The Standard of Care for Lymphedema: Current Concepts and Physiological Considerations

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Overall Goals

- Reduce Risk
  - Detect Early
  - Arrest & Reduce
    - Maintain Gains
      - Complications
Overall Goals

- Reduce Risk
- Detect Early
- Arrest & Reduce
- Maintain Gains
- Complications

- Patient do’s & don’ts soon after they become at risk
- Patient precaution compliance

- Multiple Web Sites with Good Info
- Not all precautions validated
- Some may be ‘over-kill’
- Informed and educated patient
- Common Sense Approach
Overall Goals

• Reduce Risk
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  • Maintain Gains
  - Complications

• Pre-surgical Assessment
• Periodic test via emerging early detection methods
• Self recognition of symptoms
Worsens Without Treatment

- Surgery
- Radiation

Lymphedema Severity

Time

Fibrosis Develops

Seek Therapy

Symptoms

Late Treat

Arrest & Reduce

Worsens Without Treatment
Worsens Without Treatment

- Catch it Early
- More Treatable
- Less Complications

Early Detection
“Sub-Clinical”

Early Treat

Late Treat

Fibrosis Develops

Symptoms

Seek Therapy

Arrest & Reduce

Surgery

Radiation

Time

Pre-surgical Assessment

Lymphedema Severity
Overall Goals

• Reduce Risk
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PHASE I
• Manual Lymphatic Drainage
• Compression Bandaging
• Decongestive Exercise
• Skin Care
Phase I - Intensive

Complete Decongestive Physiotherapy (CDP)

- Manual Lymph Drainage (MLD)
- Compression Bandaging
- Exercise and Skin Care
- ± Intermittent Pneumatic Compression (IPC)
Phase I - Intensive

Complete Decongestive Physiotherapy (CDP)

MLD ➔ Compressive Bandage ➔ Decongestive Exercise
Lymphatic Drainage

Lymph flow and drainage determined by normal physiological processes and lymphatic pathways
Lymphatic Drainage

Lymph flow and drainage determined by normal physiological processes and lymphatic pathways.

Lymph flow through normal pathways reduced or absent due to nodal or lymph vessel obstruction and dysfunction.
Therapeutic Strategy
Use Alternate Routes & Optimize Conditions

Lymph flow depends on pathway pressure gradient and resistance

Pressure Gradient
Intra-Lymphatic

Pressure Gradient
Truncal Tissue
MLD and New IPC Approach

First sequentially treat lymph receiving regions (1→5) to optimize gradient and minimize resistance for subsequent limb drainage procedures.

Mayrovitz et al. (2009) Home Health Care Management & Practice (in press)
MLD and New IPC Approach

First sequentially treat lymph receiving regions (1→5) to optimize gradient and minimize resistance for subsequent limb drainage procedures.

Then progressive treatment of limb and trunk with suitable manual or pump pressures starting at the most peripheral region (5→1).
Adjunctive IPC Therapy

ROLE

Phase I → Component of in-clinic therapy
Phase II → Component of at-home maintenance therapy

TYPES

Basic → Limited Adjustability – Non-Programmable

Advanced → Calibrated – Sequential - Programmable
  • With Truncal Clearance Capability
  • No Truncal Clearance Capability
IPC Parameters

Calibrated
Pressure setting (manual or programmed) corresponds to *pressure delivered to skin*

Sequential
During drainage phase, compression progresses *distal → proximal* consistent with physiological concepts

Programmable
Software control to permit *customization* of compression parameters to account for variable patient conditions e.g. painful, ulcerated or fibrotic areas
Adjunctive IPC Therapy

**Newer IPC Approach**
- Initial ‘preparation phase’
- ‘Work & Release’

**‘Older generation’ IPC**
- Limb drainage
- ‘Squeeze & Hold’

Differences Among Therapy Parameters
Pressure Timing and Pattern

Flexitouch® System

‘Work & Release’

Lympha Press® System

‘Squeeze & Hold’

Mayrovitz HN
Physical Therapy
2007;87:1379-1388
Concerns of too high a pressure have been raised in the literature regarding ‘older generation’ IPC\(^1\) and poor pressure calibration\(^2\)


“Compression pumps should be used only under the supervision of a trained health care professional because high external pressure can damage the lymphatic vessels near the skin surface.”

http://www.cancer.gov/cancertopics
Therapist IPC Important Features

Use or recommend IPC?

<table>
<thead>
<tr>
<th>Feature</th>
<th>YES N=28</th>
<th>NO N=22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Chamber Wound Treat</td>
<td><img src="#" alt="Bar Chart" /></td>
<td><img src="#" alt="Bar Chart" /></td>
</tr>
<tr>
<td>Trunk Treat Calibrated Pressure Work and Release Fibrosis Treat</td>
<td><img src="#" alt="Bar Chart" /></td>
<td><img src="#" alt="Bar Chart" /></td>
</tr>
</tbody>
</table>

* p<0.01
Therapist IPC Use Concerns

*Use or recommend IPC*

- **Truncal Edema**
- **Fibrotic Cuff**
- **Genital Edema**
- **High Pressure**
- **Patient Tolerance**

![Bar chart showing average concern levels for different IPC use concerns.](chart)

- **YES N=28**
- **NO N=22**

*Average Concern*  

* p<0.001
Overall Goals

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PHASE II
- Self MLD
- Compression Garment
- Self Bandaging
Potential Risks of Ineffective Home Self Maintenance

• Loss/Reversal of Phase I Achievements

• Interim Development of Complications
  
  e.g. Fibrosis, Inflammation, Cellulitis, Pain

• Therapeutic Interventions for Complications
  and new rounds of Phase I therapy requiring
  additional patient time, suffering and costs
Breast Cancer Treatment-Related Lymphedema

After Vignes et al.

N=537 newly diagnosed pts

Compared to end of Phase I
Increased > 10% → 51%
“Stable” ± 10% → 20%
Decrease >-10% → 29%

N= 426
356

Self MLD
Elastic Sleeve
LS Bandage

Lymphedema Volume (ml)

Start Phase I 6 months 12 months
Compliance – Risk of Increase

<table>
<thead>
<tr>
<th></th>
<th>n (% of total)</th>
<th>n (%) of patients with volume increase (&gt;10%)</th>
<th>RR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>246 (69)</td>
<td>129 (52)</td>
<td>1*</td>
<td>0.99 (0.77 to 1.20)</td>
</tr>
<tr>
<td>No</td>
<td>110 (31)</td>
<td>57 (52)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low stretch bandage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>263 (74)</td>
<td>120 (46)</td>
<td>1*</td>
<td>1.55 (1.30 to 1.76)</td>
</tr>
<tr>
<td>No</td>
<td>93 (26)</td>
<td>66 (71)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elastic sleeve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>322 (90)</td>
<td>159 (51)</td>
<td>1*</td>
<td>1.61 (1.25 to 1.82)</td>
</tr>
<tr>
<td>No</td>
<td>34 (10)</td>
<td>27 (79)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Phase II Outcomes: Compliance

**Fairly Conclusive**
- Low Stretch Bandaging
- Compression Garment

**MLD - Inconclusive**
1. Phase I MLD $\rightarrow$ Major initial reductions
2. Self reported use/non-use as an index may or may not be valid
3. Impact of MLD on stable and decrease?
4. No measure or knowledge that proper self-MLD technique was used!
IF Phase I outcome is very effective and IF patients are \(~100\%\) compliant with respect to garment use, bandages and exercises THEN Self MLD may not add much to outcome

BUT --- the above is at best only sometimes true

SO ---- Assistance in MLD compliance is needed

- ROM and Functional impairments
- Aging population of cancer survivors
- Physical demands of effective MLD
- Difficulty of properly done self-MLD
- \(~35\%\) of patients report doing self-MLD\(^1\)

Short-Term Home Maintenance
MLD Assistance via Advanced IPC

Data from: Wilburn et al. BMC Cancer 2006, 6:84
Phase II Outcomes: Compliance IPC Usage

Users Abandoning Pump Use by 6-7 Months

1. Lynnworth, M. NLN Newsletter 1997;(10)
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- Pre-surgical Assessment
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Quantitative Assessment Methods

Early Detection & Treatment Effectiveness

- **Limb Volumes**
- **Bioimpedance**
- **Local Tissue Fluid**
- **Tissue Properties**

{ Limbs
Any at Risk Location (e.g. Trunk, Face and etc.)}
Limb Volumes and Circumference

Circumference
If unilateral then lymphedema if difference > X cm

Automated

Multiple Circumferences

Manual

Geometric Model or Algorithm

If unilateral then lymphedema if volume difference > Y ml
If volume difference > Z %

Limb Volumes

www.limbvolumes.org

Visit
Arm Lymphedema Metric Criteria

LE rate dependent on criteria used


Differences
- Between sides
- or vs. baseline
Bioimpedance

Principle: Tissue Water ~ Electrical Impedance
Arm Lymphedema

Contol Ratios (N=60) 3SD = 0.102

Patients > 3SD of Controls and Confirmed LE

Resistance Ratio Between Arms

Local Tissue Water

Principle: Tissue Water ~ Dielectric Constant
Potential Diagnostic Utility

No overlap between Patients vs. Controls

Patient Arms
Affected/Control
1.64 ± 0.30
N=18

Control Arms (Max/Min)

Premenopausal
1.04 ± 0.04
N=15

Postmenopausal
1.04 ± 0.04
N=15

Single MLD Treatment
Lower Extremity Lymphedema

N=20
P<0.001

N=6
P<0.05

Mayrovitz et al. Lymphology 2008;41:87-92
Breast Cancer Pre-Surgical

Cancer Side

Arm Volumes (ml)

2160±564

Bioz 306±34

TDC

Bioz 307±34

Healthy Side

2164±509

24.9±5.2

24.3±4.5

22.3±2.9

Insignificant Side-to-Side Differentials at Baseline

Fibrosis & Tissue Property Changes

Principle: Indentation Force ~ Tissue ‘Hardness’
Single MLD Treatment

Lower Extremity Lymphedema

Force (g)

- Calf
  - pre-MLD
  - pst-MLD
  - Tissue ‘softening’
  - N=22
  - P<0.001

- Thigh
  - N=6
  - P<0.01
Single Flexitouch® Application

Force (g)

Indentation Depth (mm)

N = 12

Pre-FT

Pst-FT

P<0.001

Tissue ‘Softening’

30 minute below knee application

Pre-FT

Pst-FT

N = 12

Tissue ‘Softening’
Summary

- Risk Reduction → Catch it early → Treat it intensively → Maintain Gains
- Historically and Generally Accepted Approaches → CDP ± IPC
- Phase I: MLD + SS Compression Bandage + Exercise + Skin Care
- Phase II: Self MLD + Elastic Garment + Bandage + Exercise + Skin Care
- Phase II compliance is a factor in maintaining gains

IPC use if programmable and if it provides truncal clearance prior to limb pumping may increase compliance and improve outcomes

- Early detection with biophysical measures should be actively pursued
- Pre-surgical assessments can likely aid in the early detection process
Thanks for your Attention