New Techniques in the Evaluation of Lymphedema: Defining the Pathophysiology

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NORMAL

ABNORMAL

“Lymphatic transport in patients with chronic venous insufficiency and venous leg ulcers following sequential pneumatic compression”

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DEVELOPER OF LYMPHOGRAPHY, CLASSIFICATION, AND CLINICAL EVALUATION OF LYPHEDEMA


IMAGING STUDIES IN LYPHEDEMA

• LYMPHOGRAPHY: Anatomic study → No Function

• LYMPHOSCINTOGRAPHY: Kinetic Study → no detail & no function
Near-infrared fluorescence lymphatic imaging

Device: NIRF imaging device based upon military night goggle vision with unprecedented non-invasive imaging sensitivity

Initial drug: Indocyanine green administered at a fraction (microdose) of approved dose in an off-label route of administration

NIRF rivals nuclear imaging due to advantages of sensitivity, rapid acquisition, and non-radioactivity.

Healthy Lymphatics of the Legs


DEFINING THE PATHOPHYSIOLOGY OF THE LYMPHATICS IN VENOUS LEG ULCERS AND THE RESPONSE TO COMPRESSION

Near-infrared fluorescence lymphatic imaging [NIRFLI]

LYMPHATIC FUNCTION WITH VLU

- Lymphography in VLU limbs → dermal back flow, hyperplastic lymphatics and reduced # of lymphatic vessels (Negus D BJS 1969)
- [LYMPHOSCINTOGRAPHY] Significant decrease in lymphatic function in ulcerated and nonulcerated limbs of patients under 65 years old compared with healthy control limbs (Mortimer P. Int Angiology. 1995;14(suppl 1,no 3):32-35)

PILOT STUDY

- Twelve patients with VLU
- seven males and five females
- multiple-year history of bilateral ulceration.
- Lymhедema at enrollment was confirmed in nine subjects, based upon a positive Stemmer’s sign.
- All Near-infrared fluorescence lymphatic imaging [NIRFLI]

NIRFLI FINDINGS

- All 12 subjects with CVI, NIRFLI showed dermal backflow and extravascular fluorescence that was visualized as “pooling” of ICG-laden lymph near the ulcers

DERMAL BACKFLOW

POOLING AT DISTANT SITE
**NIRFLI FINDINGS**

- Tortuous and/or dilated conducting lymphatic vessels were visualized in 10 subjects

**CONTRACTIONS OF THE LYMPHANGION**

- 0.46 ± 0.3 lymphatic contractions/min in normal subjects
- Diminished contractile events too infrequent to be quantified in VLU patients → DECREASED PUMPING

**THE EFFECT OF SPC ON LYMPHATIC FLOW IN VLU**

SPC IN BOTH → INTRA- & EXTRAVASCULAR MOVEMENT OF FLUORESCENCE TO THE INGUINAL REGION

**THE EFFECT OF SPC IN VLU PRE VS. POST**

- Newly fluorescent lymphatics in 7/12 subjects
- Emptying of fluorescence from intravascular and/or extravascular spaces in at least five subjects
- A major route of lymph fluid clearance with SPC occurs through the interstitial space as well as through functional lymphatic vessels
- SPC did not appear to cause movement of ICG from the intravascular to extravascular tissue compartment, but rather moved ICG in their respective compartments proximally.

**THE EFFECT OF SPC ON FLUID CLEARANCE**

Our preliminary results show that SPC moves intravascular lymph proximally, one may expect minimal movement of fluid from the intravascular to extravascular space with SPC therapy, though further investigation is needed to confirm this hypothesis

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