“Focus on”: Linfedema e Lipedema

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Lymphedemmas
La Classificazione dei linfedemi cronici degli arti secondo Tosatti

- **Arte superiore**
  - malattie varioquinesi
  - non conseguenti a mastectomia

- **Arte inferiore**
  - STASI
  - nello spazio interstiziale e nei collectori
  - da reflusso gravitazionale da ipoplasia o da displasia da ostacolo da aumentata linfogenesi
  - insufficienza dei collettori valvolare e parenchimalina linfonodale

- **Insensibilità**
  - familiare, precoce, neuro-endocrino (puberale, gravidico, menopausale) post-traumatico, post-inflammatorio (post-infantile, post-flogistico, ecc.), da raggi x, neoplastico (primitivo e secondario).

- **Acquisiti** (non è quasi sempre necessaria una alterazione congenita perché si manifestino?)

- Misti associati a flessopatie e, molto più raramente, ad arteriopatie

**1965**

**1974**

Paris, 1974
CHRONIC LIMB LYMPHEDEMA
TOSATTI’S CLASSIFICATION (1967)

Upper Limb (rare: those not secondary to mastectomy)

Congenital with praecox or tardive manifestation

Lower Limb

Acquired (there is almost always a congenital manifestation, or else why do they occur?)

LYMPHEDEMA

stasis in the interstitial space and collectors

from gravitational reflux, from hypoplasia or from dysplasia, from obstruction, from ↑ lymphogenesis

Insufficiency of the collectors (valvular and parietal) and lymph-nodal

Familial praecox neuro-endocrinal (pubertal, pregnancy, menopausal), postraumatic postinflammatory (postlymphangitis, postphlebitis, etc.), from radiation, neoplastic (primitive or secondary)

Mixed: associated with phlebopathies, and more rarely with arteriopathies
LYMPHEDEMA CLASSIFICATION
(ETIOLOGICAL BASIS)

CONGENITAL OR PRIMARY
FROM BIRTH (CONNATAL)
0-2 Years
SPORADIC

ACQUIRED OR SECONDARY
PRAECOX < 35 yrs
TARDIVE > 35 yrs

LAD I
LAAD
LAD II

HEREDITARY (FAMILIAL)

POST-LYMPHANGITIS
POST-SURGICAL
POST-RADIATION
POST-TRAUMATIC
POST-FILARIAL

LEGEND:
LAD I: LYMPHANGIODYSPLASIA
LAD II: LYMPHADENODYSPLASIA
LAAD: LYMPHANGIO-ADENO-DYSPLASIA
(C.Papendieck, 2001)

C.Campisi, 2001
## STAGING FOR PROGNOSIS OF LYMPHEDEMA

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
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</thead>
</table>
| I     | A. Latent lymphedema, without clinical evidence of edema, but with impaired lymph transport capacity (provable by lymphoscintigraphy) and with initial immunohistochemical alterations of lymph nodes, lymph vessels and extracellular matrix.  
B. Initial lymphedema, totally or partially decreasing by rest and draining position, with worsening impairment of lymph transport capacity and of immunohistochemical alterations of lymph collectors, nodes and extracellular matrix. |
| II    | A. Increasing lymphedema, with vanishing lymph transport capacity, relapsing lymphangitic attacks, fibroinductive skin changes, and developing disability.  
B. Column shaped limb fibrolymphedema, with lymphostatic skin changes, suppressed lymph transport capacity and worsening disability. |
| III   | A. Properly called elephantiasis, with scleroindurative pachydermitis, papillomatous lymphostatic verrucosis, no lymph transport capacity and life-threatening disability.  
B. Extreme elephantiasis with total disability. |

**INFLAMMATION!**

*ISL Consensus Document (by C. Campisi, 2009)*
# STAGING FOR PROGNOSIS OF LYMPHEDEMA

<table>
<thead>
<tr>
<th>Lymph Nodal Impairment</th>
<th>Lymph Vessel Impairment</th>
<th>Interstitial Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td></td>
<td></td>
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<tr>
<td>III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lymphostasis ➔ Inflammation & Excess Fibro-Adipose Tissue

By E. Fulcheri, C. Campisi, F. Boccardo et al.
Pre-Op and Post-Op Evaluations

Clinical Parameters
Echo Color Doppler (V/A)

Lymphoscintigraphy (S/P & T. I.)

I. G. F. Microlymphography – PDE Test
Derivative Lymphatic Microsurgery represents, today, the most effective therapeutic procedure, when performed in the earliest stages of Peripheral Lymphedema, according to our long clinical experience and related long-term clinical outcomes (>20 yrs)

Single-Site Multiple Lymphatic Venous Anastomoses (MLVA)
An alternative Microsurgical option for cases of Phlebo-Lymphedema with stable and persistent Venous Hypertension (early 1980s)
Single-Site Lymphatic Anastomoses

- MLVA or MLVLA are performed at a single adaptable incision (inguinal-crural region or upper-middle third of the volar surface of the arm) using both superficial and deep lymphatic vessels, previously stained with blue dye.

Single Site: upper-middle third of the volar surface of the upper arm

Long-Term Stable Results
Single Site:
inguinal - crural region
Long-Term Stable Results
Single-Site Lymphatic Anastomoses

The rationale behind the single-site approach is twofold ...
Single-Site Lymphatic Anastomoses

1) Lowered Infection Risk:

- A single incision means less surface area exposed to microbes

- The incision is made proximally:

  In our experience, infections are more likely to occur distally, starting in the hands and feet. This is most likely due to the poor mobilization of immune cells to lymph nodes due to chronic lymph stasis

Single-Site Lymphatic Anastomoses

2) Increased Vessel Caliber

- Larger Lymphatic vessels are easier to use for anastomoses

2) Increased Vessel Caliber

- Larger Lymphatic vessels allow a greater flow of lymph through each anastomosis

  - Multiple LVA are created in close proximity to vein valves; thus the suction induced by these valves is sufficient to overcome the differential pressure

  - Lymph is immediately pulled into the vein, preventing thrombosis of the anastomoses

Single-Site Multiple LVA

- Single Incision
- Single Operating Microscope
- Multiple Anastomoses (Superficial & Deep)
- Multiple Long-Term Effectiveness

‘TIMING’: EARLY Application = LONG-TERM results!
CLyFT for LYMPHEDEMA

Complete Lymphedema Functional Treatment
Staging - Guided

Phase 1
- CPT
- 6-12 Months

Phase 2
- LM → FLLA-LVSP
- 1 week

Phase 3
- Post-op Rehab
- FU (5 years)

Genoa Protocol, 2007-2017
1973-2017 → 4192 Cases Treated by Microsurgery
MLVA / MLVLA (FU 5 – more than 20 Years)

Long-Term, Stable Results
MLVA / MLVLA 1973 - 2017

> 80% rate of stable Volume Reduction in the earliest stages (IB-IIA)

By C. Campisi
LYMPHATIC “SINGLE-SITE” MICROSCU RGERY GENOA PROTOCOL - 2016

$F =$ Fast (Length of Surgery: 15’ - 20’ / Anastomosis – 60’ - 150’ / in total)
$I =$ Increasing (both Lymph Transport Capacity & Patient Turnover)
$E =$ Effective (Significant Edema Volume Reduction in the Long-Term)
$R =$ Recovering (High-Grade Clinical & QoL Restoration)
$A =$ Aesthetic (Remarkable & Stable Cosmetic Results)
$E =$ Economic (Low-Cost Surgery requiring only 1 OpMi & 2 Surgeons, according to the available budget in every hospital, in every area of the world!)

MLVA / MLVLA Microsurgery

= F.I.E.R.A.E. Microsurgery
NEW ADVANCES

For Advanced Stages of Lymphedema (IIB-III) LM is able to give only partial results.

That is why we developed a “Lymph Vessel Sparing Procedure (2012)”, with Liposuction-Like technique (i.e. Selective Liposuction) that is called:

**FIBRO-LIPO-LYMPH-ASPIRATION (FLLA-LVSP)**

The aim of the new FLLA-LVSP procedure is to remove the remaining excess fibro-adipose tissue of the lymphedematous limb previously treated by MLVA.
FLLA

Pathophysiological Basis

Aspirated Material from the Liposuction Technique, without any treatment, in a transparent container

Typical Stratification after Formalin Fixation: Supernatant Serum (top), Fat Corpuscles, Blood Serum (bottom)

Thickened and Fibrous Connective Tissue with small Blood and Lymphatic Vessels  E.E. 10 - 20x

Lymphostasis → Inflammation & Excess Fibro-Adipose Tissue

Lymphatic Vessels and Walls with Markedly thickened Peri-Adventitial Matrix
The endothelium of the vessel is clearly positive to immunohistochemical staining with antibodies to CD31. IIC - CD31, 10x and to antibodies to CD31. IIC - CD34, 10x

How Can We Avoid Lymphatic Vessel Injuries during Liposuction?

- Lymphoscintigraphy
- Lymphochromic Test by Blue Patent Violet (BPV)
- IndoCyanine Green Fluorescent Microlymphography with PDE Test
- EchoDoppler Mapping of the Principal Superficial Veins in close proximity to the Lymphatic Network

Safe Liposuction

= Lymph Vessel Sparing Liposuction

FLLA
Progression of Volume Loss with Combined Surgical Treatment

Pre - Surgery

Post - MLVA

Post - FLLA
MLVA + FLLA
MLVA + FLLA

Surgery Without Age Limits!
LYMPHEDEMA STAGING - LYMPHATIC MICROSURGERY PROGNOSIS

LYMPHEDEMA

PREVENTION

TO AVOID LYMPHATIC INJURIES

LY.M.P.H.A.*

TREATMENT

EARLY STAGE

Multiple LVA**

EARLY ‘Single-Site’ MLVA Application Avoids LATER Surgery!

LATE STAGE

Multiple LVLA***

1. Multiple LVA** / LVLA **

2. FLLA – LVSP ****

(*) Lymphatic Microsurgical Preventive Healing Approach
(**) Lymphatic Venous Anastomoses (Multiple)
(***) Lymphatic Venous Lymphatic Anastomoses
(****) Fibro-Lipo-Lymph-Aspiration by Lymph Vessel Sparing Procedures

‘TIMING’!
LIPEDEMA is a localized swelling of the lower limbs, which is:

- Bilateral
- Symmetrical
- With a soft consistency
- Develops due to the build-up of adipose tissue
- “Chaps-style”, starting from the hips and moving down to the ankles
LIPEDEMA

PATHOPHYSIOLOGY

**Trigger Mechanism**: Micro-angiopathy takes place in the adipose tissue leading to higher protein permeability and, at the same time, more fragile capillaries.

As a consequence of higher permeability, high-protein content fluid builds up in the surrounding cell area.

The skin bruises easily due to higher capillary fragility.

Skin resiliency is severely decreased, while skin compliance (skin stiffness, expressed in mmHg, measured with a special device) is increased:

- The skin loses its helping role as a venous pump in the lower extremities
- Macrophages, which can scavenge plasma proteins outside lymphatic vessels, are rarely present in adipose tissues

The lymphatic system eventually becomes overloaded, leading to the onset of lipo-lymphedema in the later stages of disease
## LIPEDEMA

### Differential Diagnosis

<table>
<thead>
<tr>
<th></th>
<th>Lipedema</th>
<th>Lymphedema</th>
<th>Lipolymphedema Lympholipoedema</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unilateral</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bilateral</td>
<td>Yes</td>
<td>Possible</td>
<td>Yes</td>
</tr>
<tr>
<td>Bilateral-Symmetrical</td>
<td>Yes</td>
<td>Rare</td>
<td>Rare</td>
</tr>
<tr>
<td>Bilateral-Asymmetrical</td>
<td>No</td>
<td>Frequent</td>
<td>Frequent</td>
</tr>
<tr>
<td>Foot</td>
<td>No</td>
<td>Affected</td>
<td>Affected</td>
</tr>
<tr>
<td>Stemmer sign</td>
<td>Negative</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>Skin folds</td>
<td>Normal</td>
<td>Deep</td>
<td>Deep</td>
</tr>
<tr>
<td>Softness</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Bruises</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Erysipelas</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Angiosarcoma</td>
<td>No</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>
LIPEDEMA

TREATMENT

Combined Decongestion Therapy (CDT):
• Manual and mechanical lymphatic drainage
• Adequate elastic compression and/or proper short stretch bandages,
• Therapeutic exercises,
• Careful skin hygiene

Adequate BMI Control:
• Weight loss program
• Diet

Lymphatic Microsurgery:
• Single-Site Lymphatic Anastomoses – MLVA
• ‘Lymph vessel sparing’ Liposuction of excess adipose tissue – FLLA-LVSP
Single-Site Lymphatic Anastomoses

LIPO-LYMPHEDEMA
MLVA + FLLA

LIPO-LYMPHEDEMA
Chylous Disorders
Chylous and Thoracic Duct Disorders

Etiopathogenesis

- Chylous dysplasias (45%)
- Thoracic Duct obstructions (15%)
- Traumas and iatrogenic damages (15%)
- Neoplastic involvement of abdominal lymph structures
- Infections (TBC)
- Filariasis (25%)
Thoracic Duct Dysplasia, Cisterna Chyli, and Chyliferous Vessel Dysplasia, Gravitational Reflux Syndrome.

**Clinical Manifestations**

<table>
<thead>
<tr>
<th>Chylothorax, Chylomediastinum, Chylopericardium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chylous Ascites, Mesenteric Cysts, Malabsorbment Syndrome</td>
</tr>
<tr>
<td>Chyluria</td>
</tr>
<tr>
<td>Chyledema (lower limbs, external genitalia, other sites)</td>
</tr>
<tr>
<td>Lymphostatic warts</td>
</tr>
<tr>
<td>Chylous arthritis</td>
</tr>
<tr>
<td>Chylocele</td>
</tr>
<tr>
<td>Chylometrorrhea-Chylocolporrhea</td>
</tr>
</tbody>
</table>

### Primary (Dysplasia)

- Agenesis, Aplasia, Hypoplasia
- Hyperplasia
- Atresia
- Stenosis
- Multiple Fistulas
- Cysts
- Diffuse Dilatation

### Secondary

- Stenosis (neoplastic, filariasis)
- Dilatation (adhesions, phlogosis, neoplastic)
- Traumatic
Chylothorax | 49
Chyloperitoneum and Associated Syndromes | 108
Chyledema | 169
<table>
<thead>
<tr>
<th>2) DIAGNOSTIC PROTOCOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>- <strong>Blood tests:</strong> serum protein, albumin, triglyceride, cholesterol, calcium, and hemoglobin levels</td>
</tr>
<tr>
<td>- <strong>Thoracocentesis or paracentesis</strong></td>
</tr>
<tr>
<td>- <strong>Functional Tests</strong> – (Fatty meal, a1-antitrypsin clearance, etc.)</td>
</tr>
<tr>
<td>- <strong>Imaging</strong> (US, Eco-Color-Doppler, Lymphoscintigraphy, Lymphochromic Test with Blue Patent Violet (BPV), Photo Dynamic Eye (PDE), Lymphangio-MR, Thoraco-abdominal CT scan, Direct Lymphography – CT)</td>
</tr>
<tr>
<td>- <strong>Video thoracoscopy or laparoscopy</strong></td>
</tr>
</tbody>
</table>
3) BASIC MEDICAL TREATMENT PROTOCOL

• **Nutritional Management**

Total Parenteral Nutrition – Hypo-alipid and Hyper-proteic Diet *(Medium Chain Triglycerides - MCT)* / Chiloil*

• **Drug Management**

Somatostatin Analogs / Octreotide

Antiobiotics

• **Drainage of the Effusion (Thoracocentesis / Paracentesis)**
Surgical Treatment Protocol for Chylous Gravitational Reflux Syndromes and Related Primary / Congenital or Acquired Disorders (Chylothorax, Chyloperitoneum & Related Syndromes)

### 4) SURGICAL TREATMENT PROTOCOL (AFTER FATTY MEAL)

- Drainage of Pleural / Peritoneal Chylous Effusion (Open / VATS / VLS)
- Identification of the Site(s) of Chylous Leakage
- Ruptured lymphatic vessels can be ligated, oversewn, or clipped
- Treatment of the pleural / peritoneal leaking areas (washing with sclerosing drugs and Trémollières-like solutions; glues, and other optional haemolymphostatic materials) / Talc Pleurodesis
- Reconstruction of the Thoracic Duct (T.D.-Azygos Vein Anastomosis) when possible (!)
- Thoracic Duct Ligation, if absolutely needed (!)
- Removal of lymphocele, chylous cysts, and/or chylomas
- Resection of Chylo-lymphangectasic-lymphangiodysplasic tissue (if present)
- “Spaced-out” anti-gravitational ligatures of dysplastic and ectasic chylo-lymphatic collectors
- CO₂ LASER complementary welding
- Derivative Multiple Lymphatic-Venous Anastomoses (MLVA) or Reconstructive Multiple Lymphatic-Venous-Lymphatic Anastomoses (MLVLA) Microsurgery, when possible and needed (!)
Interposition of autologous vein shunts
Multiple LV Anastomoses, with optimal valvular continence of the superimposed vein segment.
A – drainage of chylous ascites
B - exeresis of lymphangestastic-lymphangiodysplastic tissues
C - chylous-venous shunt
D – several liters of chyle removed during surgical treatment
Clinical Case

49yr old woman with congenital thoracic duct dysplasia. The spontaneous rupture caused bilateral chylothorax, treated with thoracentesis and pleurodesis. Post-operatively, the patient developed a voluminous left cystic neoformation, laterocervical and supraclavicular.
...3 Years Later...
Some more of our clinical casuistry...

Spontaneous, recurrent, Chyloperitoneum related to Chylous-Lymphangio-Dysplasia. Reactive Chylous Peritonitis, Acute Appendicitis, and right Hydrocele
- Resection of chylous-lymphangio-dysplastic omentum.
- Closure of multiple chylous-peritoneal fistulas with anti-gravitational ligatures
- Appendectomy, cholecystectomy
- Eversion/resection of tunica vaginalis of right testis

Before

After

- Congenital Chyledema with gravitational reflux due to chylo-lymphangio-adenodysplasia of the left leg.
- Saccular deformation of the medial surface of the left thigh with lymphostatic verrucae papillomatosis
- Surgical excision of the elephantiasic tissue with associated derivative/reconstructive lymphatic-venous microsurgery of the left thigh, and CO2 LASER Treatment of the lymphostatic papillomatosis
Chyleedema of Lower Limbs and External Genitalia

LVA + LASER + Reductive Plastic Surgery
TAKE HOME MESSAGE

Lymphatic Disorders Surgical Management

The Best Practice: State of the Art
Modern Surgical Treatment of Lymphatic Disorders

EBM Latest Main References 2000-2017


Modern Surgical Treatment of Lymphatic Disorders
EBM Latest Main References 2000-2017


