



# Rebirth of Lymphangiography

Maxim Itkin MD, FSIR

# History of Lymphangiography



- **Dr. Hernani Monteiro**
  - First pedal lymphangiography described by at the University of Porto in **1931**
- **Mr. John Bernard Kinmonth**
  - “The best way to do this is to show up the lymphatics first with patent blue dye injected subcutaneously and then to inject the contrast medium directly into a lymphatic”

Kinmonth JB. Lymphangiography in man; a method of outlining lymphatic trunks at operation. *Clin Sci (Lond)* **1952**;11:13–20.

Kinmonth JB. Lymphangiography in Clinical Surgery and Particularly in the Treatment of Lymphoedema: 1954. *Ann R Coll Surg Engl* **1954**;15:300–15.

# History of Lymphangiography

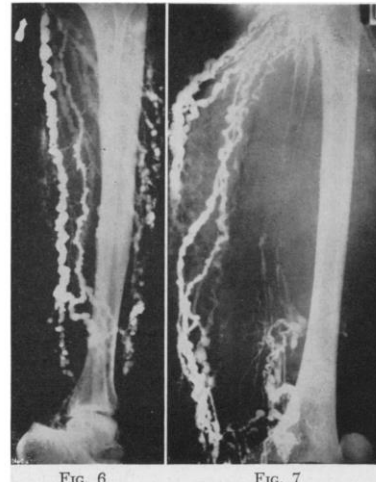


FIG. 6. Retrograde flow of diodone in lymphatics in case of lymphedema (description in text).  
FIG. 7. Upward flow of diodone in lymphatics in case of lymphedema (description in text).

of plasma over a period of time. No significant dilatation of the lymph trunks took place over periods of three to four weeks.

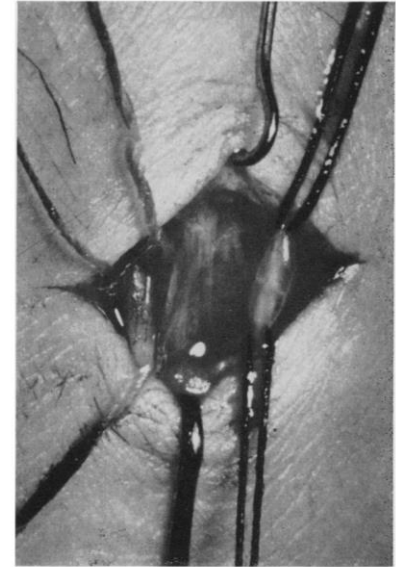


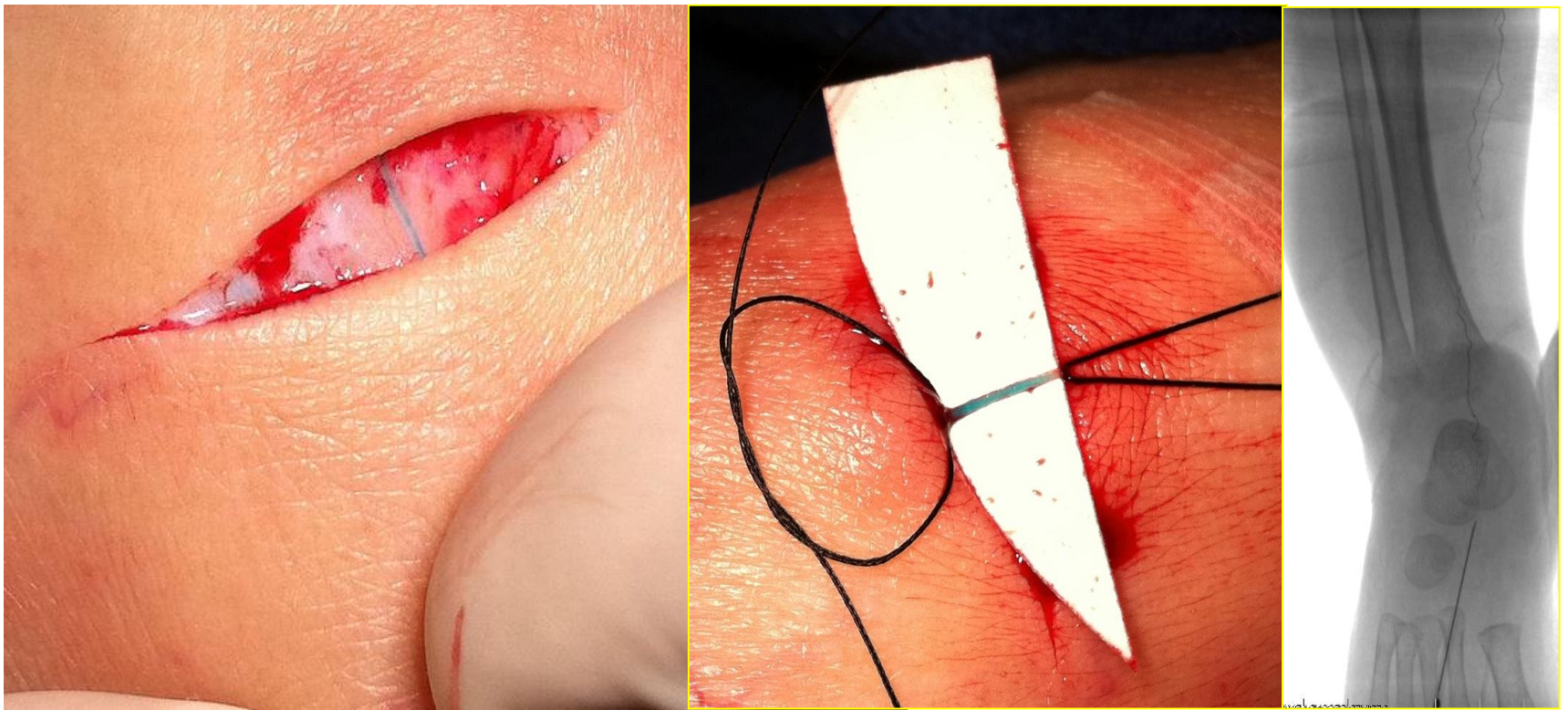
FIG. 8. Dilated translucent lymphatic (black threads, right) on dorsum of foot. Injection of diodone showed dilated lymphatics in leg. A vein (white threads) lies to its left.

Kinmonth JB. Lymphangiography in man; a method of outlining lymphatic trunks at operation. *Clin Sci (Lond)* 1952;11:13–20.  
Kinmonth JB. Lymphangiography in Clinical Surgery and Particularly in the Treatment of Lymphoedema: 1954. *Ann R Coll Surg Engl* 1954;15:300–15.



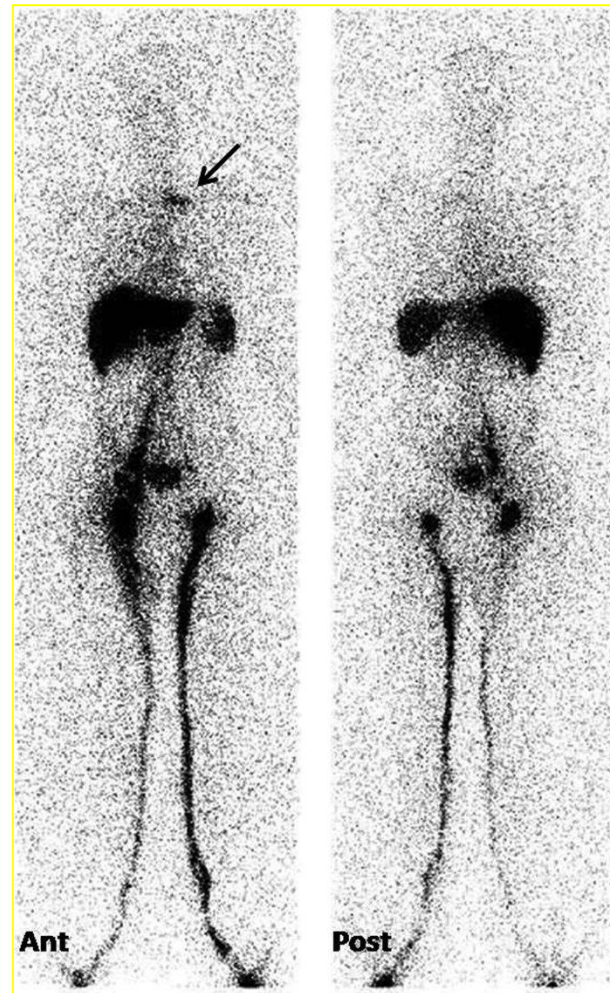
# Traditional Lymph Flow Imaging Techniques

## Pedal Lymphangiogram



# Traditional Lymph Flow Imaging Techniques

## PEDAL LYMPHOSCINTIGRAPHY

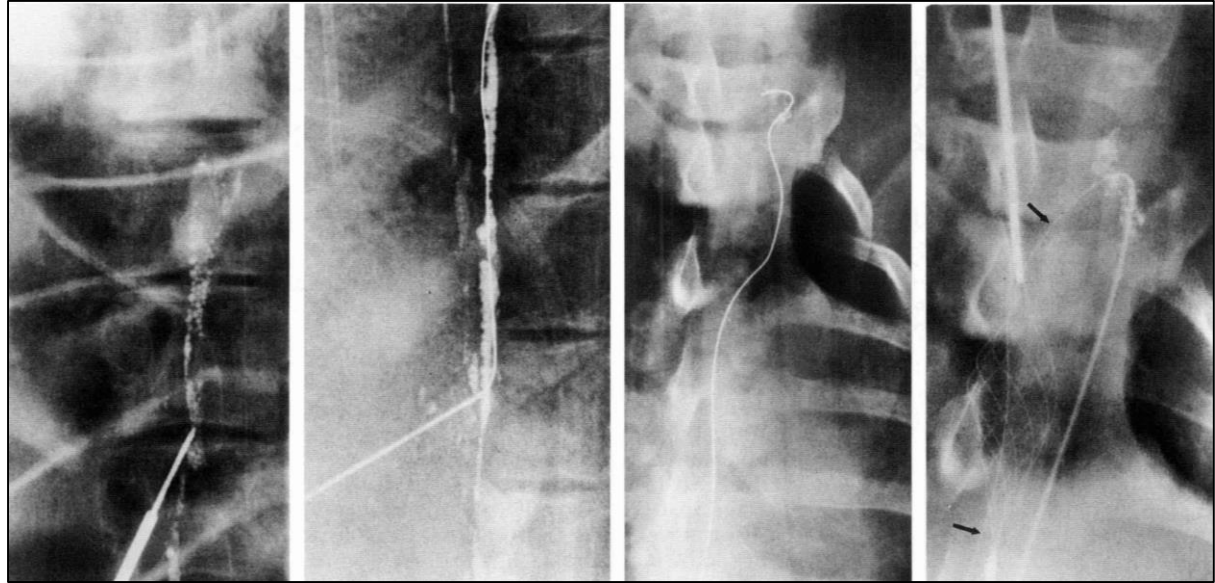
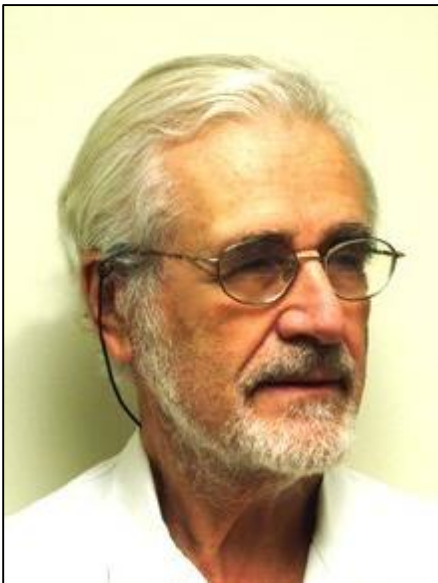


# Old Indications for Lymphangiography

- **Diagnostic**
  - Lymphatic ducts-lymphedema
    - Doesn't contribute to the treatment
    - Can make lymphedema worse
  - Lymph nodes-liquid cancers
    - Completely replaced with cross sectional imaging

# Lymphatic Interventions is a New Drive for Lymphangiography

## Constantine Cope



Cope C. Percutaneous thoracic duct cannulation: feasibility study in swine. *J Vasc Interv Radiol.* 1995;6:559–564.

# “Therapeutic” Indication or Lymphangiography

## Intranodal Lymphangiography

- **Chylothorax**
  - Traumatic
  - Non-traumatic
  - Neonatal
- **Chylous ascites**
- **Plastic Bronchitis**
- **Groin lymphorrhea/lymphocele**
- **Lymphatic malformations**

## Liver Lymphangiography

- **Protein Losing Enteropathy**
- **Chylous ascites**
- **CHF ascites**



# “Therapeutic” Indication or Lymphangiography

## Future indications

- Externalization of the thoracic duct
  - Gut lung syndrome
  - T cell depletion therapy
  - Congestive heart failure
  - T cell harvesting
- Stenting of the thoracic duct
  - Ascites in liver cirrhosis treatment

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Future

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and stress.

### Lapa Express Massage

*A fully body massage that aims to release tension and reduce muscle fatigue in people who have little time available*

30min, 55€

### Foot and Head Massage

*A soothing foot massage followed by a gentle head massage.*

45min, 60€

### Stone Therapy

*The deep penetrating heat from the stones are used to massage the body to ease the pain and tension of muscles as well as deeply relax and rebalancing mind and body.*

90min, 130€

### Reflexology

*Gentle pressure applied to the feet, releasing blockages and restoring the free flow of energy to the whole body.*

50min, 65€

### Lymphatic Drainage

*This light pressure massage is designed to work on the lymphatic system to facilitate the removal of toxins and boost the circulation. Acts favourably against cellulite, swelling and heavy legs.*

60min, 100€

### Shiatsu

*Works by applying pressure to the meridian and acupuncture points, bringing the physical energy into balance and promoting health. Also strengthens the immune system, reduce stress and promotes self-healing.*

75min, 100€

### Lapa Aromatherapy

*Relaxing massage using aromatic oils, with the beneficial effect of strengthening the immune mechanisms and preventing illness.*

50min, 75€

### Body Cleansing

#### Aromatic Bath

*Choose between an Energising Bath, Hydrating Bath or Exotic Relaxing Bath.*

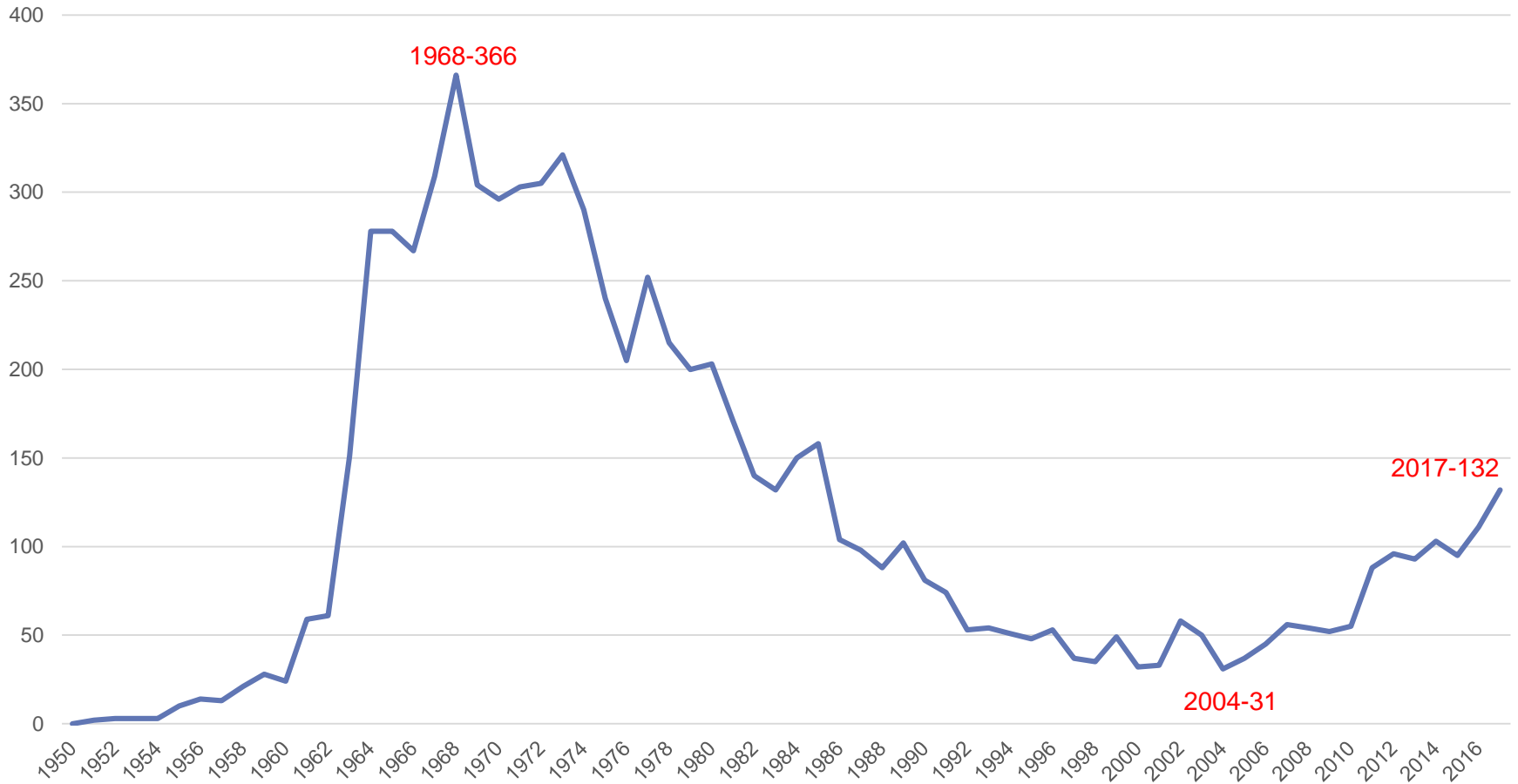
25min, 45€

ngiography

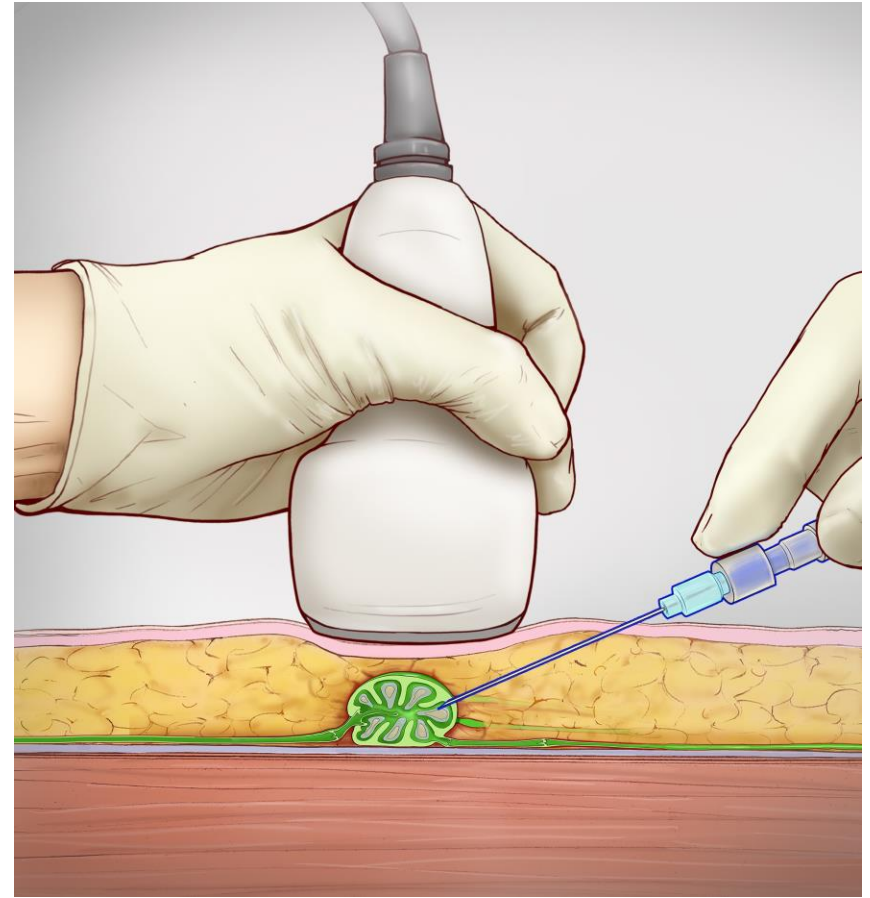
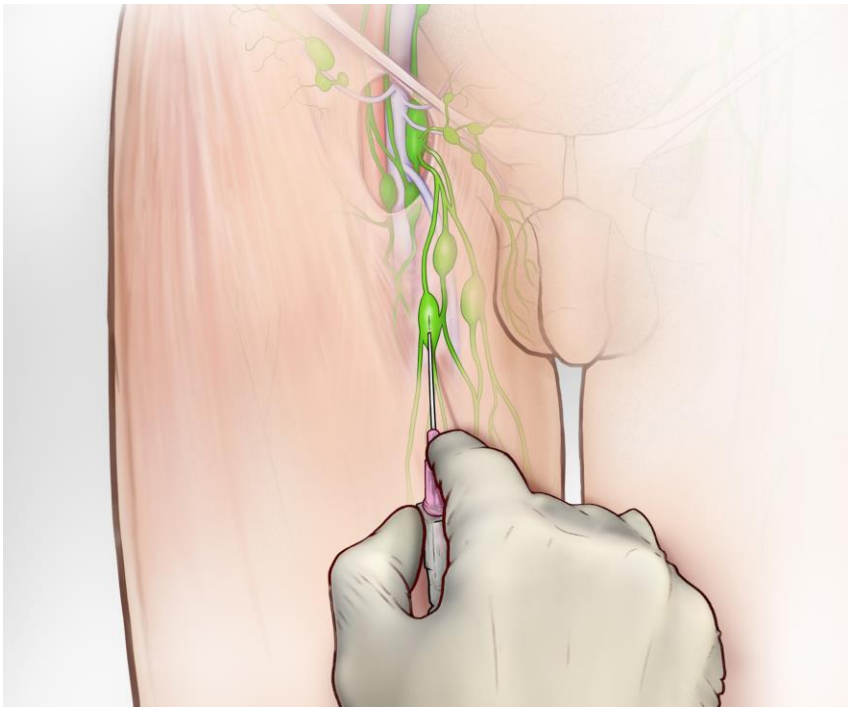
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# Lymphangiography Manuscripts Over the Years

Number of the manuscripts per year



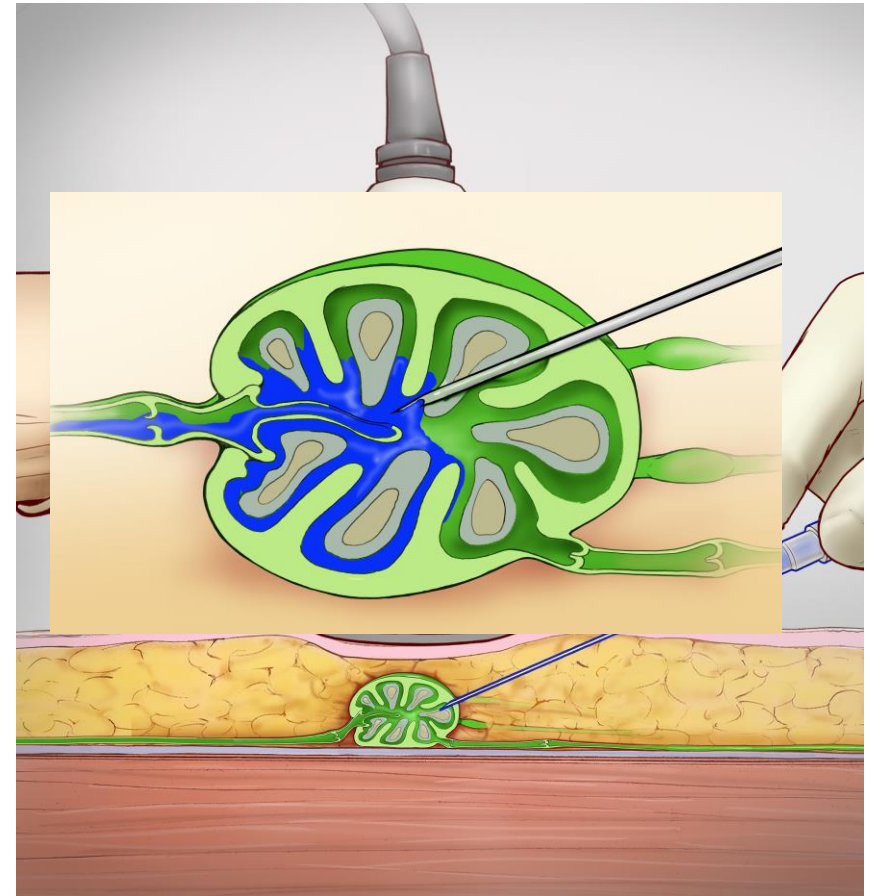
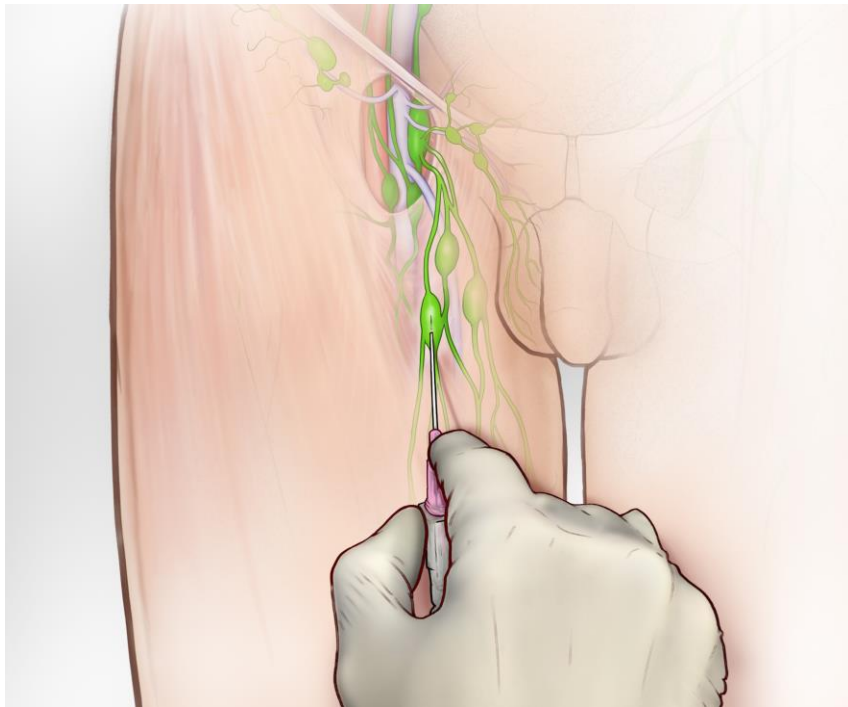
# Intranodal Lymphangiography



Nadolski GJ, Itkin M. Feasibility of ultrasound-guided intranodal lymphangiogram for thoracic duct embolization. J Vasc Interv Radiol. 2012



# MR Intranodal Lymphangiography



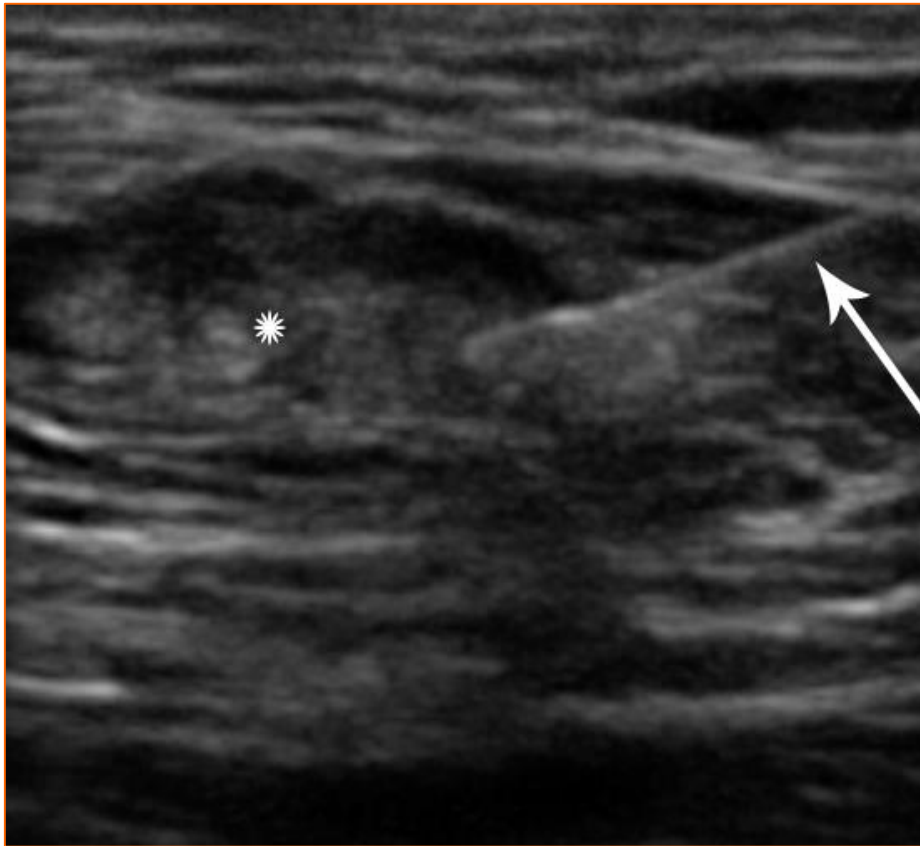
Nadolski GJ, Itkin M. Feasibility of ultrasound-guided intranodal lymphangiogram for thoracic duct embolization. J Vasc Interv Radiol. 2012

# IL Set Up

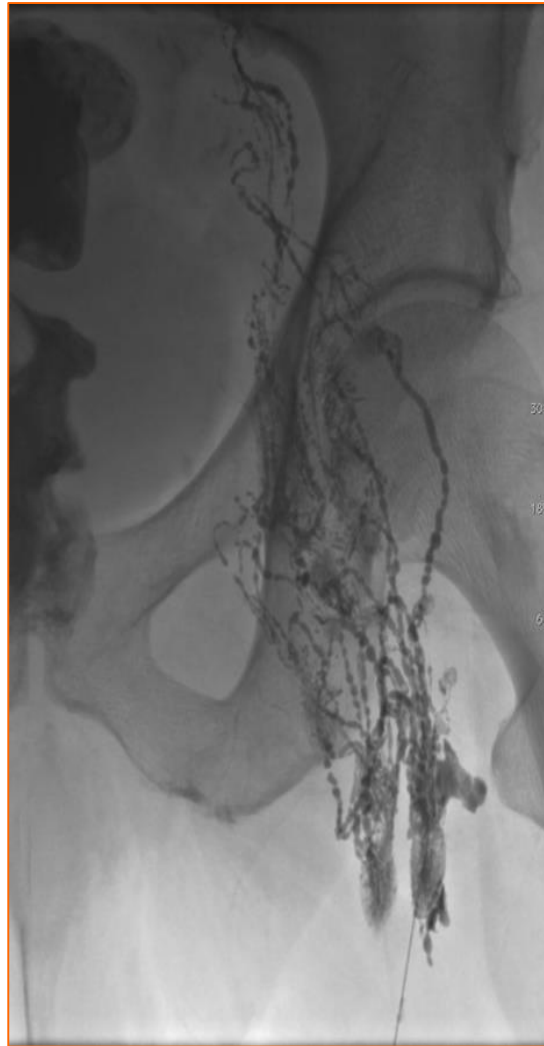
- 25 G spinal needle (BD)
- 20 cc of Lipiodol
- Extension tubing
- Long tunnel under the skin
- Tegaderm



# US Guidance



# Intranodal Lymphangiogram



Nadolski GJ, Itkin M. Feasibility of ultrasound-guided intranodal lymphangiogram for thoracic duct embolization. *J Vasc Interv Radiol.* 2012

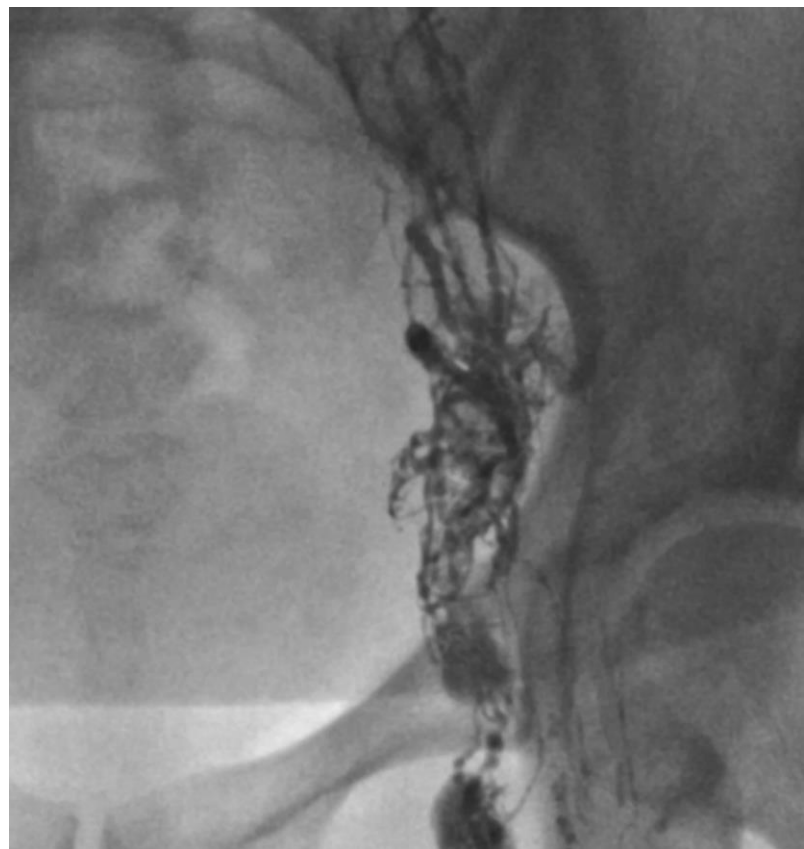
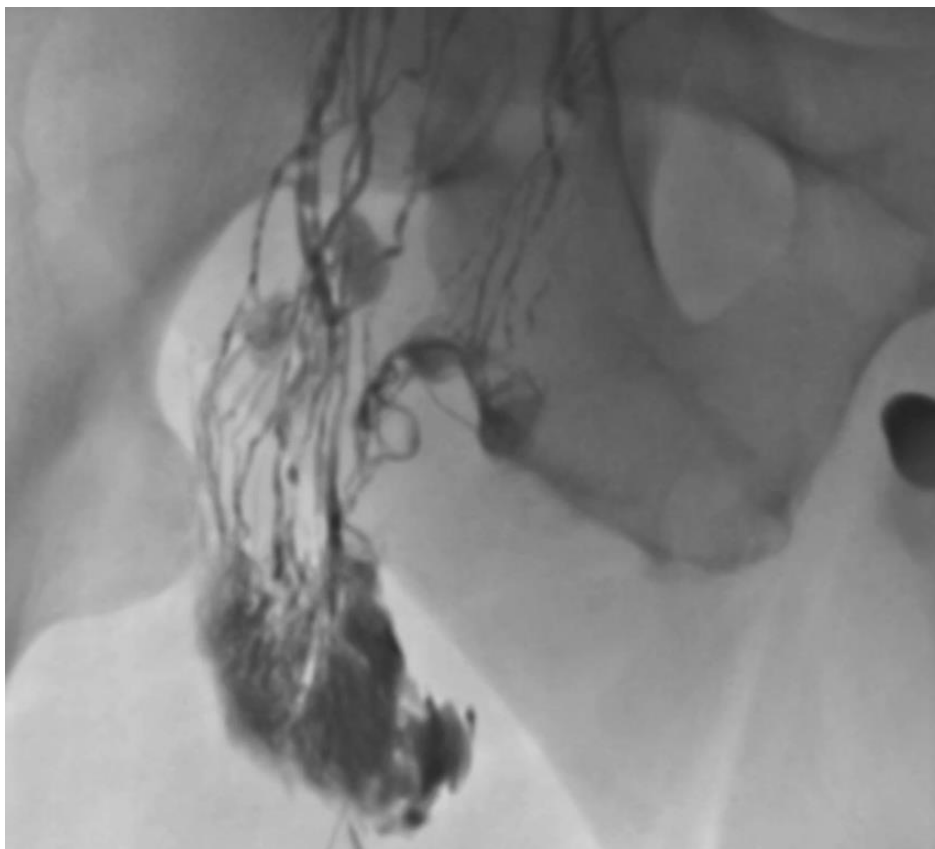


# Pneumatic Compression

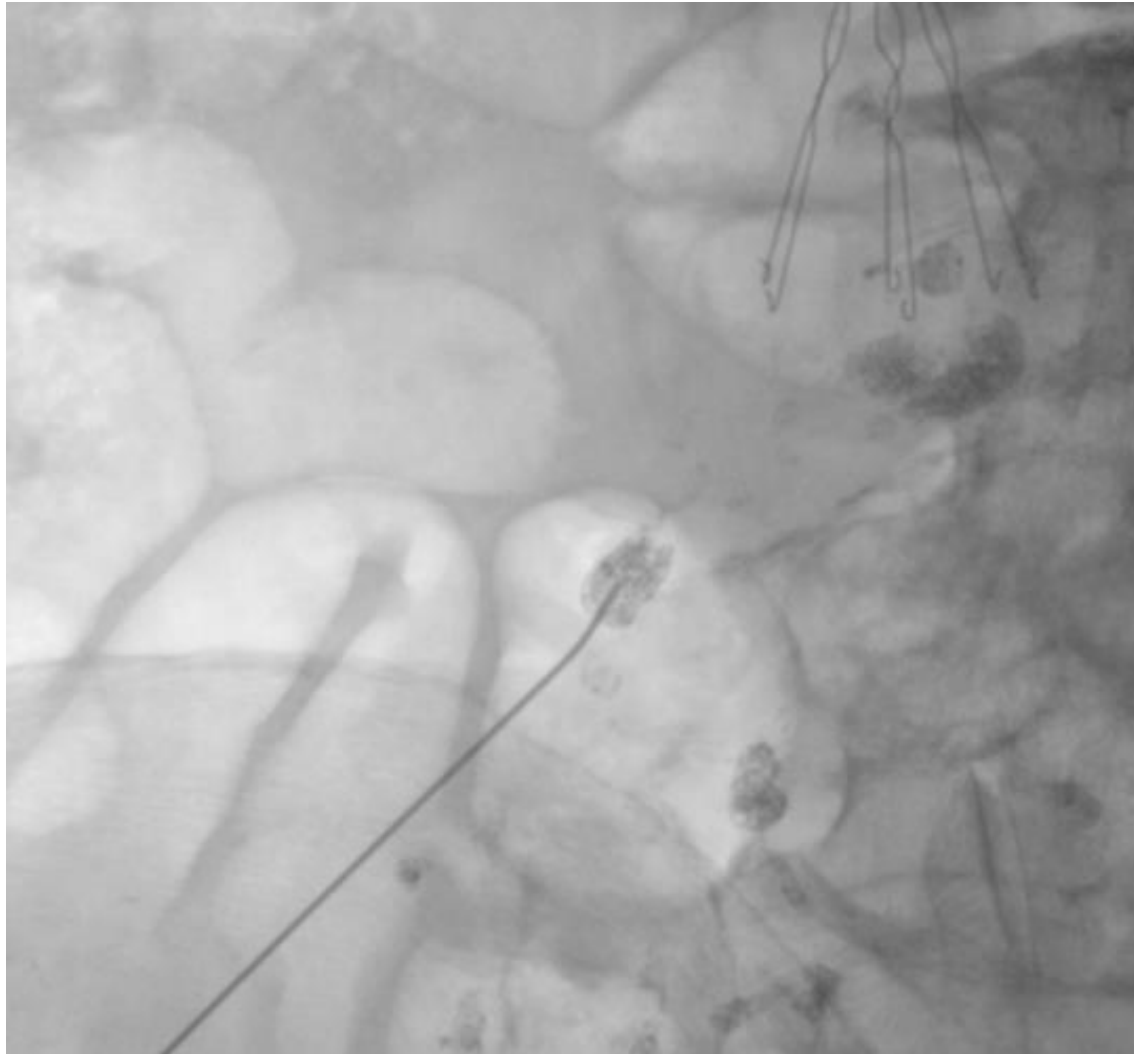


Use of sequential pneumatic compression devices to reduce thoracic duct catheterization procedure time.  
Meisinger, Q et al. JVIR, Volume 28 , Issue 2 , S133 - S134

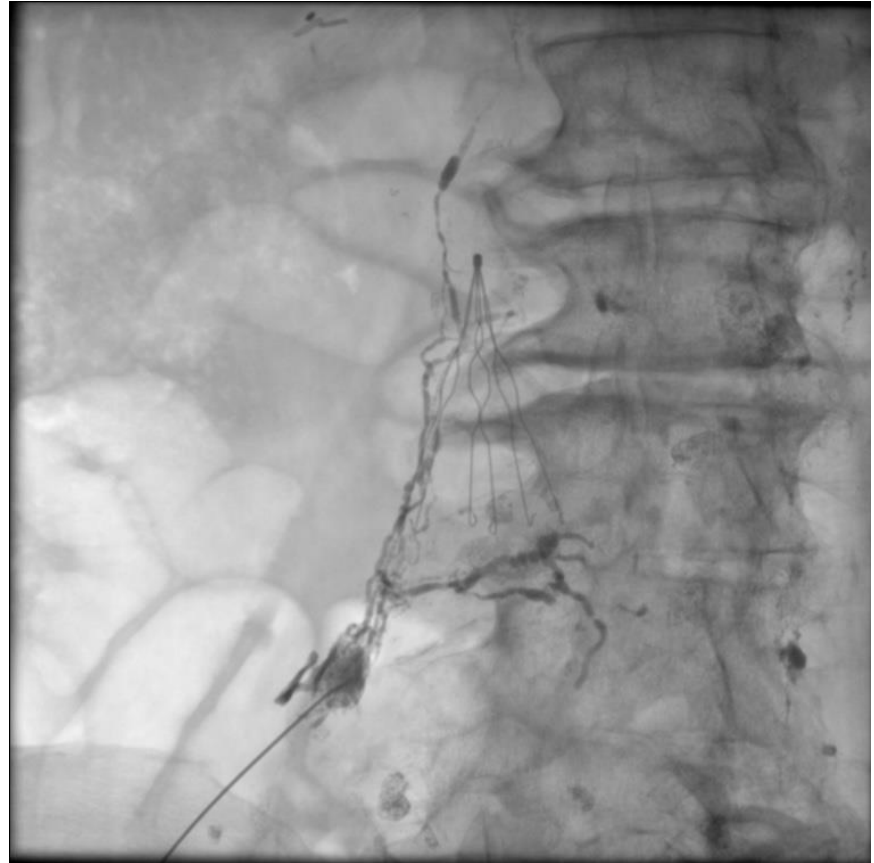
# Saline Flash



# Intestinal Lymphangiography

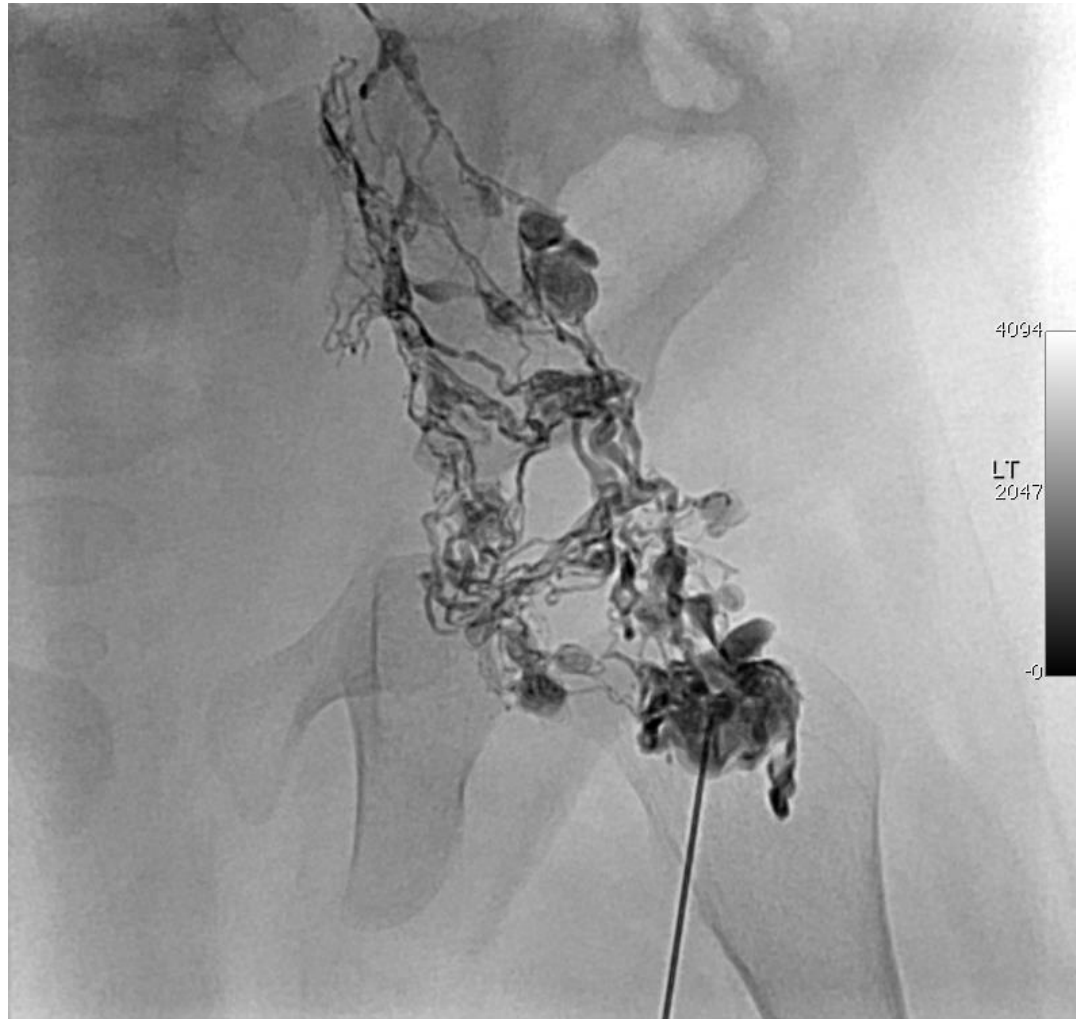


# Intestinal Lymphangiography

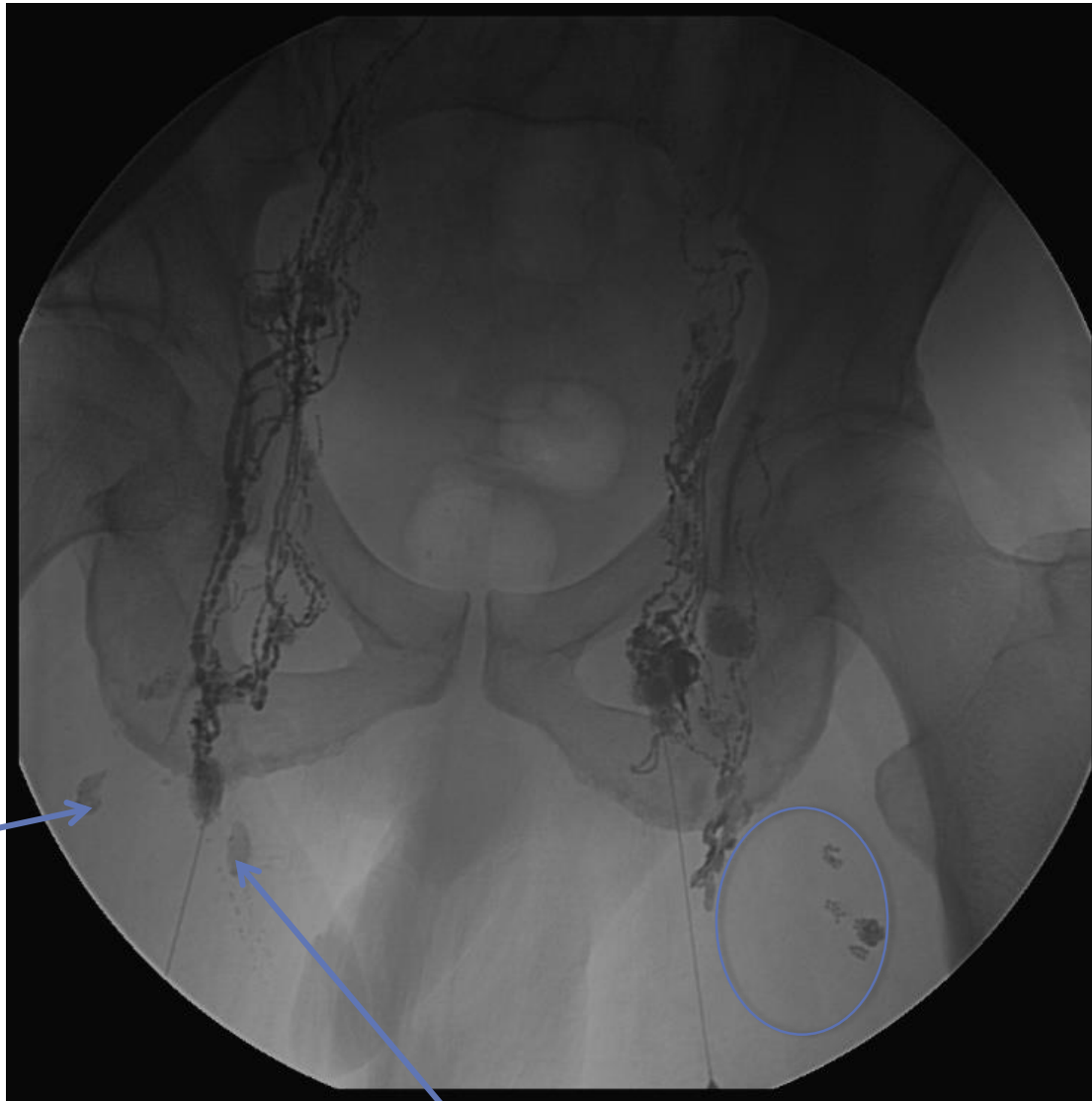




# IL Child

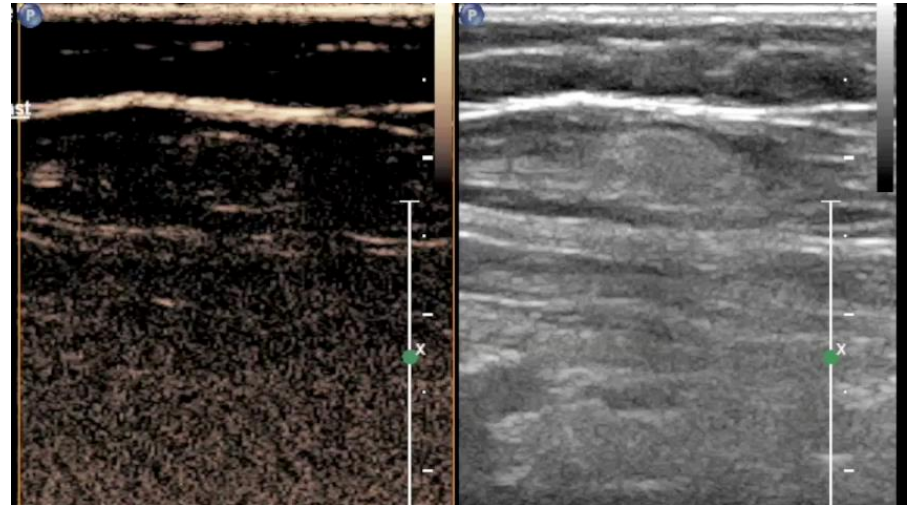
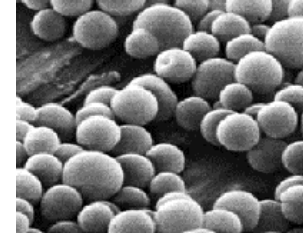


# Shunt to Vein



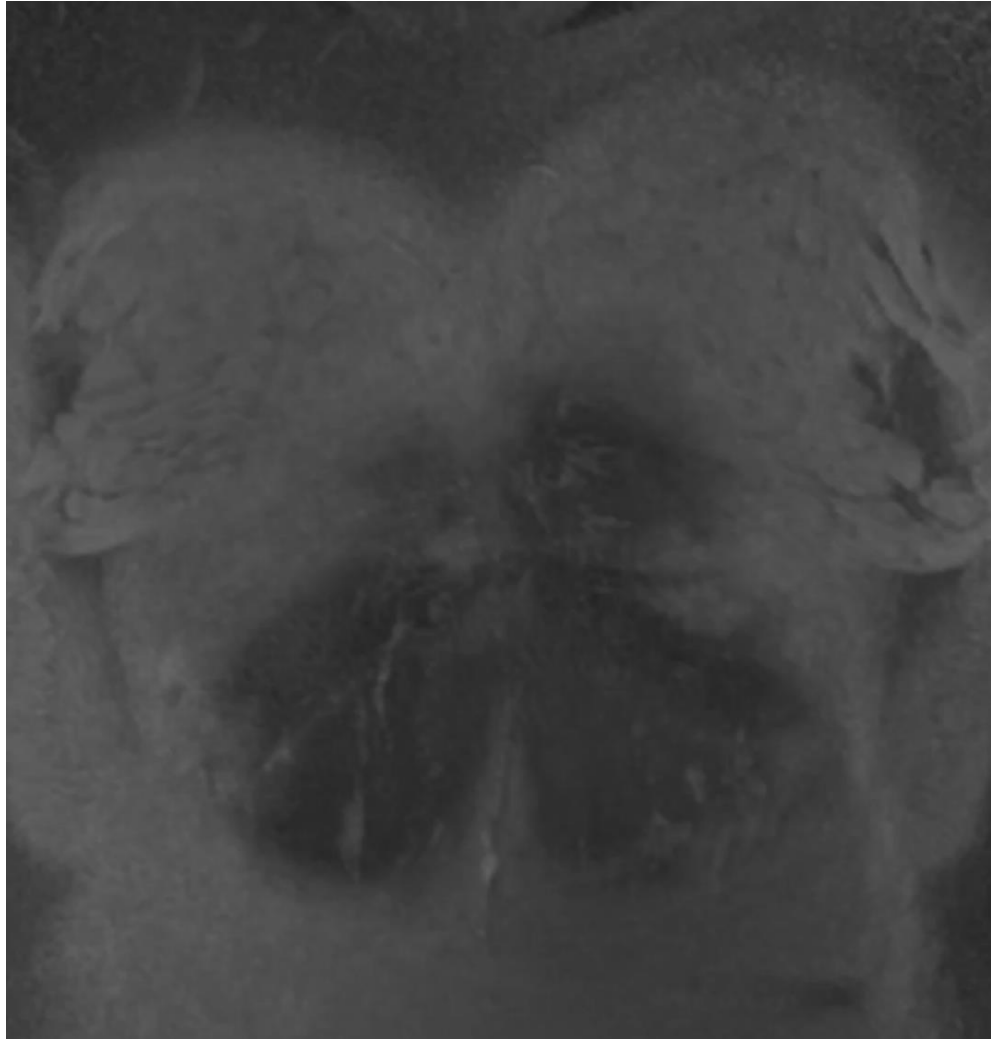
# Contrast Enhanced MR Lymphangiography

Position of the needles (US contrast)



Dori Y, Zviman MM, Itkin M. Dynamic Contrast-enhanced MR Lymphangiography: Feasibility Study in Swine. *Radiology*. 2014 Nov;273(2):410–6.

# MR Lymphangiogram



# Cardiac Plastic Bronchitis

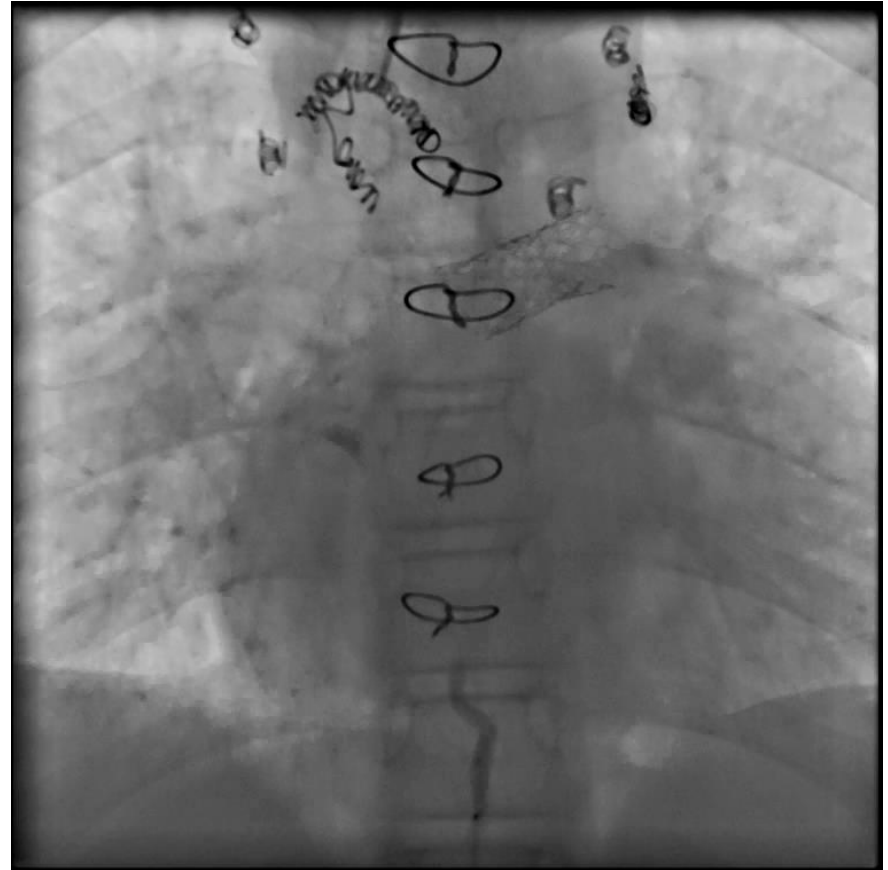


**Formation of large  
gelatinous or rigid  
branching airway casts**

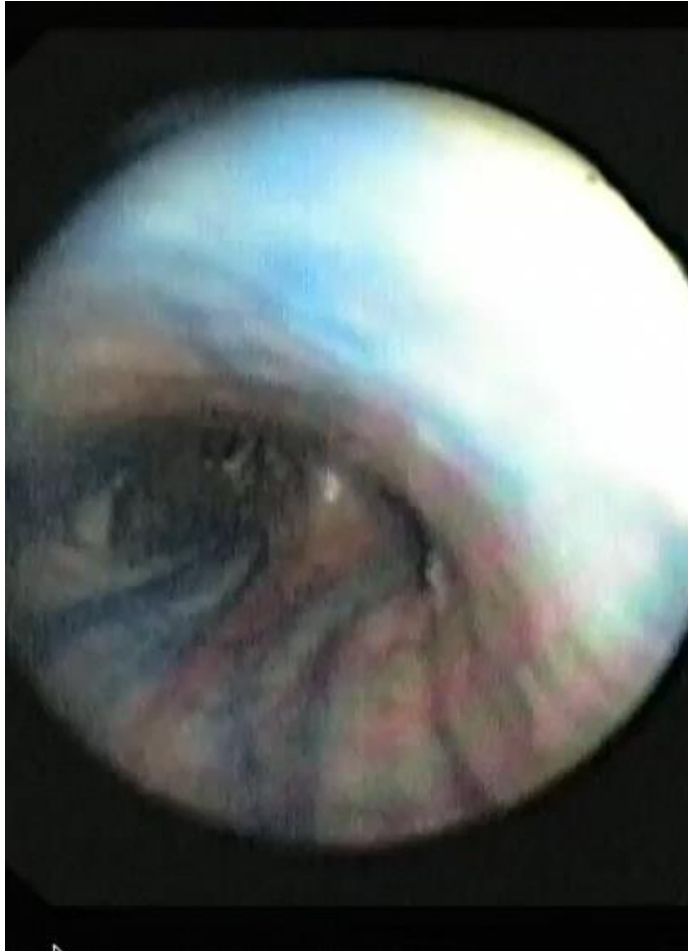
**Right heart failure in  
patients with  
congenital heart  
disease**



# MR Lymphangiography



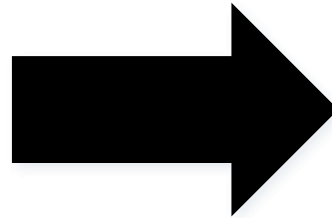
# TD Injection with MB



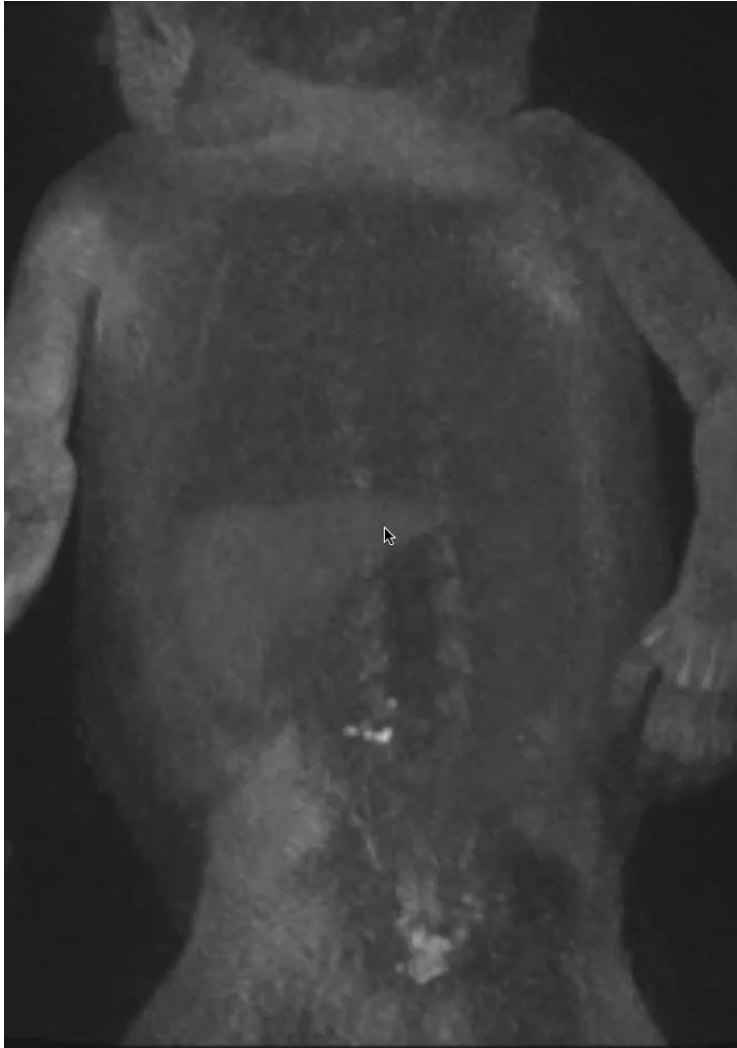
# PB Lymphatic Embolization-Outcome

- **18 Patients with “cardiac” PB**
- **16 demonstrated pulmonary lymphatic perfusion**
- **15/16(94%) –significant improvement of their symptoms**
- **Median follow-up 315 days**

# Outcomes



# Contrast Enhanced MR Lymphangiogram



**Congenital Lymphatic Dysplasia**



# Liver Lymphatic System

## **Ernest Starling (1894)**

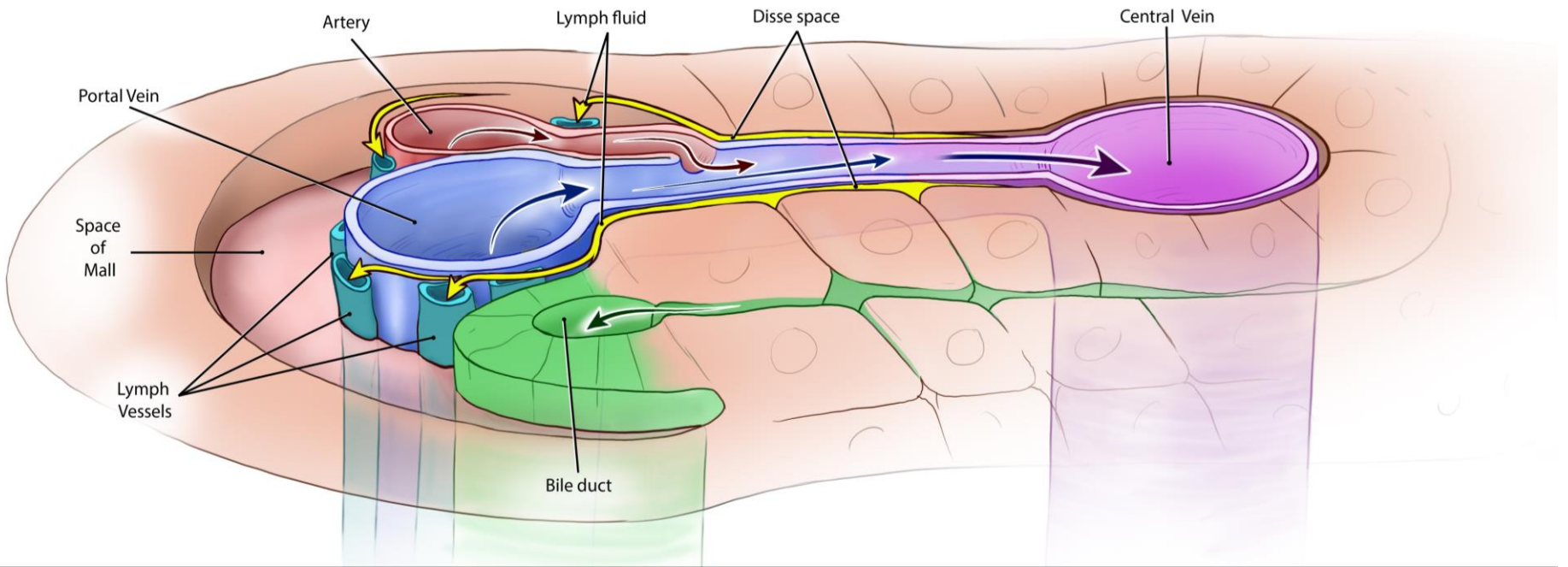
- First described liver lymphatic flow

**Normal liver lymph contributes 30-40% of the flow to the TD**

**Estimate 500-800 ml/day**

**40% of total body proteins returned to blood circulation through TD**

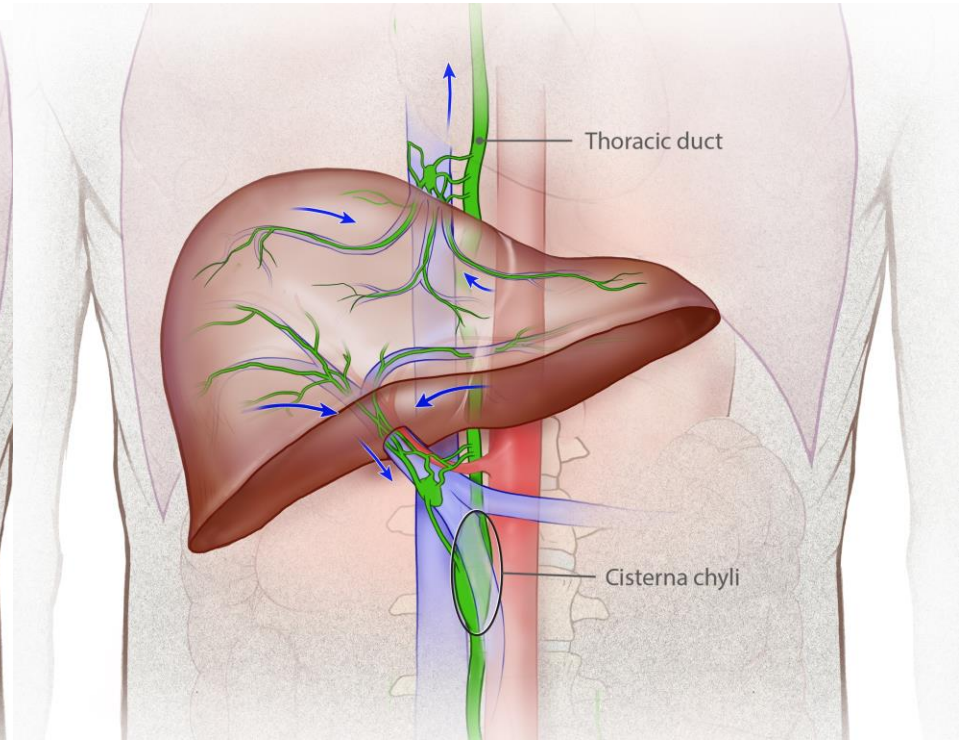
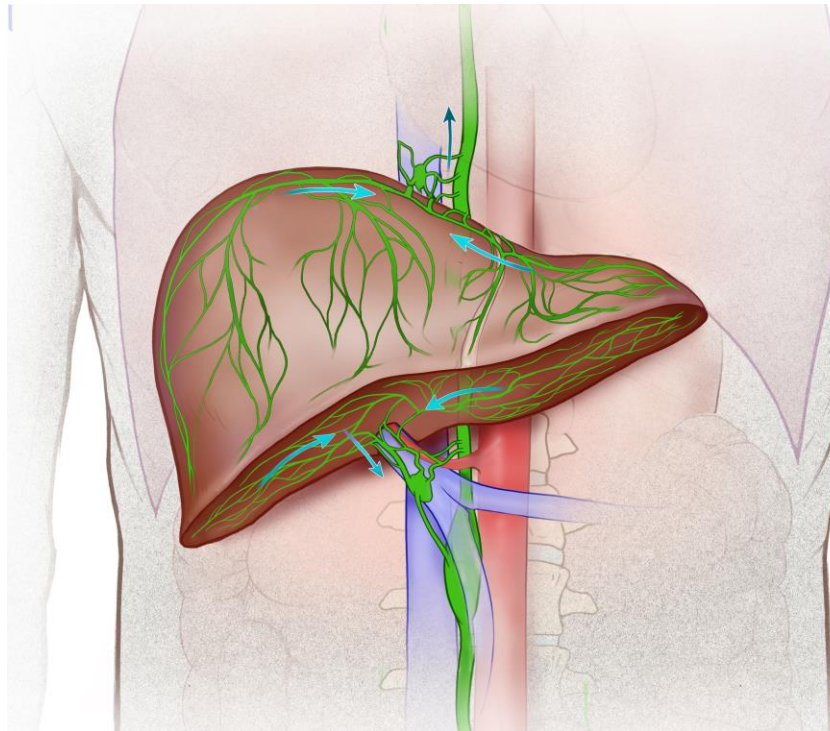
# Liver Lymph Production



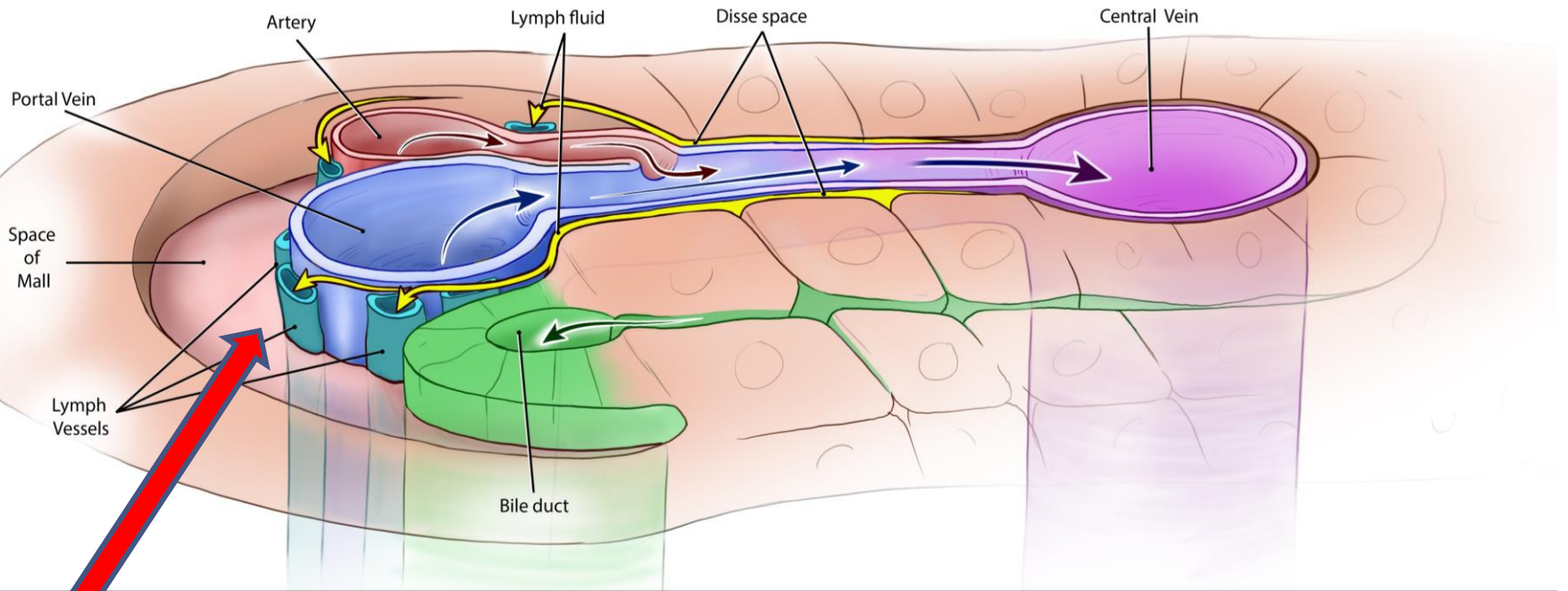
# Liver Lymphatic System-Anatomy

Superficial

Deep

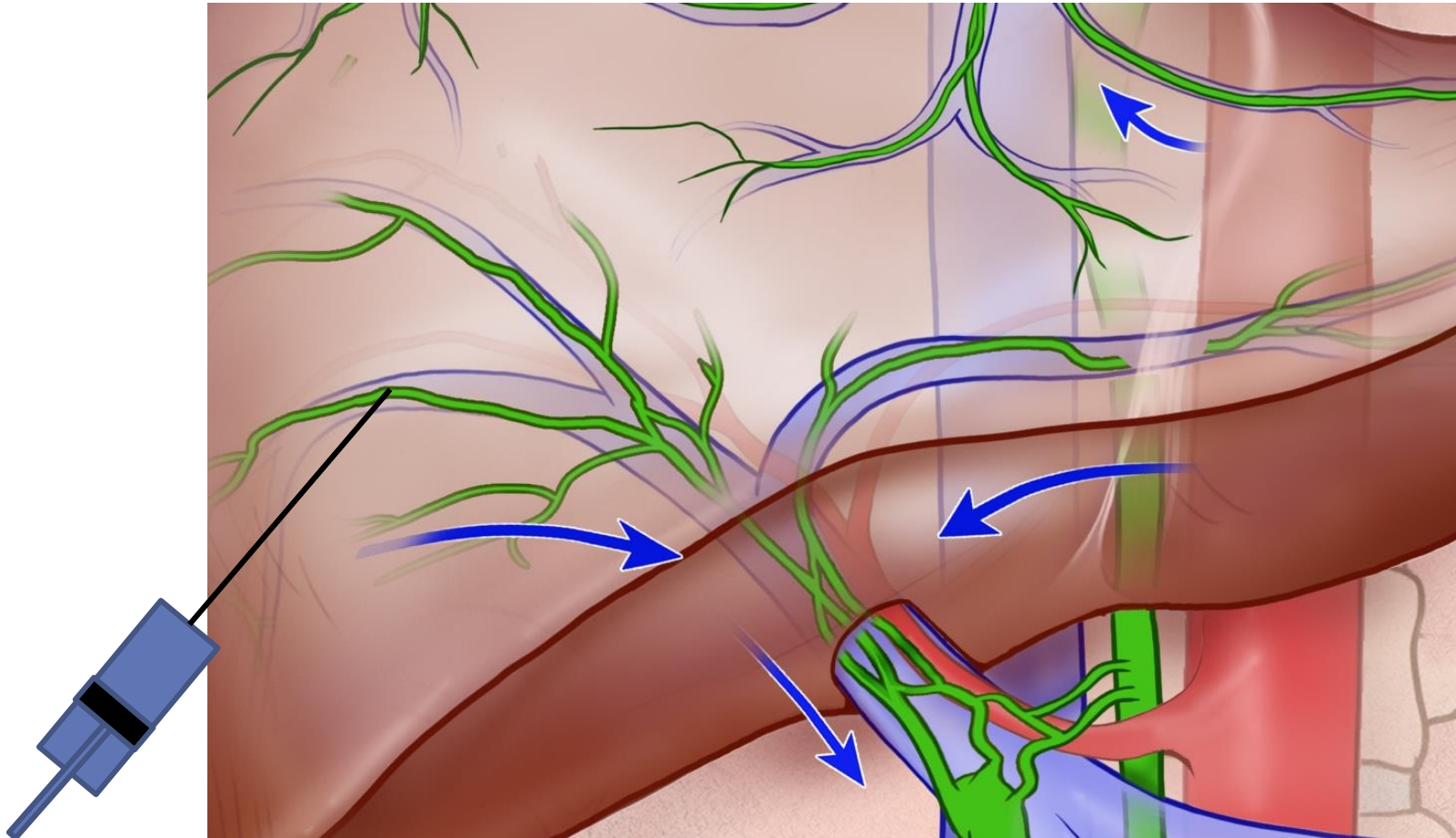


# Liver Lymphangiography



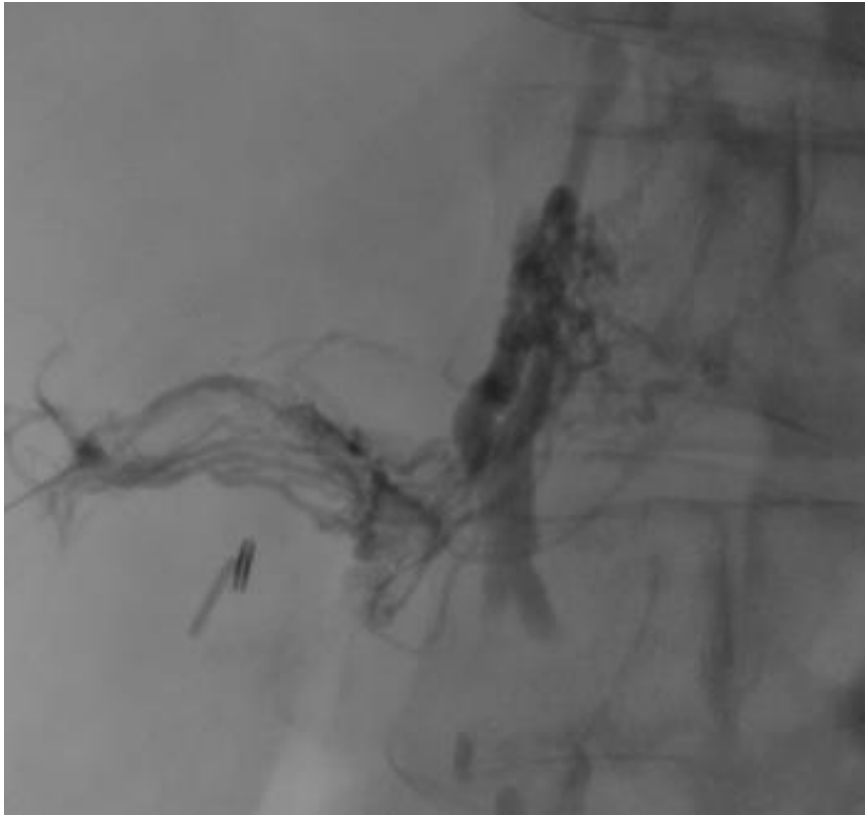


# Liver Lymphangiography

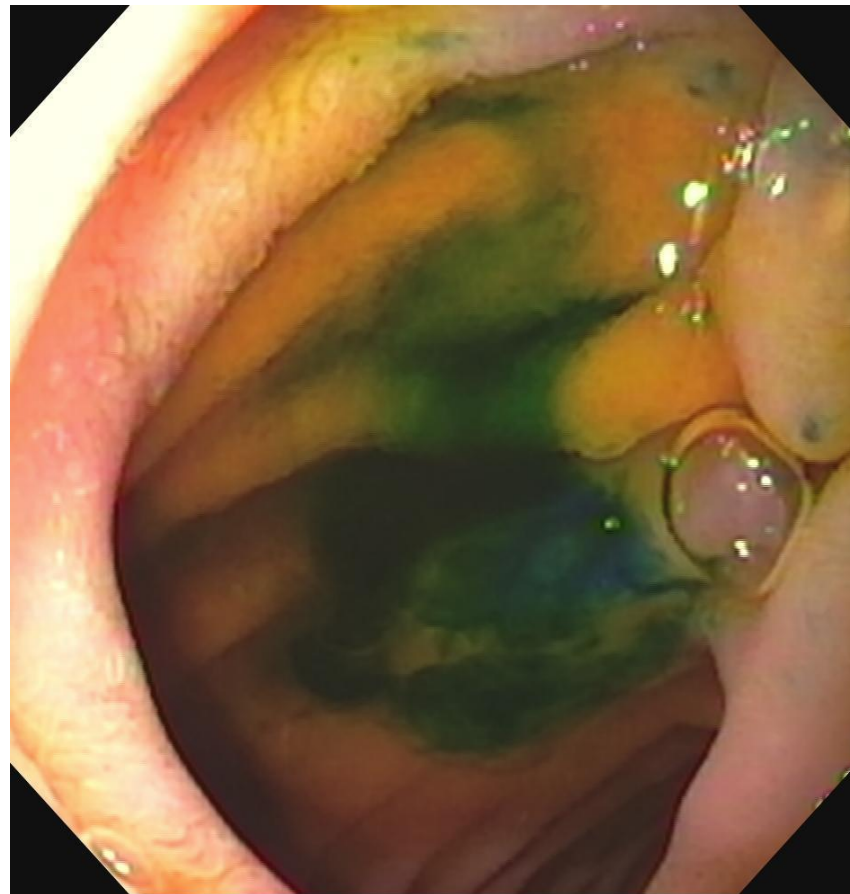
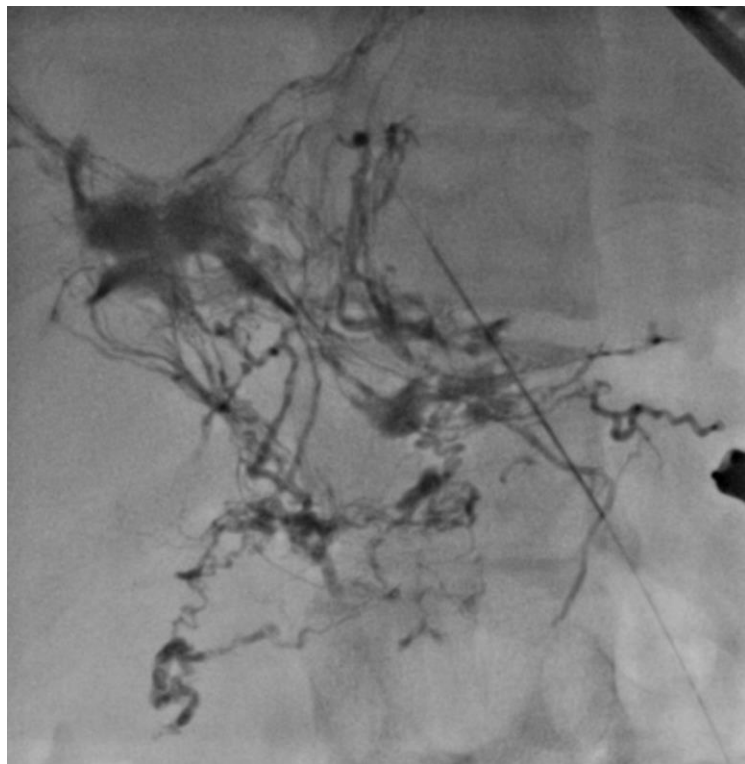




# Communication of the Liver Lymph with TD

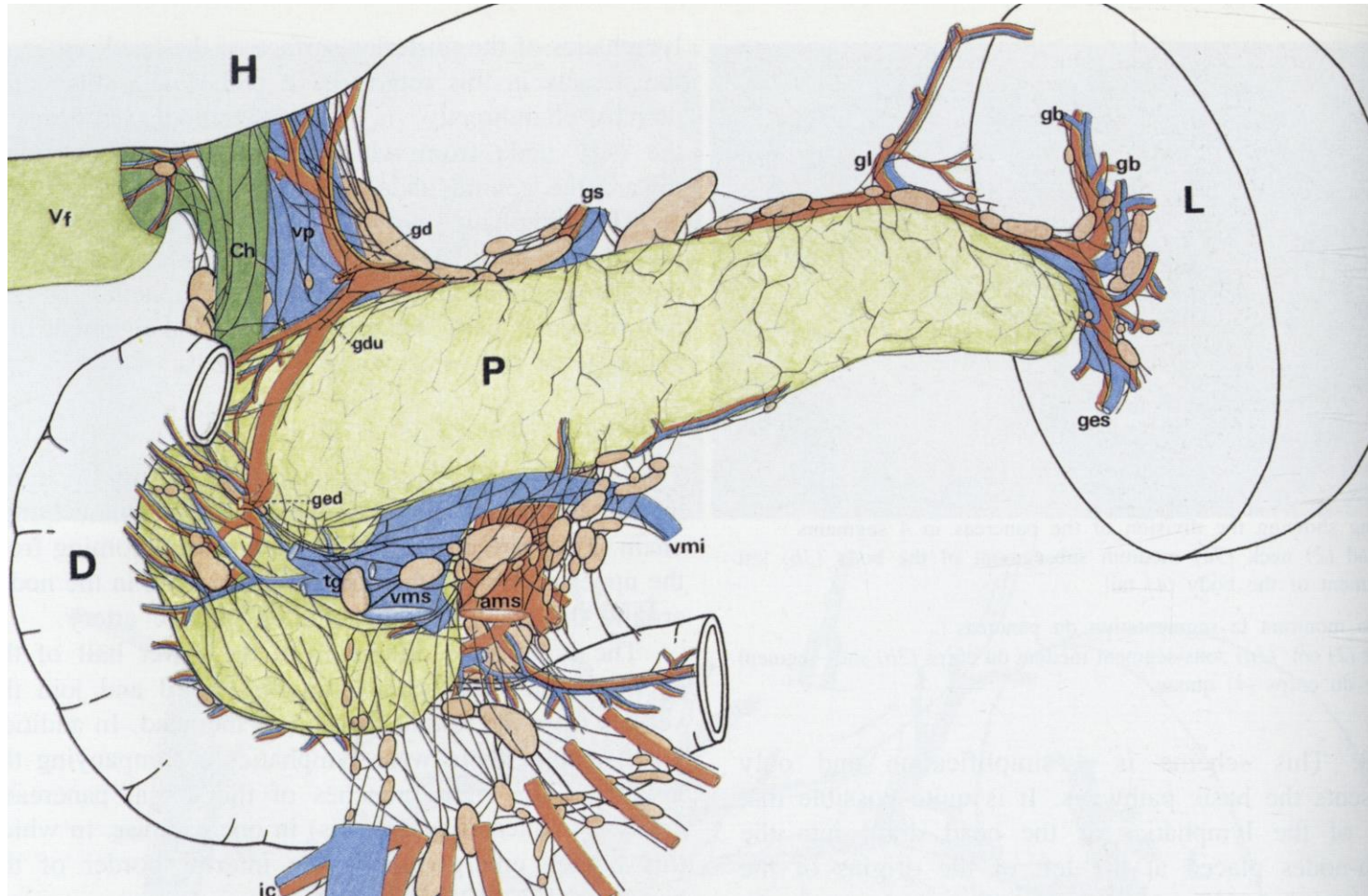


# Liver Lymphangiogram PLE

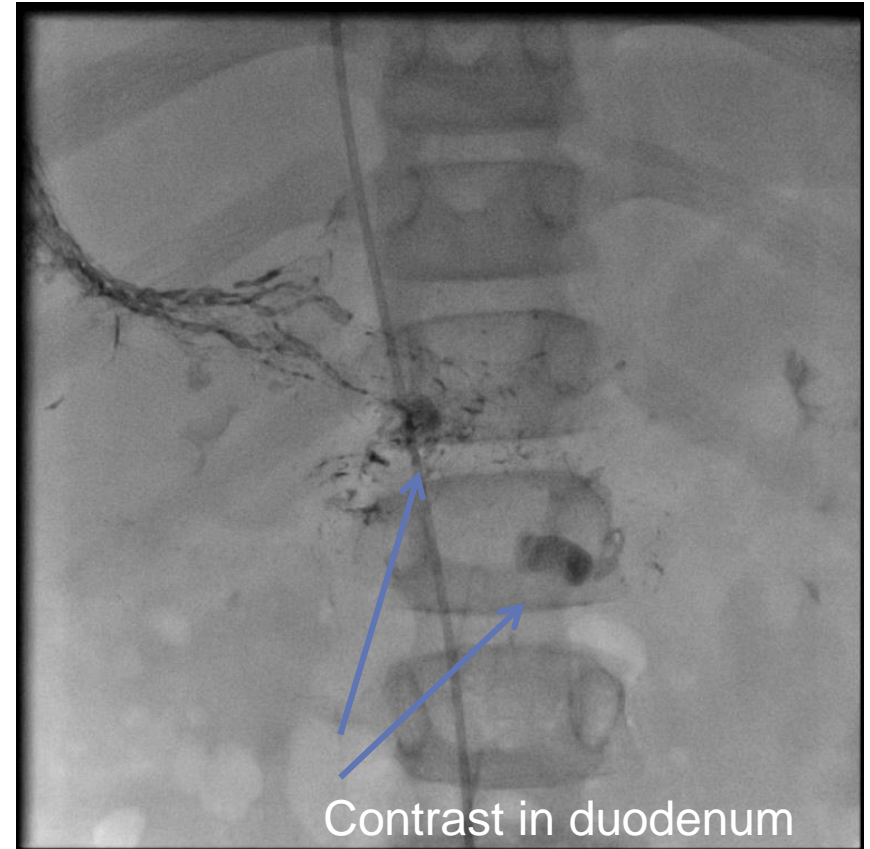


[Final](#)

# Hepatoduodenal Lymphatic Connection



# Liver Lymphangiogram PLE



Final

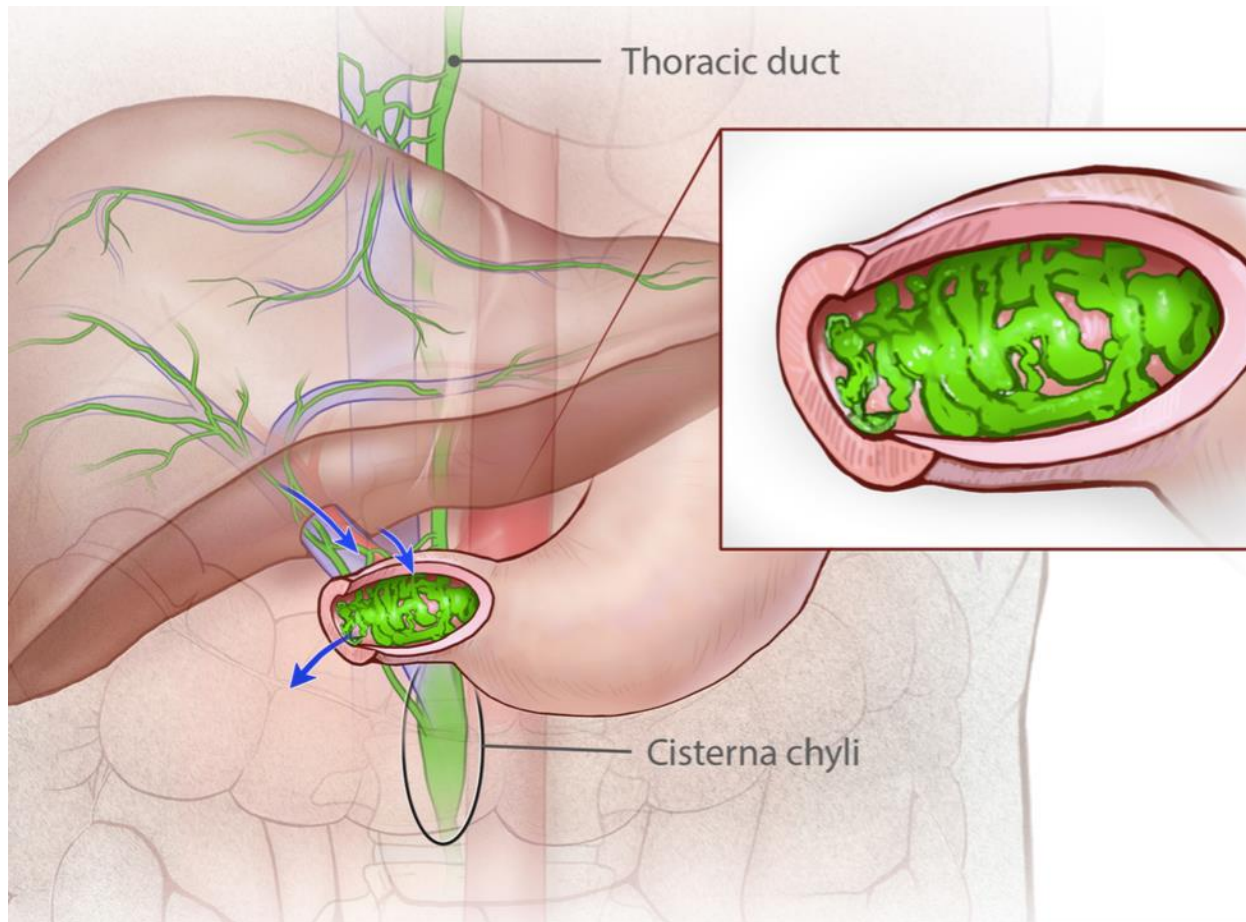


# Hepatoduodenal Lymphatic Connection

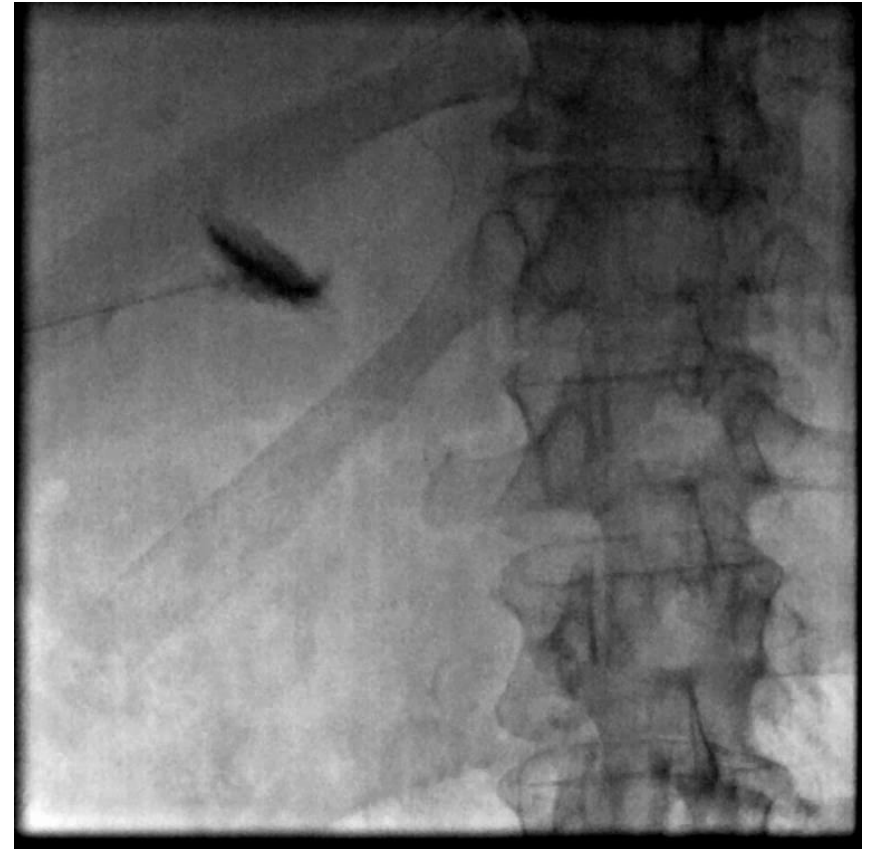
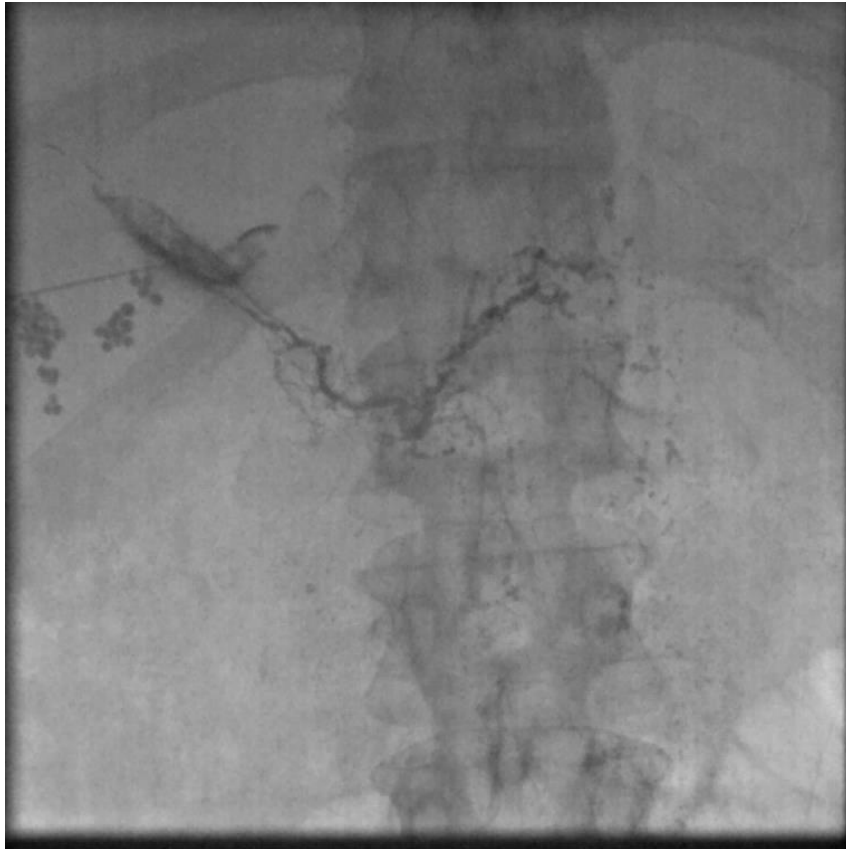




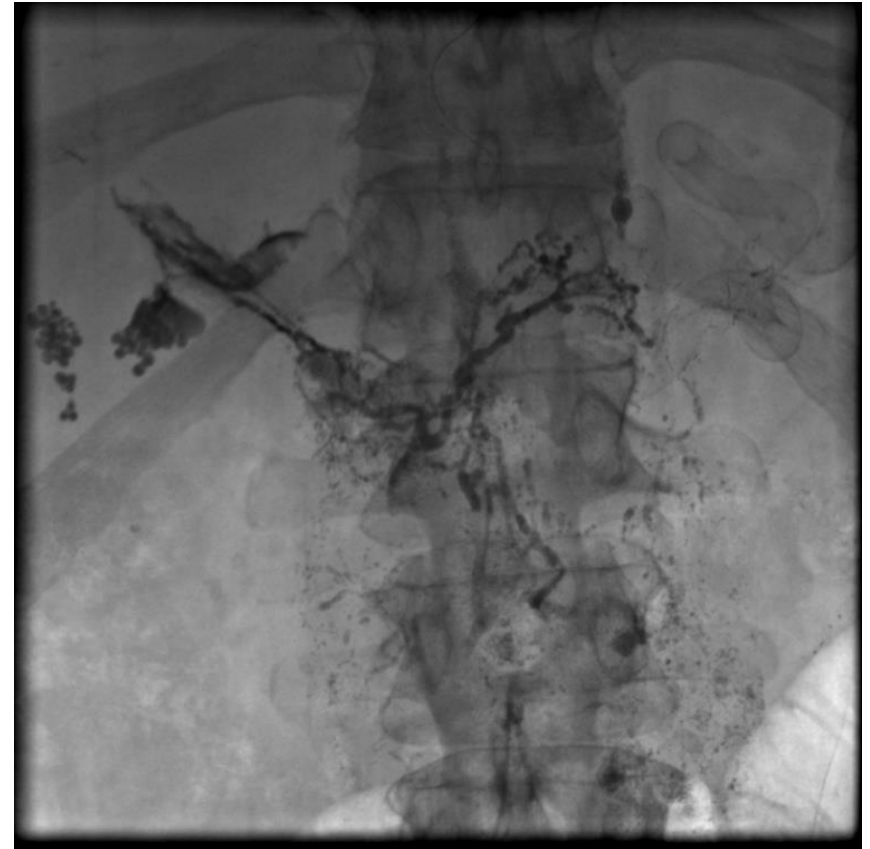
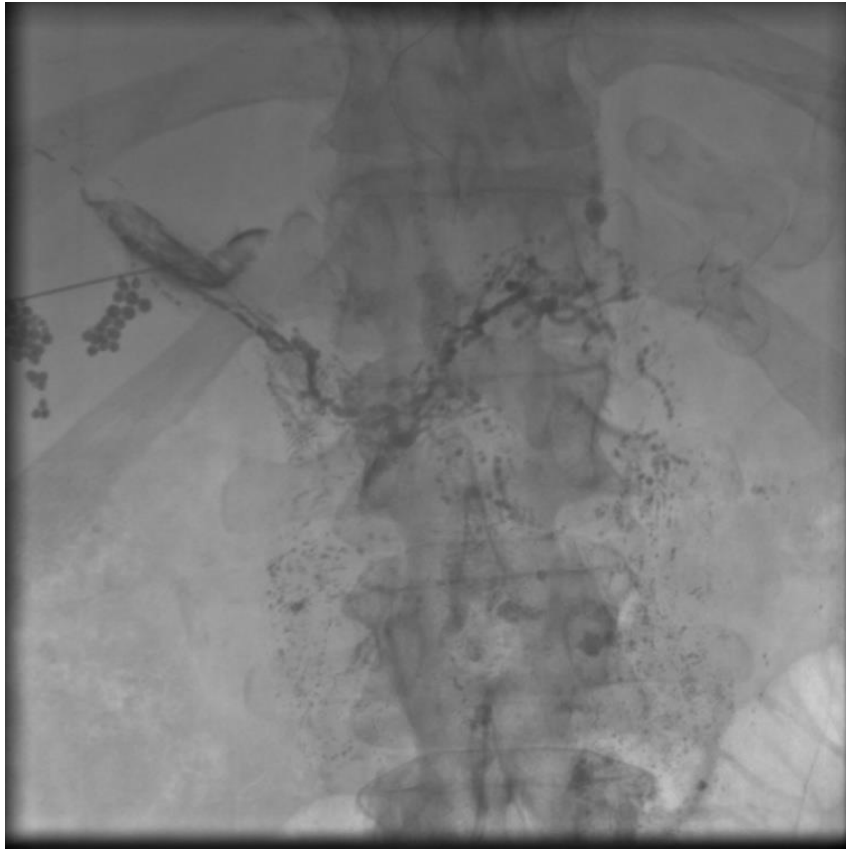
# PLE-Leakage Diagram



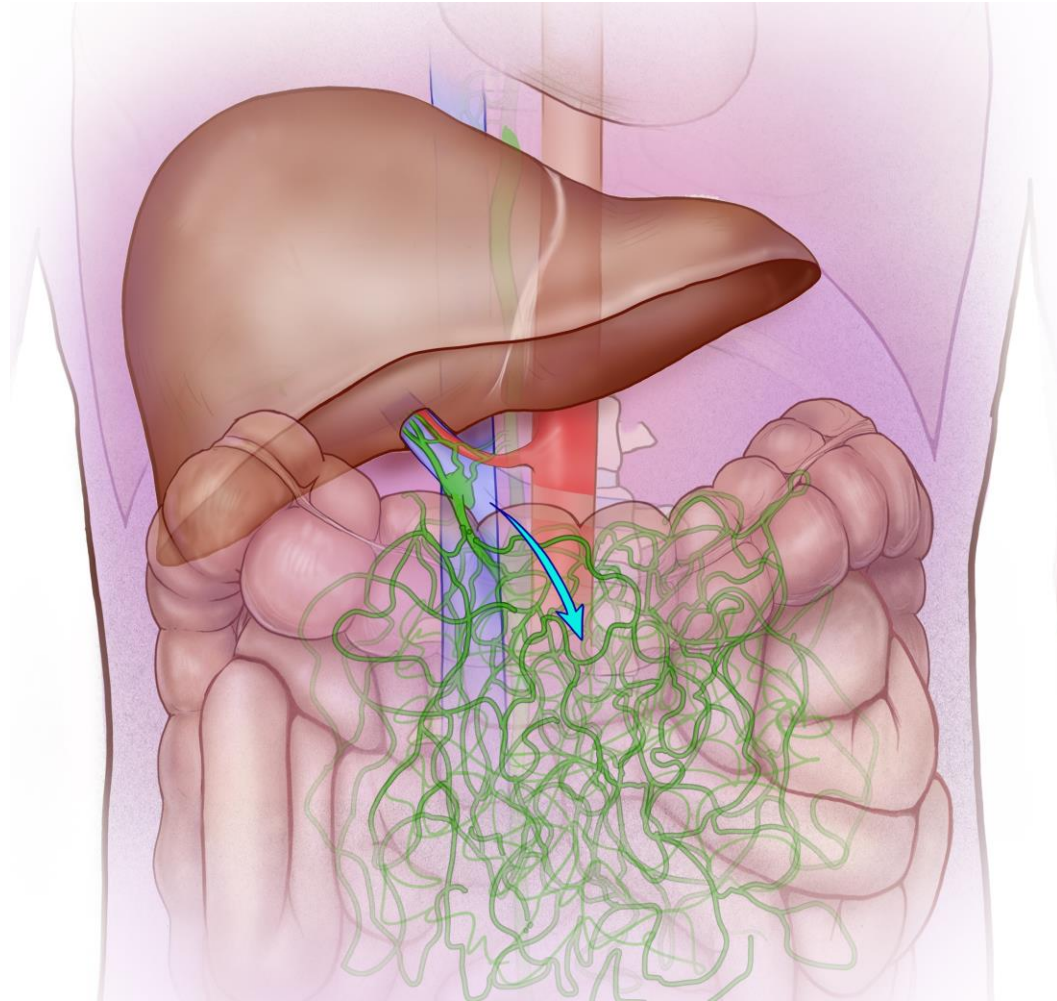
# Liver Lymphangiogram-CHF Ascites



# Liver Lymphangiogram-CHF Ascites



# Liver Lymphangiogram-CHF Ascites



# Conclusion

- **New lymphatic interventional techniques inspire rebirth of the lymphangiography**
- **Needs of the development of technically less challenging methods**
- **Need of the development of dedicated lymphangiography equipment**
- **Now we can only image parts of the lymphatic systems**
  - Non-Invasive imaging of the liver lymphatics
  - Intestinal lymphatics
  - Lung lymphatics
  - Kidney lymphatics



Thanks!

