poses some hazard when they are due to underlying bone or other underlying structures.

An example would be the crest of the tibia when an elastic bandage is applied to shape the stump in an amputation below the knee.

As a consequence, before prescribing an elastic support it is necessary to reduce the volume of the limb.

3. Symptoms of DEEP VENOUS THROMBOSIS require IMMEDIATE MEDICAL attention.

4. The existence of an impairment of ARTERIAL PERFUSION is a contraindication to any type of COMPRESSION.
Thank you for your attention!