

OFFICIAL ORGAN
OF THEEUROPEAN GROUP OF LYMPHOLOGY
LATIN-MEDITERRANEAN CHAPTER OF ISL
SOCIETÀ ITALIANA DI LINFANGIOLOGIA
CZECH SOCIETY OF LYMPHOLOGY
ROMANIAN SOCIETY OF LYMPHOLOGY
GREEK SOCIETY OF LYMPHOLOGYTHE EUROPEAN JOURNAL
OF
lymphology

and related problems

VOLUME 24 • No. 69 • 2013

INDEXED IN EXCERPTA MEDICA

SUMMARY**Clinical Sciences****Original articles**

- Primary prevention after breast cancer surgery: Echo-Colour-Doppler diagnostics versus lymphoscintigraphy exam
Marina Cestari, MD p. 1
- Microlymphatic surgery for the treatment of iatrogenic lymphoedema
Corinne Becker, Joshua Levine, Constance Chen, Julie Vasile, Bernardo Nogueira Batista p. 5
- Microsurgical lymphatic-venous multiple anastomoses: indications and clinical outcome
Francesco Boccardo, MD, PhD, Corrado Campisi, MD, Lidia Molinari, MD, Stefano Spinaci, Sara Dessalvi, MD, Corradino Campisi, MD, PhD, FACS p. 9
- Linforoll: a new device for lymphoedema treatment. Preliminary experience
Michelini S., Caldirola R., Olszewski W., Pissas A., Dimakakos E., Forner Cordero I., Michelotti L., Cardone M. p. 14
- Letter to the Editor: “About lymphoscintigraphies and pneumatic massage”
Pierre Bourgeois, MD, PhD p. 18
- School of lymphoedema prevention: your care, our goal
Teresa Torralba-Puebla, Leire Ortiz-Fernandez, Maria Zamarripa-Cuesta p. 25
- Brief overview of the benefits of Nordic Walking in the treatment of primary and secondary lymphoedema
C. Gonzalez-Castro p. 28

Calendar40TH EUROPEAN CONGRESS OF LYMPHOLOGY
SEPTEMBER 25-27, 2014 - GENOA - ITALY p. 31

THE EUROPEAN JOURNAL OF LYMPHOLOGY AND RELATED PROBLEMS (EJLRP)

The EJLRP - official organ of the European Group of Lymphology (ESL), Czech Society of Lymphology, Romanian Society of Lymphology, Greek Society of Lymphology, the Latin-Mediterranean Chapter of Lymphology (LMCL), the Società Italiana di Linfangiologia (SIL) covers all fields of Lymphology and aims to present a multidisciplinary approach to diseases of the lymphatic system, with information on the analysis, control and treatments of such diseases.

Topics

The topics include:

- anatomy and anatomopathology
- physiology and physiopathology
- pharmacology
- diagnostic methods (conventional radiology, nuclear medicine, ultrasonography, computed tomography, biopsy, nuclear magnetic resonance)
- therapy (surgery, medicine, radiotherapy, physical)
- oncology (primary lymphatic system diseases, lymphonodal metastatic process)
- immunology
- post-therapeutic complications
- upper and lower limb edemas

Manuscripts publications

Submitted manuscripts will be published in the form of Editorial, Review article, Original article, Teaching article, Special article, Work in progress, Case Report, Short Communications, Letter to the Editor (in English), Abstract (in English)

They will be subdivided in Clinical and Basic Sciences.

Send manuscripts to:
the Executive Editor

Dr. S. MICHELINI

Department of Vascular Rehabilitation
S. Giovanni Battista Hospital
Via L.E. Morselli, 13 - 00148 Rome, Italy
Tel. +39 06 655961 - Fax +39 06 65596235
e-mail: sandro.michelini@fastwebnet.it

The Editor-in-Chief

Prof. Dr. F. BOCCARDO

Department of Surgery, Lymphatic Surgery and Microsurgery
S. Martino Hospital, University of Genoa
Largo R. Benzi, 8 - 16132 Genoa, Italy
Fax 0039010532778 - e-mail: Francesco.boccardo@unige.it

Associate-Editors also can receive and promote articles and start the review process.

Publications languages

Official language of the Journal is English.

Publication rate

The EJLRIP is published on a quarterly basis.

Subscription rates - All members of European Group of Lymphology or of National societies (with which the ESL has a cooperation agreement and whose fee includes a subscription to the EJLRP) receive the Journal free of charge.

Subscription rate for non-members is:

- for all issues, 30 € within European Countries, 50 € elsewhere,
- for single issue, 15 € within European Countries, 18 € elsewhere.

Annual subscription rate of ESL: 80 €

Please make cheque (in euro) to order of the ESL and to be sent to the Treasurer of the ESL: Mr J.P. BELGRADO, Treasurer of the ESL, Service de Kinésithérapie, Avenue Paul Héger, 28, OF 168, 1050, Brussels, Belgium.

E-mail: belgrado@ulb.ac.be or transfer the corresponding amount on the following Bank Account of the ESL n. 210-0557380-70 N° IBAN BE60 2100 5573 8070 BIC GEBABEBB (Générale de Banque), with mention of your name and of the year(s) subscription.

Change of address - Please notify the Secretary and the Treasurer of the ESL of any change of address and telephone number at least 30 days prior to the issue date by sending both the old and new address.

Data base & Treasurer of the ESL - J.P. BELGRADO: Université Libre de Bruxelles, CP 168, Av. F.D. Roosevelt, 50, 1050 Bruxelles, Belgium. Tel. +32 2 650.24.34 - Fax: +32 2 280.13.33 - Mobile +32 475 63.34.34

Business communications - Business communications concerning advertising, subscriptions, change of address, and permission requests should be sent to the Secretary, O. LEDUC, Service de Kinésithérapie, Avenue Paul Héger, 28 CP 168, 1050 Brussels, Belgium. Tel. (32) (2) 650.24.70 - Fax: (32) (2) 650.24.73.

Advertisements are subject to editorial approval and restricted to products or services pertinent to lymphology.

Advertising rates can be obtained from the Secretary and Treasurer.

Miscellaneous - The use of general descriptive names, trade names, trademarks, etc., in the publication, even if not specifically identified, does not imply that these names are not protected by the relevant laws and regulations.

While the advice and information in this Journal is believed to be true and accurate at the date of its going to press, neither the authors, the Editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

The Editors do not accept any responsibility for opinions that may be made by the authors.

Areas of distribution - Austria, Belgium, Czech Republic, Denmark, Egypt, France, Germany, Greece, Holland, Hungary, Israel, Italy, Japan, Norway, Poland, Portugal, Rumania, Russia, Spain, Sweden, UK, USA.

E.S.L. EXECUTIVE COMMITTEE

Distinguished Honorary President
LEDUC ALBERT (Belgium)

President

MICHELINI SANDRO (Italy)

Vice-Presidents

BAUMEISTER RUDIGER (Germany)

BOCCARDO FRANCESCO (Italy)

Secretary

LEDUC OLIVIER (Belgium)

Treasurer

BELGRADO JEAN PAUL (Belgium)

Scientific Committee President

BOURGEOIS PIERRE (Belgium)

Scientific Committee Vice President

DIMAKAKOS EVANGELOS (Greece)

Member

BOURGEOIS PIERRE (Belgium)

BRORSON HÅKAN (Sweden)

BRUN JEAN PATRICE (France)

CAMPISI CORRADINO (Italy)

ELIŠKA OLDŘICH (Czech Rep.)

FÖLDI ETHEL (Germany)

FORNER CORDERO ISABEL (Spain)

LEDUC ALBERT (Belgium)

OLSZEWSKI WALDEMAR (Poland)

PAPENDIECK CRISTOBAL (Argentina)

PISSAS ALEXANDRE (France)

RIQUET MARC (France)

THIBAUT GILBERT (France)

EUROPEAN JOURNAL OF LYMPHOLOGY AND RELATED PROBLEMS

Past Editors-in-Chief: P. BOURGEOIS (Belgium) - C. CAMPISI (Italy) - S. MICHELINI (Italy)

Editor-in-Chief: F. BOCCARDO (Italy)

Assistant Editors: A. FAILLA (Italy) - G. MONETA (Italy) - DIMAKAKOS EVANGELOS (Greece) - FORNER CORDERO ISABEL (Spain)

Associate-Editors: RGH BAUMEISTER (Germany) - A. LEDUC (Belgium) - M. RIQUET (France) - H. BRORSON (Sweden) - O. ELIŠKA (Czech R.) - R. NUNO GRANDE (Portugal), C. CAMPISI (Italy)

Executive-Editor: S. MICHELINI (Italy)

Assistant Executive-Editors: O. LEDUC (Belgium), J.P. BELGRADO (Belgium)

National delegates and Scientific Committee: G. AZZALI (Italy) - A. BEHAR (France) - K. BENDA (Czech. Rep.) - J. BRUNA (Czech. Rep.) - R. CLUZAN (France) - E. DIMAKAKOS (Greece) - E. ELIŠKA (Czech Rep.) - E. FÖLDI (Germany) - M. FÖLDI (Germany) - I. FORNER-CORDERO (Spain) - P.S. MORTIMER (Great-Britain) - NUNO R. GRANDE (Portugal) - W. OLSZEWSKI (Poland) - A. PECKING (France) - A. PISSAS (France) - O. RADA (Romania) - A. SOUSA PEREIRA (Portugal) - G. THIBAUT (France) - M. WALD (Czech. Rep.)

International Board of Trustees: MFC ANDRADE (Brazil) - M. WITTE (USA) - C. PAPENDIECK (Argentina) - M. OHKUMA (Japan)

Secretary: O. LEDUC (Belgium)

Treasurer: J.P. BELGRADO (Belgium)

ESL Awards: Caplan price (anatomie, clinical) one year and the other year Papamiltiades price (physiology or patho physiology).

Graphics: Duògrafi snc, Rome - Printed by Arti Grafiche srl, Pomezia (Rome)

Instructions to authors

General

Submission of an original article implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that it is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out (including ethical committees and national licencing authorities); that, if and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher; and that the manuscript will not be published elsewhere in any language without the consent of the copyright holders.

Manuscripts should be submitted in triplicate (original and two copies); they should be double-spaced, with wide margins on one side of the paper only, and should be carefully prepared in the style of this journal and checked before submission. Typing errors should be corrected legibly.

All manuscripts are subject to copy editing and, if necessary, will be returned to the authors for open questions to be answered or for missing information to be supplied before being sent to the printers. When extensive corrections are necessary, authors are responsible for having manuscripts retyped.

Pages should be consecutively numbered, starting with the title page. The desired position of figures and tables should be marked in the margin.

Changes in the proofs should be kept to a minimum: a charge will be made for changes introduced after the manuscript has been set in type.

Organization of the manuscript

The speed of publication depends greatly upon following these guidelines precisely.

1. The manuscript should be divided clearly into an Introduction, Materials and Methods, Results, Discussion and Conclusion and References. The text should be concise and consistent as to spelling, abbreviations, etc...

2. The **title page** should include the title of the work, first and last name(s) of author(s), name of institution, any footnotes referring to the title (marked with an asterisk), and the address of the author to whom the proofs are to be sent.

To facilitate communication between the authors, editors and publisher, the author should furnish a **telex or fax number** on the title page of the manuscript.

3. The **abstract** should be a summary of the hypothesis or aims of the work, the basic material and methods and the conclusion of the study.

4. Immediately following the abstract, up to 7 relevant **key words** should be supplied for subject indexing.

5. **Footnotes**, other than those referring to the title heading, should be numbered consecutively.

6. The accuracy of the **References** is the responsibility of the authors.

The list of references should only include works that are cited in the text and that have been published or accepted for publication. Personal communications should be mentioned in the text only. The list should be in alphabetical order according to the first author's name. Works by two authors should be listed alphabetically according to the second author's name, then chronologically; those by three or more authors should be in chronological order. References should be styled as follows.

Biancos J.A., Eimaleh D.R., Leppo J.A. (1986) Effect of glucose and insulin infusion on the myocardial extraction of a radioiodinated methyl-substituted fatty acid. *Eur. J. Nucl. Med.* 12: 120-124.

Gullberg G.T., Malko J.A., Eisner R.L. (1983) Bounday determination methods for attenuation correction in single photon emission computed tomography. In: Esser PD (ed). *Emission computed tomography: current trends*. Society of Nuclear Medicine, New-York, pp. 33-53.

Meltzer YL (1971) Hormonal and attractant pesticide technology. Noyes data, Park Ridge, New Jersey.

Citations in the text should be given in parentheses (Child 1941; Godwin and Cohen 1969; MacWilliams et al., 1970), except when the author is mentioned, as in "and the study of Hiliman and Tasca (1977)".

7. **Tables** should be submitted on separate sheets. Numerical data given in graphs and tables must not be duplicated.

8. All **figures**, whether photographs, graphs or diagrams, should be numbered consecutively throughout and submitted on separate sheets. Plate layouts or single figures may either match the width of the column (9 cm) or be 11.8 cm in width with the legend at the side.

The maximum height for a figure or plate is 23 cm, including the legend printed at its foot. Photographs can be grouped into plates. They must be mounted on regular bond paper, not on cardboard.

All photographs and electron micrographs should be supplied as high-contrast glossy prints trimmed at right angles. Inscriptions on illustrations should allow for reduction if this is necessary; figures and letters should have a final height of 2 mm after reproduction.

Color illustrations will be accepted: however, the authors will be expected to make a contribution (approximately BF 7.500 per page) to the additional costs involved.

9. Typewritten **mathematical equations** should be clear, so that there is no opportunity for misinterpretation by the printer.

All letters contained in formulae as well as single letters in the text are automatically set in italics and therefore require no underlining. Hence, abbreviations that appear in formulae and are to be set in roman type (the type normally used for the text) should be specially marked by underlining in yellow, if possible.

It will be helpful to the printer if *Greek characters are underlined in red and script in green*. Lowercase letters should then be underlined once and capital letters twice; this applies also to Latin letters in formulae (in pencil). Boldface type (heavy type) should be marked by wavy underlining.

Subscripts and superscripts should be indicated by an inverted caret below the line, or a caret above the line, respectively: 12_2 ; a subscript to a subscript is styled: 12_2 .

Obscure primes and dots must be clarified for the printer. The following must be differentiated clearly: number 1 and letter l; zero 0 and letters O, o, e, c, n, u, v, primes and apostrophes. Fractional exponents should be used in, stead of root signs and the solidus (/) for fractions whenever they are horizon. tal; an exp notation must be numbered sequentially in arabic numerals in parentheses on the right-hand side of the page.

10. Fifty (50) *offprints* of each paper with additional copies are available in lots of 100, (provided the order is received with the corrected proofs) may be supplied charged to the authors.

11. Enclose the picture of the first author of each article.

**XXXX Congress
of the European Society
of Lymphology**

President:

Francesco Boccardo, MD, PhD (Italy)
scient_info@esl2014.com

September 25-27, 2014

Genoa, Italy

Congress Secretariat: info@esl2014.com

PRIMARY PREVENTION AFTER BREAST CANCER SURGERY: ECHO-COLOUR-DOPPLER DIAGNOSTICS VERSUS LYMPHOSCINTIGRAPHY EXAM

MARINA CESTARI, MD

“Pianeta Linfedema” Study Centre, Terni, Italy

info@pianetalinfedema.it

ABSTRACT

In this study, upper limb Echo-Colour-Doppler venous exam was carried out in patients with no clinical evidence of oedema, who had previously undergone monolateral breast cancer surgery. Deep and superficial veins of compared arms were explored and their sizes measured.

During the evaluation, an asymmetrical calibre of cephalic veins was noticed in most cases, due to the increase of the homolateral side, and consequently it was decided to focus the attention on these measurements, and to compare them to the lymphoscintigraphy previously carried out, in order to investigate an eventual correlation.

So far, this study has highlighted how the asymmetry of cephalic veins seems to have a correlation with the results of the lymphoscintigraphy both in lymphadenectomy and in sentinel node biopsy.

INTRODUCTION

It is known that when lymphatic vessels are in difficulty, veins do not remain indifferent (increase of the calibre and the flow) as a kind of twinning exists between them and with this awareness, it was decided to analyze the venous system behaviour in subclinical stage after monolateral breast cancer surgery.

After the evaluation of the calibre of bilateral superficial and deep veins by Echo-Colour-Doppler exam, the attention was focused on the cephalic vein, due to its different homolateral behaviour compared to other veins.

The compared calibre of cephalic veins was measured, analyzed and compared to the results of the lymphoscintigraphies carried out in all patients.

MATERIALS AND METHODS

The study was carried out in three phases:

1st. The patient laid supine on the bed (back at 30°) and with arms alongside the body, the physiotherapist measured and marked the

compared upper limbs, and the lymphologist measured the compared calibre of superficial and deep veins by Echo-Colour-Doppler (Sonoline Antares 7.5 MHz probe) at the end of expiration.

During this investigation the following results were noted:

- sometimes a symmetry of all superficial and deep veins,
- sometimes an asymmetry of cephalic veins, due to homolateral increase, and at the same time the symmetry or asymmetry of basilica veins and the symmetry of deep veins.

2nd. Following this preliminary evaluation, the attention was focused on the calibre of the cephalic vein due to its behaviour, and as it resulted very easy to follow in all its course, above all in the arm and it was then decided to measure the calibre of compared cephalic veins.

The focus point of the study was not the absolute calibre (and the measure of flow), but only the compared one.

Using the above-mentioned method of evaluation, the compared calibre of cephalic veins of 56 patients were measured.

Patient characteristics:

- females aged 25-60 years,
- 45 monolateral axillary lymphadenectomy patients and 15 monolateral sentinel node biopsy patients, who had undergone surgery between 3-18 months before examination,
- all sub-clinical stages.

The following results were noted in sentinel node biopsy:

- a symmetry in 46% of the cases (photo 1),
- an asymmetry, due to a homolateral increase of the calibre, in 54% of the cases (photo 2).

The following results were noted in lymphadenectomy:

- a symmetry in 23% of the cases (photo 3),
- an asymmetry, due to homolateral increase of the calibre, in 77% of the cases (photo 4).

The precise meaning of the symmetry or the asymmetry was the point in question.

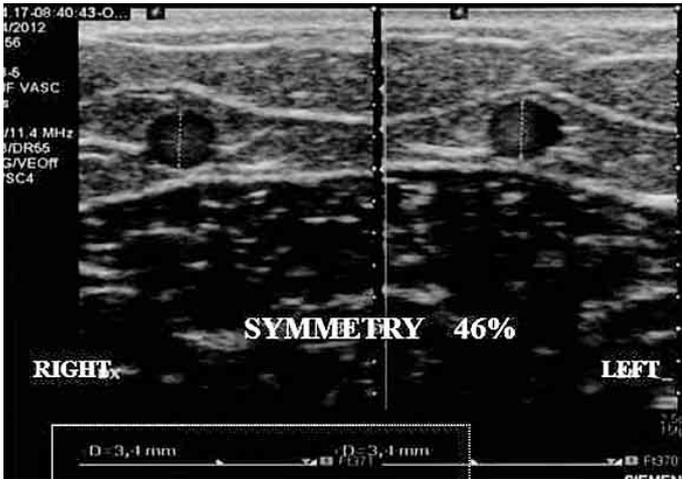


Photo 1

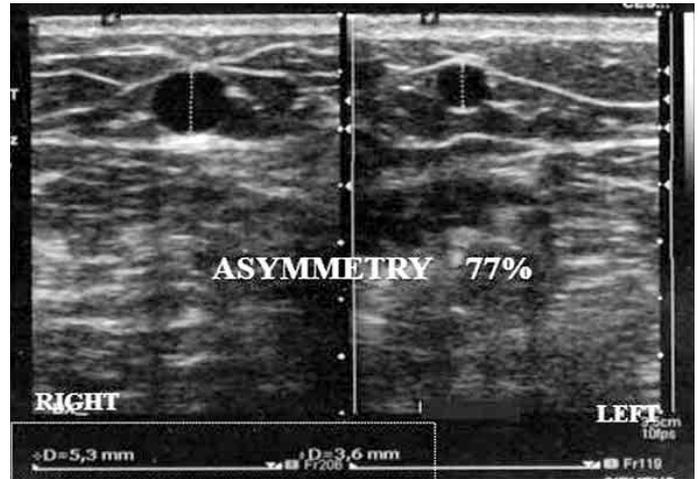


Photo 4

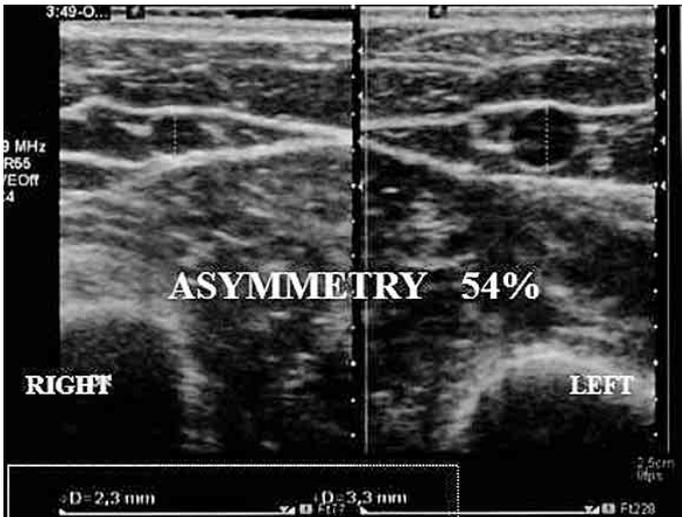


Photo 2

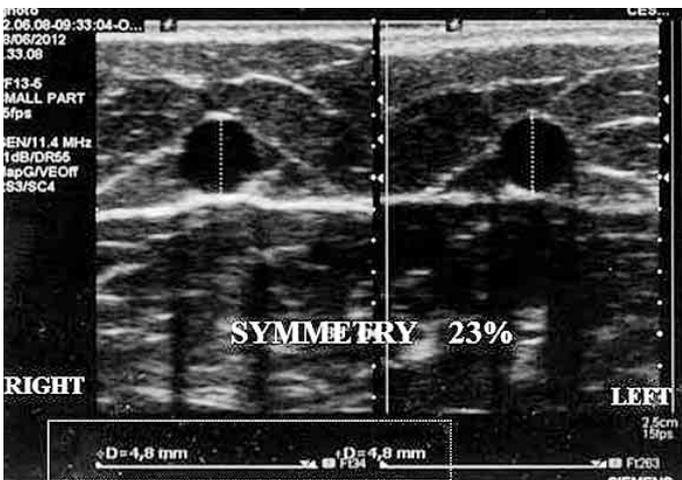


Photo 3

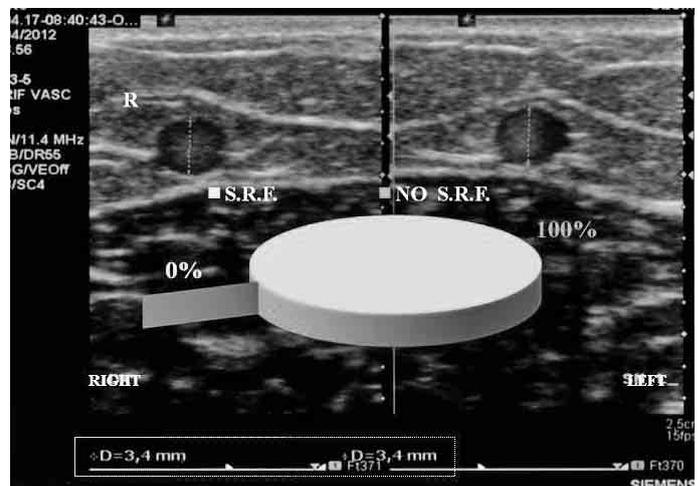


Photo 5

3rd. At this point it was decided to compare the Echo-Colour-Doppler findings with the lymphoscintigraphy exam in order to better understand. All patients had undergone lymphoscintigraphy performed in the Nuclear Department of Santa Maria Hospital in Terni (bilateral subcutaneous injections of 99mTc nanosized colloids in interdigital space, 185 MBq-2,035mBSv) the results of which were: homolateral slower radiotracer flow (initial dermal-back flow and/or stops along the arm) or no slower radiotracer flow. It was also decided to compare the symmetry or asymmetry to surgical side (right or left).

RESULTS

Sentinel lymph node biopsy

The symmetry of cephalic veins (54%) always corresponded to normal exam (photo 5), while the asymmetry (46%), due to homolateral increase, corresponded to slower radiotracer flow in 100% of the cases (photo 6).

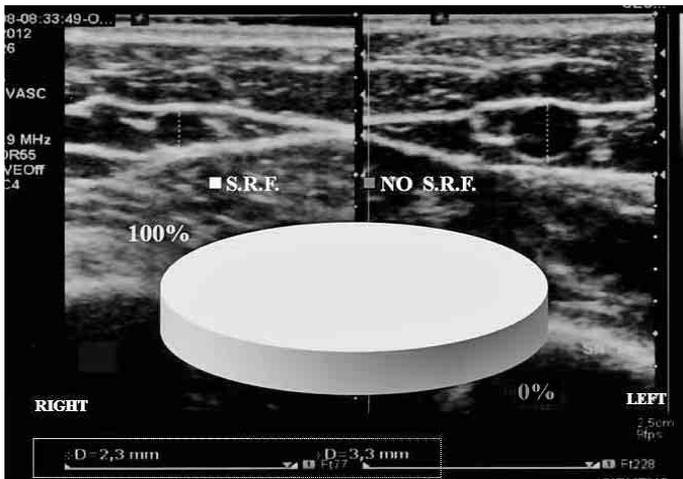


Photo 6

On comparing the surgical side it was noted:

- in the cases of symmetry, right side in 33% of the cases and left side in 67% of the cases; all patients were right handed,
- in the cases of homolateral increased, right side in 50% of the cases and left side in 50% of the cases; all patients were right handed.

Lymphadenectomy

The symmetry (23%) corresponded to no slower radiotracer flow in 67% of the cases and slower radiotracer flow in 33% of the cases (photo 7), while in the cases of asymmetry (77%) due to homolateral increased size, a slower radiotracer flow was present in 100% of the cases (photo 8).

On comparing the surgical side it was noted:

- in the cases of symmetry, right side in 50% of the cases and left side in 50% of the cases; all patients were right handed,
- in the case of homolateral increase, right side in 21% and left side in 79% of the cases; all patients were right handed.

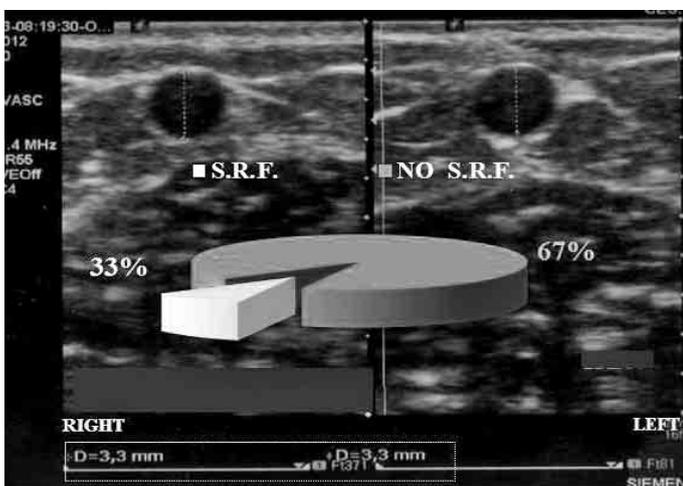


Photo 7

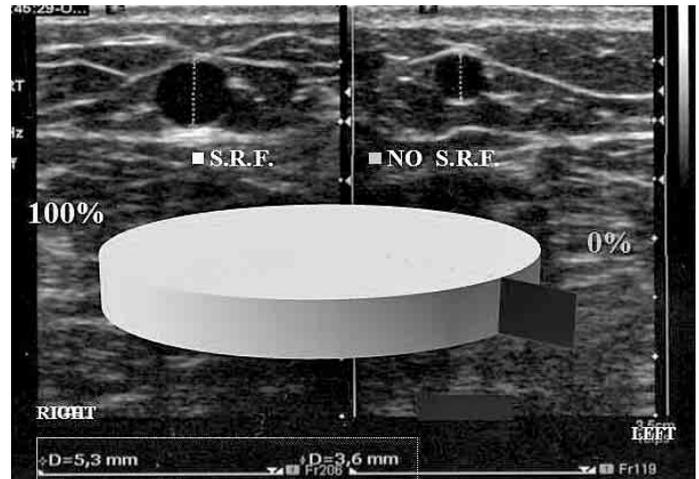


Photo 8

In this study the side of surgery (right or left) was not relevant as in the cases of right side in right-handed patients, no heavy activities or sports were carried out.

CONCLUSION

It is known that when lymphatic vessels are in difficulty, veins do not remain indifferent (increase of the calibre and the flow) as a kind of twinning exists between them and with this awareness it was decided to analyze the venous system behaviour in subclinical stage after monolateral breast cancer surgery.

In this study the size of compared cephalic veins was measured by Echo-Colour-Doppler exam in patients with no clinical evidence of oedema, who have undergone monolateral breast cancer surgery. and it was decided to focus the attention on these measurements, and to compare them to the lymphoscintigraphy previously carried out, in order to investigate an eventual correlation.

The results highlight how the increase of the calibre (and the flow) of homolateral cephalic vein seems to have a correlation with the results of the lymphoscintigraphy.

Further investigation is required in order to understand the meaning of changes in the calibre of the cephalic vein size in the ambit of subclinical stage, but a consideration has to be made: in both situations, sentinel node biopsy and lymphadenectomy, a homolateral increase of calibre of cephalic vein always corresponds to slower radiotracer flow (100% of the cases).

It is known that lymphoscintigraphy allows the identification of patients at risk of oedema onset, those who present slower radiotracer flow, which might not otherwise be identified, but it is possible that the homolateral increase of the cephalic vein could help to identify those patients who present a potential risk.

The confirm of this hypothesis, in the ambit of primary prevention, would be very interesting, as this measurement process is simple, fast and, above all, economical.

REFERENCE

1. Bourgeois P., Leduc O., Leduc A.: *Imaging techniques in the management and prevention of post-therapeutic upper limb oedemas*. Cancer, 1998; 83(12 Suppl): 2805-13.
2. Bourgeois P.: *Effects of age and lateralization on lymphoscintigraphy interpretation*. Nucl. Med. Commun., 2002 Mar; 23 (3): 257-60.
3. Celebioglu F., Perbeck L., Frisell J., Gröndal E., Svensson L., Danielsson R.: *Lymph drainage studied by lymphoscintigraphy in the arms after sentinel node biopsy compared with axillary lymph node dissection following conservative breast cancer surgery*. Acta Radiol., 2007; 48: 488-495.
4. Cestari M.: *Role of lymphoscintigraphy in primary prevention after breast cancer treatment*. European Journal of Lymphology, 2012, Vol. 23, No. 65, 11-13.
5. Laura Ferreira de Rezende, Felipe Villela Pedras, Celso Dario Ramos, and Maria Saete Costa Gurgel: *Evaluation of lymphatic compensation by lymphoscintigraphy in the postoperative period of breast cancer surgery with axillary dissection*. J. Vasc. Bras., Vol. 7, No. 4, Porto Alegre Dec. 2008 Epub Dec 12, 2008.

MICROLYMPHATIC SURGERY FOR THE TREATMENT OF IATROGENIC LYMPHOEDEMA

CORINNE BECKER¹, JOSHUA LEVINE², CONSTANCE CHEN², JULIE VASILE²,
BERNARDO NOGUEIRA BATISTA¹

¹Lymphedema Centre, Clinique Jouvenet, Paris, France

²New York Eye and Ear Infirmary, New York, USA

Corresponding address: Corrine Becker - corinne.becker.md@gmail.com
Lymphedema Center
6 square Jouvenet
75016 - Paris, France

ABSTRACT

Lymphedema is a common chronic and progressive condition after cancer treatment. Lymph node dissection and radiation therapy required for oncological treatment put cancer patients at high risk for secondary lymphedema. Patients with breast cancer, pelvic tumors and cancers of the limb, especially melanomas and sarcomas, meet this profile.

Autologous lymph nodes transplantation is an anatomical reconstruction of the lymphatic system and can severely improve quality of life for patients affected with this condition. The lymphatic flap can be dissected at three different donor sites: the inguinal, lateral thoracic and cervical regions.

Indications of the procedure based on clinical and radiological data are discussed. The operative techniques are reviewed, and some results presented. Microbiological evidence to support this procedure is analyzed. In the specific group of breast cancer patients, enlarged abdominal flaps can simultaneously reconstruct the missing breast and treat lymphedema.

Combination with other procedures, like lymphovenous anastomosis, excisions for grade 4 lymphedemas (elephantiasis), and external liposuction for lipoedema are possible.

Key words: breast cancer, lymphedema, lymph node dissection, radiotherapy, VGEF-c, lymphangiogenesis, TRAM, DIEP, SIEA.

INTRODUCTION

Lymphedema is the result of a disruption of the lymphatic transport system, leading to accumulation of protein-rich lymph fluid in the interstitial space. The accumulation of edematous fluid manifests as the soft and pitting edema seen in early lymphedema. Progression to nonpitting and irreversible growth of the extremity is thought to be the result of two mechanisms. First, the accumulation of lymph fluid leads to an inflammatory response, which causes increased fibrocyte activation. Second, fat deposition occurs when malfunctioning lymphatics are unable to transport fat molecules effectively⁽¹⁾. Clinically, patients develop firm subcutaneous tissue, progressing to overgrowth and fibrosis.

Lymphedema is a common chronic and progressive condition after

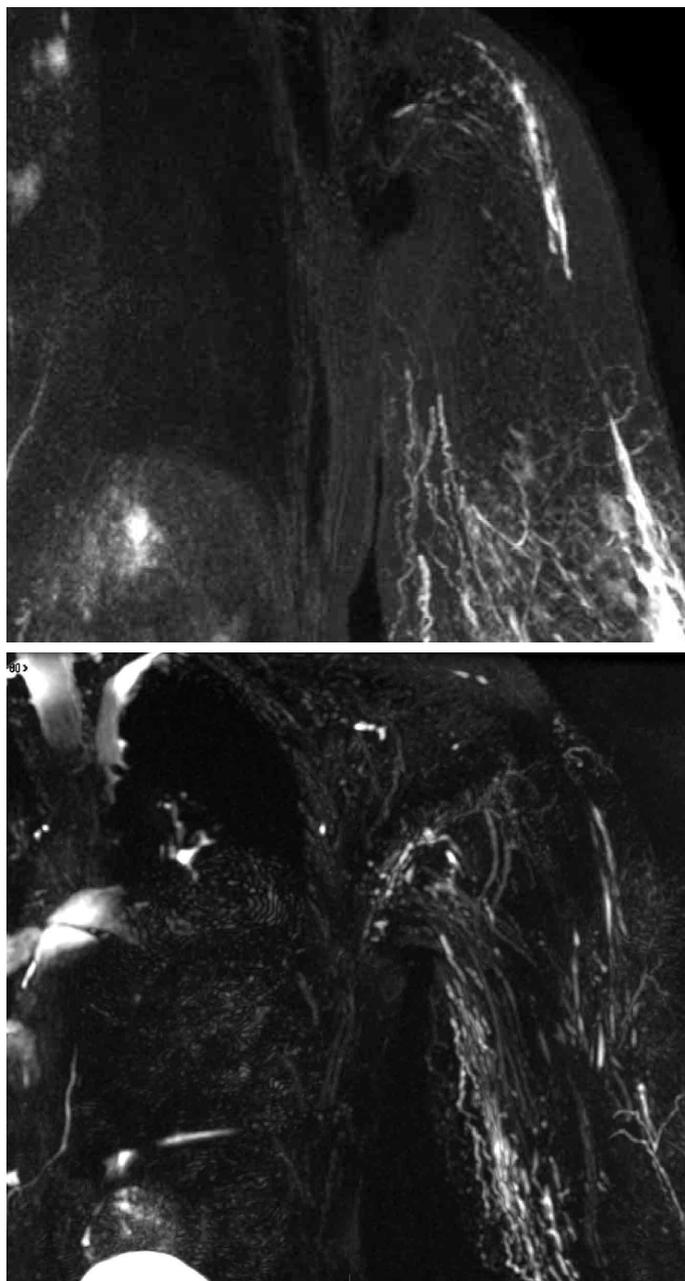
cancer treatment. The reported incidence of lymphedema varies due to different methods of assessment^(1,2,3), long follow-up required for diagnosing lymphedema, and lack of patient education regarding lymphedema⁽⁴⁾. In a 20 years follow-up of breast cancer patients, 49% of patients reported sensation of lymphedema and 13% (33 of 263 women) had augmented measures of the affected arm⁽⁵⁾. The incidence of lymphedema after breast cancer treatment ranges from 24% to 49% after mastectomy, and 4% to 28% after lumpectomy⁽¹⁾. Patients requiring more extensive breast cancer treatment with axillary node dissection and radiation have the greatest risk for development of lymphedema. However, even less extensive dissection and removal of few lymph nodes for sentinel lymph node biopsy is associated with a 5% to 7% incidence of upper extremity lymphedema⁽⁶⁾.

The incidence of lymphedema after treatment of other malignancies is reported as: 16% with melanoma, 20% with gynecologic cancers, 10% with genitourinary cancers, 4% with head and neck cancers, and 30% with sarcoma. Patients requiring pelvic dissection and radiation therapy for treatment of cancer malignancies have a reported lymphedema rate of 22% and 31%, respectively⁽³⁾. Other risk factors for developing lymphedema after cancer treatment are obesity, infection, and trauma⁽¹⁾.

Tissue changes and lymphostasis result in increased susceptibility to infection in the lymphedematous extremity. Clinically, patients may develop cellulitis from minor trauma that would otherwise be insignificant in a normal extremity. Frequent infections due to lymphedema are known as acute inflammatory episodes (AIE) and may require hospitalization for treatment with intravenous antibiotics. Each episode further damages the lymphatic channels and perpetuates a vicious cycle. Patients with repeated AIE may need lifelong antibiotic prophylaxis. A recent study found that 25.5% of breast cancer patients undergoing lymph node dissection developed subsequent erysipelas. Lymphangitis is an inflammation of the lymphatic channels that occurs in response to a distal infection such as paronychia, an insect bite, or secondary infections on inter-digital spaces. Lymphangiosarcoma is a rare malignant tumor that occurs in long-standing cases of lymphedema. The sarcoma first appears as an ecchymotic mark, a purplish discolorization, or a tender skin nodule in the extremity, typically on the anterior surface. It progresses to an ulcer with

crusting, and finally to extensive necrosis involving the skin and subcutaneous tissue. It metastasizes quickly. Stewart-Treves syndrome (STS), defined as angiosarcoma arising from post-mastectomy lymphedema, has an extremely poor prognosis, with an overall mortality rate of 70-90% even after limb amputation (median survival of 19 months). (Figure 1)

Conservative lymphedema therapy is the backbone for providing symptomatic improvement of lymphedema and may slow the progression of the disease. Multiple layers of short elastic bandages are wrapped around the limb to try to push the liquid upstream. Customized compression garments are subsequently



Iatrogenic lymphoedema (ext seroma seen even) operated by LNT. Result one year after surgery. Neo lymphatic ducts seen!

placed. Decongestive lymphatic therapy is prescribed for life. The major drawbacks of conservative treatment are: time consuming, labor intensive, requires specialized therapists, and requires dedication from the patient. In addition, insurance companies will cover therapists for bandaging and massage therapy only for an allotted number of sessions per year, requiring the patient to pay for extra sessions. While some patients might have good results with conservative therapy, another group of patients will have a total blockage of the lymph drainage pathways, due to the surgical removal of lymph nodes and scarring from radiotherapy needed for oncological treatment.

In these patients, lymphoscintigraphy will show no regional lymphatic uptake of the distally injected radioactive marker. More recently, magnetic resonance lymphography (MRL) with T2 weighted imaging allows visualization of the lymphatic system anatomy with greater sensitivity, without need of any injection⁽⁷⁾. Surgical options for lymphedema treatment fall into two broad categories: debulking procedures and physiologic procedures. Debulking procedures may involve elliptical wedge excision of excess skin and subcutaneous tissue from an extremity or liposuction. Wedge excision of tissue can provide immediate symptomatic relief to a patient with severe lymphedema. Liposuction is another effective modality for removing excess fat deposition found in lipoedema formed as a result of abnormal lymphatic transport. Intense compressive garments are necessary life-long⁽⁸⁾. Complications of debulking procedures may be chronic wounds, infection, widened scars, hematoma, skin necrosis, damage to remaining lymphatics, and worsening of the lymphedema⁽³⁾.

Physiologic procedures are the lymphatic system reconstructions by free autologous lymph nodes transplantations (ALNT). The nodes replace the removed lymphatic tissue, bridging the lymphatic pathways thru the scarred tissue. VEGF-c produced at the lymphnodes promotes lymphangiogenesis to reconnect the distal and proximal systems⁽⁹⁾.

Lymphovenous anastomoses (LVAs)⁽¹⁰⁾ are effective in early stages of lymphedema. They remain patent if the pressure in the lymphatic system is higher than in the venous system. Lympholymphatic grafts⁽¹¹⁾ have important donor site morbidity, and the procedure is technically challenging and time consuming. For each patient, combinations of these procedures might be indicated to achieve better results.

SURGICAL TREATMENT IN SECONDARY LYMPHEDEMA

Secondary lymphedemas are common in oncologic treatment, especially after lymph node dissection and radiotherapy. Cancers whose treatments are commonly associated with lymphedema include breast cancer, pelvic tumors (i.e., enlarged hysterectomies and prostatectomies), Hodgkin's tumors, sarcoma, and melanoma. Alternatively, lymphedema may also be caused by non-oncologic procedures such as saphenous vein removal, hernia repair, thigh lifts or internal liposuction.

Lymphedema resistant to conservative therapy, pain or signs of brachial plexus neuropathy and chronic infections are the preferred indications for ALNT.

If conservative treatment fails to bring satisfactory, long-lasting results and MRL or lymphoscintigraphy demonstrate an absence of drainage by regional lymph nodes in the affected limb, ALNT could be performed to replace the missing lymphatic tissue. Liberation of the scar tissue and replacement with vascularized non-irradiated tissue can treat neuromas, and stop the progression of the paresis in the plexus neuropathies. Chronic infections are also a major indication for LNT because of the immunological functions of the lymph nodes. In breast cancer reconstruction patients, it is possible to enlarge the circumflex iliac free lymph node flap with the deep inferior epigastric flap (TRAM or DIEP). This approach allows for breast reconstruction and axilla liberation with lymphatic tissue transplantation. This procedure is intended only for women planning a breast reconstruction with an established lymphedema. Going into an axilla of a previously operated patient with no lymphedema is a serious risk of inducing an iatrogenic lymphedema.

OPERATIVE TECHNIQUE

Autologous lymph node transplantation for upper limb lymphedema

The dissection starts at the axillary region. The fibrosis is dissected and the thoracodorsalis vessels are identified. Vascular branches, with suitable sizes for micro anastomosis, are prepared. If a neuroma is encountered or chronic pain and palsy are present, external neurolysis is performed. The thoracobrahial space must be decompressed. The extension of the flap needed is estimated. Three different lymph nodes flap can be transferred. The superficial inguinal lymph node flap starts with an incision performed over a line located between the iliac crest and the pubis. The length of the incision depends on the flap size needed to fill the defect. The subcutaneous tissue is incised to the depth of the fascia cribiformis, where a superficial diagonal vein can be found. The fatty tissue located deeper to this superficial fascia and superficially to the muscular aponeurosis contains lymph nodes that can be transferred based on the circumflex iliac vessels. This pedicle can be dissected and the flap can be elevated around the isolated vessels. Inferiorly, the inguinal crest is a very important limit of the dissection, and preserving the deep lymph nodes is very important to prevent secondary lymphedema at the donor site. The flap is then transferred to the recipient site at the axilla, with microsurgical technique.

Autologous lymph node transplantation for lower limb lymphedema

In the lower limb, the surgical procedure is the inguinal equivalent to the previously described. The donor sites are normally the lateral thoracic region and, rarely, the cervical region. The ALNT for secondary lymphedema of the lower limb is similar to the one described for congenital lymphedemas, further in this same issue.

Enlarged abdominal flaps

The inguinal lymph nodes flap can be incorporated to the flap of the adjacent skin and fat on the lower part of the abdomen, based

on the superficial inferior epigastric vessels (SIEA) or the deep inferior epigastric vessels (free TRAM or DIEP). To harvest the nodes, the incisions of the abdominal flap must be lowered to the level of the iliac crest, including the inguinal lymph node flap previously described (subcutaneous tissue containing the nodes, vascularized by the circumflex iliac vessels). If the microsurgical anastomoses of the flap are made to the internal mammary vessels, the lymph node extension should be harvested at the opposite side of the pedicle. If the flap is reattached at the thoracodorsal system, the nodes can be harvested at the same side. The lymph node flap should be placed in the axillary region. It has to be inserted around the axillary vein, where the lymphatic tissue was first resected. The need for a second set of anastomosis will be assessed during surgery. SPY imaging can be used intra-operatively to evaluate the perfusion of the transferred nodes.

LVAs can be performed in the proximal and/or distal regions of the limb, depending on indication (elevated pressure in the lymphatic system). PDE is a mapping device of the superficial lymphatic pathways, useful to determine the locations of the LVAs. These are performed under big magnification, with 11-0 or 12-0 (where available) nylon sutures.

One year after ALNT, after the excessive fluid is drained from the limb, fat macromolecules deposited by the long-standing lymphedema can maintain an augmented girth of the limb. This is known as lipoedema. A selective liposuction to the external aspect of the arm can help to remove this entrapped fat.

COMPLICATIONS AND CONCERNS

Lymphocele on the donor site can be avoided with the use of a drain on the initial post-operative period (48h) and local compression. If the deep lymph nodes beyond the inguinal ligament or in the axilla are not disturbed, no iatrogenic lymphedema of the donor limb should be noted. Local infections and delayed wound healing are rare, even in irradiated tissues. The autologous lymph node flap is a buried flap. Flap monitoring is difficult. Vascular thrombosis is believed to occur in 2% of the cases, in which no improvement is perceived. For enlarged flaps, thrombosis will lead to exploration of anastomoses, and eventually flap loss. When 2 sets of anastomoses are performed, the ALNT part of the flap can remain viable.

After external liposuction for lipoedema, temporary hematoma can be present, without any harmful consequence for the patient.

CLINICAL OUTCOMES

On a series of more than 1.500 patients operated in 20 years, with stage 1,2 and 3 lymphedemas (International Society of Lymphology), 98% of patients present some degree of improvement, and 40% of the stages 1 or 2 lymphedemas have complete remission and do not need additional physiotherapy treatment. Follow-up of at least 3 years are included. Elephantiasis is never completely healed and patients will still need physiotherapy. 95% refer some kind of amelioration. Only 2% of patients keep having infection episodes.

In the lower limb, results will depend on the longevity of the lymphedema and the presence of fibrotic tissue. Bilateral

lymphedemas will have worst outcomes. Generally, the patients do loose 2 cm /months, and this during 2 years, progressively. The results are better for short duration and less severe lymphedemas. In moderate cases, MRL shows new lymphatic pathways, with effective lymph drainage. Even the long-standing lymphedema (over 15y) can show some improvement. When neuromas of the intercostal nerves are encountered, neurolysis and removal of surgical clips is effective, achieving pain-relief in 98% of patients. For brachial plexus neuropathies, neurolysis of the nerves and coverage with a non-irradiated, well-vascularized tissue (ALNT or enlarged abdominal flap) will be effective in 75% of patients. These patients experience less pain and palsy stabilization. Although sensation can be recovered the 2 following years, motor recovery is rare, and can only be expected in young patients. Tendon transfers can be beneficial for some of these patients later on their follow-up.

CONCLUSION

The lymph nodes transplantation is a good alternative to treat secondary lymphedema. The lymph nodes bridge the imposed lymphatic system defect and produce VEGF-c that stimulates lymphatic regeneration. Rate of infection episodes dramatically improves. Improvements can be seen in almost every patient. Wedge excisions in elephantiasis are sometimes needed to avoid mycosis in the deep folds, and permits bandaging. External local liposuction can be added, after LNT, to remove the excess of remaining fat in long duration lymphedemas. The enlarged abdominal flap is an elegant option to simultaneously treat lymphedema and reconstruct the breast.

REFERENCES

1. Warren A.G., Brorson H., Borud L.J. et al.: *Lymphedema: a comprehensive review*. Ann Plast Surg, 2007; 59(4): 464-72.
2. Asim M., Cham A., Banerjee S. et al.: *Difficulties with defining lymphoedema after axillary dissection for breast cancer*. N Z Med J, 2012; 125(1351): 29-39.
3. Cormier J.N., Askew R.L., Mungovan K.S. et al.: *Lymphedema beyond breast cancer: a systemic review and meta-analysis of cancer-related secondary lymphedema*. Cancer, 2010; 116(22): 5138-49.
4. Ahmed R.L., Prizment A., Lazovich D. et al.: *Lymphedema and quality of life in breast cancer survivors: the Iowa women's health study*. J Clin Oncol, 2008; 26(35): 5689-96.
5. Petrek J.A., Senie R.T., Peters M. et al.: *Lymphedema in a cohort of breast carcinoma survivors 20 years after diagnosis*. Cancer, 2001; 92(6): 1368-77.
6. McLaughlin S.A., Wright M.J., Morris K.T. et al.: *Prevalence of lymphedema in women with breast cancer 5 years after sentinel lymph node biopsy or axillary dissection: objective measurements*. J Clin Oncol, 2008; 26(32): 5213-9.
7. Arrivé L., Azizi L., Lewin M., Hoeffel C., Monnier-Cholley L., Lacombe C., Tubiana J.M.: *MR lymphography of abdominal and retroperitoneal lymphatic vessels*. AJR, 2007; 189(5): 1051-8.
8. Brorson H.: *From lymph to fat: complete reduction of lymphedema*. Phlebology, 2010; 25(1): s52-63.
9. Saaristo A.M., Niemi T.S., Viitanen T.P., Tervala T.V., Hartiala P., Suominen E.A.: *Microvascular breast reconstruction and lymph node transfer for post mastectomy lymphedema patients*. Ann Surg, 2012; 255(3): 468-73.
10. Mihara M., Murai N., Hayashi Y., Hara H., Iida T., Narushima M., Todokoro T., Uchida G., Yamamoto T., Koshima I.: *Using indocyanine green fluorescent lymphography and lymphatic-venous anastomosis for cancer-related lymphedema*. Ann Vasc Surg, 2012; 26(2): 278.e1-6.
11. Springer S., Koller M., Baumeister R.G., Frick A.: *Changes in quality of life of patients with lymphedema after lymphatic vessel transplantation*. Lymphology, 2011; 44(2): 65-71.

MICROSURGICAL LYMPHATIC-VENOUS MULTIPLE ANASTOMOSES: INDICATIONS AND CLINICAL OUTCOME

FRANCESCO BOCCARDO¹, CORRADO CAMPISI², LIDIA MOLINARI¹, STEFANO SPINACI¹, SARA DESSALVI¹, CORRADINO CAMPISI¹

¹ Unit of Lymphatic Surgery – Department of Surgery

² Unit of Plastic and Reconstructive Surgery

IRCCS S. Martino University Hospital – IST, National Cancer Institute
Genoa, Italy

ABSTRACT

Authors report their experience in the treatment of lymphatic disorders by microsurgical techniques based on histological and immunological and pathological findings. Microsurgical method consisted in multiple lymphatic-venous anastomoses (LVA). In all patients lymphatic and lymph nodal tissues were sent for histological assessment, together with specimen of the interstitial matrix. Diagnostic investigations consisted in venous duplex scan and lymphoscintigraphy. Results were assessed clinically by volumetry performed pre-operatively and post-operatively at 3-6 months and once a year for at least 5 years. The outcome obtained in treating lymphedemas at different stages was analyzed in terms of volume reduction, stability of results with time, reduction of dermato-lymphangio-adenitis (DLA) attacks, necessity of wearing elastic supports and use conservative measures post-operatively. Microsurgical multiple lymphatic-venous anastomoses allow to bring about positive results in the treatment of peripheral lymphedema, above all in early stages when tissue changes are slight and allow almost a complete restore of lymphatic drainage.

Key words: Lymphedema - Microsurgery - Pathological findings - Multiple lymphatic-venous anastomoses - Functional restore.

INTRODUCTION

Lymphedema non-responsive to conservative methods may be managed by surgical treatment.

Indications include insufficient lymphedema reduction by well performed medical and physical therapy, lymphedema relapse after interruption of physical treatment, recurrent lymphangitis, intractable pain, worsening limb function, patient unsatisfied of the result obtained by non-operative methods and willing to proceed with surgical options.

Microsurgical lymphatic-venous multiple lymphatic-venous anastomosis (LVA) consists in anastomosing lymphatic vessels to a collateral branch of the main vein, checking the perfect function of the valve apparatus, in order to be sure of the correct continence of the vein segment used for the anastomosis. This way, inside the venous tract there flows only lymph and not blood, avoiding any risk of thrombosis of anastomosis⁽¹⁻³⁾.

METHODS

When performing LVA, healthy appearing lymphatics found at the site of surgical operation are directly introduced together into the vein by a U-shaped stitch and then fixed to the vein cut-end by means of additional stitches between the vein border and the perilymphatic adipose tissue. With the use of Patent Blue dye, properly functioning lymphatics appear blue, and the passage of blue lymph into the vein branch verifies the patency of the lymphatic-venous anastomosis under the operating microscope when the anastomosis is completed.

For patients with lower limb lymphedema, anastomoses are performed at the sub-inguinal region. Lymphatic-lymph nodal superficial structures are isolated, and all afferent lymphatics are used for the operation. Lymph nodes are subjected to histopathologic examination. The usual finding in primary lower limb lymphedemas is a varying grade of nodal fibrosclerosis and thickening of the nodal capsule but with normal afferent lymphatic vessels.

For upper limb lymphedema, lymphatic-venous anastomoses are performed at the medium third of the volar surface of the arm, using both superficial and deep lymphatic collectors, evidenced by the blue dye. Deep lymphatics are found in between humeral artery, vein and the median nerve. The vein used for anastomoses is a patent branch of one of the humeral veins, and the technique most performed is the microsurgical one.

Primary lymphedemas largely include lymph nodal dysplasias (LAD II, according to Papendieck's classification⁽⁴⁾) consisting of hypoplastic lymph nodes with sinus histiocytosis and a thick and fibrous capsule with microlymphangioadenomyomatosis. In these cases, lymph flow obstruction was apparent as seen by alterations of the afferent lymphatics which appeared dilated and swollen with thickened walls and where smooth muscle cells are reduced in number and appear fragmented by associated fibrous elements. Secondary lymphedemas are largely due to lymphadenectomy and radiotherapy performed for oncological reasons (carcinoma of the breast, uterus, penis, bladder, prostatic gland, rectum, and seminoma of epididymis), as well as for complications of minor operations for varicose veins, crural and inguinal hernias, lipomas, tendinous cysts, or axillary and inguinal lymph node biopsies.

Most of the lymphedemas treated by microsurgery in our experience were at stages IB (41%) and IIA-B (52%), while 6% were stages IIIA-B.

In all patients lymphatic and lymphnodal tissues were sent for histological assessment, together with specimen of the interstitial matrix. Diagnostic investigations consisted in venous duplex scan and lymphoscintigraphy. Results were assessed clinically by volumetry performed pre-operatively and post-operatively at 3-6 months and 1-3-5 years.

Lymphoscintigraphy, performed with ^{99m}Tc-labeled antimony sulfur colloid, is employed in the diagnostic work-up of patients with lymphedema and as a test for selecting patients for derivative microsurgical operations. Lymphoscintigraphy clearly discriminates whether or not edema was of lymphatic origin and also provides important data about the etiologic and pathophysiologic aspects of the Lymphedema.

Echo Doppler is performed in all patients to identify any venous disorders possibly associated with lymphedema.

In most patients, venous dysfunctions is corrected at the same time of micro-lymphatic-venous anastomoses (i.e., valve plasty in case of venous insufficiency).

RESULTS

The results obtained in managing lymphedemas at different stages was analyzed in terms of volume reduction, stability of results with time, reduction of dermato-lymphangio-adenitis (DLA) attacks, necessity of wearing elastic supports and use conservative measures post-operatively.

Volume changes showed a significant improvement, till over 80% volume reduction comparing preoperative conditions (Fig. 1). Among patients with lymphedema at earlier stages (stage I and stage II A), over 85% could progressively give up the use of conservative measures and of elastic supports (Fig. 2), and 30% of patients with late stage lymphedema (stage II B and stage III)



Fig. 1 - Right arm lymphedema treated by microsurgical lymphatic-venous multiple anastomoses (LVA). Of note, the significant reduction of edema at short term thanks to the shunt of lymph into the blood stream.

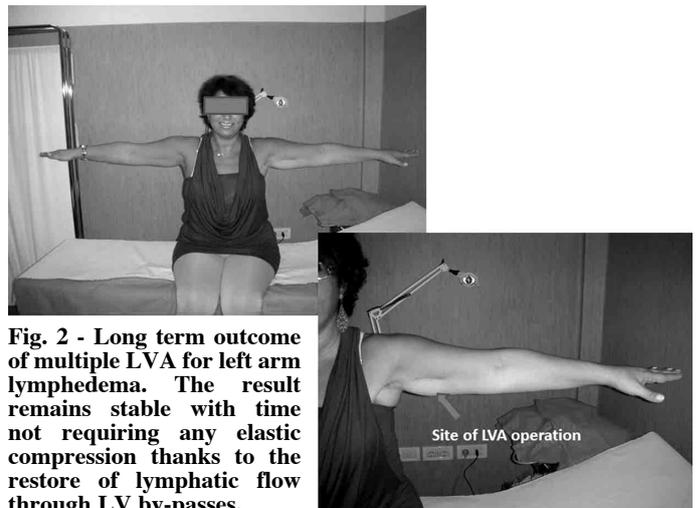


Fig. 2 - Long term outcome of multiple LVA for left arm lymphedema. The result remains stable with time not requiring any elastic compression thanks to the restore of lymphatic flow through LV by-passes.

could decrease the use of physical therapies. DLA attacks reduced of about 90%. Histological findings showed poor lymphatic and lymphnodal tissular changes in early stage lymphedemas, whilst significant fibrotic lesions were demonstrated in late stage lymphedemas.

Lymphoscintigraphy helped in verifying the patency of microanastomoses long term after operation by direct and indirect findings: reduction of dermal backflow together with the appearance of preferential lymphatic pathways not visible before microsurgery; disappearance of the tracer at the site of lymphatic-venous anastomoses due to direct tracer passage into the blood stream; and earlier liver uptake compared to pre-operative parameters (indirect patency test).

DISCUSSION

LVAs represent a means to bypass the obstacle to lymph flow through lymphatic-venous drainage (lymphatic-venous anastomoses). Combined physical therapy nonetheless represents the initial treatment of patients affected by peripheral lymphedema and it is best performed in specialized centers.

The surgical timing follows completion of conservative treatment when further clinical improvement can no longer be achieved and/or recurrent lymphangitic attacks are not further reduced⁽⁵⁾. Microsurgical operations can then be performed and provide further improvement in the condition^(6,7).

The optimal indications for lymphatic microsurgery are represented by: early stages (Ib, IIA); lymphoscintigraphy showing a low inguinal or axillary lymph nodal uptake and minimal or absent passage of the tracer beyond this proximal nodal area; excellent patient compliance; and a lymphological center where the patient can easily refer for any needs in addition to a Center of Lymphatic Surgery where the patient undergoes this specialized surgery.

At later stages (IIa and III), with absent visualization of lymphatic channels and regional lymph nodes, it is necessary to reduce the stage of the lymphedema by non-operative methods before microsurgery. After operation, it is particularly important for these



CIZETA MEDICALI S.p.A.
announces
the introduction of

VARISAN[®] TOP

• KNEE-HIGH WITH LATERAL ZIP



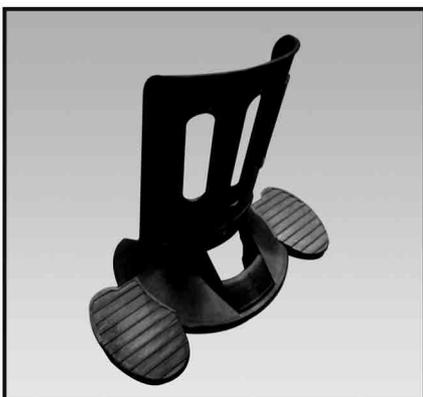
Medical compression stocking RAL certified
for leg ulcers (Ccl. 3) 34 to 46 mmHg



The leg ulcer (venous ulcers) represents the most serious consequence of venous diseases and affects an increasingly large number of people within the European and world population.

Through the establishment of an adequate compression therapy, the mechanisms decisive that cause the formation of an ulcer can be counteracted with great effectiveness and also offers advantages over the more traditional high therapy of bandages both in terms of therapeutic effectiveness (compression constant for all the day) both in terms of convenience of use and management by the patient.

• SLIP STOCKINGS ON *patent CIZETA*



The elastic compression is the only recognized therapy against the chronic venous insufficiency.

Nevertheless the difficulties of putting these elastic segments, for obese patients, the elderly, less mobile, who suffer from osteoarthritis, may limit the good compliance with treatment. The help putting some medical elastic stockings is therefore an important element to good sliding segment compression on the leg.

This is why Cizeta Medical has focused its attention on building a model of slip stockings on light, practical and easy to use.



SCIENCE & MEDICAL
QUALITY

CIZETA MEDICALI S.p.A.
Via IV Novembre, 46 - 20012 Cuggiono (MI) Italy
Tel. 02.97.21.81.1 - Fax 02.97.24.07.34
www.cizetamedicali.com – info@cizetamedicali.com



40th ESL CONGRESS - European Society of Lymphology

Lymphedema Prevention: from Genetics to Surgery

Searching for Better Lymphedema Patients' Quality of Life

September 25-27, 2014

Genoa, Italy

Welcome Address

Dear Colleagues and Friends,

The Executive Committee of the European Society of Lymphology has kindly given me the opportunity to organize the next 40th ESL Congress. It is scheduled for September 25–27, 2014 in Genoa, with the Honorary Presidency of my Mentor Prof. Corradino Campisi. I am pleased and honored to have this prestigious task. I would like to focalize the Congress on the key subject of 'Lymphedema Primary and Secondary Prevention'. All fields of interest, from basic research to clinics, are involved: from genetics and molecular biology to anatomic aspects and epidemiological studies; from pathophysiological mechanisms and pathological findings to diagnostic and therapeutic options, also in pediatrics. I am sure that the contributions of prestigious scientists devoted to Lymphology and fruitful discussion among them and all participants in the congress will bring to the development of new strategies for primary and secondary lymphedema prevention, searching for better lymphedema patients' quality of life. Sessions will include lectures, oral presentations, videos, posters and panel discussions.

I would like to invite you all to Genoa and also enjoy the beautiful 'Riviera Ligure'. Genoa is called 'La Superba' (The Superb One) due to its glorious past and impressive landmarks. Genoa's rich art, music, gastronomy, architecture and history allowed it to become the European Capital of Culture in 2004. Part of the old town was inscribed on the World Heritage List (UNESCO) in 2006.

I hope that the 40th ESL Congress will be an interesting meeting for all general physicians and specialists of all basic, medical and surgical areas, residents, physiotherapists, nurses and all sanitary persons interested in Lymphology.

On behalf of the European Society of Lymphology, I look forward to welcoming you to Genoa for the 40th ESL Congress.

With best regards,

Francesco Boccardo, MD, PhD

BRIEF OVERVIEW OF THE BENEFITS OF NORDIC WALKING IN THE TREATMENT OF PRIMARY AND SECONDARY LYMPHOEDEMA

C. GONZALEZ-CASTRO

Health Promotion Association Ipar Izarra Nordic Walking Bilbao (Bilbao-Vizcaya, Spain)

info@nwbilbao.com

ABSTRACT

Nordic Walking is a physical activity with several advantages over other types of aerobic exercise and has been proposed as an appropriate intervention in the management of both primary and secondary lymphoedema. It is a viable intervention to implement from a social-healthcare setting, however, there is a need for further research to determine general recommendations regarding frequency and intensity of the exercise programs depending on the severity of the lymphoedema.

Key words: Nordic Walking, lymphoedema, physical activity.

INTRODUCTION

Nordic Walking is a physical activity currently expanding in Europe and it is associated to important health benefits for healthy and vulnerable populations. It originated in Finland in the thirties as an off-season training for cross-country skiers and was later introduced in physical education lessons by Leena Jaaskelainen in 1966's also in Finland. The first specially designed NW poles were sold in the late nineties and owing to its great versatility and health benefits this discipline has gained popularity in many European countries. The traditional NW technique works the body in a balanced, fluid and symmetric way by adding a pair of specially designed poles to the natural way of walking¹. The poles are used to help propel the body forward preserving the natural and correct biomechanics of the normal walking pattern (Fig. 1), thus, promoting good body alignment.

Physical exercise is part of the decongestive lymphatic therapy (DLT), internationally used as a standard treatment for lymphoedema². The present article briefly explores the physiological and psychosocial benefits and implementation advantages of NW in the treatment of primary and secondary lymphoedema.

NW TO TREAT LYMPHOEDEMA

NW was found to provide physiological and psychosocial benefits in patients with secondary lymphoedema to breast cancer³⁻⁵ and has been proposed by several authors to treat lymphoedema^{6,7}. NW has already been successfully used as an intervention in the management of primary and secondary lymphoedema in countries such as Germany⁸ and is recommended by therapists and lymphoedema patient associations worldwide as part of a multidisciplinary approach. However, NW is still relatively unknown in southern European countries and the number of clinical studies in this area is limited.



Fig. 1

Table 1 - Potential benefits and advantages of NW in the treatment of primary and secondary lymphoedema (Adapted from Gonzalez Castro, 2012)

PHYSIOLOGICAL BENEFITS	PSYCHOSOCIAL BENEFITS	IMPLEMENTATION ADVANTAGES
<ul style="list-style-type: none"> ✓ Full body exercise integrating upper and lower body ✓ Increases cardiopulmonary capacity ✓ Increases upper body resistance ✓ Increases energy consumption ✓ Improves circulation ✓ Improves functional capacity ✓ Minimises overall physical deconditioning 	<ul style="list-style-type: none"> ✓ Low rate of perceived exertion ✓ Ease of learning ✓ Easy adherence ✓ Increases self-esteem ✓ Reduces stress, anxiety and depression ✓ Social activity ✓ Improves quality of life 	<ul style="list-style-type: none"> ✓ Sustainable activity: <ul style="list-style-type: none"> • Social • Environmentally friendly • Cheap ✓ Easy implementation in caring protocols

Table 1 summarises the physiological and psychological benefits and implementation advantages of NW in the treatment of primary and secondary lymphoedema⁹.

PHYSIOLOGICAL BENEFITS

Full body exercise

The main advantage of NW over normal walking is that it is a whole body workout as it integrates the work of the upper and the lower body using all main muscular chains¹. The upper body is therefore activated by the use of NW poles by pushing down and backwards against the ground propelling the body forward.

Increase of the cardiopulmonary capacity

It has been well established that compared to normal walking without poles at the same speed, NW increases cardiopulmonary capacity as it increases oxygen consumption and heart rate¹⁰⁻¹³. Moreover, even when Nordic Walking at a slower pace than conventional walking without poles this results in higher oxygen uptake and heart rate¹⁴. NW is therefore an ideal activity to increase aerobic capacity.

Increase of the upper body resistance

During NW the upper body works pushing through the specially designed poles in order to propel the body forward. NW therefore increases muscle tone and strength of the upper body. It is important to notice that several studies conclude that NW is a safe physical activity for those suffering from upper extremity lymphoedema^{4,5}. Moreover a recent randomized controlled trial in women post breast cancer treatment resulted in significantly improved upper extremity strength without exacerbation of lymphoedema after a 8 week NW intervention compared to the control group⁵.

Increase of the energy consumption

It is well established by the literature that obesity increases the risk of suffering lymphoedema². As NW is a full body exercise it results in increased caloric expenditure when compared to walking without poles^{10,11,12,15} and can therefore help to prevent/control/reduce obesity.

Improvement of the circulation

During normal walking without poles the arms swing by the sides of the body. A correct NW technique on the other hand also implies closing and opening of the hand around the pole grip¹ improving circulation, venous return and lymphatic drainage. Minimises overall physical deconditioning and improves functional capacity.

NW is a whole body aerobic exercise with physiological advantages over conventional walking without poles as it also improves upper body strength. It can aid lymphoedema patients in gaining independence in their daily life and prevent physical deconditioning and worsening of their symptoms.

PSYCHOSOCIAL BENEFITS

Low rate of perceived exertion

Although the energy expenditure during NW is higher than in conventional walking without poles, the effort is spread between the upper and the lower body and therefore the perceived exertion is lower^{13,15}.

Ease of learning

NW is a relatively easy activity to learn as it is based on the biomechanics of the natural conventional walking pattern¹ and both intensity and technique may be individually adapted to the patient's needs. Nevertheless it is important to learn the correct technique with a qualified NW Instructor.

Social activity

NW is a versatile physical activity that does not require a specific previous physical condition and owing to its low perceived exertion it is accessible to all populations, vulnerable and healthy, and across the whole life-span. Furthermore, Nordic Walking at a moderate or low speed will allow a conversation and is therefore a social activity.

Easy adherence and improved psychological status

Owing to its low perceived exertion, ease of learning and social component it is easier for patients to comply with a NW based exercise program. A study on women with secondary lymphoedema to breast cancer outlined the benefits of group exercise not only in compliance with the exercise program but also resulting in better scores for self-esteem and enjoyment¹⁶.

Improves quality of life (QOL)

NW results in physiological and psychosocial benefits and therefore can potentially contribute to improve the QOL of primary and secondary lymphoedema patients.

IMPLEMENTATION ADVANTAGES

Sustainable activity

NW is a social, environmentally friendly and cheap activity as the basic equipment needed is a pair of specially designed NW poles. It can be practiced on any surface, indoors or outdoors and is suitable to all ages.

Easy implementation in caring protocols

NW has already been integrated as part of CDT in the management of lymphoedema in different European countries⁸. It is a cheap and accessible activity to integrate in caring protocols as part of a multidisciplinary approach to treat and manage lymphoedema.

CONCLUSIONS

NW is a full body exercise with important physiological and psychosocial benefits compared to conventional walking without poles as it not only improves aerobic capacity but upper body strength and circulation. Owing to its low perceived exertion and easy implementation it is an ideal intervention for the healthcare setting.

There is a need for further research to determine general recommendations regarding frequency and intensity of the exercise programs depending on the severity of the lymphoedema. Physical exercise should be implemented as an intervention in the social-healthcare setting as part of a holistic approach to manage primary and secondary lymphoedema.

REFERENCES

1. Arrankoski T., Kettunen T.: *Il Moderno Nordic Walking*. Askel, 2011, Italy.
2. Ogawa Y.: *Recent advances in medical treatment for lymphoedema*. Ann. Vasc. Dis., 2012; 5: 139-144.
3. Sprod L., Drum N., Bentz A., Carter S.D., Schnieder C.M.: *The effects of walking poles on shoulder function in breast cancer survivors*. ICT, 2005; 4: 287-293.
4. Jonsson C., Johansson K.: *Pole walking for patients with breast-related arm lymphedema*. Physiother. Theor. Pract., 2009; 25: 165-173.
5. Malicka I., Stefanska M., Rudziak M., Jarmoluk P., Pawlowska K., Szczepanska-Gieracha J. et al.: *The influence of Nordic walking exercise on upper extremity strength and the volume of lymphoedema in women following breast cancer treatment*. IES, 2011; 19: 295-304.
6. Chang C.J., Cornier J.N.: *Lymphedema interventions: exercise, surgery and compression devices*. Sem. Oncol. Nur., 2012; 29: 28-40.
7. Vojackova N., Fialova J., Hercogova J.: *Management of lymphedema*. J. Dermatol. Treat., 2012; 25: 352-357.
8. Mrozinska M.: *Physical therapy of lymphedema in experience from the german school*. FP, 2009; 17: 62-68.
9. Gonzalez Castro C.: *El Nordic Walking como ejercicio físico a prescribir en pacientes afectados de linfedema secundario al cáncer de mama*. Apunts Med. Esport., 2012; <http://dx.doi.org/10.1016/j.apunts.2012.07.002>
10. Church T.S., Earnest C.P., Morss G.M.: *Field testing of physiological responses associated with Nordic walking*. Res. Q. Exerc. Sport., 2002; 73: 296-300.
11. Gram B., Christiansen R., Christiansen C., Jeppe G.: *Effects of Nordic Walking and exercise in Type 2 Diabetes mellitus: A Randomised Controlled Trial*. Clin. J. Sport Med., 2010; 20: 355-361.
12. Morgulec-Adamowicz N., Marszalek J., Jagustyn P.: *Nordic Walking - A new form of adapted physical activity*. Hum. Mov. Sci., 2011; 12: 124-132.
13. Sugiyama K., Kawamura M., Tomita H., Katamoto S.: *Oxygen uptake, heart rate, perceived exertion, and integrated electromyogram of the lower and upper extremities during level and Nordic Walking on a treadmill*. Am. J. Phys. Antropol., 2013; 32: 2.
14. Schiffer T., Knicker A., Hoffman U., Harwing B., Hollman W., Struder H.K.: *Physiological responses to Nordic Walking, walking and jogging*. Eur. J. App. Physiol., 2006; 98: 56-61.
15. Figard-Fabre H., Fabre N., Leonardi A., Schena F.: *Efficacy of Nordic walking in obesity management*. Int. J. Sports Med., 2011; 32: 407-414.
16. Bracha J., Jacob T.: *Using exercise classes to reduce arm lymphoedema*. JOL, 2010; 5: 46-55.

SCHOOL OF LYMPHEDEMA PREVENTION: YOUR CARE, OUR GOAL

TERESA TORRALBA-PUEBLA*, LEIRE ORTIZ-FERNANDEZ*, MARÍA ZAMARRIPA-CUESTA**

Physical Medicine and Rehabilitation Department, Cruces University Hospital, Barakaldo, Bizkaia (Spain)

* *Rehabilitation physician*

** *Physiotherapist*

Corresponding Author: Teresa Torralba-Puebla

Telephone 607287677

Fax 946006182

Email: ttorralba@hotmail.es

Dirección: Paseo Landabarri, n. 28, 3D, PC: 48940, Leioa, Vizcaya, Spain

ABSTRACT

Introduction: Patients who undergo lymphadenectomy need advice on preventive care to avoid the development of lymphedema. ⁽¹⁾

Objectives: To present the School of Lymphedema Prevention after Breast cancer Surgery.

Material and Methods: Prospective observational study of the rehabilitation outpatient medical consultation assessed woman. Patients were referred from Department of Gynecologic Oncology, Oncology and Radiotherapy. ⁽¹⁾

Preventive measures were explained individually in the first appointment, prevention standards and home exercises were delivered. If they required lymphatic drainage therapy, they were recruited for the School of Lymphedema Prevention. A monthly meeting was organized up to 14 people. It was opened to patients and one family member was allowed. We informed about what the lymphedema is, how to prevent and treat it.

Then, we established a roundtable where patients could express their worries and concerns. At the end of each session, a satisfaction survey was given. *Material Resources:* meeting room, computer, projector and roundtable. *Human resources:* rehabilitation physician and skilled physiotherapist.

Results: A total of 27 meetings were conducted from 17 March 2010 until 20 March 2013 and 184 people attended to School of Lymphedema Prevention. The survey showed high degree of satisfaction.

Conclusions: School of Lymphedema Prevention focuses on training and educating patients at risk of developing lymphedema or suffering from lymphedema and its families. Emphasis is on prevention, promotion of autonomy and activities of daily living, psychological and emotional support and reducing waiting list.

Key Words: lymphedema, prevention, rehabilitation, mastectomy, school, education.

INTRODUCTION

Lymphedema is a chronic swelling of a body part and often the unintended consequence of cancer surgery and/or radiation. ⁽¹⁾ Since the introduction of Combined Decongestive Therapy, the medical community has been capable of offering effective treatment. Lymphedema therapists and educators have realized about the importance of patient education in the prevention and management of this condition. Unfortunately, as there is no “cure”, the long term maintenance inevitably becomes the responsibility of the patient. ⁽²⁾

The aim of creating the School of postmastectomy Lymphedema Prevention was to prevent the onset of lymphedema or to slow its progression in postmastectomized women who had underwent lymphadenectomy associated or not to radiation therapy (1,2). In our hospital, the school was established as innovative and specifically to meet the demands and expectations of these women, providing the closest possible attention and tailored to their needs.

OBJECTIVE

Our aim is to present our School of Lymphedema Prevention after Breast cancer Surgery.

MATERIAL AND METHODS

It is a prospective observational study of the rehabilitation outpatient medical consultation assessed woman. Patients were referred from Department of Gynecologic Oncology, Oncology, Radiotherapy and others.

Preventive measures were explained individually in the first appointment, prevention standards and home exercises were delivered. ^(3,4,5,6,7,8,9) If patients required lymphatic drainage

therapy, they were recruited for the School of Lymphedema Prevention. A monthly meeting is organized up to 14 people. It is opened to patients and one family member is allowed. We inform about what the lymphedema is, how to prevent and treat it. Then, we establish a roundtable where patients can express their worries and concerns. At the end of each session, they are given a satisfaction survey. (Table 1)

Material Resources: meeting room, computer, projector and roundtable.

Human Resources: rehabilitation physician and skilled physiotherapist.

RESULTS

A total of 27 meetings were conducted from 17 March 2010 until 20 March 2013, 184 people attended to School of Lymphedema Prevention.

The survey showed high degree of satisfaction (Fig. 1). They had the opportunity to learn the basic anatomy and physiology of the lymphatic system to understand better the risks and also their own condition. Subjectively, they were more willing to make the commitment, to learn and to implement self-care techniques.

DISCUSSION

Secondary lymphedema after surgery for breast cancer that involved dissection of axillary lymph nodes is a complication of the patients. In order to this, emphasis should be placed on prevention. Early physiotherapy with educational strategy was associated with a lower risk. Nonetheless, most of the studies showed that women were not adequately informed after surgery and/or radiation therapy. Our team has implemented an educational strategy for the patients at risk of developing lymphedema and also for those who have already developed. Our aim was to improve care quality, avoid further complications and to reduce more individualized physiotherapy treatments, so that we could manage in a better way our public resources. We believe that our study shows evidence of high degree of satisfaction and commitment for using self-care measures. Unfortunately, there is no data of the decrease development of secondary lymphedema due to different particular criterion for diagnosing a measuring lymphedema. In other hand, the fact of including patients relatives could increase the participation in the program as a feed-back or external support. Nowadays, we are developing a more complete educational program which will include combined aerobic, stretching and resistance training exercises.

Table 1

	Absolutely	Not really	Absolutely not
Do you think what you learned in the workshop will help you to prevent the development of lymphedema?			
Do you think what you learned in the workshop will help you to take care of yourself?			
Do you believe that your self-esteem, self assessment and view of your self are better after the workshop?			
	Very suitable	Suitable	Not very suitable
What do you think about the place where the workshop took place?			
What do you think about the schedule?			
What do you think about the length of the workshop?			
	Very interesting	Interesting	Not very interesting
In general terms, what do you think about the workshop?			
Rate your satisfaction level (0-10)			

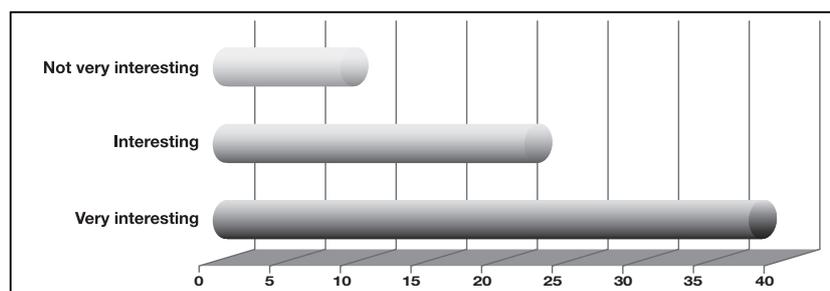


Figure 1

CONCLUSIONS

The School of Lymphedema Prevention focuses on training and educating patients at risk of developing lymphedema or suffering from lymphedema and its families. Emphasis is on prevention, promotion of autonomy and activities of daily living, psychological and emotional support.

REFERENCES

1. Coen J.J., Taghian A.G., Kachnic L.A., Assad S.I.: *Risk of lymphedema after regional nodal irradiation with breast conservation therapy*. Int. J. Radiat. Oncol. Biol. Phys., 2003; 55: 1209.
2. Fleissig A., Fallowfield L.J., Langridge C.I., Johnson L. et al.: *Post-operative arm morbidity and quality of life. Results of the ALMANAC randomised trial comparing sentinel node biopsy with standard axillary treatment in the management of patients with early breast cancer*. Breast Cancer Res. Treat., 2006; 95: 279.
3. Moseley A.L., Piller N.B., Carati C.J.: *The effect of gentle arm exercise and deep breathing on secondary arm lymphedema*. Lymphology, 2005; 38: 136-45.
4. Biringir B.C., Gaul C.A.: *Full-body exercise training improves fitness and quality of life in survivors of breast cancer*. Cancer J. Strength Cond. Res., 2006; 20.
5. McNeely M.L., Rowe B.H., Klassen T.P.: *Effects of exercise on breast cancer patients and survivors: a systematic review and meta-analysis*. CMAJ, 2006; 175: 34-41.
6. Valenti M., Porzio G., Aielli F. et al.: *Physical exercise and quality of life in breast cancer survivors*. Int. J. Med. Sci., 2008; 5(1): 24-28.
7. Schitz K.H.: *Balancing Lymphedema Risk: Exercise versus deconditioning for breast cancer survivors*. Exerc. Sport Sci. Rev., 2010; 38: 17-24.
8. Herrero F., San Juan A.F., Fleck S.J., Balmer J. et al.: *Combined aerobic and resistance training in breast cancer survivors: A randomized, controlled pilot trial*. Int. J. Sports Med., 2006; 27(7): 573-80.
9. Hayes S.C., Reul-Hirche H., Turner J.: *Exercise and secondary lymphedema: Safety, potential benefits and research issues*. Med. Sci. Sports Exerc., 2009; 41(3): 483-9.

SCHOOL OF LYMPHEDEMA PREVENTION: YOUR CARE, OUR GOAL

M. Zamarripa-Cuesta, T. Torralba-Puebla, L. Ortiz-Fernández, R. Santos-Reyes, Z. Velerdas-Martinez, R. Zaballa-Fernandez.
Physical Medicine and Rehabilitation Department, Cruces University Hospital, Barakaldo, Bizkaia (Spain).

INTRODUCTION: Lymphedema is chronic swelling of a body part and often the unintended consequence of cancer surgery and/or radiation. Since the introduction of Combined Decongestive Therapy, the medical community has been able to offer effective treatment for this condition but lymphedema therapists and educators are discovering the vital role of patient education in the prevention and management of this condition, as there is no "cure" and long term maintenance inevitably becomes the responsibility of the patient.

OBJETIVE: To present our School of Lymphedema Prevention after Breast cancer Surgery.

MATERIAL AND METHODS: Prospective observational study of the rehabilitation outpatient medical consultation assessed woman. Patients were referred from Department of Gynecologic Oncology, Oncology, Radiotherapy...

Preventive measures were explained individually in the first appointment, prevention standards and home exercises were delivered. If they required lymphatic drainage therapy, they were recruited for the School of Lymphedema Prevention.

A monthly meeting is organized up to 14 people. It is opened to patients and one family member is allowed. We inform about what the lymphedema is, how to prevent and treat it. Then, we establish a roundtable where patients can express their worries and concerns. At the end of each session, they are given a satisfaction survey.

Material Resources: meeting room, computer, projector and roundtable.
Human Resources: rehabilitation physician and skilled physiotherapist.



OSAKIDETZA
GUDU F.H.C.
GOSUKETZAKO UNIBERTSITATE ospitalea
HOSPITAL UNIVERSITARIO CRUCES



Escuela de linfedema

Dra. Tereasa Terralra
Médica especialista del departamento de
Hospital de Cruces

RESULTS: 27 meetings were conducted from 17 March 2010 until 20 March 2013. 184 people attended to School of Lymphedema Prevention. The survey showed high degree of satisfaction. They had opportunity to learn the basic anatomy and physiology of the lymphatic system better understand the risks and their own condition. Subjectively, they were more willing to make the commitment to learn and implement self-care techniques.

CONCLUSIONS: School of Lymphedema Prevention focuses on training and educating patients at risk of developing lymphedema or suffering from lymphedema and its families. Emphasis is on prevention, promotion of autonomy and activities of daily living, psychological and emotional support.



	Mucho	Poco	Nada
¿Crees que te beneficiarás en el futuro de aprender a prevenir la aparición del linfedema?	+	-	-
¿Crees que te beneficiarás en el futuro de aprender a cuidar mejor a tu cuerpo a partir de ahora?	+	-	-
¿Crees que te beneficiarás con el taller de educación, la teoría de clases y sesiones?	+	-	-
¿Crees que te beneficiarás en su grado de participación, desarrollo, entendimiento, bienestar o salud?	+	-	-

	Muy aburrido	Aceptable	Interesante
¿Qué opinión del lugar donde tenemos nuestras sesiones?	-	-	+
¿Cómo te ha parecido el material?	-	-	+
¿Cómo te ha parecido la duración de cada sesión?	-	-	+

	Muy interesante	Interesante	Poco interesante
En general, el Taller de linfedema	+	+	-

¿Qué tanto te ha gustado el taller? (0 a 10)

	0 puntos	1 punto	2 puntos	3 puntos
¿Qué tanto te ha gustado el taller?	+	+	+	+

LETTER TO THE EDITOR: “ABOUT LYMPHOSCINTIGRAPHIES AND PNEUMATIC MASSAGE”

Prof. PIERRE BOURGEOIS, MD, PhD
Head of Clinic,
Service of Nuclear Medicine,
Past President of the European Society of Lymphology,
Institut Jules Bordet,
Université Libre de Bruxelles,
121, Bd de Waterloo,
B-1000, Brussels, Belgium,
Tel.: 32-2-5413276
Fax: 32-2-5413224
Mail: pierre.bourgeois@bordet.be

*To the Editor in Chief of the European Journal of Lymphology and Related Problems,
To the Editor in Chief of Lymphology,
To the Editor in Chief of Phlebology*

Dear colleagues,

Although I have read with interest the paper by Olszewski et al entitled “Hydraulics of tissue fluid during pneumatic compression in lymphedema of lower limbs”⁽¹⁾, I am raising many questions and objections to the methodology, results and conclusions that the same authors give in their other articles entitled “Lymphoscintigraphy of lymph flow and tissue fluid flow during intermittent pneumatic massage of lower limbs with obstructive lymphedema”⁽²⁾, “Where do lymph tissue fluid flow during intermittent pneumatic massage of lower limbs with obstructive lymphedema?”⁽³⁾ and “Pathways of lymph and tissue fluid flow during intermittent pneumatic massage of lower limbs with obstructive lymphedema”⁽⁴⁾ :

“Minor problems”

- 1) With regard to and in contradiction to the titles provided, at least one of the six patients of whom they show pictures of has no obstructive oedema. Indeed, the patient in figure 2 presents lymphatic vascular lesion at the level of the calf with vascular lymphatic reflux and “dermal backflow” but no intra-abdominal blockade (iliac nodes are visualised) as other patients’ figures show.
- 2) In their “patients” paragraph of their “material and methods”, they write that their patients had “diagnosis of one lower limb”. Unfortunately, at least one shown in figure 5 is reported to have (obviously) “lymphedema of both lower limbs”. Additionally, it would have been important to precise how many patients had primary and secondary lower limb edemas.

- 3) In their “lymphoscintigraphic staging paragraph of their “material and methods”, they write that they staged II patients with “no iliac lymphatics”. I do not understand then how they can include in their series and analyze the pictures of their patient’s figure 2 where iliac lymph nodes are clearly seen.
- 4) In their “Lymphoscintigraphy technique” paragraph of their “material and methods”, they report that they injected 3 mCi of ^{99m}Tc HSA nanocolloids. But they performed three injections per foot: does it mean, either that they injected 9 mCi per foot, or that they performed 3 injections of 1 mCi per injection? Can they also precise which was the activity of ^{99m}Tc-O4 injected in the vial of Nanocoll, which was the volume of reconstitution, which volumes were injected in the interdigital spaces and in the sole and which volume and activity represent the “1/10th of the Nanocoll dose” they used for their “lymphoscintigraphy of skin and subcutis of hypogastrium”?

“Major problems”

- 5) In their “lymphoscintigraphic staging” and “Lymphoscintigraphy technique” paragraphs of their “material and methods”, there is one contradiction. In the 1st, they report “inguinal nodes... appearing 2 hours after isotope injection” and in the 2nd, they write that “Imaging was performed... immediately after isotope injection”. I have the experience that intradermal injections can give very fast and important visualisation of the lymphatic system of the lower limbs⁽⁵⁾ but I am somewhat astonished by the pictures shown and reported as obtained “immediately after isotope injection”.

Were their lymphoscintigraphies obtained 2 hours after injections or/and immediately after injection? If all their lymphoscintigraphies were obtained 2 hours after injections (see following point 6 and 7), I would understand partly some of the problems I have with the analysis of the figures presented by the authors (see point 13).

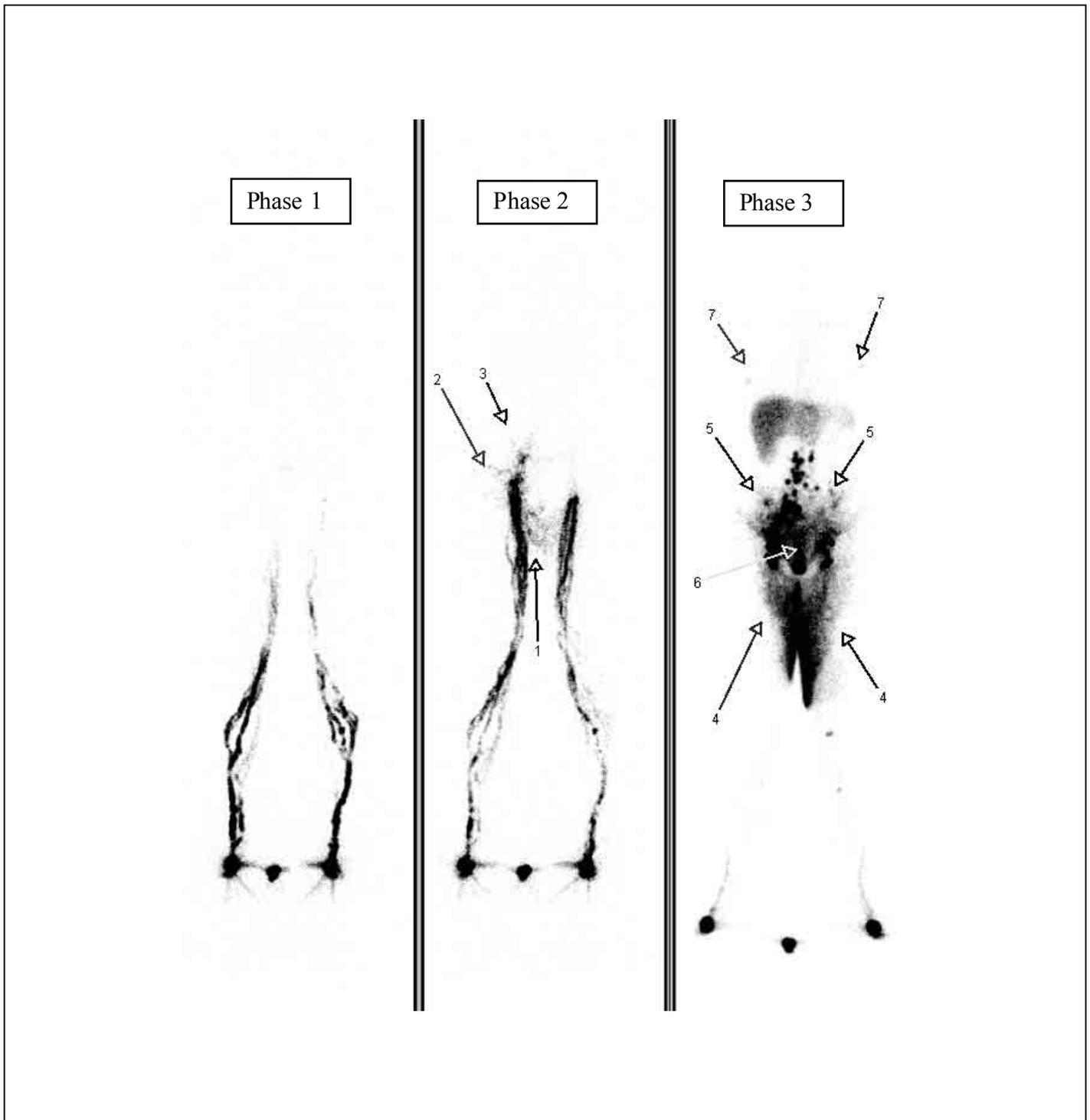
- 6) The authors also report that “lymphoscintigraphy was carried out in each patient in two sessions: the first without pneumatic massage and the second days later following a 45 minutes limb pneumatic massage”. Does it mean that they used different timings to perform their lymphoscintigraphies (2 hours after injections for the “first session without pneumatic massage”) and “immediately after injection” (?) “days later following limb pneumatic massage”?
- 7) Finally, my two previous points raise one important methodological question for which I do not find the answer in their methods. In order to demonstrate the effect of pneumatic massage on the lymphoscintigraphic movements of the isotope, the authors compare pictures obtained “BEFORE” and “AFTER” but to which pictures do they then refer?

I can see two logical possibilities (but I am not sure that they cover what they did):

- a) the lymphoscintigraphies obtained during the 1st session without pneumatic massage are the BEFORE ones and the lymphoscintigraphies obtained “days later” during the 2nd session “following a 45 minutes limb pneumatic massage” are the AFTER ones? If it is the case, I would then raise the problem of the reproducibility of their imagings related to differences in the intradermal injections (“pure” or not), in the timings after injections (2 hours with or without additional application of 45 minutes of pneumatic massage? Or only 45 minutes immediately after the isotope injection?), in the physical activities of their subjects between the injection and the imagings,...
 - b) the other possibility (?) is (would have been) more methodologically correct: they have (?) compared lymphoscintigraphies BEFORE (immediately after injections?) and AFTER 45 minutes of pneumatic massaging BUT on lymphoscintigraphies obtained the same day.
- 8) Further in the same “Lymphoscintigraphy technique” paragraph of their “material and methods”, they write that they “evaluated” “the surface area” “of the inguinal lymph nodes (LN) of both limbs”. But:
 - a) On their figures 2 and 3, iliac lymph nodes can be visualized and on their figure 7 the lumbo-aortic LN too. Were these iliac and lumbo-aortic lymph nodes included in their surface area evaluation?
 - b) Additionally, their evaluation method is a somewhat unusual approach in the Nuclear Medicine world. What is seen (“the surface”) is related to the activities in the lymph nodes but “the surface” (in pixels, surface units for the nuclear medicine imagings) will depend on the thresholds used to delineate the structures. With regard to one of the aims of their work (the demonstration of the lymph fluid movements after pneumatic massage), it has also to be reminded that the radiocolloids in the lymphatic vessels are taken up by and accumulated in the lymph nodes. The “surface” of the lymph nodes may not change after pneumatic massage but the activity might increase and be the sign that lymphatic contents have been pushed in these LN by pneumatic massages. Why did they not analyze the changes in the activities (in counts per area) at the level of the oedematous limbs “before/after” pneumatic compression?
 - 9) They also write at the end of the “Lymphoscintigraphy technique” paragraph of their “material and methods” that they analyzed the ratio of these surfaces against the “contralateral normal extremity”. What happened for the patient with bilateral oedema?
 - 10) In their “Statistical evaluation” paragraph of their “material and methods”, they write that they used Student’s T-test. Do they perform paired or unpaired T-test?
 - 11) From a methodological point of view, I do not understand very well why they analyzed “ratio oedematous/normal limb”. Why did they not analyze the changes of their “surfaces” at the level of the oedematous limbs “before/after” of the application of pneumatic compression? In fact, I understand only such an analysis “ratio oedematous/normal limb” if the protocol of the authors corresponds to the possibility previously raised at point 7) a)... with the corresponding critics.
 - 12) In their “Lymphoscintigraphic evaluation of lymph and tissue flow in the massaged limb” paragraph of their “results”, they write “After massage in stage II (Fig. 2) and some cases of stage III (Fig. 3)” ... “the tracer” ... “flowed” ... “to” ... “retro-peritoneal space”. I disagree completely with their interpretation of their Figures 2 and 3. What are seen are iliac lymph nodes but no iliac lymphatic vessels (and no non-vascular “spaces”).
 - 13) I also have many problems and disagree completely with their interpretation of the following pictures:
 - a) Figure 2:

Their right-sided anterior and posterior whole body scans are “said” AFTER (pneumatic massage) and they show limited lymphatic extravasations at the mid part of the right calf BUT their left-sided anterior and posterior whole body scans reported as BEFORE (pneumatic massage) show left popliteal nodes that would have (??) disappeared (??) AFTER pneumatic massage on the right limb. It is not possible. Lymph nodes with radiocolloid accumulation in their reticulo-endothelial component donot disappear.

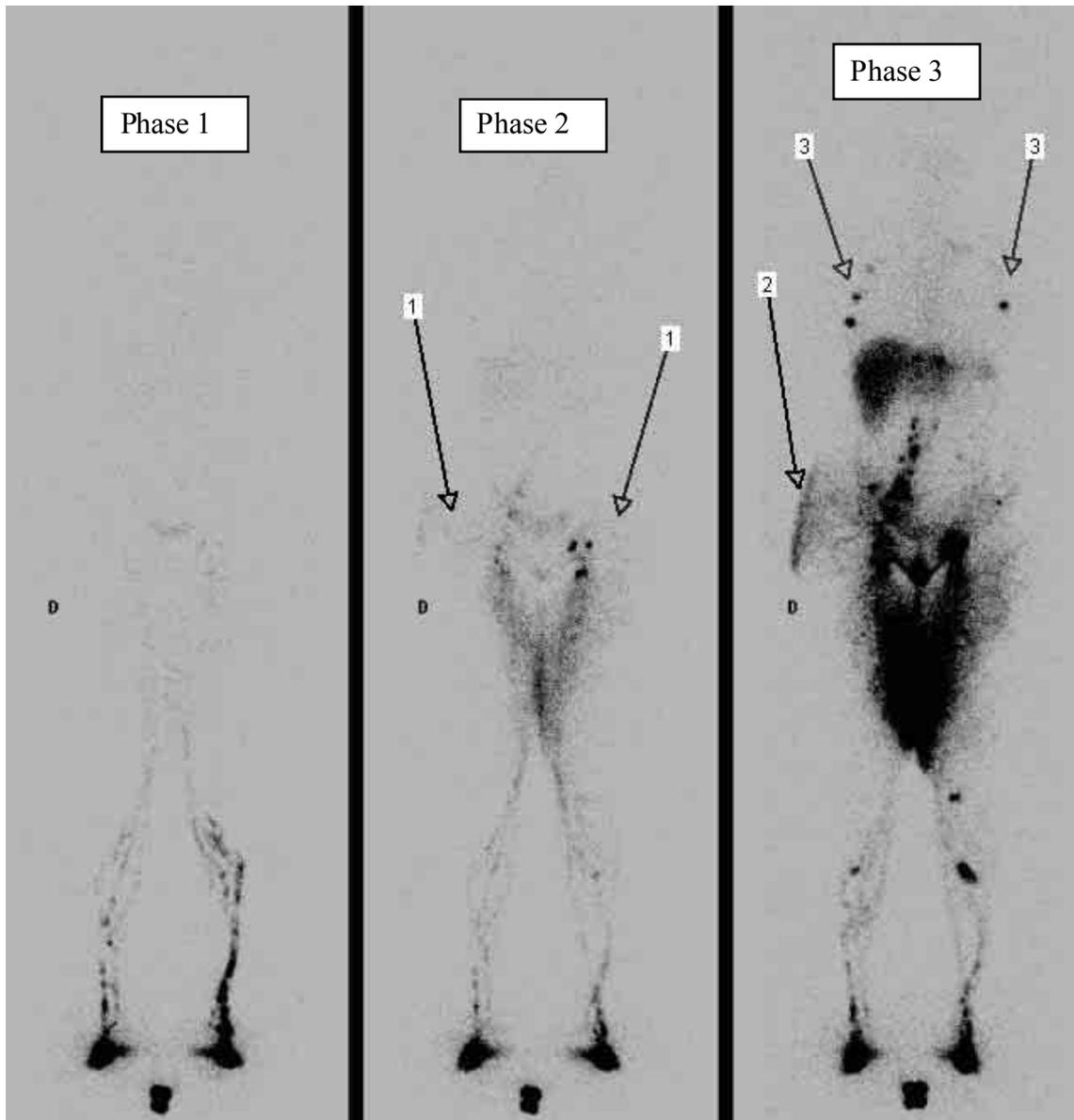
Additionally, on these BEFORE pneumatic massage whole body scans, there is one extensive dermal backflow



Legend figure 1:

Woman 41 years old, with the diagnosis of carcinoma of the cervix uteri in 09/2005, operated in 01/2006 (Wertheim) followed by radiotherapy in 07/2006, with –thereafter- edema at the level of the pubis and of upper and inner part of the left thigh THEN bilateral , upper and inner part of the thighs THEN in 05/2007with extension of the edema to the abdominal wall.

On these anterior whole body scan imagings obtained in 09/2008, lymphatic vascular reflux can be seen after our phase 2 (5 minutes of bilateral tiptoeing) from the right inguinal nodes toward the inner part of the right thigh (arrow 1), toward the external part of the righth buttock (arrow 2) but also toward the right abdominal wall (arrow 3). After a walking of one hour (phase 3), lymphatic reflux toward and in the superficial lymphatic collateralisation networks can be seen at the level of the inner and upper parts of both thighs (arrows 4), at the level of the inferior abdominal wall (arrows 5), of the pelvic area (arrows 6), also with bilateral faint visualisation of axillary nodes (arrows 7) (proof that the lymph can spontaneously flow through the abdominal wall and cross the « Sappey's » line).



Legend figure 2:

Same woman as in figure 1 but these anterior whole body scan imagings were obtained in 02/2012. Lymphatic vascular reflux are now seen after our phase 2 (5 minutes of bilateral tiptoeing) bilaterally from the inguinal nodes toward the inner part of the right thigh, toward the external part of the right buttock (arrow 1) but also toward the right abdominal wall (arrow 3). After a walking of one hour (phase 3), lymphatic reflux toward and in the superficial lymphatic collateralisation networks can be seen more extensive at the level of the external part of the right buttock (arrows 2), at the level of the inferior abdominal wall, of the pelvic area but now more clearly than in 2008 in right and left axillary nodes (arrows 3).

at the level of the mid part of the right calf (and may be also at the level of the foot) that would have (??) disappeared (??) AFTER pneumatic massage (??). That is also completely incredible. I would accept the reverse situation: limited lymphatic extravasation at the mid part of the right calf that would evolve towards extensive dermal backflow at the same level.

It therefore seems to me, either that their presentation (BEFORE-AFTER) and interpretation are erroneous, or that these pictures raise the question of the reproducibility of their imagings in the framework of their methodological protocol.

b) Figure 3:

What is their interpretation of the foci of activity seen on their AFTER anterior whole body scans in the left part of the abdomen? In my experience, such foci of activity may represent “in transit” lymph nodes on collateralisation pathways.

c) Figure 4:

The authors analyze “the faint outline in the thigh” as “No lymphatics”. I disagree, since this faint activity is in “lymphatics”.

d) Figure 5:

The authors analyze what they observe on their BEFORE whole body scans at the level of the thigh “as isotope” ... “in tissues subcutaneous spaces”. I disagree since these are “lymphatic vessels” reaching on both sides the inferior parts of the inguinal areas.

Additionally, I am quite sure that on their AFTER anterior whole body scan, the small area of activity seen on the right side near the bladder activity is one lymph node.

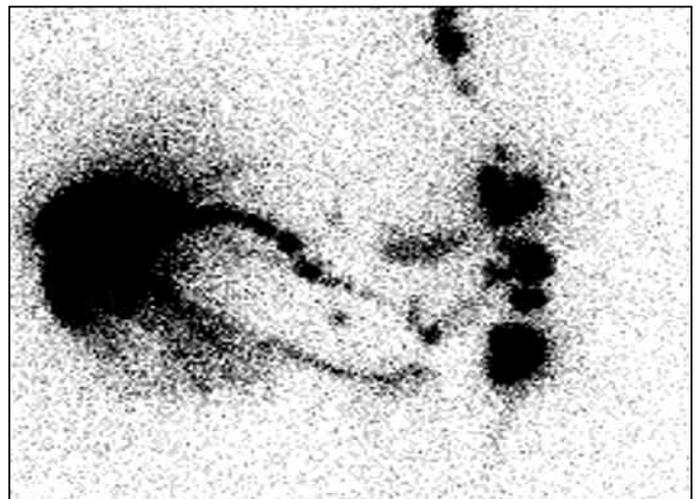


Figure 4

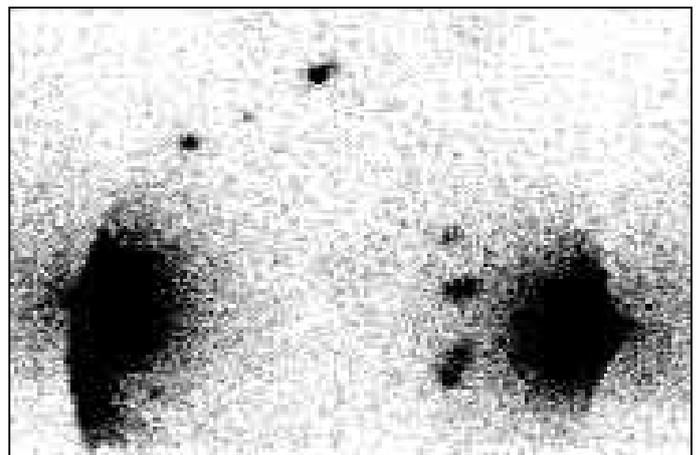


Figure 5

e) Figure 6:

Their right-sided anterior and posterior whole body scans are “said” AFTER (pneumatic massage) and they show intradermal injection in the left lower abdominal quadrant: why?

Their left-sided anterior and posterior whole body scans are reported as BEFORE (pneumatic massage) results (with arrows showing lymphatic vessels not at the level of the right calf but above the level of the knee, at the level of the thigh). Again, these pictures, either raise the question of the reproducibility of their imagings in the framework of their methodological protocol, or they are completely incredible and for the following reasons:

- 1) Again, left popliteal nodes are well and better seen on the BEFORE anterior and posterior views than AFTER pneumatic massage applied on the other limb?? (see comments for fig 3.)

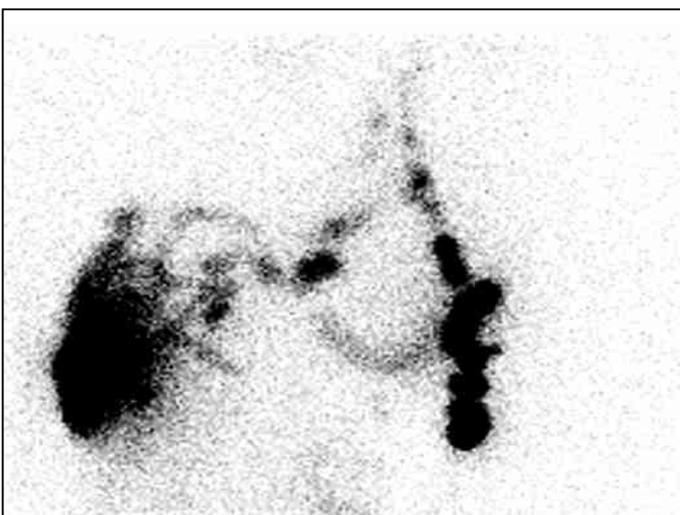


Figure 3

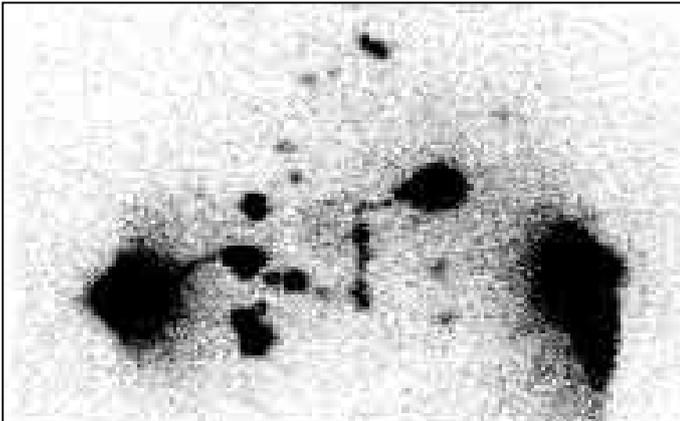


Figure 6

- 2) Left ilio-lumbo-aortic nodes can also be seen on the BEFORE anterior and posterior views and they would have disappeared AFTER pneumatic massage??
- 3) Liver activity is additionally seen on the BEFORE anterior and posterior views and it would have disappeared AFTER pneumatic massage (the liver is taken up and accumulating the colloids reaching the systemic circulation) ??

I would accept the reverse situation but, as for their Figure 2 interpretation, I think that it is wrong.

With regard to their injection in the left lower abdominal quadrant, they write in their results that “there was minimal radial spread of the isotope from the site of injection”. It think that it is wrong: it may be a simple artefactual “star-dust” effect well known by experienced isotopists, one effect that can be observed on the distal part of their anterior whole body scans above the sites of injection in the feet of their patients in Fig. 2 (AFTER one), Fig. 4 and Fig. 6 (BEFORE ones).

- f) “there was no flow to...the gluteal region” BUT at least on their Figure 2 AFTER and their Figure 5 AFTER, lymphatic activity is seen in the external part of the left buttocks at the level of the bladder activity.

14) I also have many problems and completely disagree with some of the authors’ conclusions in their discussion:

- a) the “information” that “pneumatic compression of the lower limb pushed isotope in lymph in the remnant lymphatics and tissue fluid in the interstitial space toward the inguinal region and femoral canal” is not supported by their results, at least by the pictures presented in Figures 2, 5 and 6.
- b) “the isotope injected intradermally in the hypogastrium did not spread during both manual and pneumatic drainage to the upper and contralateral quadrants”. I accept the sentence but I raise the following remarks:
 - 1) it is based on only five cases, three who were staged II and two who were staged IV

- 2) in two patients, they report drainage towards inguinal nodes (staged II?), which can be normally expected in such situations and in fact excludes drainage to the upper and contralateral quadrants
- 3) based on my experience, such intradermal injections are useful in patients staged III or IV (according to their proposal of classification)
- 4) their ten minutes of massage (how was it performed?) might have been insufficient to show lymphatic drainage and
- 5) “1/10th of the Nanocoll dose” (activity and volume not specified) may have been insufficient as to give one adequate image⁽⁶⁾.

- c) they also write that their study provide the “information” that “no isotope filling fluid channels crossing the inguinal crease or running toward the gluteal area was visualized” and “there was no isotope flow either in lymphatics or in tissue fluid to the hypogastrium”. Again (and apart my remark 13.f) I accept the sentence but I raise the following remarks:
 - 1) it is true for their 15 patients and
 - 2) it is true only with their imaging protocol.

All my colleagues performing lymphoscintigraphies for instance in women after Wertheim and irradiation for gynaecological cancer and who present with pre-pubic oedema and/or oedema of the magna labia would be able to show pictures of lymphatic dermal backflow in the lower part of the abdomen (see Figures 1 and 2).

Additionally and as shown by our figures 3 to 6 (presented in previous ESL scientific meetings), with intradermal injection at the level of the external part of the buttock (figures 3 to 6) and/or at the level of the “hypogastrium” (figure 4: left side), it is easily possible (sometimes without any manual “lymphatic” massage) to demonstrate vascular lymphatic collaterals from the external part of the buttock:

- a) reaching iliac lymph nodes above one inguinal area without any lymph node (Figure 3),
- b) flowing anteriorly through the homolateral inguinal area toward the mid line, crossing the mid line prepubic, delineating the left magna labia and reaching the heterolateral inguinal nodes (Figure 4),
- c) flowing posteriorly through the homolateral abdominal wall and reaching the homolateral lumbo-aortic nodes (Figure 5: same patient as for figure 4: posterior view),
- d) flowing anteriorly from the left “hypogastrium” toward the mid line, descending along the scar, crossing the mid line prepubic (just in front of the urinary bladder activity) and reaching the heterolateral right inguinal nodes (Figure 6).

I do have a great respect for past works carried out by Olszewski’s group and I cited him frequently for instance during past European Society of Lymphology meetings but, in the present situation, their work (and these papers) cannot be accepted as a scientific reference, at least with regard to their lymphoscintigraphic methodology, interpretation of their

imaging and their related conclusions for pneumatic massage.

To be positive and in order to face the questions raised by the authors, I would have proposed to carry out the following protocols (which could be realized by the same group or by another group):

- a) perform days apart two sets of lymphoscintigraphies in the same patients, the 1st 45 minutes after injection and without pneumatic massaging and the 2nd 45 minutes after injection and with pneumatic massaging directly applied after injections,
- b) perform days apart four sets of lymphoscintigraphies in the same patients, during the 1st session image your patients 45 minutes and 90 minutes after injection and without pneumatic massaging and during the 2nd session image your patients again 45 minutes and 90 minutes after injection but with pneumatic massaging being applied between the 1st and the 2nd imaging.

Additionally, I would invite the readers interested by the problem to go and read my article "Proposal of (practical and fundamental) guidelines (and information) for those who wish to report (and/or to interpret/analyse) lymphoscintigraphic investigations ("The devil is in the details")" that will be published in the European Journal of Lymphology and related Problems and also on the European Society of Lymphology Web Site.

REFERENCES

- 1) Olszewski WL, Pradeep J, Zaleska M, Cakala M, Gradalski T, Szopinska S: *Hydraulics of tissue fluid during pneumatic compression in lymphedema of lower limbs*. Eur J Lymphology 2011; 22: 14-19.
- 2) Olszewski WL, Cwikla J, Zaleska M, Domaszewska-Szostek A, Gradalski T, Szopinska S: *Lymphoscintigraphy of lymph flow and tissue fluid flow during intermittent pneumatic massage of lower limbs with obstructive lymphedema*. Eur J Lymphology 2011; 22: 1-6.
- 3) Olszewski WL, Cwikla J, Zaleska M, Domaszewska-Szostek A, Gradalski T, Szopinska S: *Where do lymph tissue fluid flow during intermittent pneumatic massage of lower limbs with obstructive lymphedema?* Phlebology, 2011; 19: 188-195.
- 4) Olszewski WL, Cwikla J, Zaleska M, Domaszewska-Szostek A, Gradalski T, Szopinska S: *Pathways of lymph and tissue fluid flow during intermittent pneumatic massage of lower limbs with obstructive lymphedema*. Lymphology, 2011; 44: 54-64.
- 5) Bourgeois P, Leduc O, Belgrado JP, Leduc A: *Scintigraphic investigations of the superficial lymphatic system: quantitative differences between intradermal and subcutaneous injections*. Nucl Med Commun, 2009; 30: 270-274.
- 6) Bourgeois P: *Scintigraphic investigations of the lymphatic system: the influence of the injected volume and quantity of labeled colloidal tracer*. J Nucl Med, 2007; 48: 693-695.

LINFOROLL: A NEW DEVICE FOR LYMPHOEDEMA TREATMENT. PRELIMINARY EXPERIENCE

MICHELINI S., CALDIROLA R., OLSZEWSKI W., PISSAS A., DIMAKAKOS E., FORNER CORDERO I., MICHELOTTI L., CARDONE M.

San Giovanni Battista Hospital – ACISMOM – Rome

ABSTRACT

The study born from the need to use a therapeutic methods scientifically correct and reproducible consisting in a equipment dedicated to the lymph drainage in which the physical parameters to be used, operator dependent, can be universally standardized. In the study were enrolled 86 patients suffering from primary and secondary lymphedema. After the treatment the AA observed a medium decrease of 22% of circumference of limbs and a medium decrease of 72% of tonometric parameters. The study demonstrated the effectiveness of the device and the availability according to the EBM.

Key words: Lymph drainage. Evidence based medicine.

INTRODUCTION

Manual lymph drainage is one of the most important elements of complex physical decongestive treatment recommended by the guidelines of the most important scientific societies dedicated to this field^(1,2,3). The technique has a therapeutic etiologic effect and not symptomatic, as it promotes the absorption of the protein component present in the extracellular space, which is typical of the forms of lymphatic edema as of primary than of secondary kinds. The same proteins that stagnate in the interstitium promote the stimulation by the fibroblasts of the production of collagen fibers and sclerosis; this confers to the lymphatic edema the characteristic of early increase in the consistency of the tissue and consequent partial clinic irreversibility^(1,5,6,12,13).

Manual lymph drainage, in its various proposed techniques, consists of a series of manual maneuvers, with pressure, that the operator performs on the tissues by means a logical and precoded sequence in the various districts, with the aim of relieving the pressure on the treated area^(1,2,3,4,5,6,7,14). However, just because the technique is performed by the physiotherapist is strongly “operator-dependent” and may differ execution, also important, not easily verifiable. For this reason it is very difficult to standardize this therapeutic tool, at least as understood until today which leads to a difficult objective on the part of health systems insurance, public or private, that have difficulty recognizing a proven scientific technique itself, and this despite the evidence of clinical findings, although always positive variables.

The need to use therapeutic methods scientifically correct and

reproducible pushed to manufacture an equipment, named “Linforoll”, dedicated to the lymph drainage in which the physical parameters to be used, operator dependent, can be universally standardized. This fact in the view of compliance with the current concepts of EBM. Manual techniques commonly used today, are too subjective and operator dependent: so not universally standardized⁽⁸⁾.

MATERIALS

Linforoll consists of a roller magnetically applied to a handpiece which is connected with a computerized system containing a program that transmits in real time the pressures exerted by the roller on the same underlying tissues. The device is calibrated so that the ideal pressure to be exerted is positioned about 60 millimeters of mercury, and provides, through lighting systems of “alarm”, any reduction or excess pressure that differ from those set as optimal. For each clinical case must be performed at least 10 sessions (with a variable time per session variable between 20’ and 45’).

When the pressure is included from fifty and sixty millimeters of mercury you can see a green light on the device. Any excess of pressure that differs from those set as optimal promote a red on the device light. Any reduction pressure that differs from those set as optimal promote a yellow light.

Before to start the first therapeutical session it’s mandatory to fill all the patients’ data (diagnosis and reason for the treatment), weight, height, cirtometric and tonometric emphasis and stadiation^(9,10,11). In the second work session, by choosing “new session”, it’s possible directly go on the patient’s profile. At the end of sessions cycle, it’s possible to make the final measurements on patient.

Regarding the history, all the most important aspects must be filled and, in particular, the cause that initially determined lymphoedema

Most important medical records are included in the appliance: anamnesis, staging of illness, body max index, volume of limb and so on. Regarding the edema’s measurements data entry it is possible to enter pre-treatments data. The grading and BMI will be automatically calculated. After must enter cirtometric data related to the right limb and the left limb (pre stands for before treatment) (Fig. 1)^(8,9).

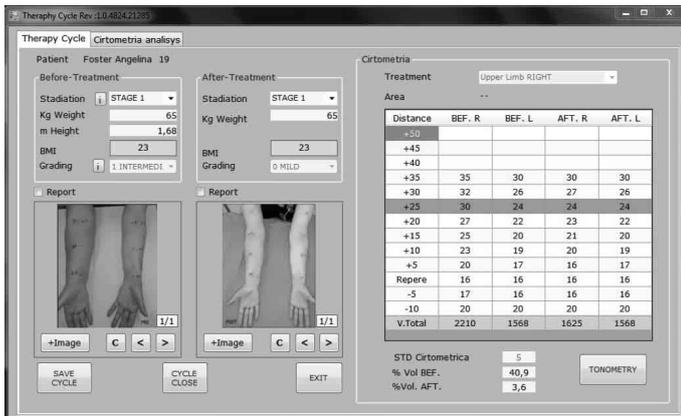


Fig. 1 - Data recording after patient treatment with Linforoll.

After the operator enter all the tonometric data of the right limb and left limb, up to 5 seconds or 3 minutes before to start the treatment.

Then can be included in the program, limb circumferences at several levels so that the device, automatically, can calculate the limb volume using the formula of the truncated cone volume, pre and post treatment (8,9). It's also possible put in the program a picture of the patient before the treatment and at the end of therapy. In this way is stored in the program also visual images for a patient monitoring in time (Fig. 1).

In the study were enrolled 86 patients suffering from primary and secondary lymphedema, 38 male and 48 female, located in the lower limbs, upper limbs, external genitals and face, both unilateral and bilateral, aged between 2 to 80 years old. The AA. divided patients homogeneously in two groups: group A which was treated with linforoll and elastic compression and group B treated by usual manual lymphatic drainage and elastic compression.

The inclusion criteria were represented by primary non syndromic lymphoedema and secondary lymphoedema.

Exclusion criteria were: cardiac failure, hepatic failure, arterial hypertension and particular psychiatric problems to clinical judgement.

The treatment consisted of 10 sessions, five days a week for two consecutive weeks. The sessions lasted from twenty-five to forty-five minutes. The protocol was variable, depending on the clinical stage and location of the oedema. The pressures were between fifty and sixty millimetres of mercury. The AA. considered the volume of the limbs, the tissue texture and range of motion of the major joints of the limbs.

The program provides a series of coded sequential steps that include the preparation of lymph node stations along the limb and the treatment, area by area, of all areas of treated anatomical region, both for the upper limbs and for the lower limbs.

At the end of the treatment it is performed a multilayer bandage inelastic on the anatomical area concerned as for the traditional treatment protocols.

The pressure exerted by the operator that rotates the roller on the skin surface of the patient must be constant. This was possible by observing the LED positioned on the handpiece, which must always show a green light, throughout the rolling maneuver.

During the maneuvers should not be produced pain or redness of the skin.

The study aims to examine the volume of the anatomical region affected by edema and the tissular consistency.

The values are recorded at baseline and after 10 sessions of drainage. The volume is calculated automatically by means of a computerized processing based on the formula for the volume of a truncated cone, based on the detection of the circumferences of limbs affected by edema. The tissue consistency should be detected at the same levels of the measurements of the circumferences of the limb (with the tonometer) with the foresight to detect mainly in correspondence of the anatomical areas in which clinically is more increased the local consistency.

RESULTS

At the end of treatment from the point of view of the medium circumferences of limbs we observed a substantial positive result in the two groups, with slight better results of group "A" in decreasing the average volume (19% decrease of volume in group A, 16,5% in group B – Fig. 2). Related results were obtained as concerned the tonometry that showed a discrete average reduction of consistency of tissue in relation to the initial conditions (Decrease of 9,5% of tonometric value respect to the basal in group A, 7,8% in Group B – Fig. 3).

The same recovery of range of motion in the main joints of limbs in the two groups was practically coinciding (about 50% of increase of ROM in the interested Joint after treatment – Fig. 4).

The study examined also the effect of lymphatic transport by linforoll by observing the modifications of the lymphoscintigrafic find, pre-treatment and post-treatment. as is evident in this upper treated limb clinical (Fig. 5) in which, after treatment, appears proximal lymph nodes, not visible in basic conditions.

The same results were observed in the examination of lower limbs (Fig. 6), before and after the treatment. It's possible to see the reduction of dermal back flow of ankle, the appearance of a collateral pathway in the left inguinal region and the appearance of right popliteal lymph nodes.

This is a clear demonstration of the etiologic effect of the device in clinical application.

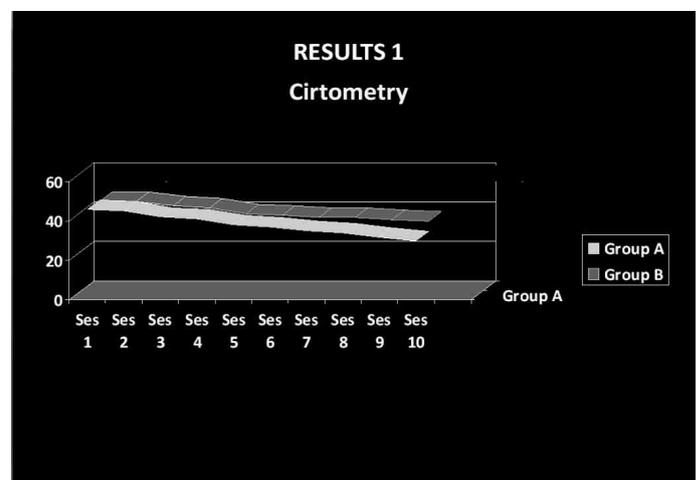


Fig. 2 - Reduction of limb measurement after group A and B.

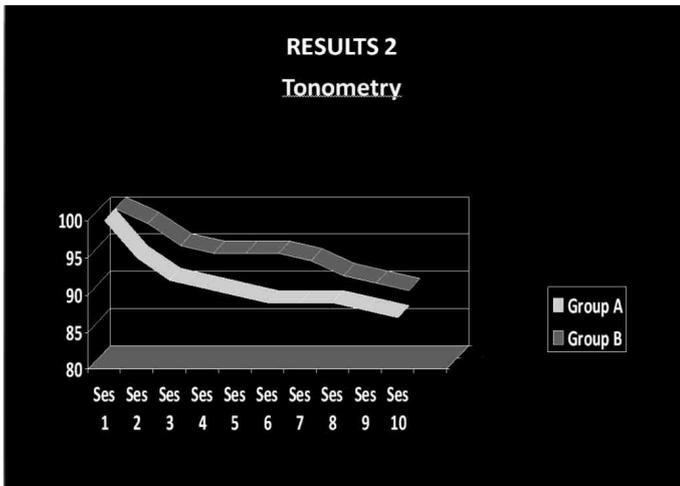


Fig. 3 - Reduction of consistency after treatment in group A and B.



Fig. 4 - Improvement of ROM after treatment in group A and B.



Fig. 5 - Lymphoscintigraphy of upper limbs before and after a session of linforoll treatment.

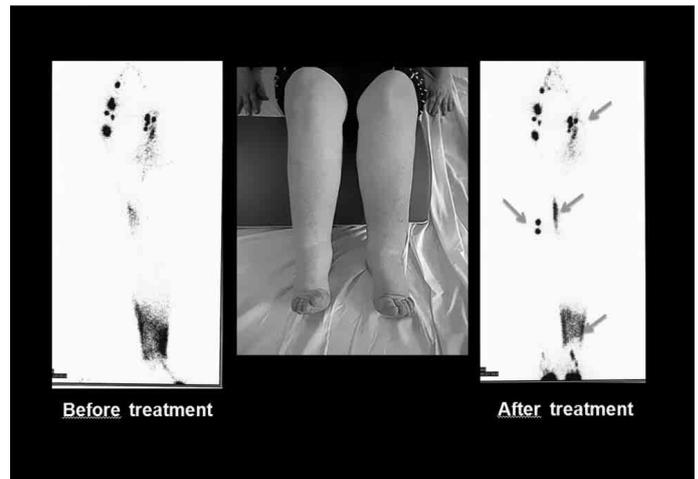


Fig. 6 - Lymphoscintigraphy of lower limbs before and after a session of linforoll treatment.

DISCUSSION AND CONCLUSION

This preliminary study testify the effectiveness of the device and the availability according to the Evidence Based Medicine.

In conclusion linforoll showed an important efficacy and effectiveness, an easy running practice and avoiding excessive reliance on operator skills.

An additional utility of linforoll is represented by the possibility to determine the volume of limb in each time of treatment, permitting an univocal interpretation of data obtained after the treatment, otherwise not possible with common manual measurement solutions.

The time of treatment is totally coinciding with the manual lymphatic drainage (this, too operator-depending) ^(15,16,17).

The clinical results between the two methods are about coinciding, but linforoll is more and more in line with the evidence based medicine, allowing standardization of parameters used during the treatment and permitting data savage, useful in comparing results both after each treatment, and between different sessions ⁽¹⁸⁾.

In the next steps the AA will consider the patients compliance, the operator feedback, possible collateral effects on patients (still today nothing), collateral effects on the operator, causes of possible stop to the treatment, best results on volume decrease (if in primary or secondary kind of lymphoedema), the operator's applied energy (very interesting data) and the total energy applied during the total cycle of treatment.

REFERENCES

1. Campisi C., Boccardo F.: *Terapia Funzionale Completa del Linfedema (CLyFT: Complete Lymphedema Functional Therapy): efficace strategia terapeutica in 3 fasi*. Linfologia, 2008; 1: 20-23.
2. Casley-Smith J.: *Modern treatment for lymphoedema*. The Lymphoedema Association of Australia, Inc., Adelaide, 1994.

3. Connell F., Brice G., Jeffery S., Keele Y.V., Mortimer P., Smansour S.: *A new classification system for primary lymphatic dysplasias based on phenotype*. Clin. Gen., 2010, Vol. 77, 5, 438-452.
4. Foldi M., Foldi E.: *Foldi's Textbook of Lymphology*. Elsevier, San Francisco, 2009.
5. Gasbarro V., Michelini S., Antignani P.L., Tsolaki E., Ricci M., Allegra C.: *The CEAP-L classification for lymphedemas of the limbs: the italian experience*. International Angiology, 2009, Vol. 28, N. 4: 315-324.
6. International Society of Lymphology: *The Diagnosis and treatment of peripheral lymphoedema*. Lymphology, 2009, 42: 51-60.
7. Leduc A.: *Le drainage lymphatique. Théorie et pratique*. Paris, Masson, 1980.
8. Michelini S., Caldirola R., Forner Cordero I., Olszewski W., Pissas A., Dimakakos E., Michelotti L.: *Linforoll: a new device for lymphoedema treatment. Preliminary experience*. The European Journal of Lymphology, Vol. XXIV, nr. 67, 25, 2013.
9. Michelini S., Pissas A., Olszewski W., Dimakakos E., Forner Cordero I., Caldirola R., Michelotti L.: *Linforoll: a new device for lymphoedema treatment*. Abstracts book 24° ISL Congress, Rome, 16-20 Sept. 2013 (p. 166).
10. Lee B.B., Andrade M., Bergan J., Boccardo F., Campisi C., Damstra R., Flour M., Glociczki P., Laredo J., Piller N., Michelini S., Mortimer P., Villavicencio J.L.: *Diagnosis and treatment of primary lymphedema*. Consensus document of the International Union of Phlebology (IUP)-2009. International angiology a journal of the International Union of Angiology Volume: 29, Issue: 5, Pages: 454-470 (2010).
11. Michelini S., De Giorgio D., Cestari M., Corda D., Ricci M., Cardone M., Mander A., Famoso L., Contini E., Serrani R., Pinelli L., Cecchin S., Bertelli M.: *Clinical and genetic study of 46 italian patients with primary lymphoedema*. Lymphology, 2012; 45: 3-12.
12. Michelini S., Campisi C., Failla A., Boccardo F., Moneta G.: *Staging of lymphoedema: Comparing different proposal*. The European Journal of Lymphology, 2006; Vol. 16, N. 46, 7-10.
13. Michelini S., Failla A., Moneta G., Cardone M., Michelotti L., Zinicola V., Rubeghi V.: *Linee guida e protocolli diagnostico-terapeutici nel linfedema*. Eur. Med. Phys. 2008; 44 (Suppl. 1 to No. 3).
14. Michelini S., Failla A., Cardone M., Moneta G., Fiorentino A.: *Immunostimulation and reduction of infective complications in patients with lymphoedema*. The European Journal of Lymphology, 2009; Vol. 20, N. 56, 17-18.
15. Ricci M.: *Disabilità e Linfedema*. La Linfologia Italiana, 2006; Vol.1, 12-15.
16. Vodder E.: *La méthode Vodder - Le drainage lymphatique manuel*. Inst. For Lymph Drainage, DK-2880, (1969) Bagsvaer.
17. Tondi P.: *Patologie del sistema venoso e linfatico*. Verduci Editore, Roma, 2013.
18. *Lymphedema. A Concise Compendium of Theory and Practice*. Lee Byung-Boong, Bergan John, Rockson Stanley G. (Eds.). 2011, XXI.
19. Michelini S., Failla A., Moneta G.: *Manuale teorico-pratico di Riabilitazione Vascolare*. Edizioni P.R., Bologna, 2000.
20. Cavezzi A., Michelini S.: *Il flebolinfedema*. Edizioni P.R., Bologna, 1997.

patients to be followed closely to improve the clinical outcome and maintain the short-term operative results for the long term⁽⁸⁾. In case of poor patient compliance, the results may be unsatisfactory. Relative contraindications to lymphatic microsurgery are represented by cases of lymphatic-lymph nodal aplasia (extremely rare), diffuse metastatic disease, and advanced stage (IIIB) not responsive to conservative therapy. Traditional debulking operations are presently less utilized to treat lymphedema except in cases of late stage lymphedema to reduce skin folds after marked edema reduction obtained by conservative physical and microsurgical methods; in body regions relatively inaccessible to effective compression such as the genitalia; in advanced lymphatic filariasis at times combined with lymphatic-venous or nodal-venous anastomosis in the setting of widely dilated lymphatic channels; and in localized lipolymphedema associated with massive obesity and forced immobility. Nowadays, debulking techniques are performed by minimally invasive surgical approach (Liposuction according to H. Brorson⁽⁹⁾ and regulated fibro-lipo-lympho-aspiration with lymph vessel sparing technique according to CC. Campisi⁽¹⁰⁾). In recent years, both primary and secondary peripheral lymphedemas are becoming better understood and more manageable problems with increased awareness and early detection⁽¹¹⁻¹⁵⁾. Nonetheless, apparent non-operative measures are aimed at minimizing morbidity without removing the cause of the underlying disturbance^(16,17). Microsurgical LVA operations can restore lymphatic drainage, both in the short and long term, and the best results are obtained when these surgical procedures are combined with physical rehabilitative methods. Finally, we recently proposed the use of lymphatic-venous anastomoses for primary prevention of arm lymphedema, performing anastomoses at the same time of axillary lymph node dissection for breast cancer treatment (Lymphatic Microsurgical Preventive Healing Approach – LyMPHA)⁽¹⁸⁻²¹⁾ (Fig. 3-6). This technique was used also for preventing lower limb secondary lymphedema for vulvar carcinoma and melanoma of the trunk (Fig. 7-9).

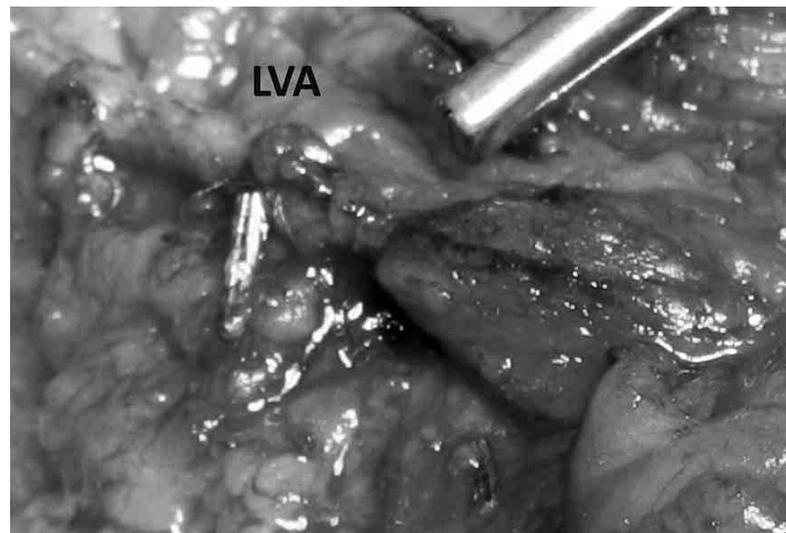
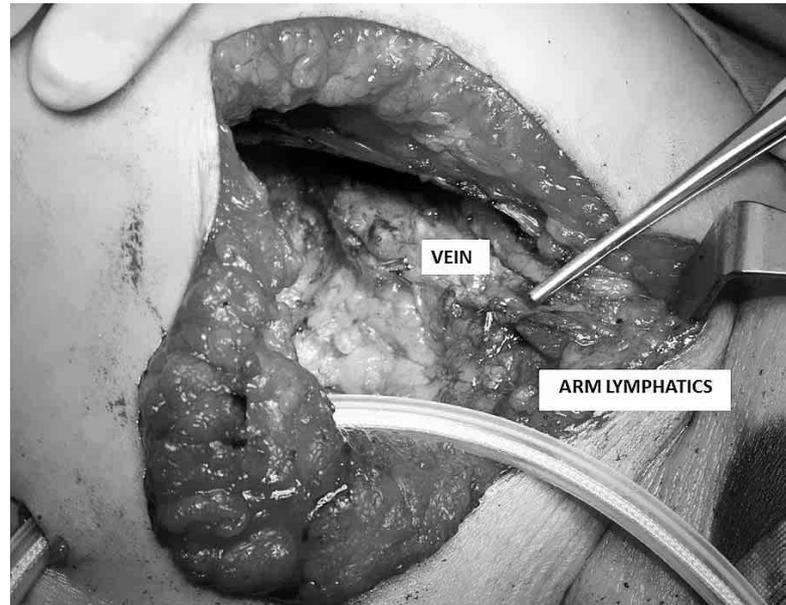


Fig. 4, 5 - Surgical pictures of LyMPHA technique. Multiple LVA is performed after completion of axillary nodal dissection to avoid upper limb lymphatic closure and maintain a proper arm lymphatic flow.

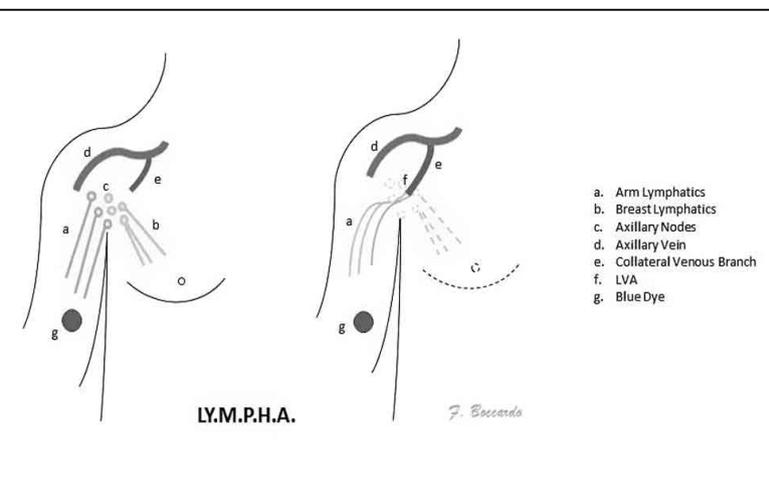


Fig. 3 - LyMPHA technique for surgical prevention of arm lymphedema in axillary nodal dissection for breast cancer. This technique proved to represent the only surgical preventive procedure.



Fig. 6 - Bilateral axillary nodal dissection associated to LyMPHA technique to prevent secondary arm lymphedema.

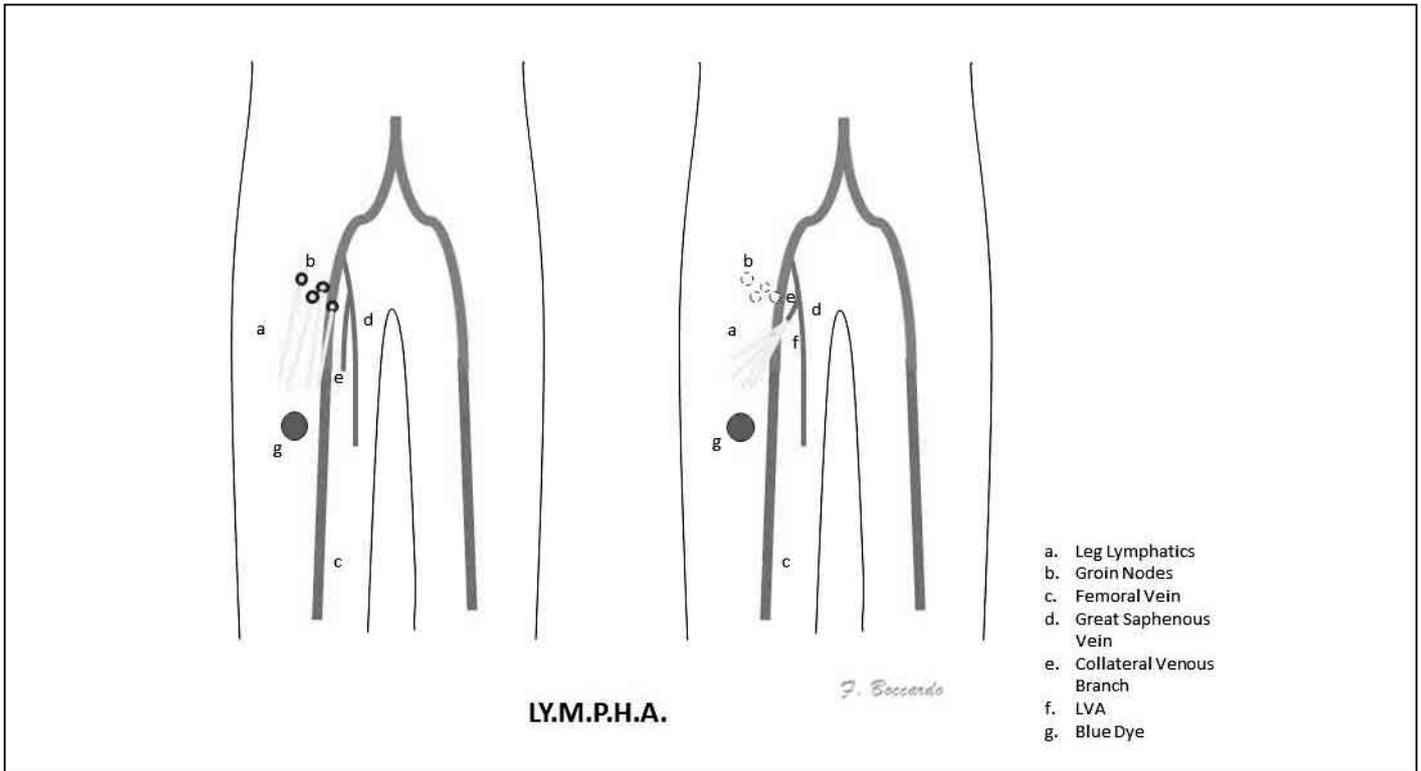


Fig. 7 - LyMPHA technique for surgical prevention of leg lymphedema in inguinal nodal dissection for vulvar cancer, trunk melanoma, penis carcinoma, etc. This technique proved to represent an effective surgical strategy to prevent iatrogenic lymphatic obstruction.

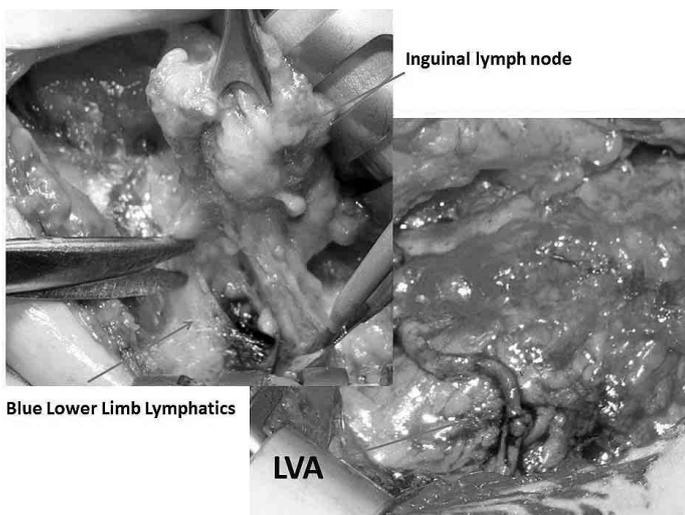


Fig. 8 - Surgical pictures of LyMPHA technique. Multiple LVA is performed after completion of inguinal nodal dissection to avoid lower limb lymphatic closure and maintain a proper leg lymphatic flow.

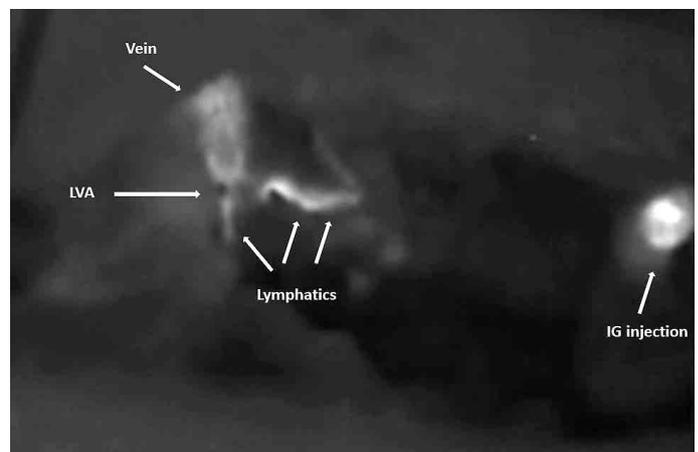


Fig. 9 - Indocyanine Green Lymphography by Photodynamic Eye technique demonstrate the patency of multiple LVA.

REFERENCES

1. Olszewski W.L.: *The treatment of lymphedema of the extremities with microsurgical lympho-venous anastomoses*. Int Angiol, 1988 Oct-Dec; 7 (4): 312-21.
2. Campisi C., Boccardo F.: *Lymphedema and microsurgery (Invited Review)*. Microsurgery, 2002; 22: 74-80.
3. Campisi C., Boccardo F.: *Microsurgical techniques for lymphedema treatment: derivative lymphatic-venous microsurgery*. World J Surg., 2004 Jun; 28(6): 609-13.
4. Papedieck C.M.: *The big angiodyplastic syndromes in pediatrics with the participation of the lymphatic system*. Lymphology, 1998; 31 (Suppl): 390-392.
5. Dellachà A., Boccardo F., Zilli A., Napoli F., Fulcheri E., Campisi C.: *Unexpected Histopathological Findings in Peripheral Lymphedema*. Lymphology, 2000; 33: 62-64.
6. Campisi C., Eretta C., Pertile D., Da Rin E., Campisi C., Macciò A., Campisi M., Accogli S., Bellini C., Bonioli E., Boccardo F.: *Microsurgery for treatment of peripheral lymphedema: long-term outcome and future perspectives*. Microsurgery, 2007; 27(4): 333-8.
7. Campisi C., Boccardo F., Tacchella M.: *Reconstructive microsurgery of lymph vessels: The personal method of lymphatic-venous-lymphatic (LVL) interpositioned grafted shunt*. Microsurgery, 1995; 16(3): 161-6.
8. Campisi C., Boccardo F.: *Terapia Funzionale Completa del Linfedema (CLyFT: Complete Lymphedema Functional Therapy): efficace strategia terapeutica in 3 fasi*. Linfologia, 2008; 1: 20-23.
9. Brorson H.: *Liposuction normalizes – in contrast to other therapies – lymphedema-induced adipose tissue hypertrophy*. Handchir Mikrochir Plast Chir, 2012 Dec; 44(6): 348-54.
10. Ryan M., Campisi C.C., Boccardo F., Campisi C.: *Surgical treatment for lymphedema: optimal timing and optimal techniques*. J Am Coll Surg, 2013 Jun; 216(6): 1221-3.
11. Bellini C., Boccardo F., Taddei G., Mazzella M., Arioni C., Villa G., Hennekam R.C., Serra G., Campisi C.: *Diagnostic protocol for lymphoscintigraphy in newborns*. Lymphology, 2005; 38(1): 9-15.
12. Bourgeois P., Leduc O., Leduc A.: *Imaging techniques in the management and prevention of posttherapeutic upper limb edemas*. Cancer, 1998; 83 (12 Suppl American): 2805-13.
13. Mariani G., Campisi C., Taddei G., Boccardo F.: *The current role of lymphoscintigraphy in the diagnostic evaluation of patients with peripheral lymphedema*. Lymphology, 1998; 31(S): 316.
14. Pecking A.P., Gougeon-Bertrand F.J., Floiras J.L.: *Lymphoscintigraphy. Overview of its use in the lymphatic system*. Lymphology, 1998; 31(S): 343.
15. Witte C., McNeill G., Witte M.: *Whole-body lymphangioscintigraphy: making the invisible easily visible*. In: "Progress in Lymphology XII", edited by N. Mitsumas, S. Uchino, S. Yabuki, Amsterdam:New York:London:Tokyo, Elsevier Science Publishers B.V., 1989: 123.
16. Campisi C. Use of autologous interposition vein graft in management of lymphedema : preliminary experimental and clinical observations. Lymphology, 1991; 24(2): 71-6.
17. Campisi C.: *Rational approach in the management of lymphedema*. Lymphology, 1991; 24: 48-53.
18. Casabona F., Bogliolo S., Ferrero S., Boccardo F., Campisi C.: *Axillary reverse mapping in breast cancer: a new microsurgical lymphatic-venous procedure in the prevention of arm lymphedema*. Ann Surg Oncol., 2008 Nov; 15(11): 3318-9.
19. Boccardo F., Casabona F., De Cian F., Friedman D., Villa G., Bogliolo S., Ferrero S., Murelli F., Campisi C.: *Lymphedema microsurgical preventive healing approach: a new technique for primary prevention of arm lymphedema after mastectomy*. Ann Surg Oncol., 2009 Mar; 16(3): 703-8.
20. Boccardo F.M., Casabona F., Friedman D., Puglisi M., De Cian F., Ansaldi F., Campisi C.: *Surgical prevention of arm lymphedema after breast cancer treatment*. Ann Surg Oncol., 2011 Sep; 18(9): 2500-5.
21. Boccardo F., Fulcheri E., Villa G., Molinari L., Campisi C., Dessalvi S., Murdaca G., Campisi C., Santi P.L., Parodi A., Puppo F., Campisi C.: *Lymphatic microsurgery to treat lymphedema: techniques and indications for better results*. Ann Plast Surg., 2013 Aug; 71(2): 191-5.