



UZ  
LEUVEN



# How can near-infrared ICG fluorescence imaging optimize compression therapy?

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# IMAGING LYMPHOEDEMA

## Imaging lymphoedema

- **US:**
  - Tickening of the skin = typical sign of lymphoedema
  - Duplex ultrasound can eliminate other causes of swelling e.g. DVT

## LYMPHOEDEMA

## NORMAL

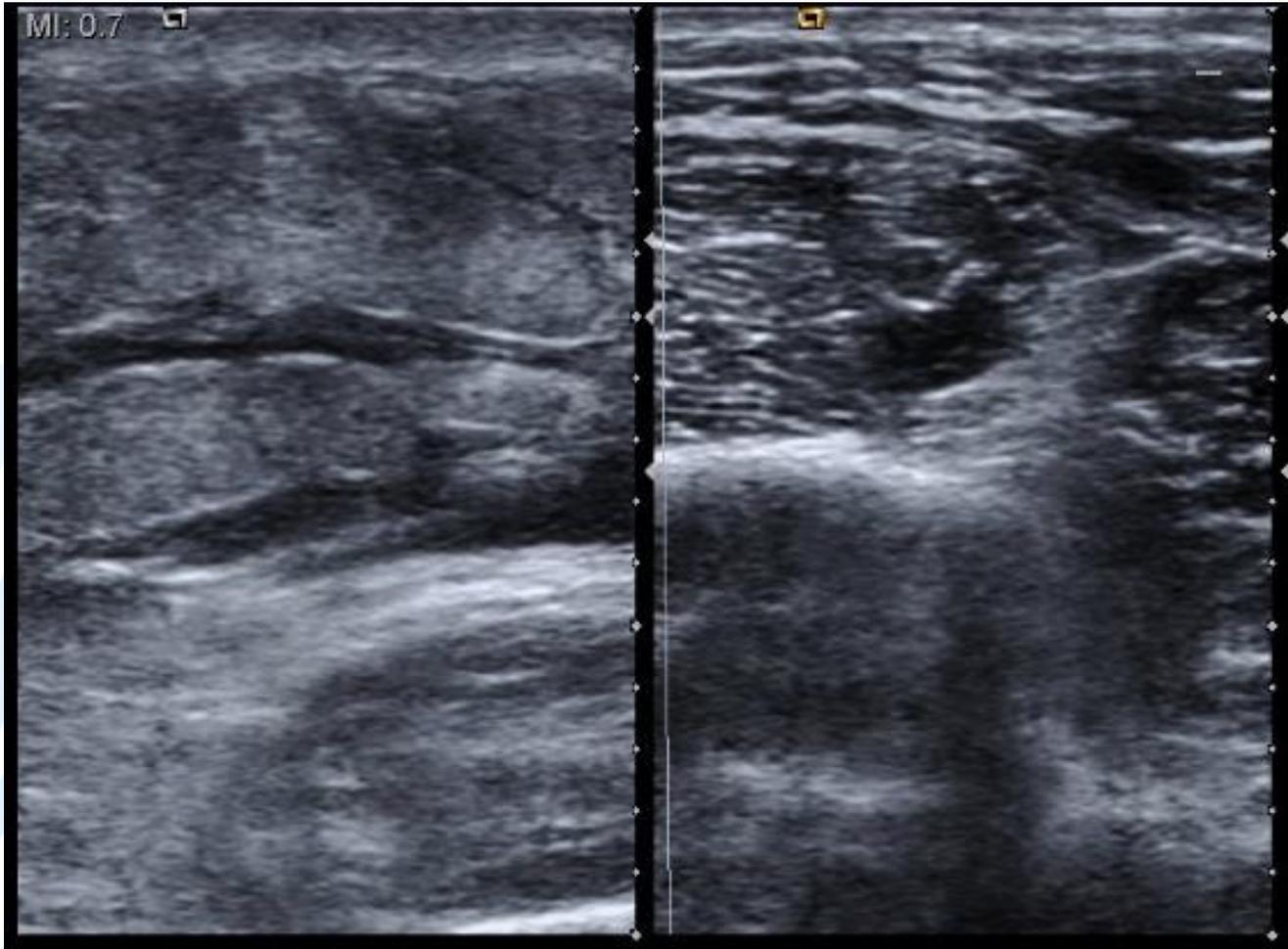
Skin



Sub-  
cutis



Muscle



Skin



Sub-  
cutis

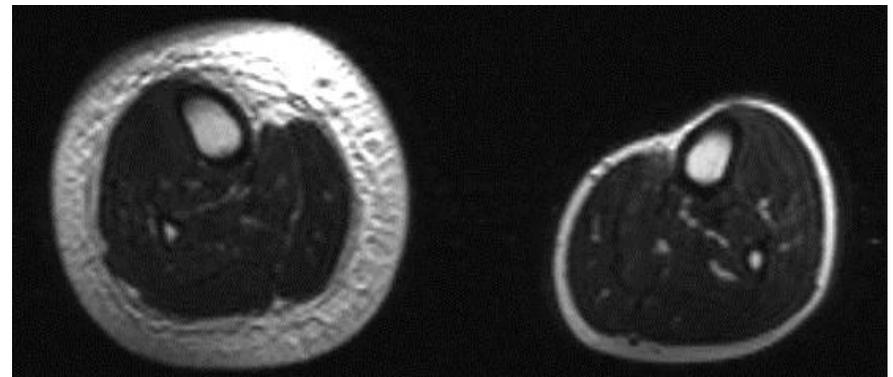


Muscle



# Imaging lymphoedema

- **CT/MRI**  
**(lymphangio)**
- Visualisation of enlarged lymph nodes
- Visualisation of lymphoedema/lymph vessels, but no information on functionality



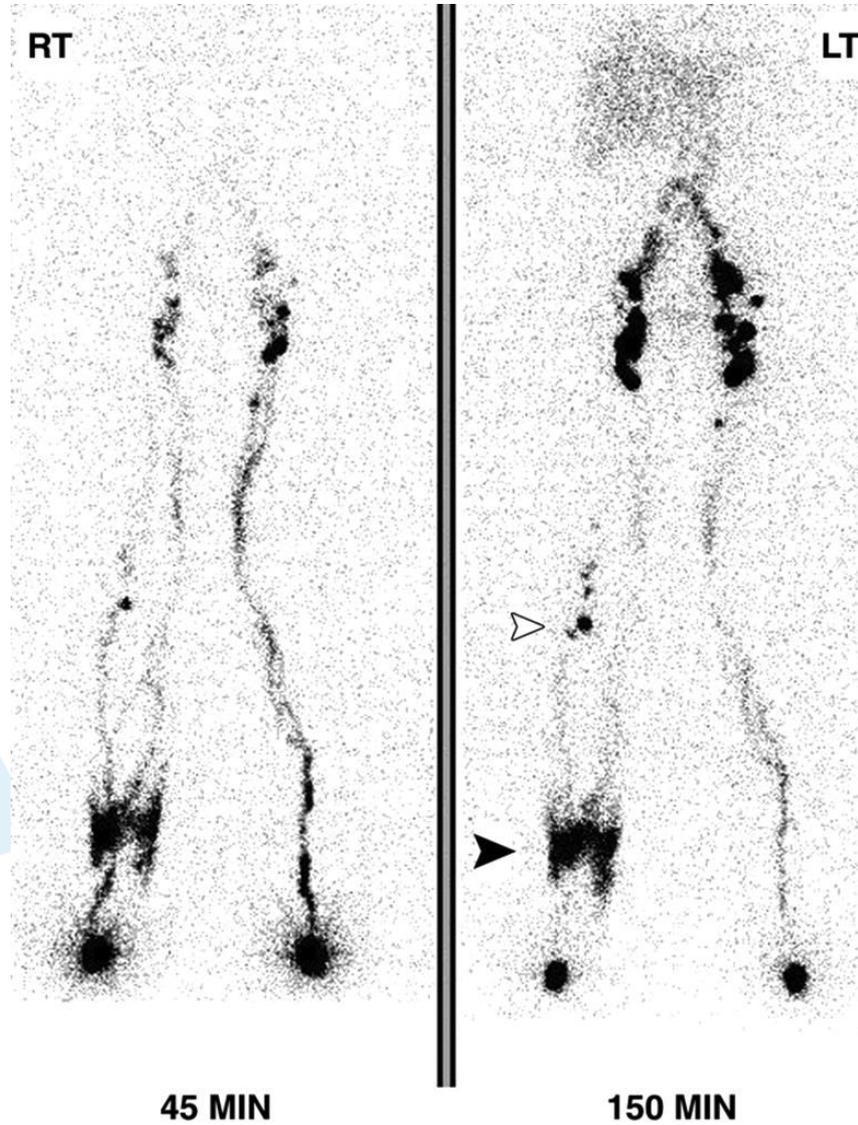
## Imaging lymphoedema

- **Lymphoscintigraphy:**
  - Injection of an isotopic agent in the first/second webspace of the extremity
  - Product is absorbed by the lymph vessels
  - Different scan moments



## Imaging lymphoedema

- **Lymphoscintigraphy:**
  - Idea of the lymph transport/amount of lymph nodes
  - Calculation of the extraction time
  - Visualisation of dermal backflow





# LYMPHOFLUOROSCOPY

# ICG fluoroscopy

- Indocyanine Green (ICG) is used in ophthalmological interventions, monitoring liver function in ICU, sentinel lymph node mapping
- Lymphofluoroscopy:
  - Details of architecture of lymph vessels (max 2 cm depth!)
  - Different patterns

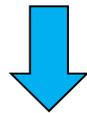
## Procedure

- Patient in sitting/ supine position
- Injection of ICG/ aqua (1:1) intradermally: 0,2 ml in 1st and 4th webspace



## Procedure

- Indocyanine green injected intradermally



dermal lymphatic capillaries

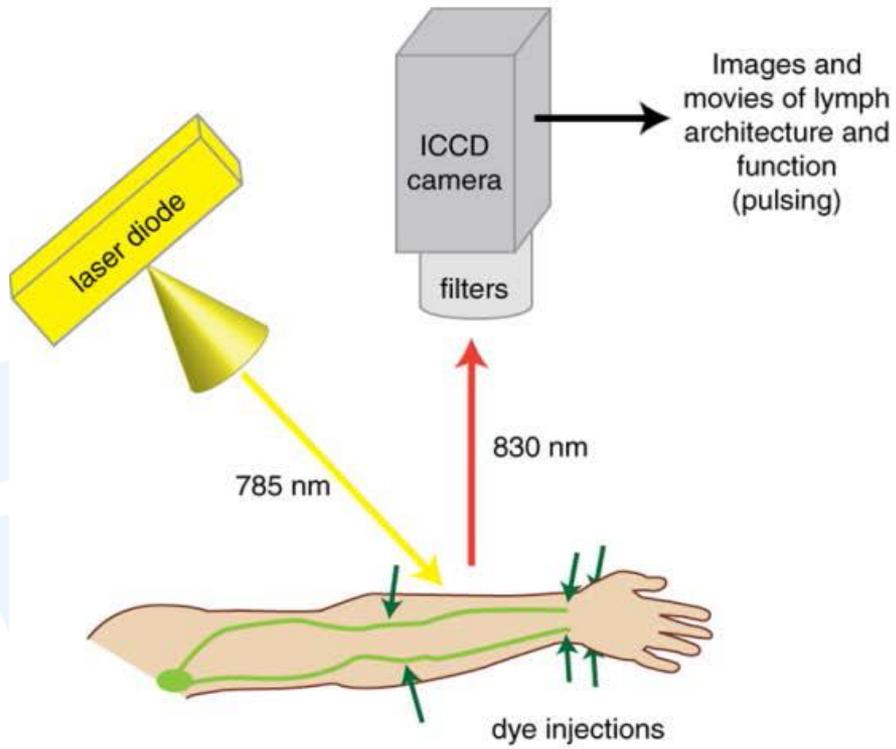


pre-collector and collector

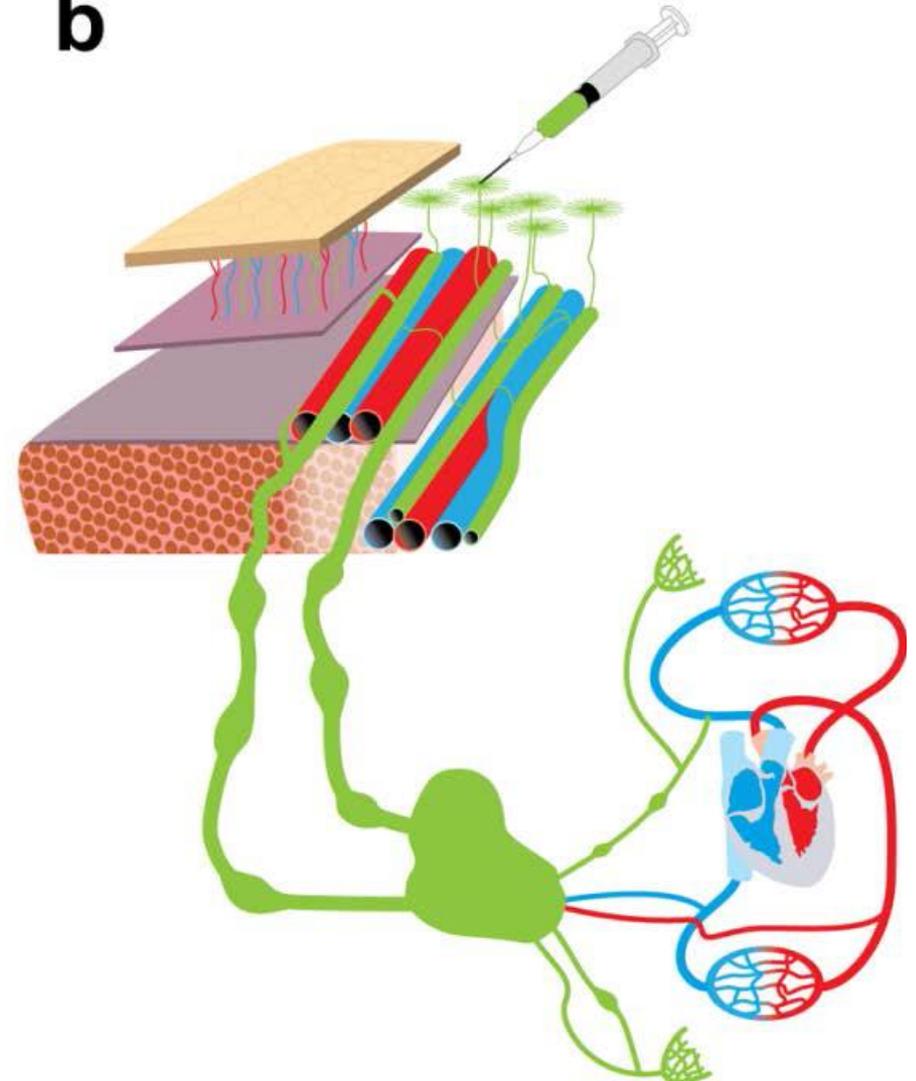
- PDE camera to obtain fluorescence images
- Two sessions (in rest – after exercise)

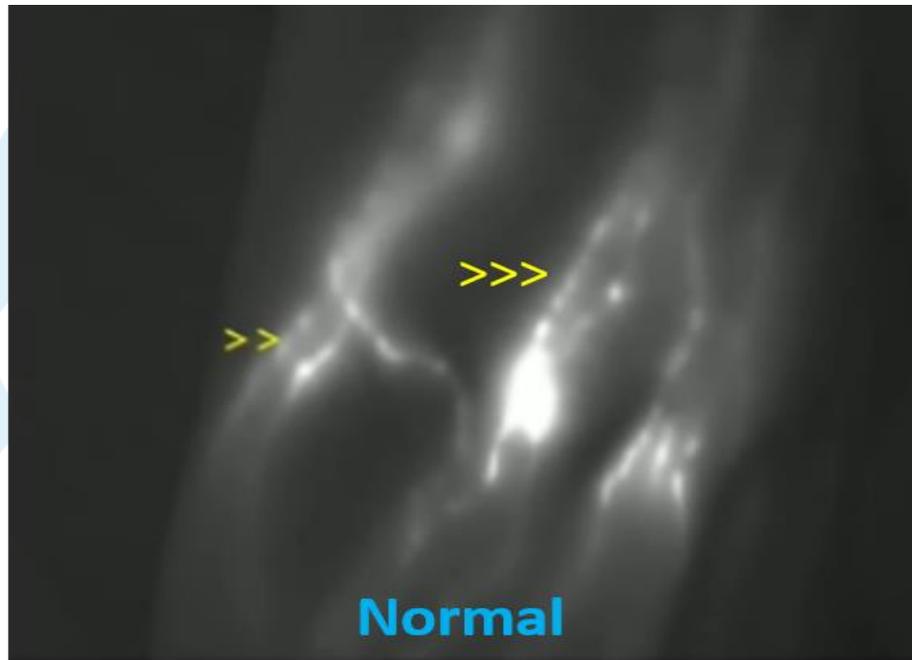
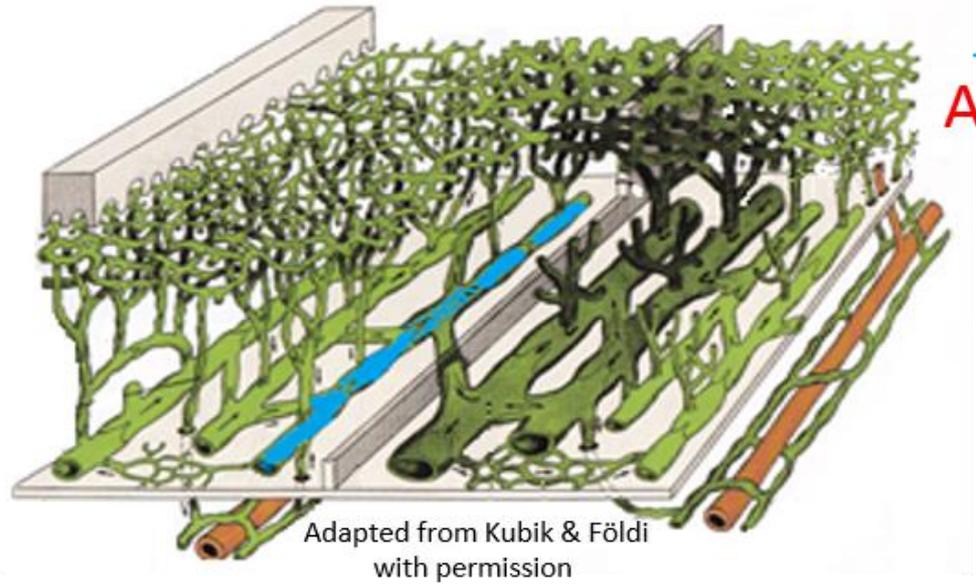


**a**



**b**



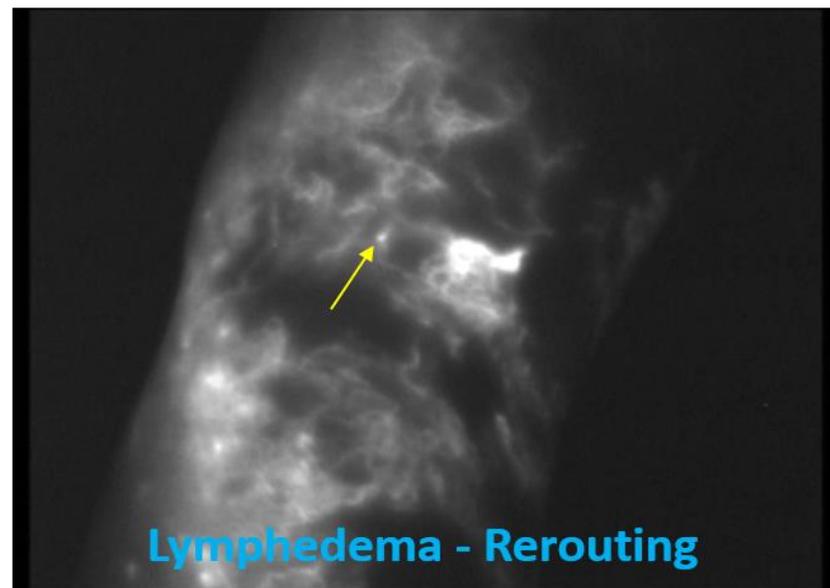
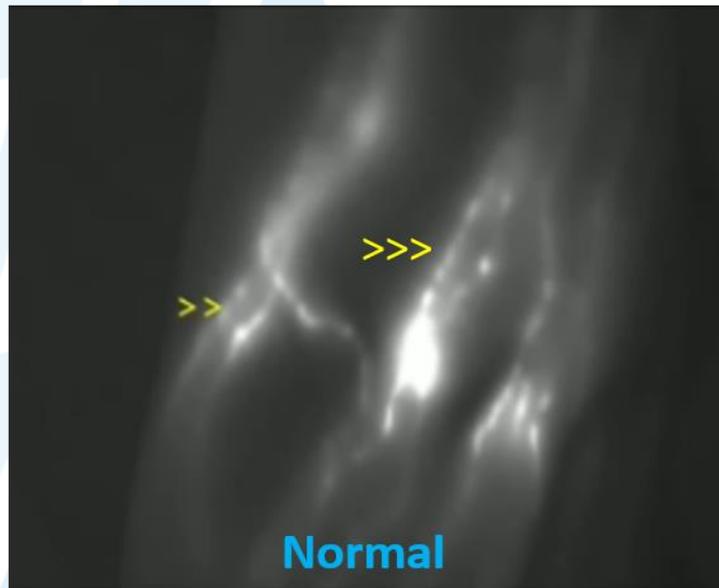
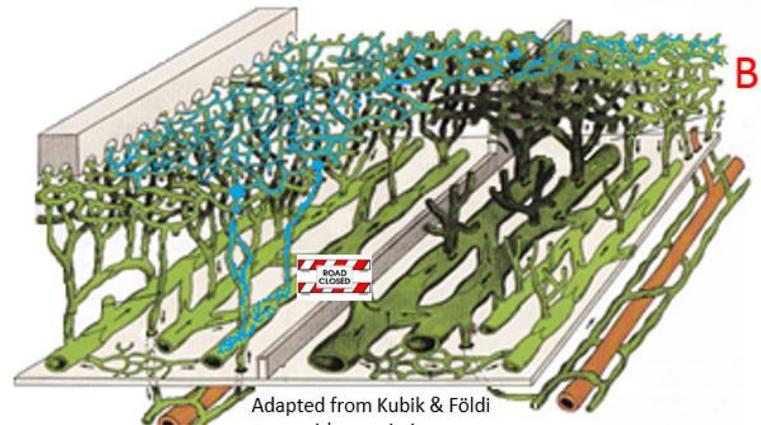
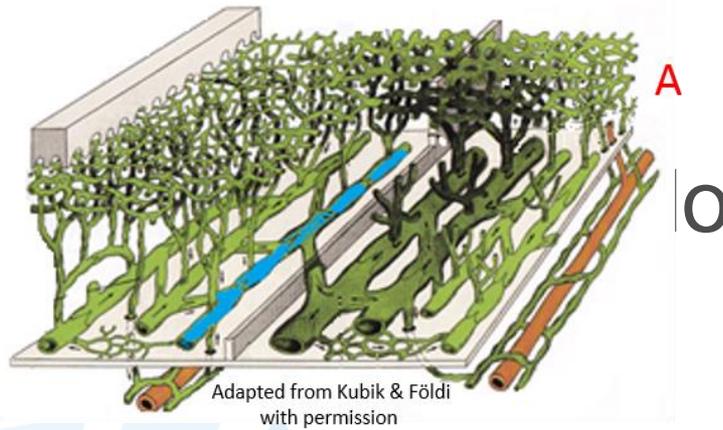


## Classification images secondary LO

- Normal pattern: linear
- Abnormal pattern: dermal backflow (DB)
  - Mild damage/ obstruction: splash DB pattern
  - Severe damage: stardust DB pattern
  - Destroyed: diffuse DB pattern

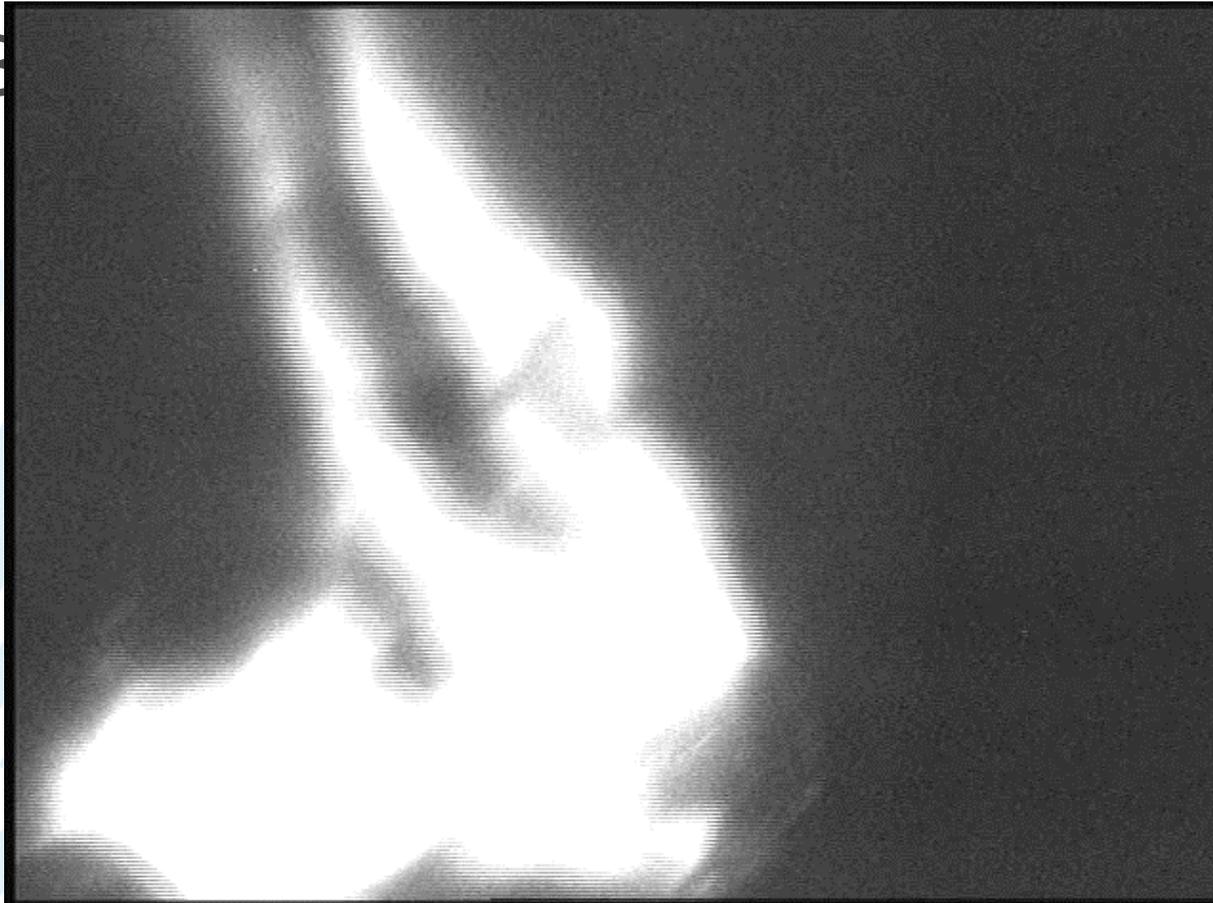
*(Yamamoto et al 2011)*

**Figure 1.** Superficial lymphatic network in the crook of the elbow



# Splash/ stardust

- E



# Moving liquid through interstitium/ network



## Advantages fluoroscopy

- No isotopic agents
- Lower cost
- Details of the superficial architecture
- Better visualisation of oedema of the foot/hand
- Real-time imaging

## Pitfalls fluoroscopy

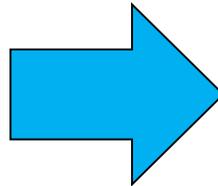
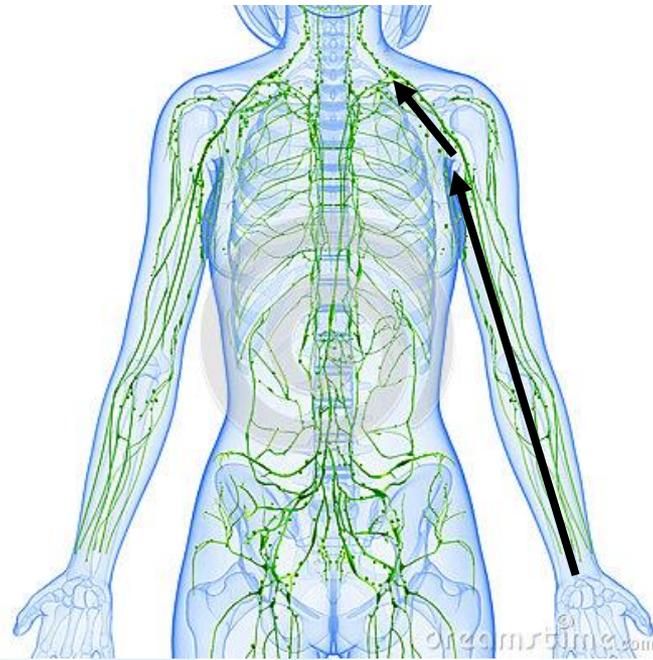
- No visualisation of deep lymph vessels (only 2 cm deep)
- In lymphoedema patients no quantification possible
- In Belgium: off label use

## Indication lymphofluoroscopy

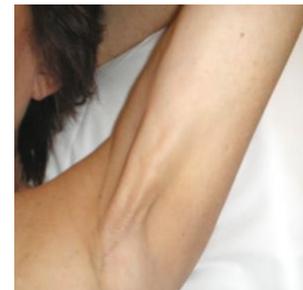
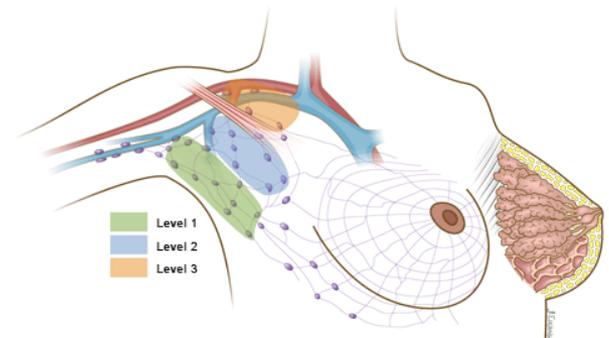
- Difficult to treat certain areas
- Deterioration of oedema
- Aid for surgical interventions

 optimize compression devices and manual lymph drainage

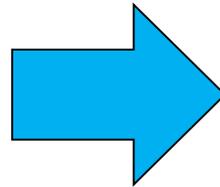
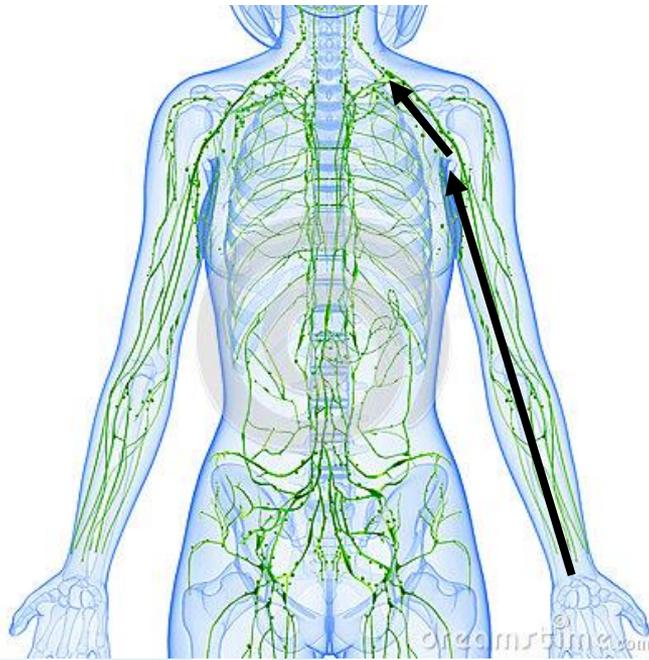
# Normal Lymphatic system



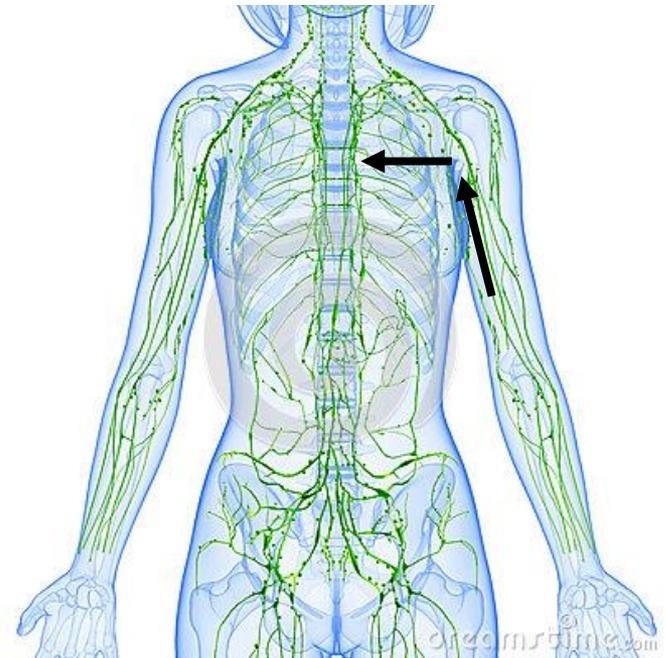
# Not normal Lymphatic system



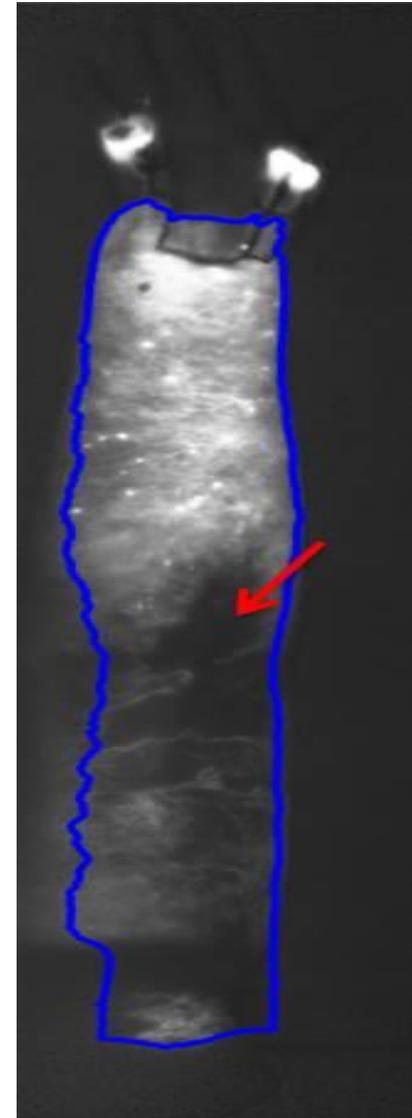
# Normal lymphatic system



# Not normal lymphatic system



# Adjusting compression

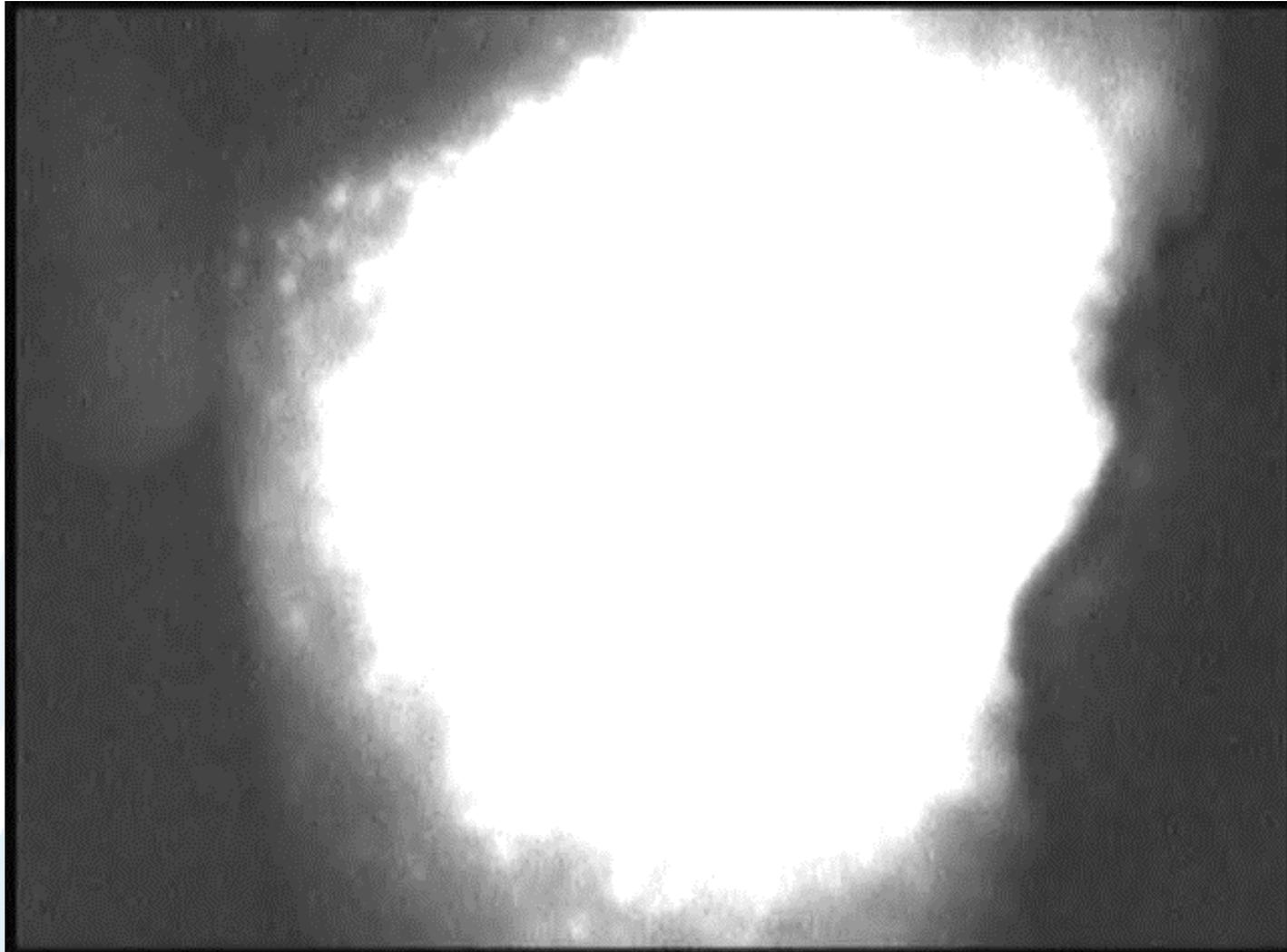


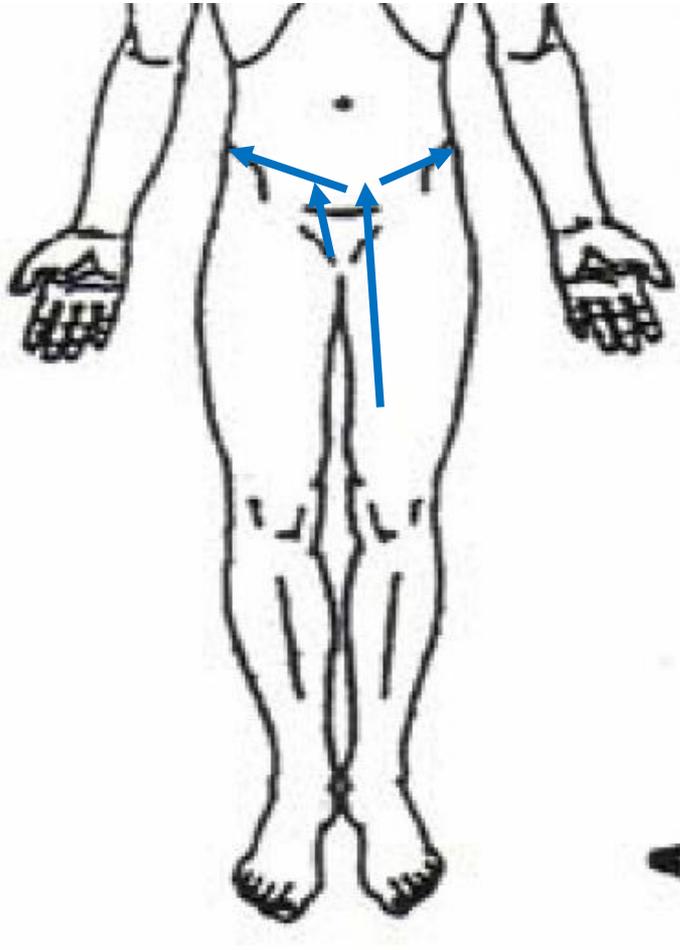


# CASE REPORTS

## Patient 1: pubic/ genital oedema

- Age: 75 y
- Prostate cancer:
  - 2011 prostatectomy and radiotherapy
  - 8-2014 lymphadenectomy ilioinguinal
- 1m postop, pubic and left leg oedema
- DLT: great improvement leg oedema, still inguinal and pubic/ scrotal oedema







Adjustment compression: AG  
compression stocking + bermuda short  
with extra padding scrotal area

## Patient 2: arm oedema

- Female, Age: 54 y
- Mastectomy and ALND left
- Pitting oedema lower arm ++  
(especially distal and ventral area)
- MLD and sleeve with glove without fingers

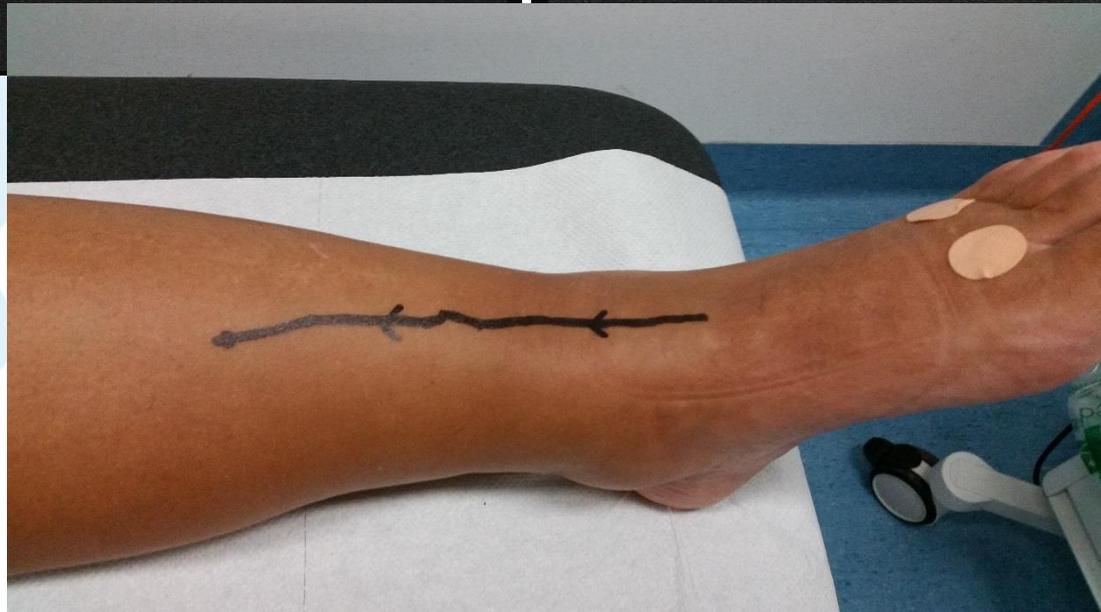
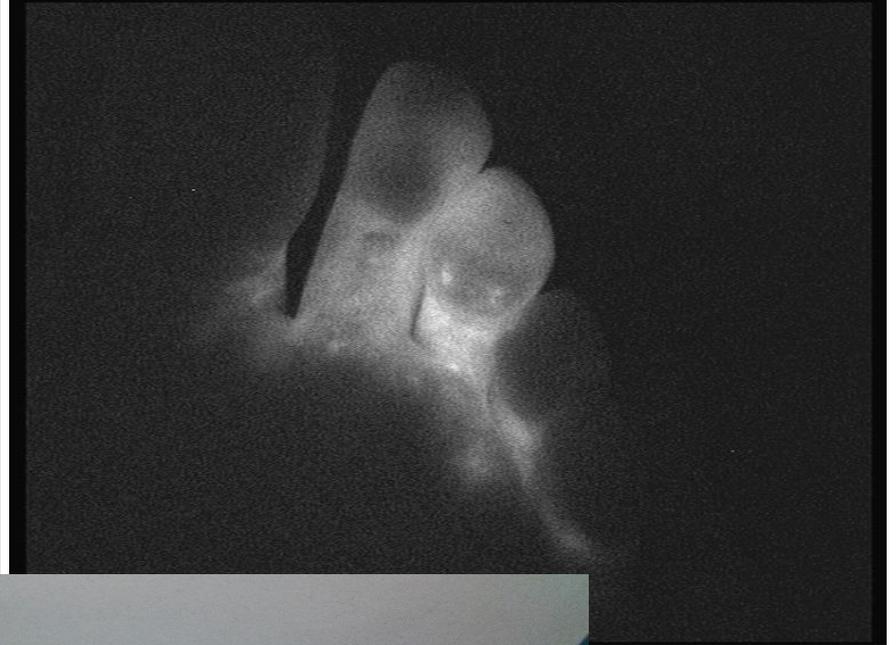
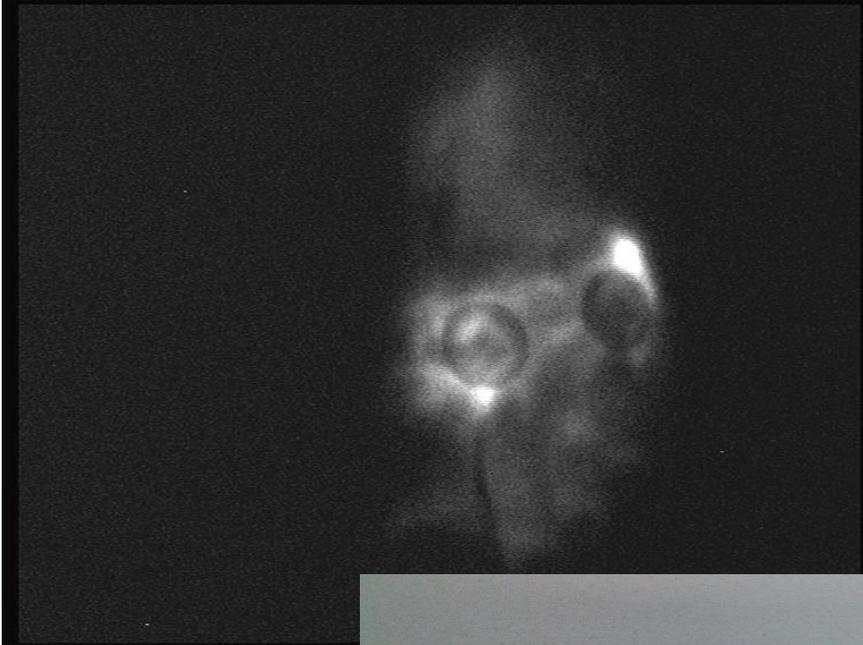


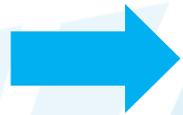
➔ Adjustment: Long glove with fingers,  
no arm sleeve



## Patient 3: leg oedema

- Female, Age: 46 y
- 2016: bilateral oedema lower legs, no good result with lymph drainage
- 06-2016: lymphoscintigraphy: bilateral disturbance lymphatic transport lower legs, no majeure abnormalities





Prescription of a compression stocking AD flat knit and a toe kap left

## Patient 4: hand oedema

- Female, Age: 57 y
- 2015: breast cancer left: Breast sparing surgery and ALND + radiotherapy + chemotherapy
- oedema left hand ++ dorsal and ventral side, lower arm







Lymph pads ventral/dorsal hand  
and lower arm under sleeve/glove

## Patient 5: oedema face

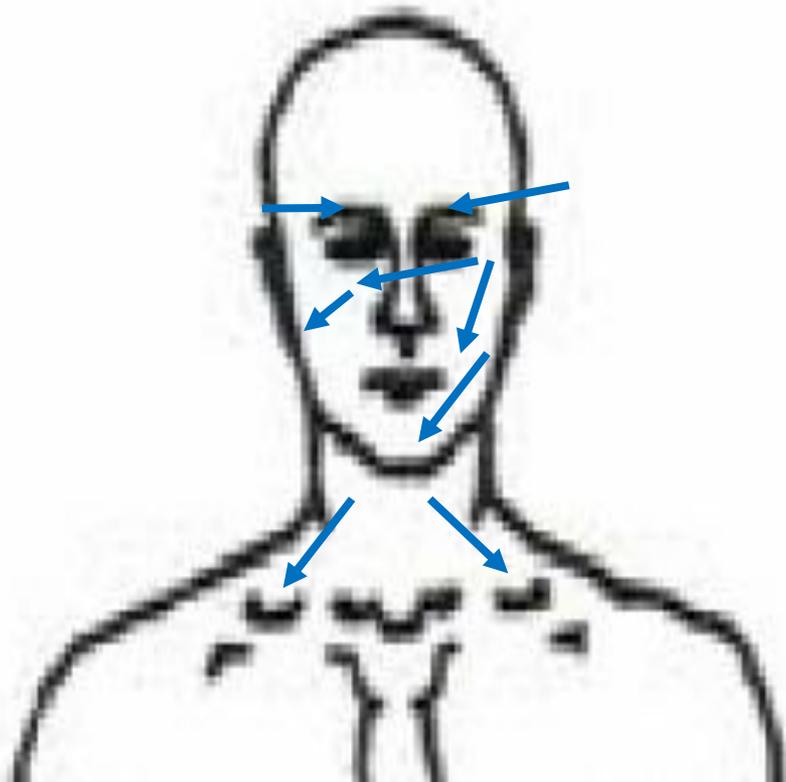
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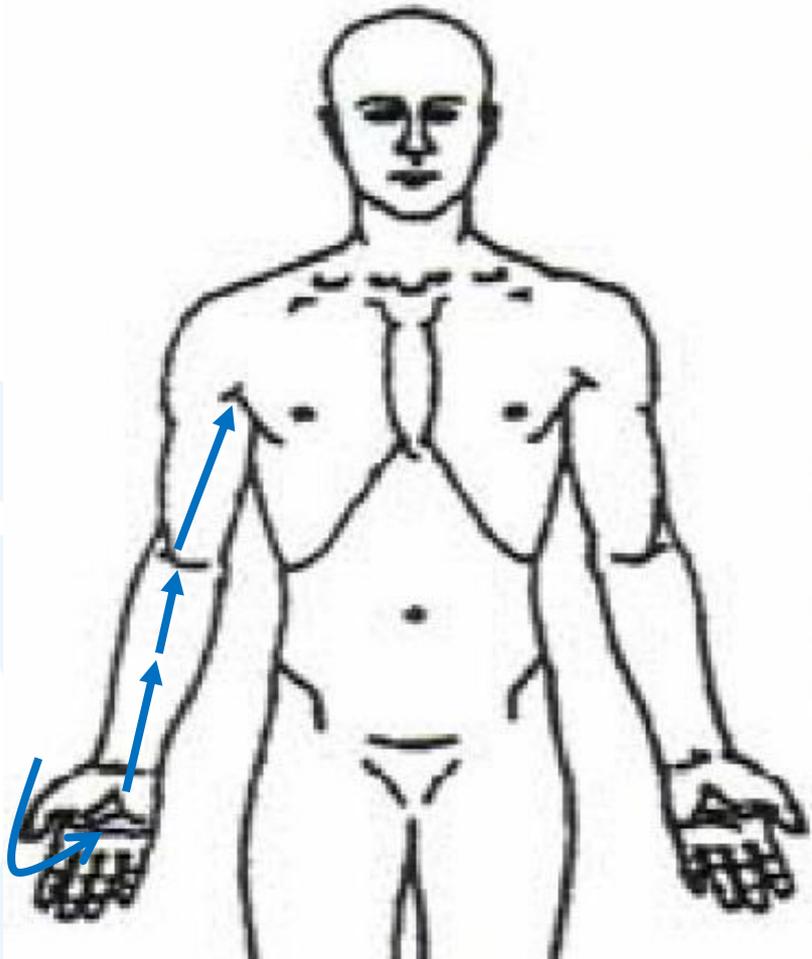
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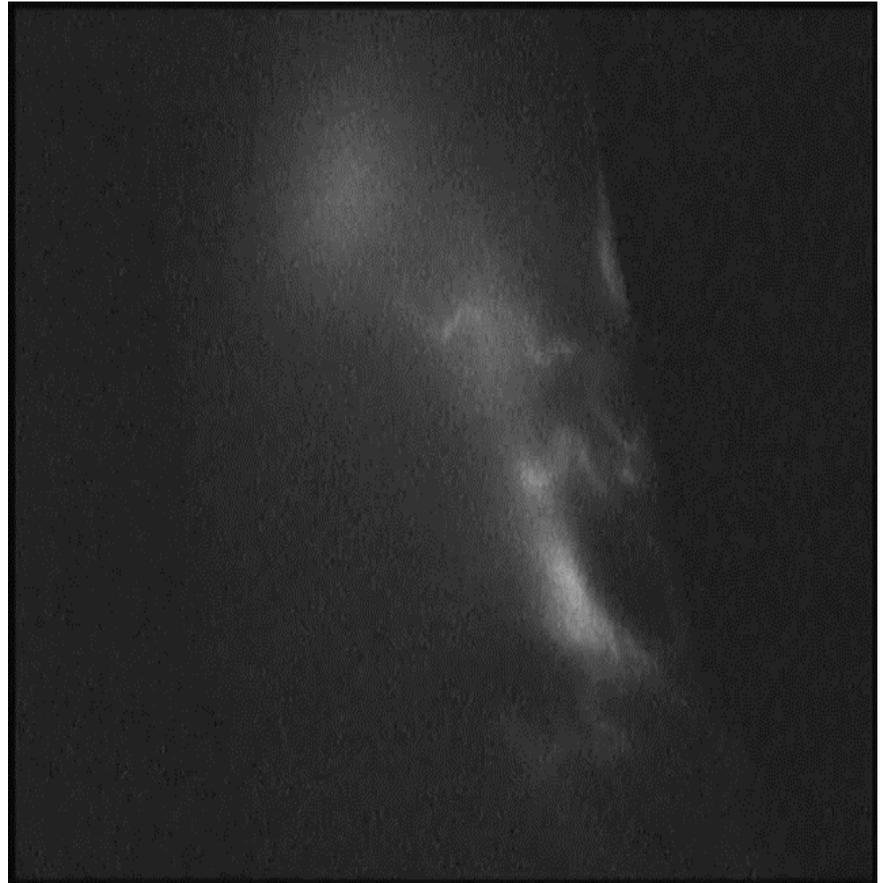
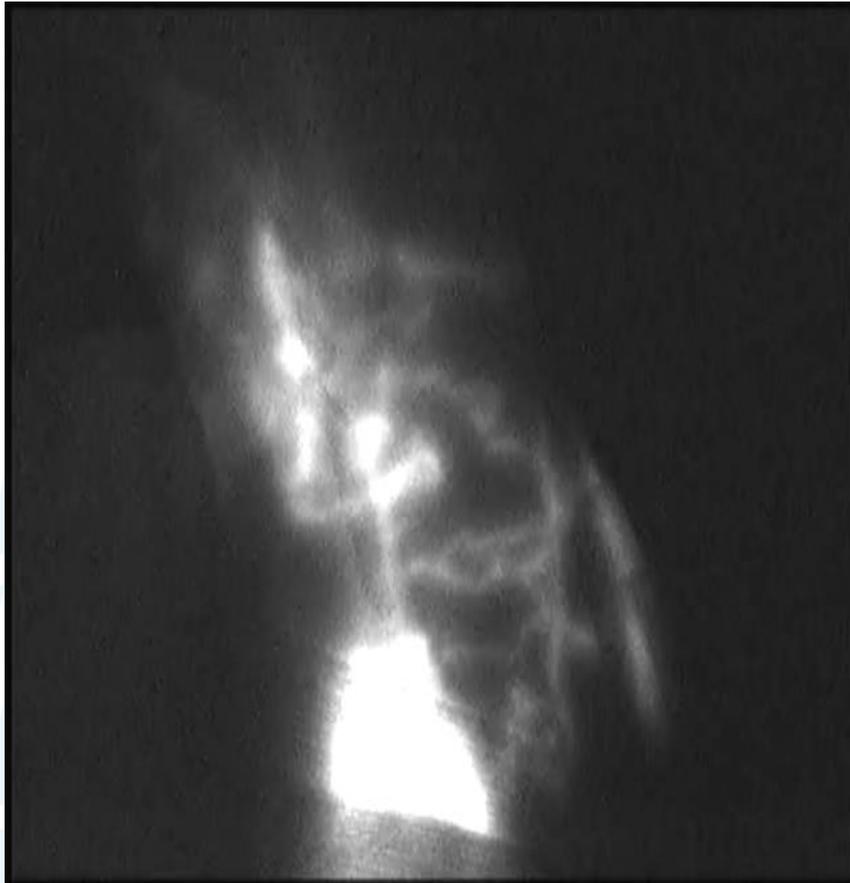
## Patient 6: hand oedema

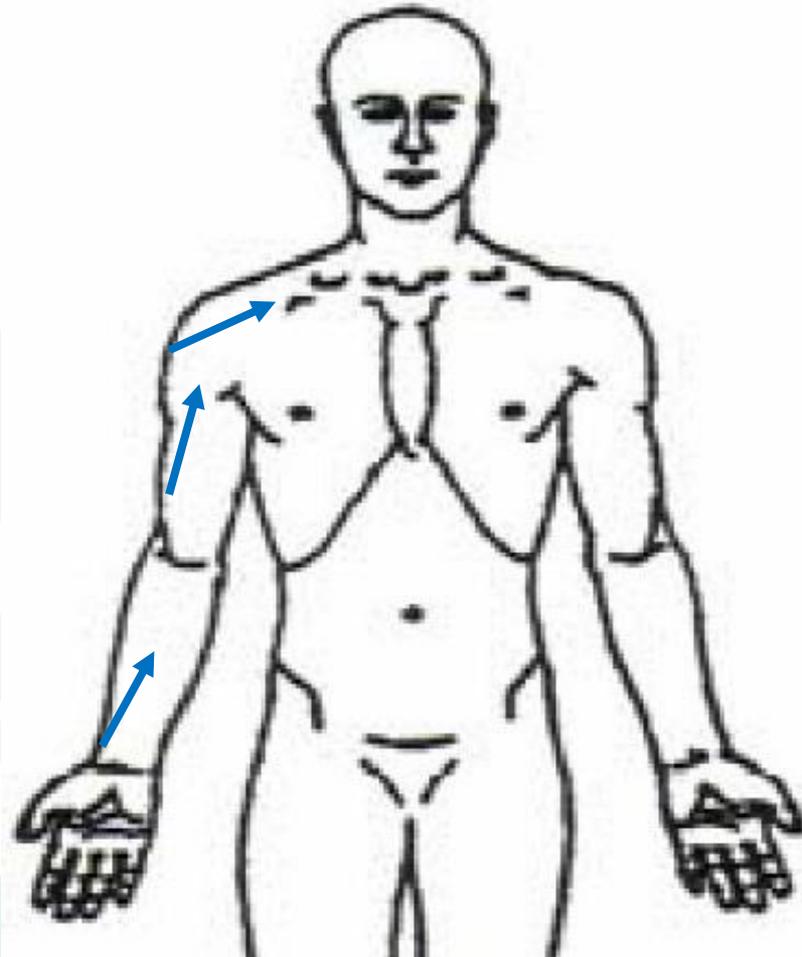
- Female, Age: 40 y
- 2003: breast cancer right: mastectomy and ALND + radiotherapy
- 2014: erysipelas
- Oedema hand since surgery, increase oedema since erysipelas
- Nevertheless consequent compression, no decrease of oedema



## Patient 7: oedema arm

- Female, Age: 52 y
- 1996: Breast sparing surgery + ALND right
- Chemotherapy and radiotherapy
- Persistent oedema dorsal lower arm despite compression and MLD





## Conclusions

- ICG lymphofluoroscopy:
  - New information
  - To optimize treatment: compression treatment and MLD
  - Future: quantification of the function of lymph transport

- Thanks to JP Belgrado to introduce us in the lymphofluoroscopy
- Thanks to our team!



**And thank you for your attention!!**

