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Università Cattolica del Sacro Cuore - Roma
Policlinico A. Gemelli - Specializzazione in Chirurgia plastica, ricostruttiva ed estetica

VASCULARIZED LYMPH NODE TRANSFER FOR UPPER EXTREMITY LYMPHEDEMA

Dr.ssa Mariachiara Fabbri

SCaLPELProject
Rome - Brno 2023

UPPER EXTREMITY LYMPHEDEMA

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Abnormal collection of high protein fluid within the interstitium due to lymph nodes and/or lymphatic vessels impairment.

CELLULAR PROLIFERATION

↓

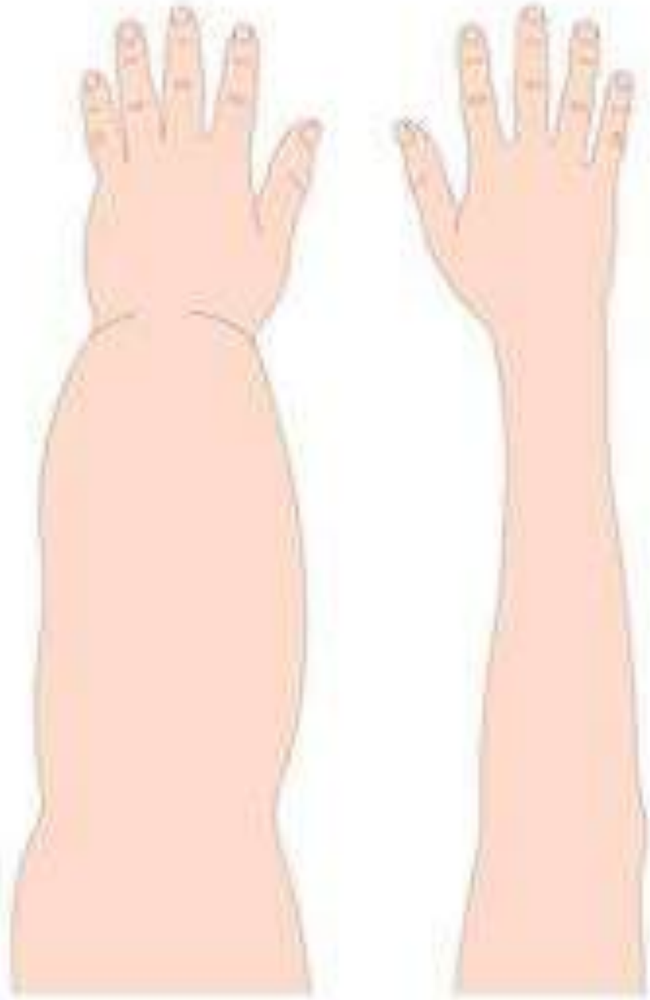
INFLAMMATION

↓

ADIPOSE HYPERTROPHY

↓

FIBROSIS



ETIOLOGY

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PRIMARY

Unusual development of the lymphatic system without connection to any medical condition. The onset could range from childhood to adult age.

SECONDARY

- Trauma
- Infections
- **Breast cancer treatment**

39%

- AXILLARY LYMPH NODE DISSECTION
- RT
- MASTECTOMY
- HIGH BMI

SYMPTOMS

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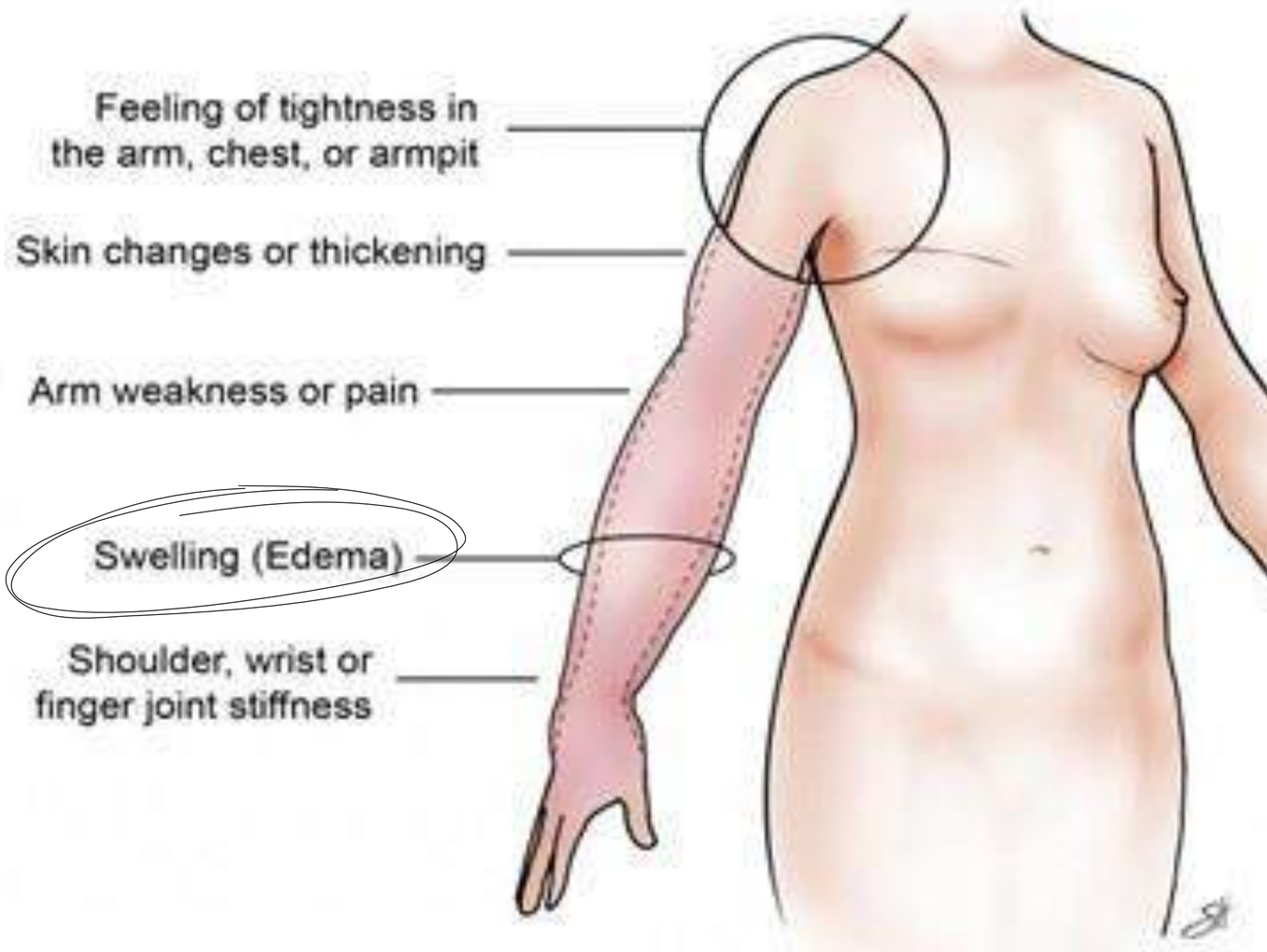

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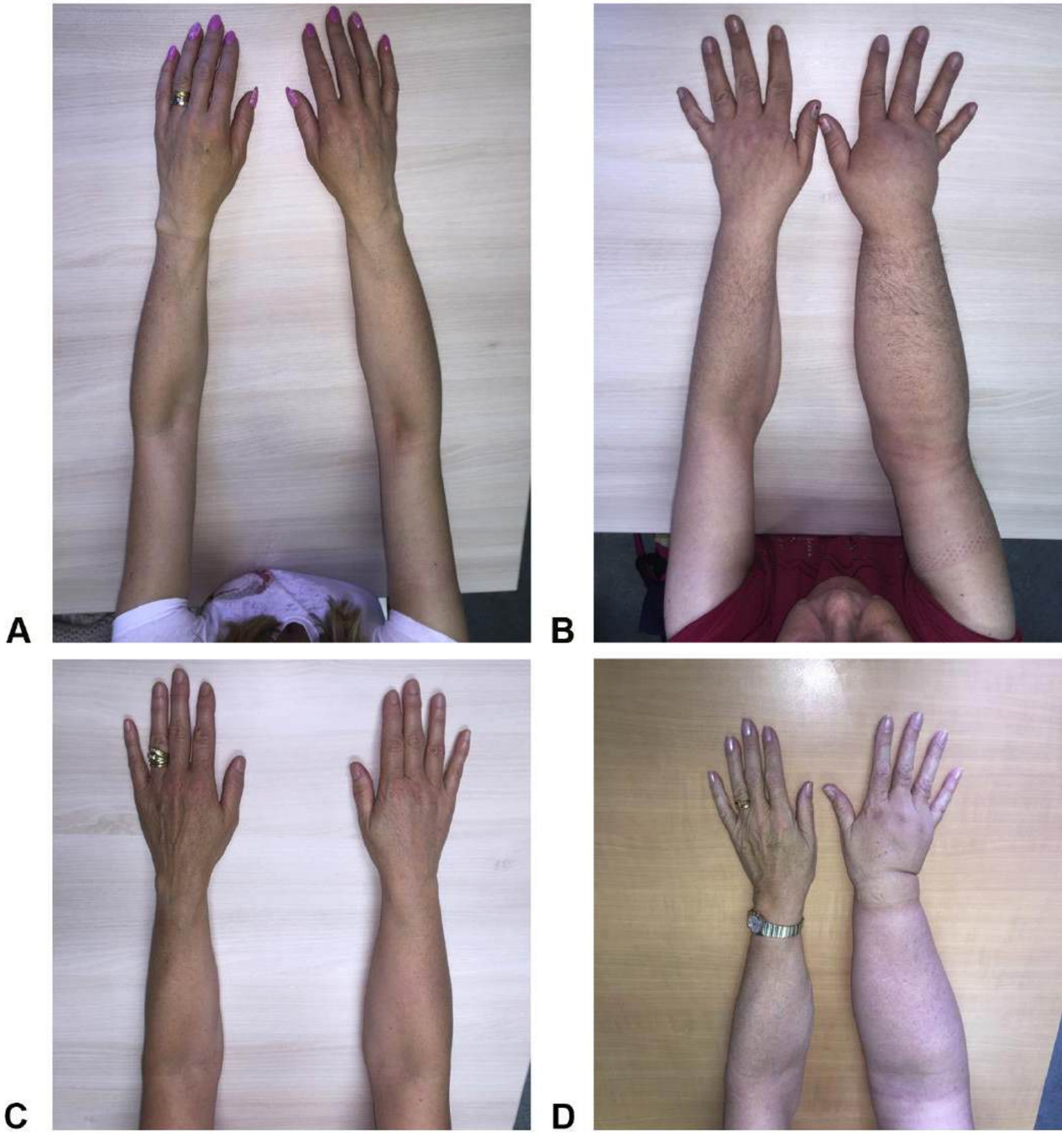
STAGING

TABLE 1. Clinical Staging of Lymphedema

Stage 0	Subclinical condition in which swelling is not evident despite impaired lymph transport
Stage 1	Early reversible pitting edema. Limb elevation will reduce swelling.
Stage 2	Irreversible lymphedema. Pitting is no longer present.
Stage 3	End-stage lymphedema with elephantiasis. Pitting is absent and trophic skin changes (acanthosis, fat deposits, and wart overgrowths) develop.



IMAGING ASSESSEMENT

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Patients with healthy lymphatics are candidates for LVA surgery.

TABLE 2. Imaging Techniques for Lymphedema

Feature	Radionuclide Lymphoscintigraphy	ICG Lymphography	MRL
Anatomic information	Poor resolution	Excellent resolution of superficial lymphatics	Excellent resolution of lymphatic vessels, lymph nodes, venules, and interstitial tissues
Functional information	Excellent information regarding lymph vessel and lymph node function	Shows only functioning of superficial lymphatics	Not ideal to assess function
Radiation exposure	Yes	No	No
Can be done in clinic or operating room	No	Yes	No

GS for diagnosis

ULTRA HIGH-FREQUENCY ULTRASOUND:

THE CHANGE IN SURGICAL INDICATIONS

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Ultra High-frequency Ultrasonographic Imaging with 70 MHz Scanner for Visualization of the Lymphatic Vessels

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Florence Belva, MD, PhD†
Giuseppe Visconti, MD, PhD§
Nobuko Hayashi, MD¶
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Marzia Salgarello, MD§

Background: Identification and localization of functional lymphatic vessels important for lymphaticovenular anastomosis. Conventional high-frequency ul sound (CHFUS) has been reported to be useful for them, but it has some disadv tages. In this article, we present new capabilities of ultra high-frequency ultrasou (UHFUS) for imaging of the lymphatic vessels, which may overcome the weakn of CHFUS.

Methods: Thirty unaffected extremities in 30 unilateral secondary lymphede patients (13 upper limbs and 17 lower limbs) were examined. Identification the lymphatic vessels using UHFUS and CHFUS were performed at 3 sites in e

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ICG LYMPHOGRAPHY

Lymphatics no deeper than 2cm

No information regarding interstitial tissues,venous system or lymph nodes

Bad for high BMI

Cannot visualize lymphatic flow masked beneath dermal backflow

No used in iodine allergic pts

UHFU

70 MHz frequencies

Resolution up to 30 µm

Can detect smaller lymphatic vessels (d < 0,3 mm) in the superficial layer (no deeper than 1 cm)

Can distinguish between lymphatic vessels and other structures

It shows lymphatic vessels in regions masked by dermal backflow pattern even in advanced lymphedema stage

TREATMENT

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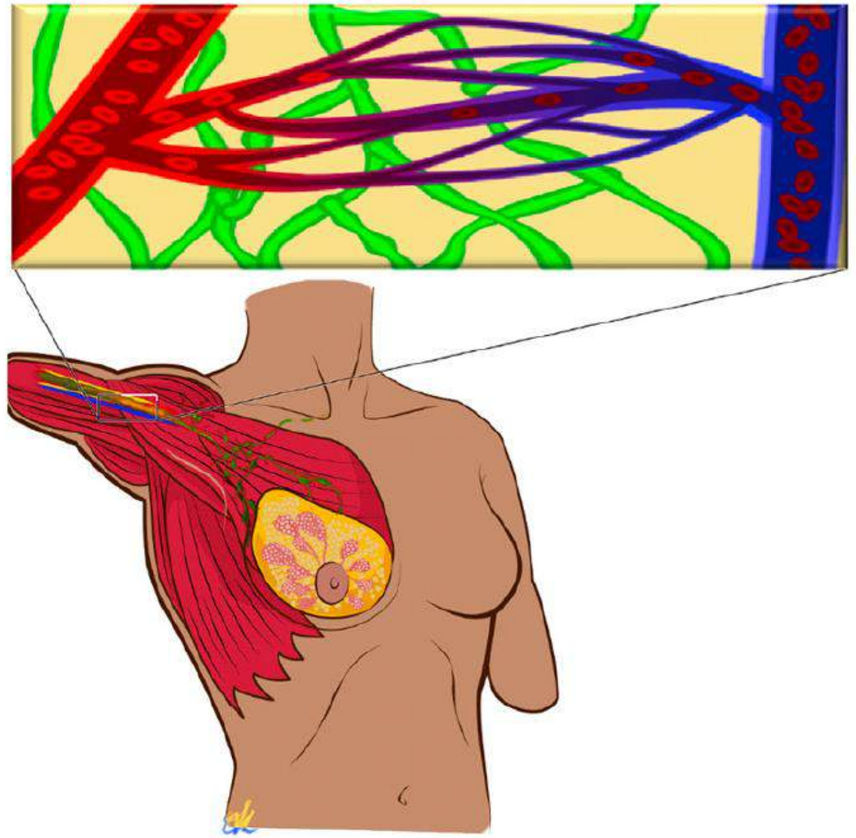
REHABILITATION

Phase I
Skincare
Manual Lymphatic Drainage (MLD)
Muscle Pumping Exercises
Hydraulic Pressotherapy
Multilayer Compression Bandage

Phase II
Skincare
Compression Garments Wearing
(low-stretch elastic stocking or sleeve)



SURGICAL TREATMENT

Combined surgical procedures

Physiologic Procedures
Lymphaticovenular Anastomosis (LVA)
Vascularized Lymph Node Transfer (VLNT)

Reductive Procedures
Liposuction
Charles' Procedure
Radical Reduction with Preservation of Perforators

NON SURGICAL TP FAILED

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GRADE 0,1,2 PITTING EDEMA

MICROSURGERY

ICG LYMPHOGRAPHY + UHFU

GRADE 2,3 NO PITTING EDEMA

LIPOSUCTION AND DEBULKING PROCEDURES

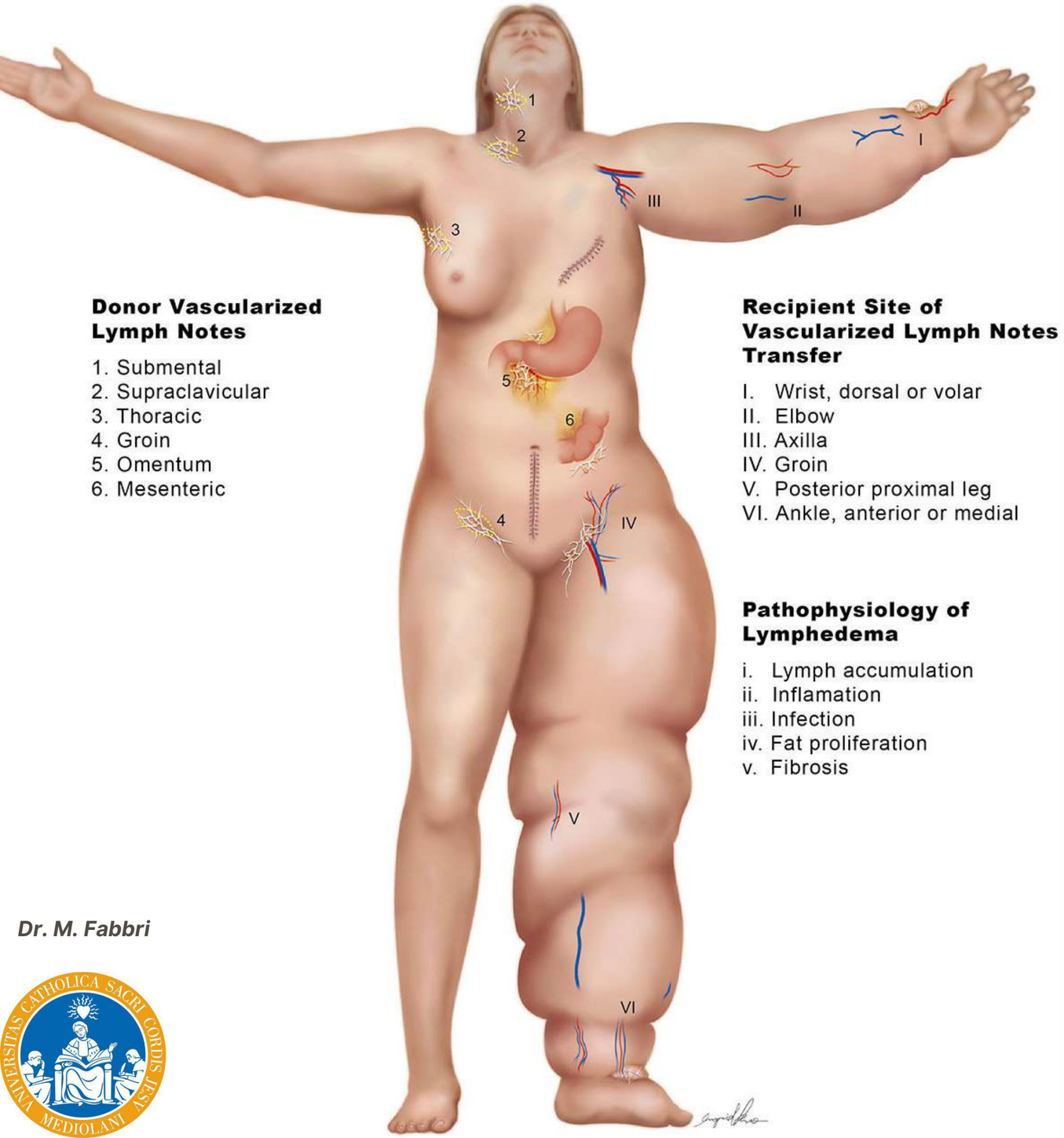
FUNCTIONAL LV

LVA

NON FUNCTIONAL LV

VLNT

VASCULARIZED LYMPH NODE TRANSFER



Donor Vascularized Lymph Notes

1. Submental
2. Supraclavicular
3. Thoracic
4. Groin
5. Omentum
6. Mesenteric

Recipient Site of Vascularized Lymph Notes Transfer

I. Wrist, dorsal or volar
II. Elbow
III. Axilla
IV. Groin
V. Posterior proximal leg
VI. Ankle, anterior or medial

Pathophysiology of Lymphedema

i. Lymph accumulation
ii. Inflamation
iii. Infection
iv. Fat proliferation
v. Fibrosis

The transferred nodes may act as a pump absorbing the interstitial fluid and pumping it into the venous circulation through an intrinsic LVS driven by perfusion gradients between arterial inflow and venous outflow.
Also transplanted LNs may secrete VEGF-C that will stimulate lymphoangiogenesis and the creation of new lymphatic collateral pathways.

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WHICH VASCULAR LYMPH NODE FLAP IS THE BEST FOR UPPER EXTREMITY LYMPHEDEMA?

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	PROS	CONS
Groin flap	• Minor morbidity of the donor site • Abundant surrounding soft tissue • Possibility to combine with DIEP flap for breast reconstruction	• Risk of iatrogenic lower extremity lymphedema
Supraclavicular flap	• Minor morbidity of the donor site • Possibility to harvest 2 independent LNF • Thinner flap • No iatrogenic lymphedema	• Well trained surgeon • Anatomical variations
Submental flap	• No iatrogenic lymphedema • Longer and bigger pedicle	• Risk of injuring the marginal mandibular nerve
As a pedicled flap *Lateral thoracic flap*	• Minor morbidity of the donor site • Longer pedicle • Dividing the flap on different vascular pedicles for multilevel transfer	• Risk of iatrogenic upper extremity lymphedema
Gastroepiploic flap	• Absent risk of iatrogenic lymphedema	• Complications related to laparoscopic procedure
Jejuno mesenteric flap	• Absent risk of iatrogenic lymphedema • Reliable lymph node packet	• Complications related to laparoscopic procedure

The flap is harvested on the superficial branch of the superficial circumflex artery

GROIN LN FLAP

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The most common complication is LEL: how to avoid it?

Reverse lymphatic mapping

Be aware of the anatomy

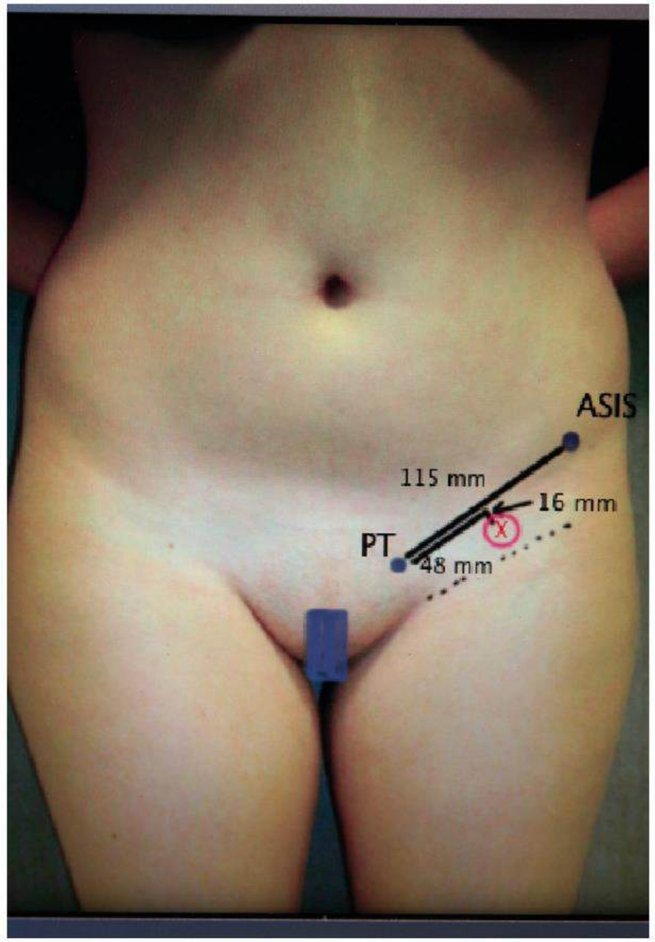


FIGURE 2 Anatomic landmarks for the planning of a VGLNF

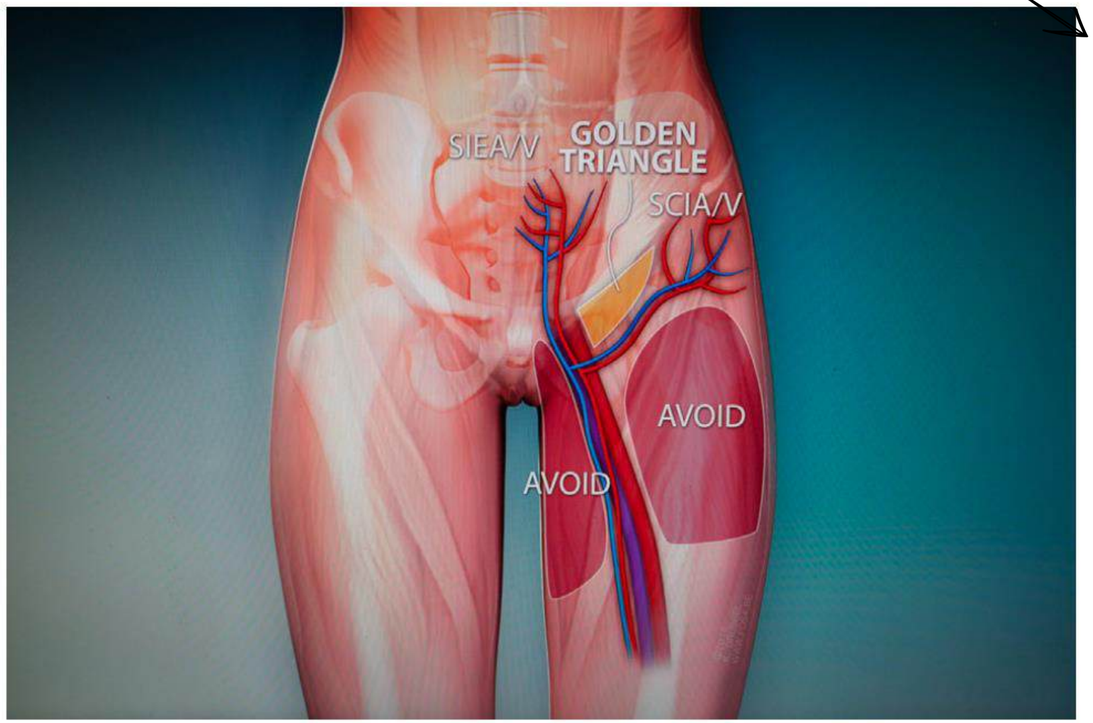
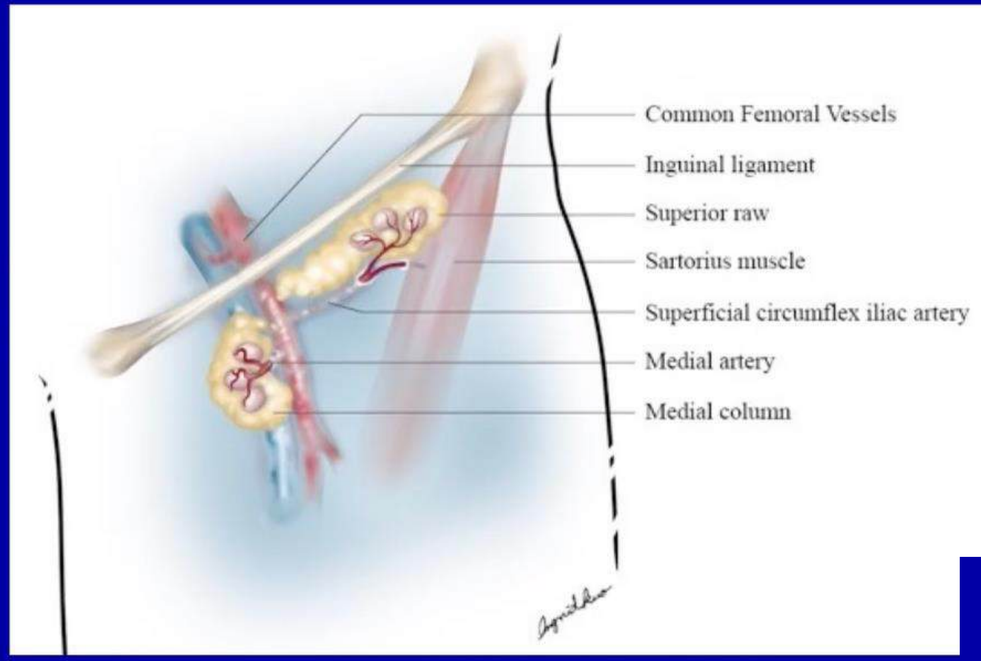


FIGURE 1 Anatomic boundaries of "the Golden Triangle." The zones marked in red are the zones where no lymphatic tissue should be harvested or included in the flap

Key points:

- Superficially located to the deep fascia
- Identità SCIV and SIEV preoperatively
- Never go caudal to the SCIV and medial to the femoral artery

No. of LN:
Superior row: 3.4
Medial column: 2.8
Total: 6.2



SCIA superficial pedicle length: 2.5 cm
Medial branch pedicle length: 1.9 cm

Cheng MH, et al. *Plast. Reconstr. Surg.* 2013; 131:128(

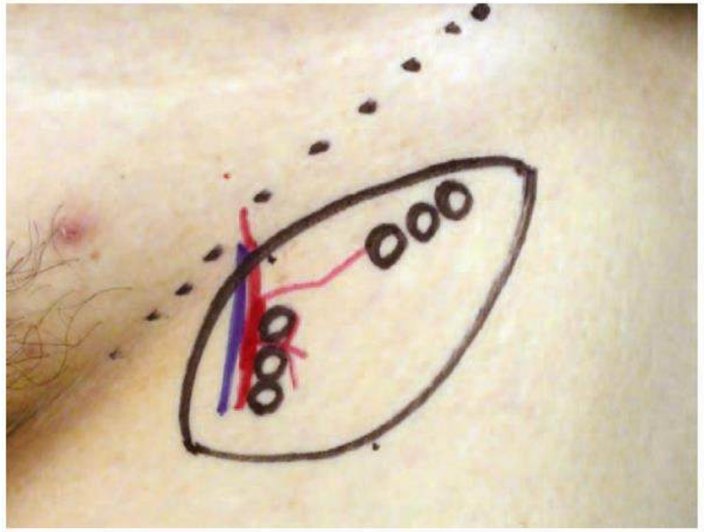


Fig. 4. A 10 × 5-cm vascularized groin lymph node flap was marked parallel to and 1 cm below the inguinal ligament.

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Vascularized Groin Lymph Node Flap Transfer for Postmastectomy Upper Limb Lymphedema: Flap Anatomy, Recipient Sites, and Outcomes

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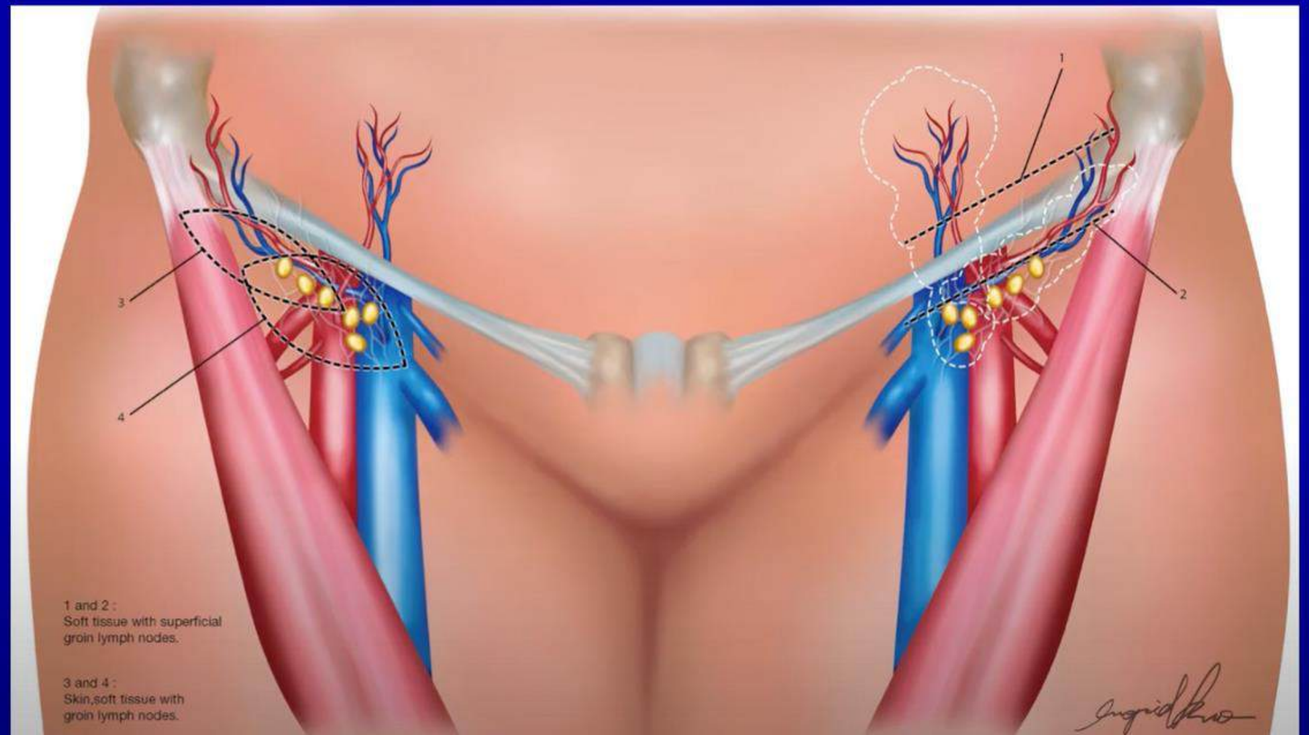
Bien Keem Tan, M.D.
Miffy Chia-Yu Lin, M.Sc.
Ju-Jung Huang, M.D.

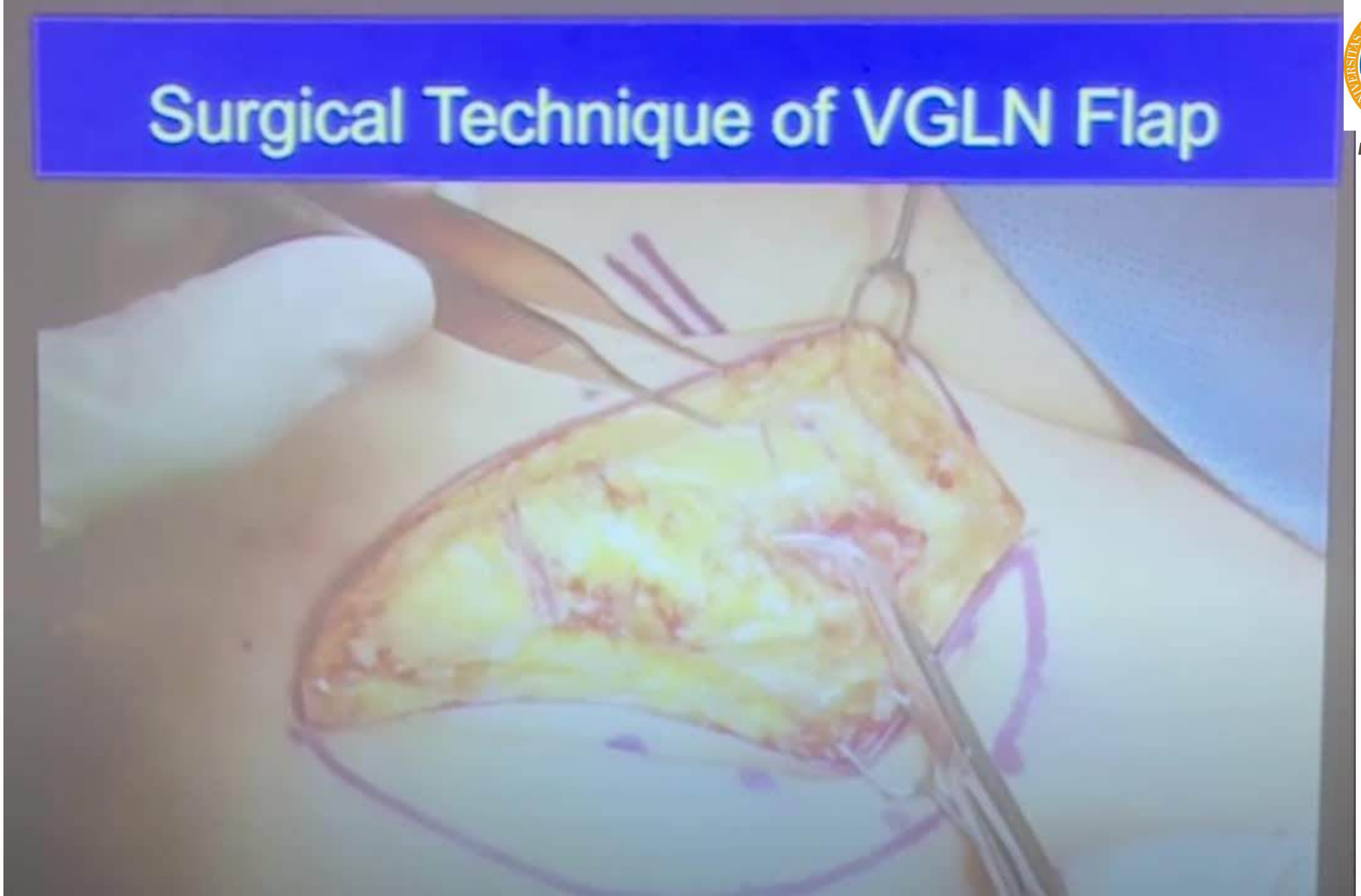
Taoyuan, Taiwan; Austin, Texas; and Singapore

Background: Vascularized groin lymph node flap transfer is an emerging approach to the treatment of postmastectomy upper limb lymphedema. The authors describe the pertinent flap anatomy, surgical technique including different recipient sites, and outcome of this technique.
Methods: Ten cadaveric dissections were performed to clarify the vascular supply of the superficial groin lymph nodes. Ten patients underwent vascularized groin lymph node flap transfer for postmastectomy upper limb lymphedema using the wrist (n = 8) or elbow (n = 2) as a recipient site. Ten patients who

Incisions With or Without Skin Paddle



Surgical Technique of VGLN Flap



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COMBINED DIEP AND VGLNF

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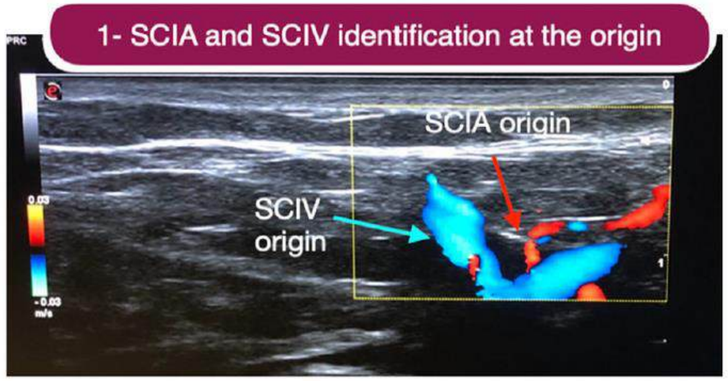
Can be harvested both as one single flap or two independent flaps

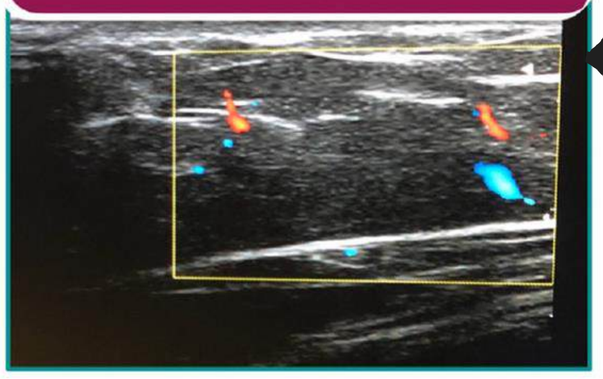
1- SCIA and SCIV identification at the origin



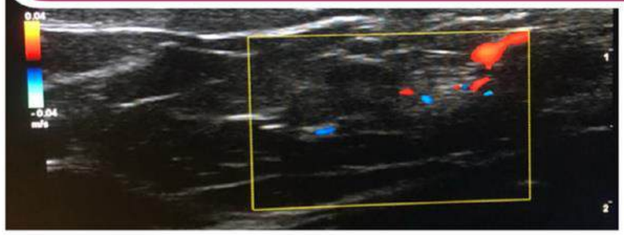
Perforators included in order to transfer a skin paddle as a monitor

2- Follow SCIA to indentify the superficial and deep branch

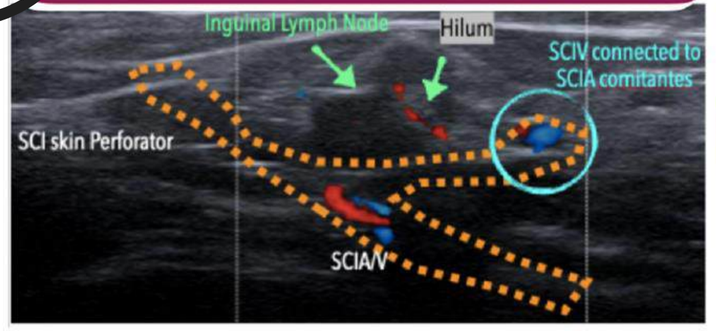
3- Locate reliable cutaneous perforators if the skin wants to be included (LYST)



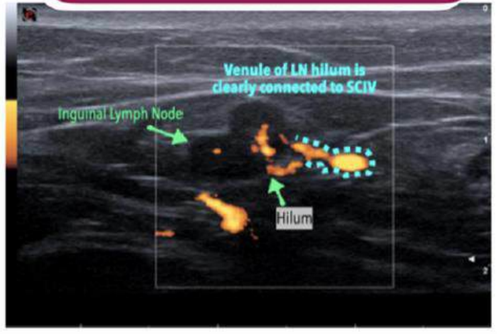
4- Locate lymph node along the vessel course



5- Evaluate microvascular Lymph Node anatomy with CDS



6-and with Power Doppler Mode



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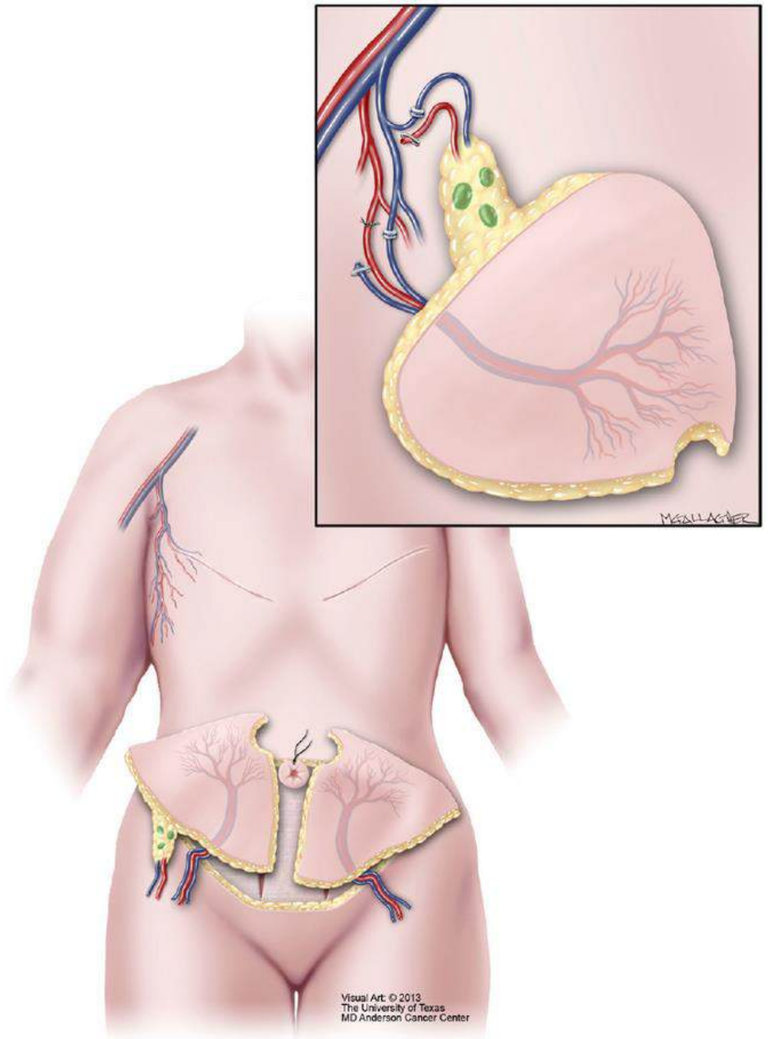
RADICAL AXILLARY SCAR RELEASE IS PERFORMED TO DECOMPRESS VASCULAR STRUCTURE, TO CREATE A recipient bed for the lymph node flap and expose branches of the subscapular axis for anastomosis of the lymph node flap; typically a **branch of the thoracodorsal vessels or the serratus vessels are used as recipient vessels,** preserving the latissimus dorsi flap lifeboat.

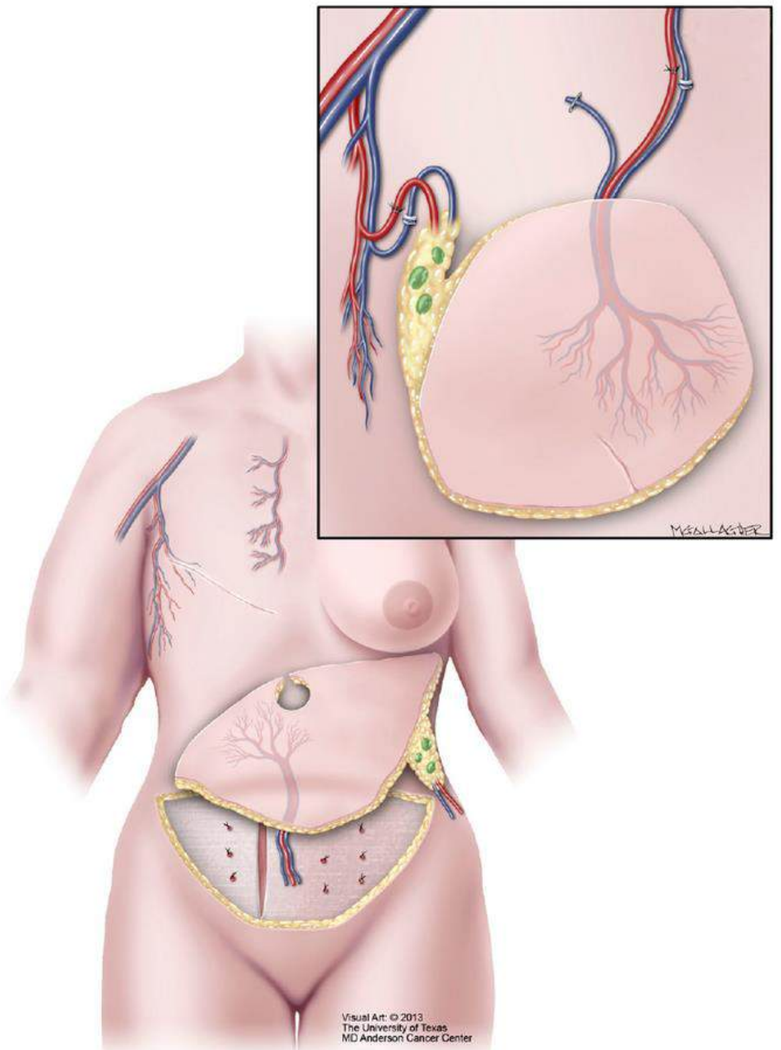
BILATERAL/HEMIABDOMEN

VLNT venous anastomoses recommended



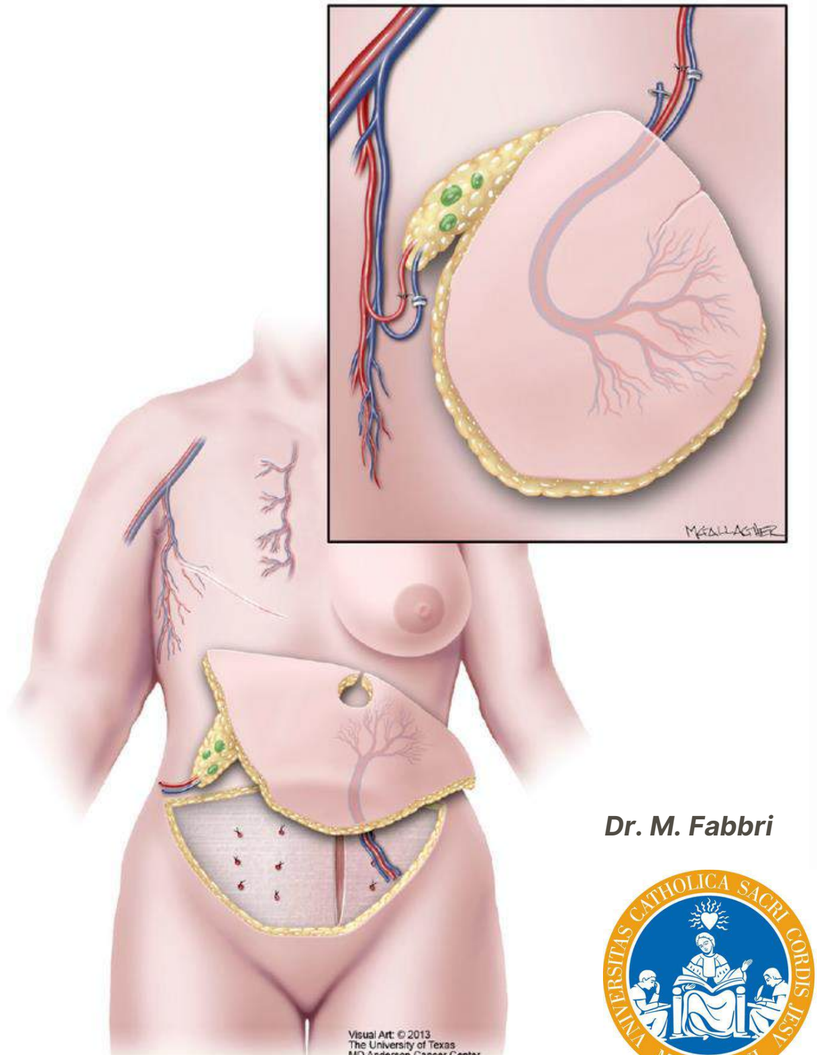
DIEP IPSILATERAL/VLNT CONTROLATERAL

180 ° rotation
VLNT venous anastomoses necessary, arterial anastomosis recommended



DIEP CONTROLATERAL/VLNT IPSILATERAL

90 ° rotation
VLNT venous and arterial anastomoses necessary



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WHAT IF PATIENT CANNOT UNDERGO A MICROVASCULAR RECONSTRUCTION?

LATERAL THORACIC LN FLAP

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ONLY LEVEL 1 LNs ARE HARVESTED

Supplied by lateral thoracic vessels

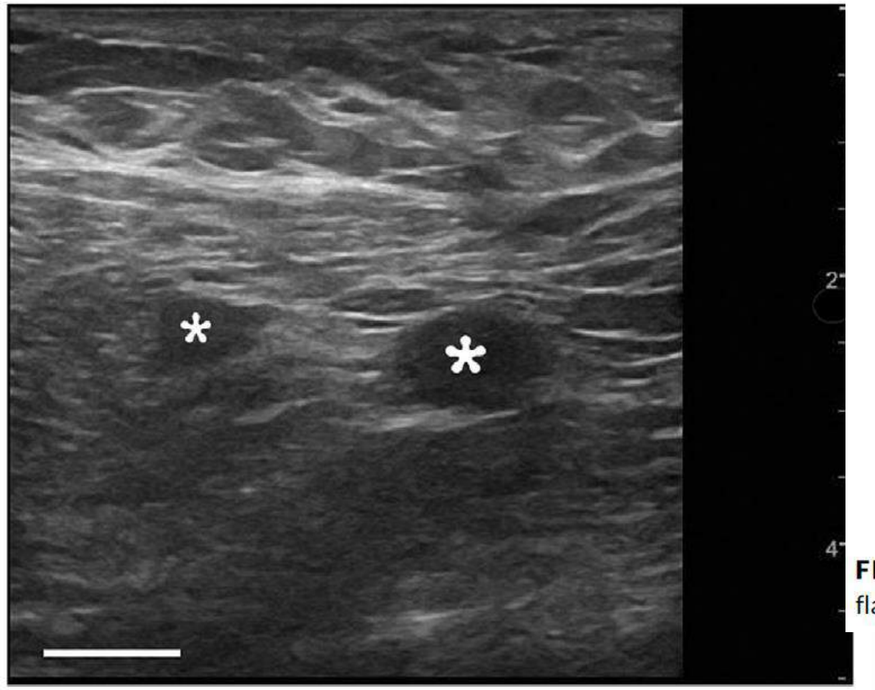

FIGURE 5 Ultrasound image of axillary lymph nodes (level I): asterisks, lymph nodes; scalebar, cm. Note the similar size of surrounding fat lobules

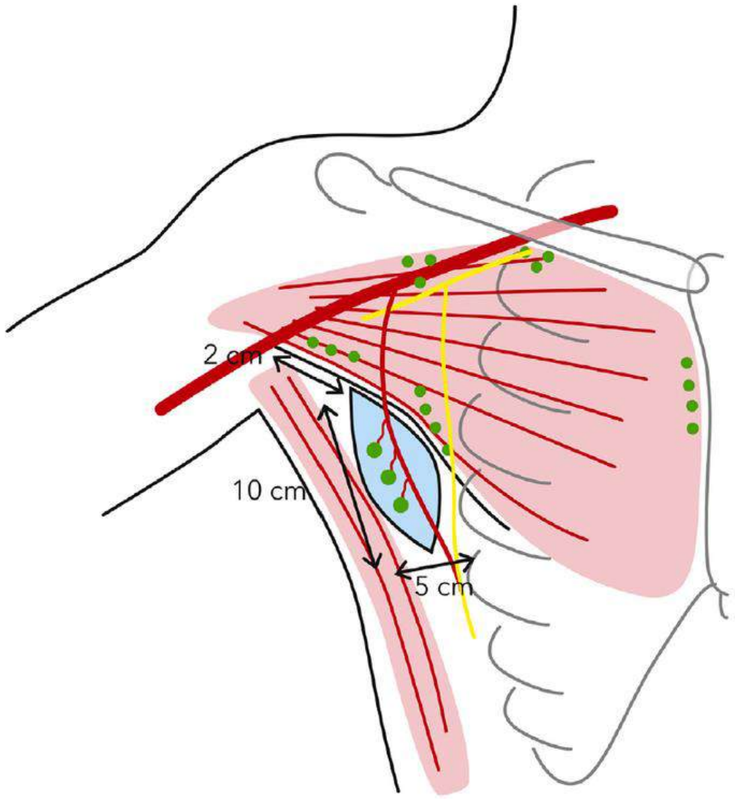

FIGURE 1 Schematic drawing of the lateral thoracic artery-based flap design

Dissection in a suprafascial plane until the pectoralis minor margin and second intercostal brachial nerve

LATISSIMUS DORSI FLAP WITH VLNT

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In approximately 60% of case branches from the lateral thoracic vessels supply lymph nodes in the superior portion of the LD muscle

Fig. 1. The skin island markings are positioned more anterior than the usual markings for an LD flap.

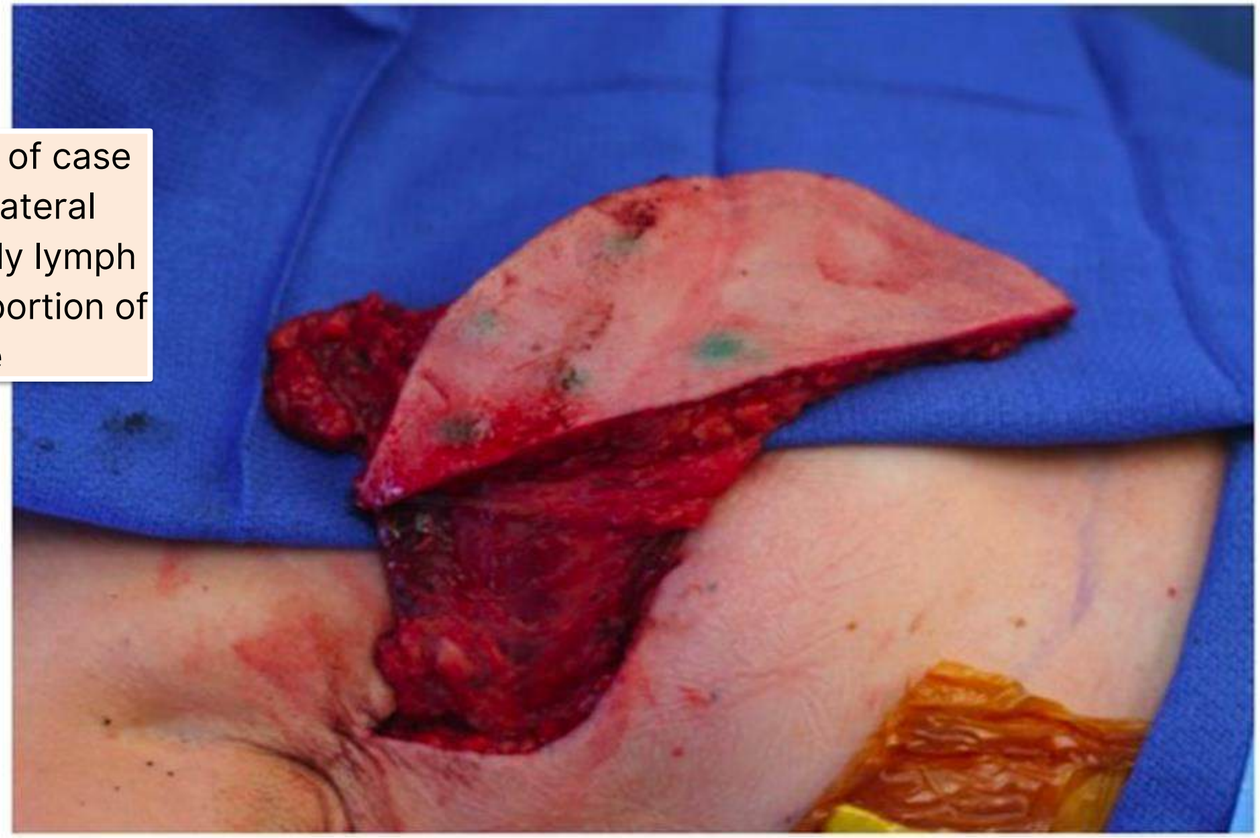

Fig. 3. For cases of ipsilateral upper extremity lymphedema, the flap is rotated to the defect as a pedicled flap.

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INSETTING

No difference between proximal and distal insets.

When lymphedema mainly affects the distal area, it exploits gravitational force. Also absence of RT damage and fibrosis.

PROXIMAL / ORTHOTOPIC

AXILLA

- Possibility to combine it with breast reconstruction
- Axillary scar release
- Creation of a recipient bed for LNF
- Decompression of axillary/subclavian vein
- Acceptable aesthetic results

MEDIAL / HETEROTOPIC

VOLAR MID ARM

- Lazy S-shaped incision below the antecubital fossa
- Anterior recurrent ulnar artery and basilic vein as recipient
- Primary skin closure without tension
- BETTER AESTHETICS

DISTAL / HETEROTOPIC

WRIST

- L-shaped incision at the volar wrist aspect
- Superficial branch of radial artery and venae concomitantes as recipient
- Need of STSG for closure without tension
- POOR AESTHETICS
- Greater post op care

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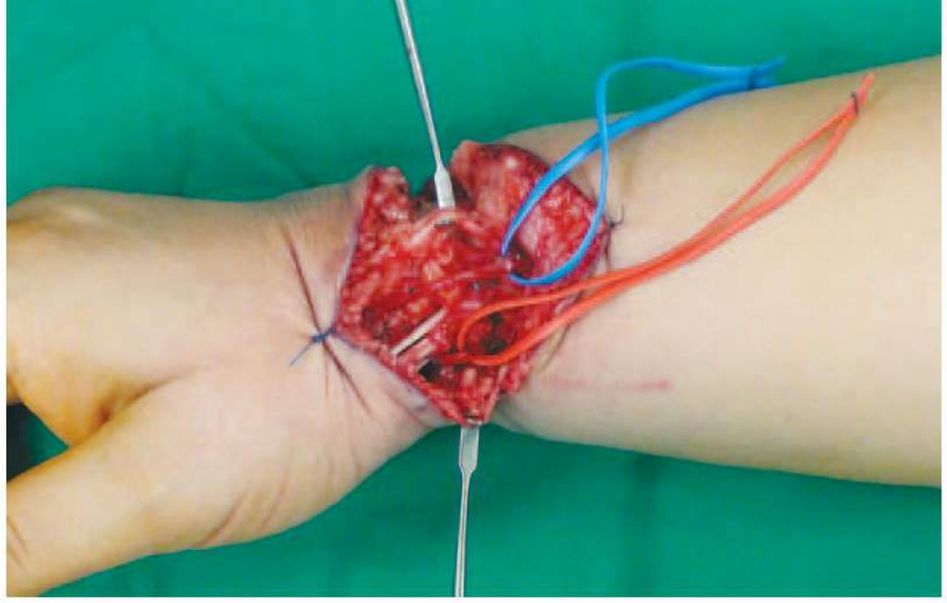


Fig. 8. The wrist was selected as the recipient site. The radial artery dorsal branch (*red loop*) was pulled from beneath the abductor pollicis longus and extensor pollicis longus to above these two tendons to avoid compression.

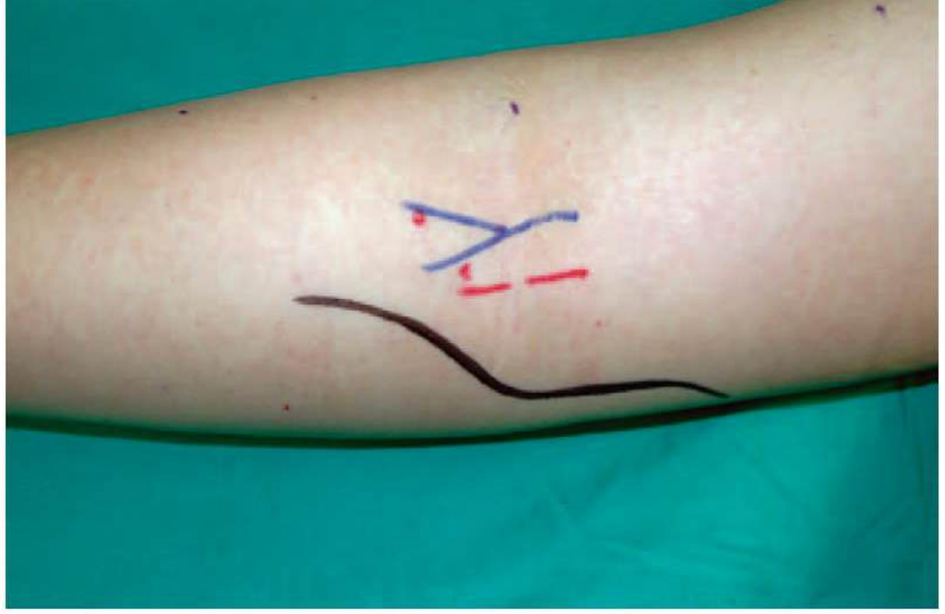
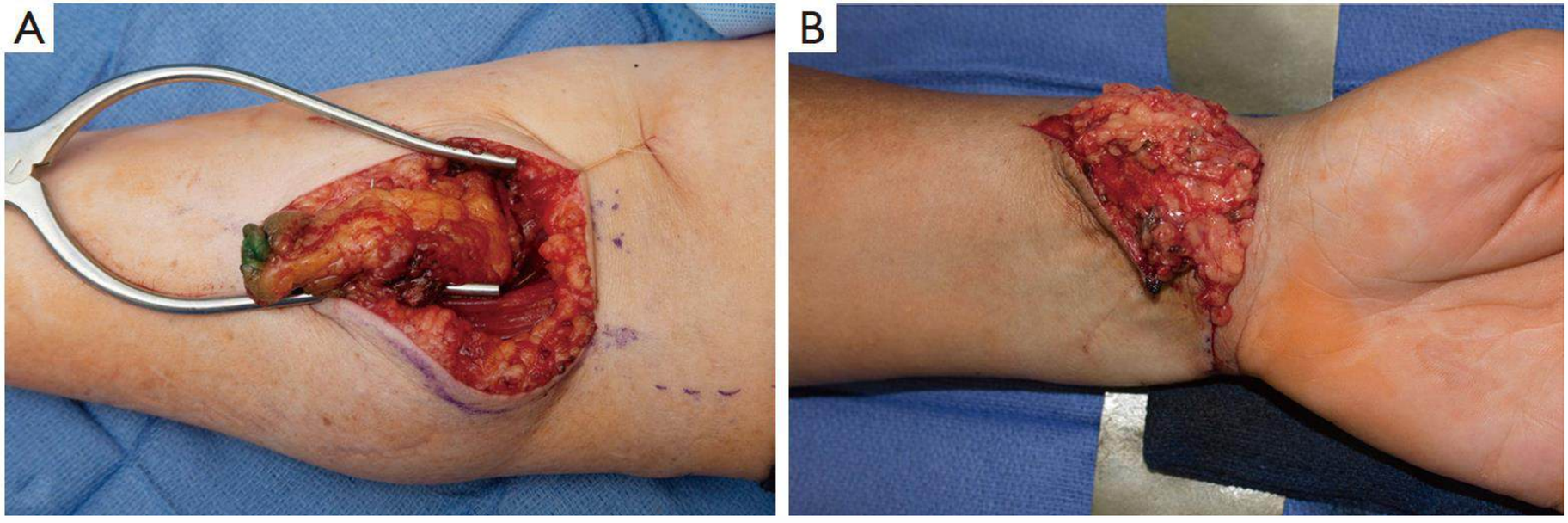


Fig. 6. The right elbow was selected as the recipient site using the anterior recurrent ulnar artery and the basilic vein as the recipient vessels.



Decrease in incidence of cellulits, pitting edema, tightness and pain

OUTCOMES

Decrease in circumference and volume

Improvement in QoL

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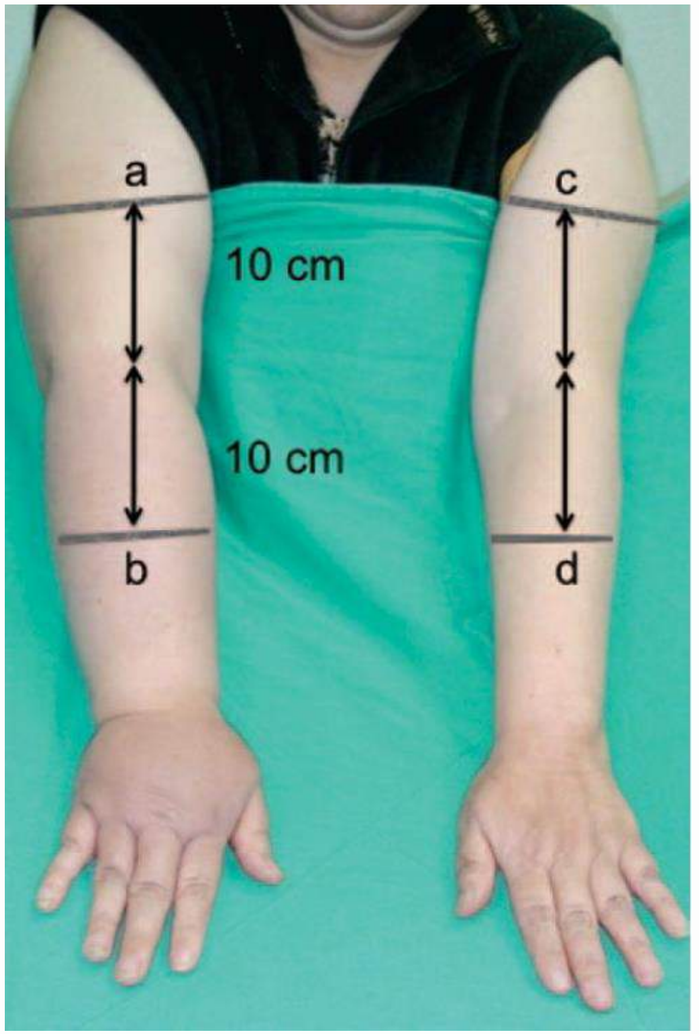
- Positive correlation between flap size and volume reduction because of the greater number of LNs and higher lymphatic tissue densities in large flaps
- The best method for measuring lymphedema is circumferential limb measurements and cellulitis episodes
- Lymphedema Quality of Life can be used to track changes in quality of life



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DISTAL INSETTING

PROXIMAL INSETTING

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THANK YOU FOR YOUR ATTENTION

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SCaLPELProject
Rome - Brno 2023