

# Which preoperative vein imaging? Duplex ultrasound

**Dr G.FRANCO**  
**Clinique Arago**  
**PARIS**

## Disclosure

Speaker name: Gilbert FRANCO

---

I do not have any potential conflict of interest

## Guideline KDOQI 2006 /EBPG 2007

### Patient preparation for permanent hemodialysis access

- 1.4 Evaluations that should be performed before placement of a permanent HD access include :
  - 1.4.1 History and physical examination, (B)
  - 1.4.2 Duplex ultrasound of the upper-extremity arteries and veins, (B)
  - 1.4.3 Central vein evaluation in the appropriate patient known to have a previous catheter or pacemaker. (A)

**No any randomized studies comparing  
venography  
and  
vascular ultrasound mapping**

# USE OF US VASCULAR MAPPING

- Increase in AVF placement using CDUS compared with physical examination  
34% VERSUS 64%
- Pre operative mapping resulted in change of procedure of 31%
- Reduction in graft placement 62% to 30%
- Reduction in tunneled haemodialysis catheters insertion (from 24% to 7%)
- Reduction in failure rate of AVF from 36 to 8,3%
- Increase primary patency rate at one year from 48 to 83%

*Allon M. Kidney Int 2001*  
*Silva MB. Vasc Surg 1998.*  
*Robbin ML. Radiology 2000.*  
*Asif A. Kidney Int 2005.*  
*Malovrh M. J Kidney Dis 2002*

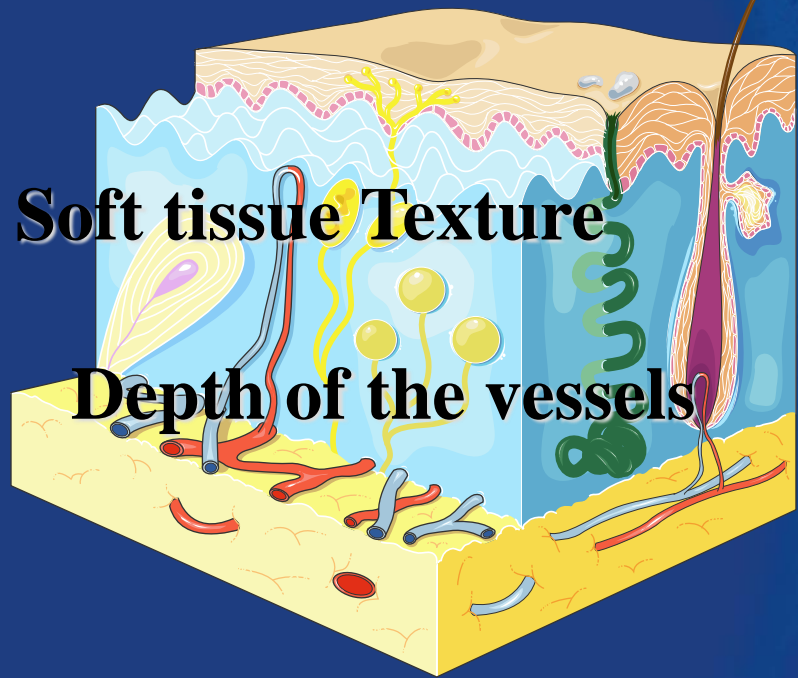
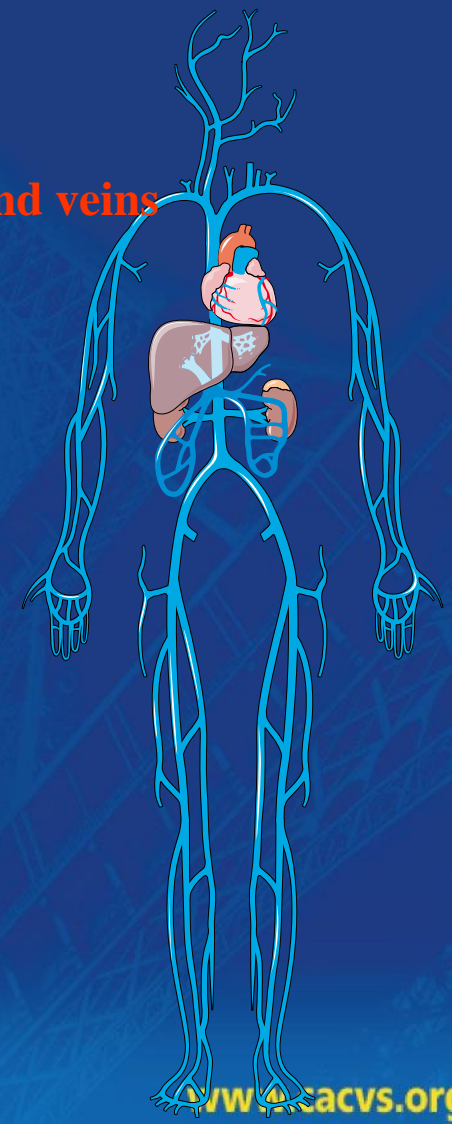
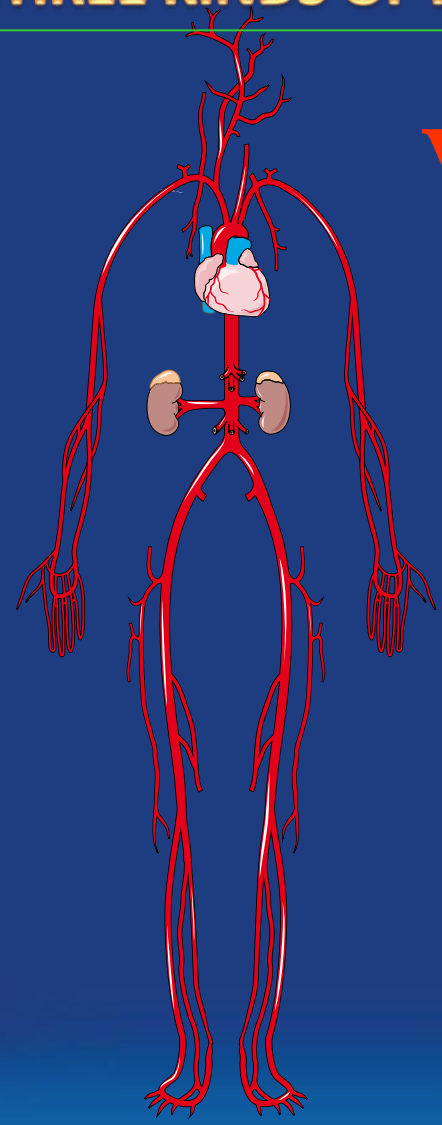


**US  
COMPARED  
TO  
VENOGRAPHY**

**US: ONLY INVESTIGATIONABLE TO PROVIDE  
THREE KINDS OF FINDINGS IN THE SAME TIME**

# Vessels assessment

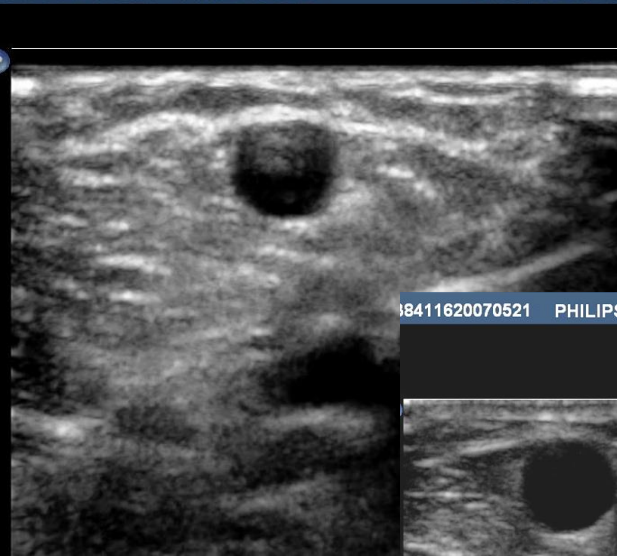
Patency and Suitability of both arteries and veins



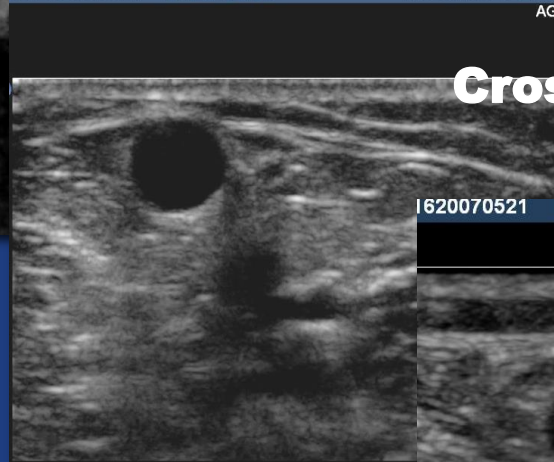
# IMAGE RESOLUTION

- **Resolution of us imaging :0,1 to 0,3 mm**
- **Better than co2 venography**
- **Similar than phlebography**

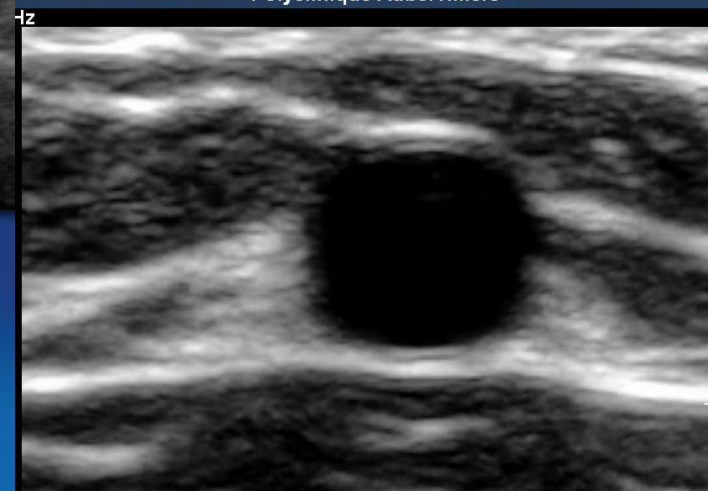
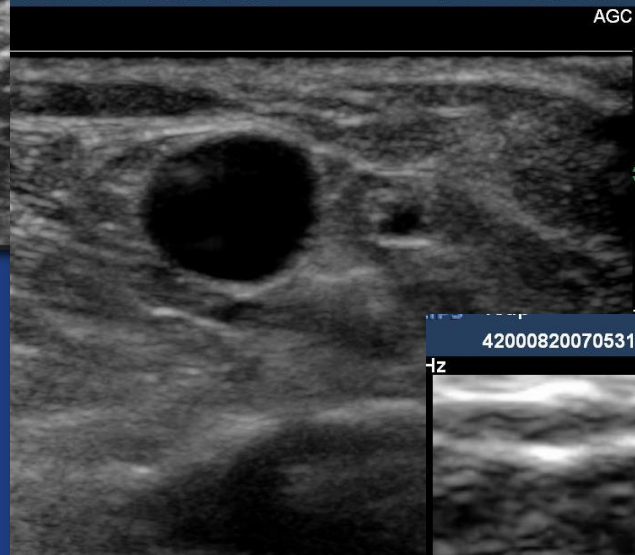




# VASCULAR IMAGING



**Cross section of basilic vein at forearm**



**Broadband linear array transducer  
(17 to 5 MHz extended frequency range)  
Compound, XRES, Harmonic Imaging  
dramatically improves the vascular image detail**

# VENOUS INVESTIGATION

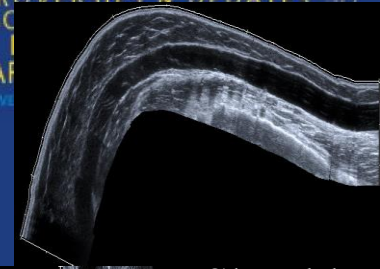
- Patency of the deep venous system
- Draw a complete mapping of the superficial veins
- **CENTRAL VEINS :**  
the only veins that cannot be directly investigated

# SUPERFICIAL VEIN

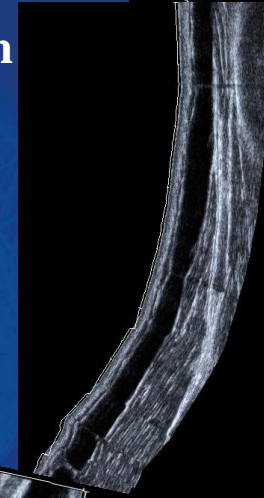
- Superficial veins can be followed from wrist to their completion
- Patency and variant anatomy emphasized
- Diameter and depth should be measured
- Distance between artery and vein

## A suitable vein appears

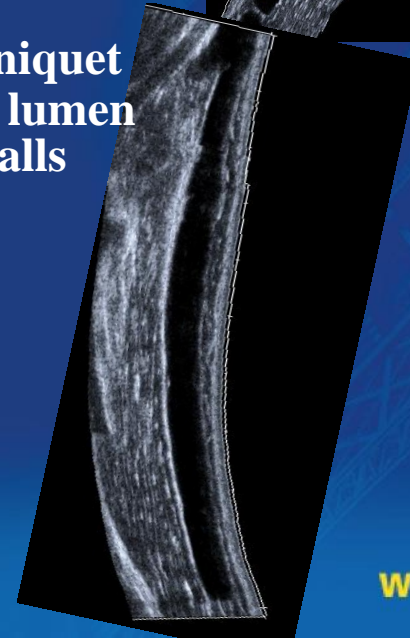
- Thin-walled
- Easily compressible and dilatable by means of a tourniquet
- Normal valve leaflets appear thin and free within the lumen
- Hypoechoic or anechoic lumina, sharply echogenic walls
- Doppler flow patterns varies with changes in intrathoracic pressure



Shoulder



Arm



Forearm

# Distance between artery and vein

## Should be taken into account and help:

- To choose the anastomosis site
- Wrist
- Snuff box
- Elbow (brachial artery or radial artery )



# SUPERFICIAL VENOUS SYSTEM



## Venous measurement

<b>AUTHORS</b>	<b>YEAR</b>	<b>VEINS</b>	<b>% OF SUCCESS</b>
<b>WONG</b>	<b>1996</b>	<b>&lt; 1.6mm</b>	<b>early failure</b>
<b>LEMSON</b>	<b>1998</b>	<b>&lt; 2 mm</b>	
<b>SILVA</b>	<b>1998</b>	<b>2.5 mm</b>	<b>83%</b>
<b>MENDES</b>	<b>2002</b>	<b>2 mm</b>	<b>76%</b>
<b>MALOVRTH</b>	<b>2002</b>	<b>IDV ↗ 60%</b>	<b>80%</b>
<b>JUNGLING</b>	<b>2003</b>	<b>2MM</b>	<b>86%</b>



# Us imaging with tourniquet

# VENOUS DISTENSIBILITY

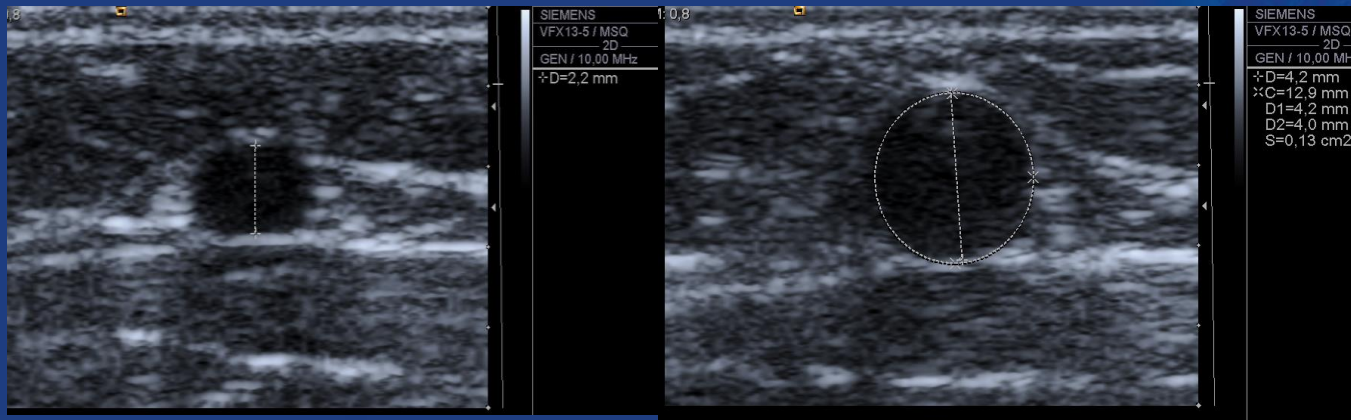
Dynamic vessel characteristics are potentially valuable

Venous distensibility : prediction of maturation and longevity

*van der Linden J, Am J Kidney Dis 2006.*

Successful avf had a significantly greater preoperative IDV after venous congestion  
( $3.35 \pm 1.15$  mm versus  $2.45 \pm 1.26$  mm) than patients with unsuccessful avf

*Malovrh M. Am J Kidney Dis. 2002.*



CDUS image of the cephalic vein at forearm,  
without (left) and with (right) tourniquet.

Increase by 2 of diameter      increase by 4 the surface

# Us imaging without tourniquet

# FOREARM CEPHALIC VEIN AT FOREARM 1.2 mm



## FREE FLOW WITHOUT TOURNIQUET

Visualisation of spontaneous flow is a better predictive factor than diameter of the suitability of the vein



# Limit of measurement

## ➤ Underestimation of vein diameter

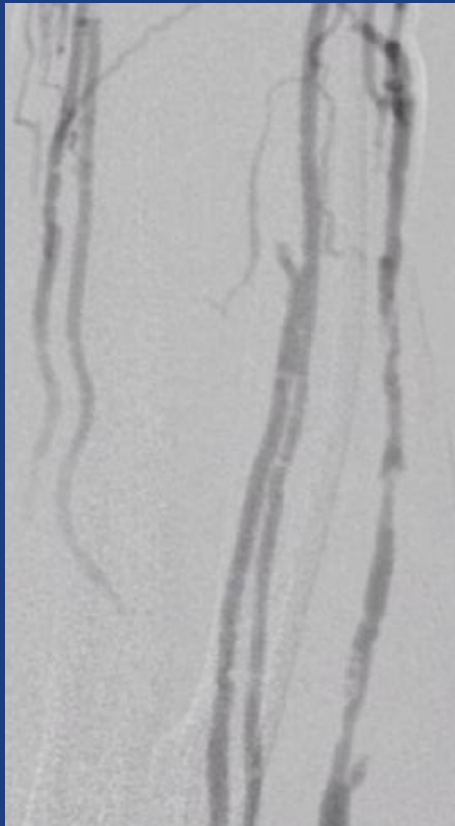
- Spasm
- Low blood pressure
- Post dialysis investigation
- Hypovolemia

## ➤ Overestimation of soft tissue

- Oedema



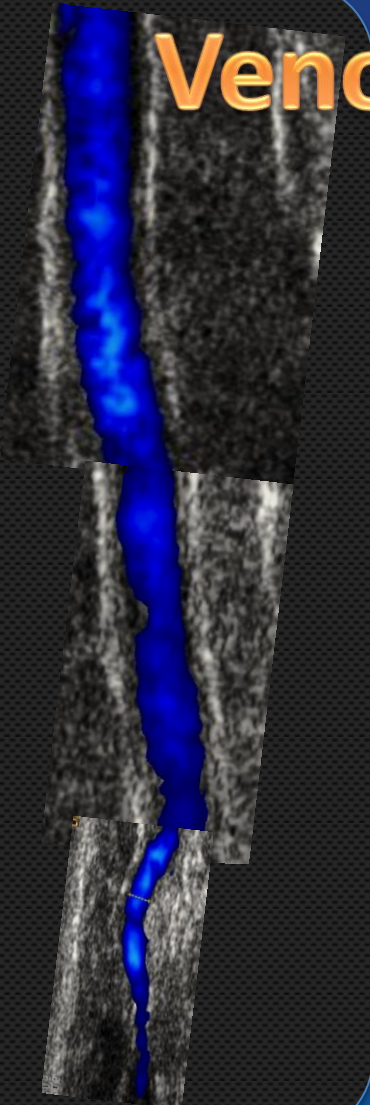
# CO<sup>2</sup> PHLEBOGRAPHY DRAWBACKS



- **Overestimation of vein diameter**
- **Under or over estimation of stenosis**
- **No possibility of skin marquage**
- **Confusion between basilic and brachial vein**
- **Lack of opacification of patent vein**

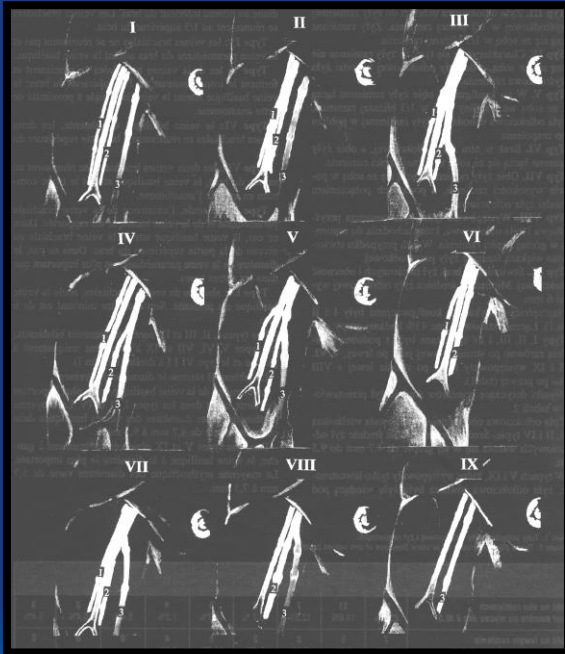
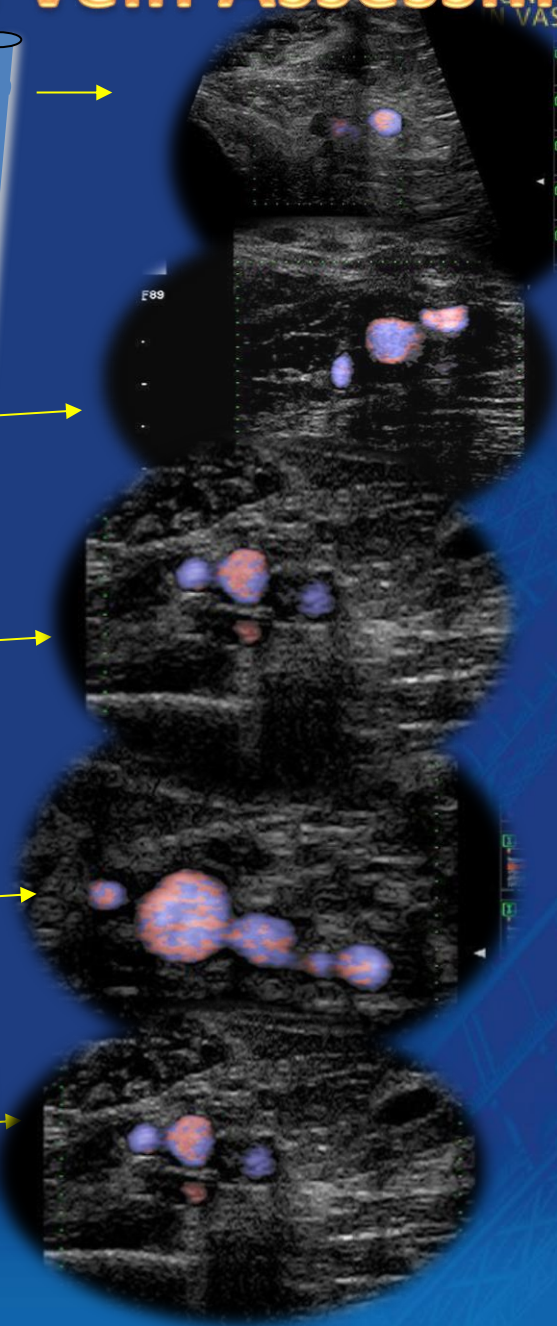
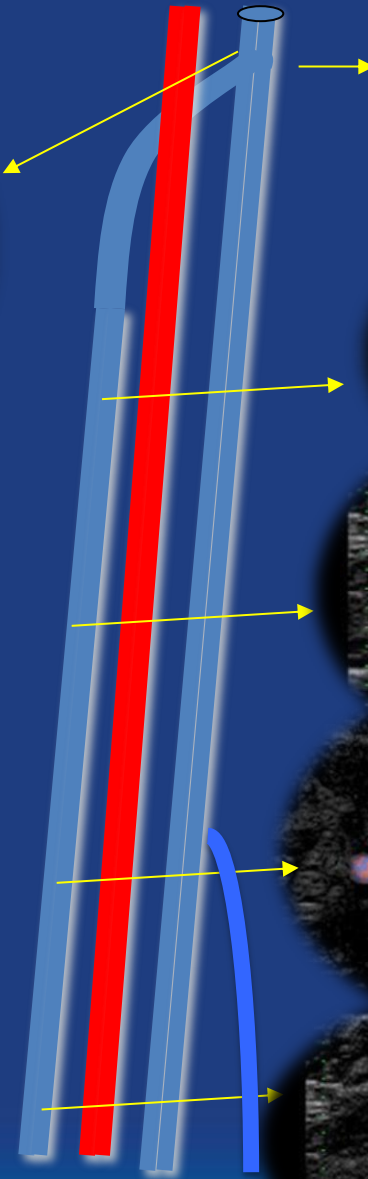
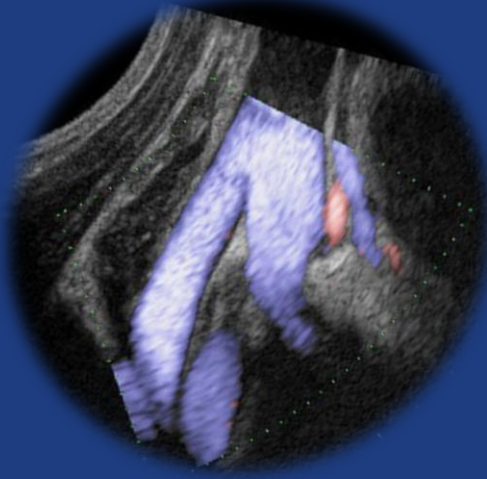
# Venography :lack of opacification

- Us can highlight veins that are not seen by venography
- in case of destruction of main root of cephalic or basilic vein



# Brachial Veins /Basilic Vein Assessment

SEPTEMBER 22-24 2015  
SAUCHE & CONFERENCE CENTER PARIS, FRANCE



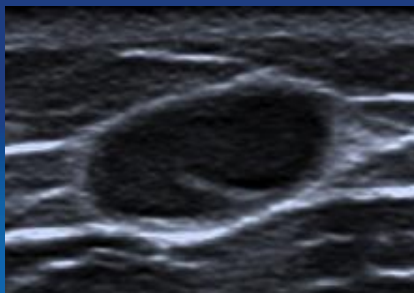
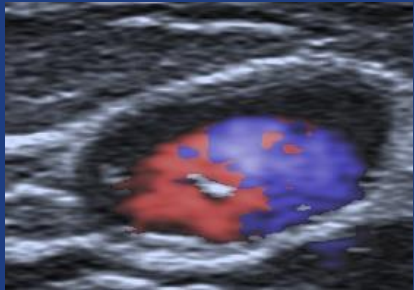


# NATURE OF THE LESION!

Often better defined with US

- **Thrombus**
- **Valve leaflet synechia**
- **Intimal thickness**
- **Compression**

# CEPHALIC VEIN UNDER ESTIMATION <sup>co2</sup> VENOGRAPHY



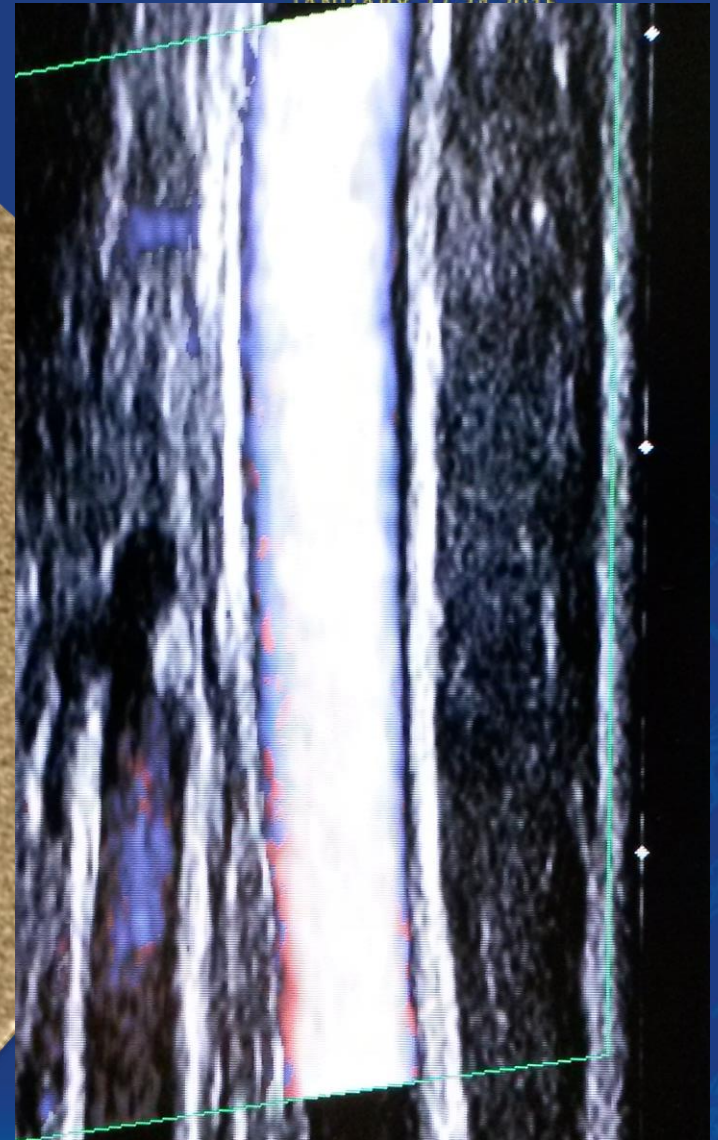
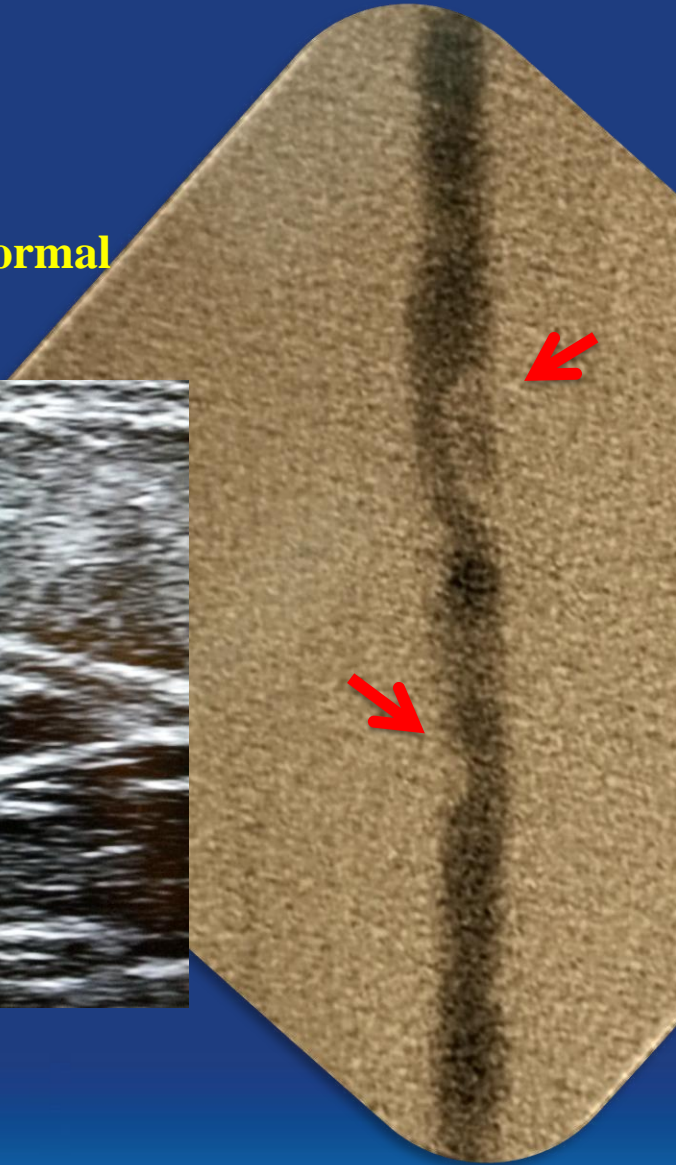
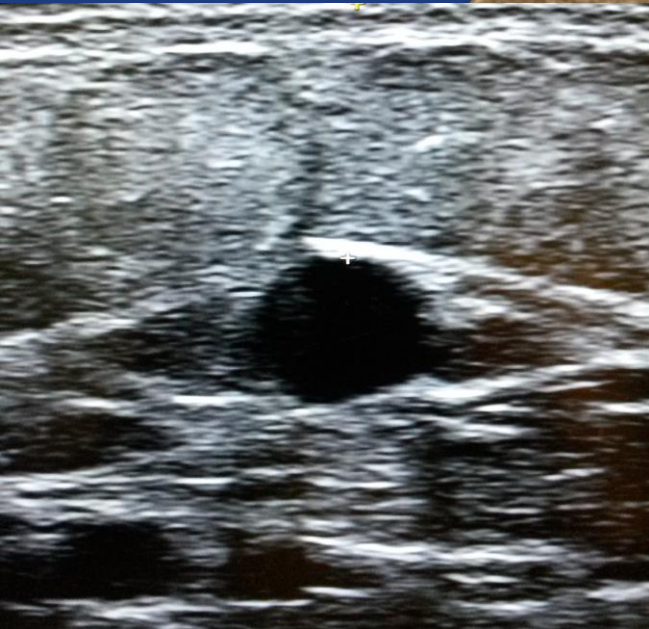


# CO2 PHLEBOGRAPHY

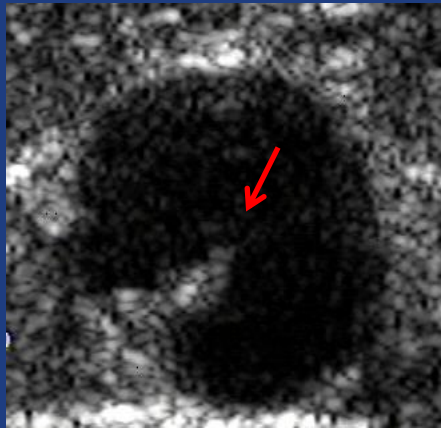
- Filling defect

## US

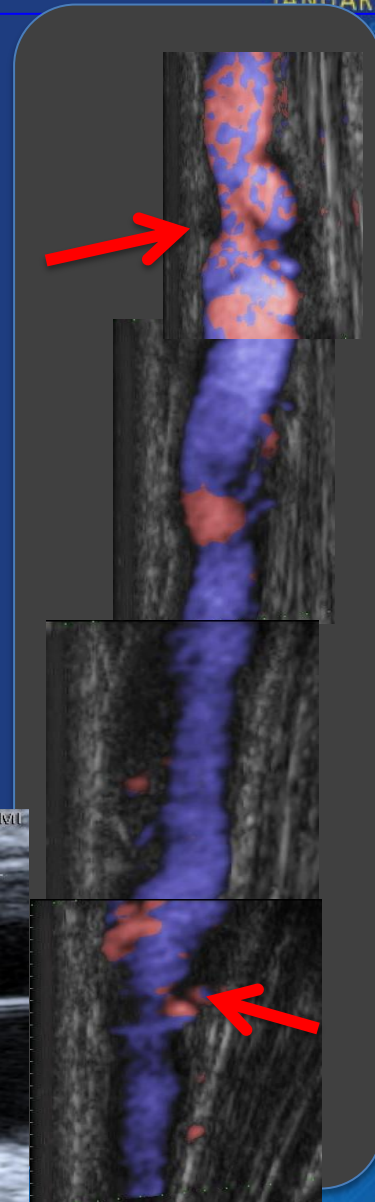
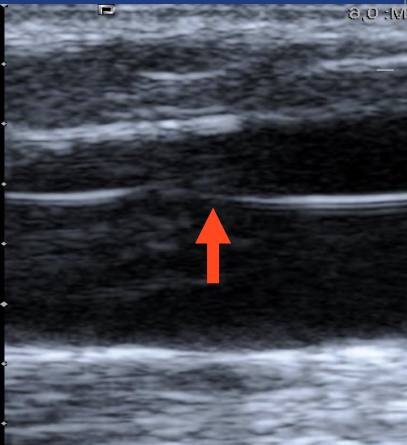
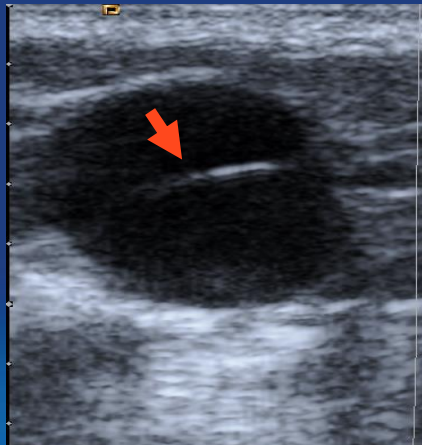
- Lumen & wall: normal



# Wall and Valve lesion leading to stenosis



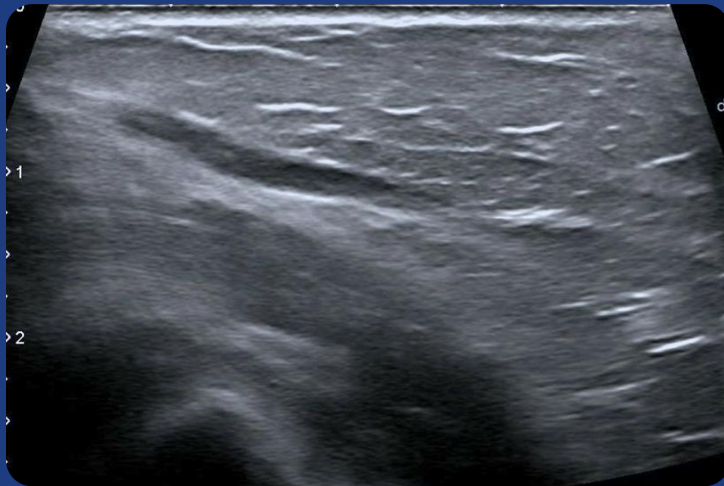
Valve Sclerosis  
Wall thickness  
Tortuosity



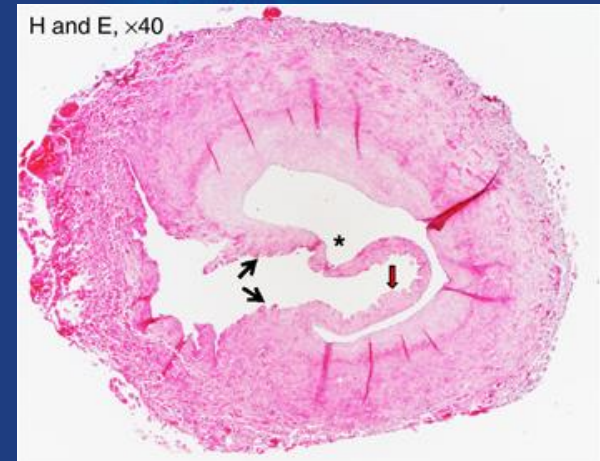
ARM BASILIC VEIN



# Valve leaflet synechia



Median root of Basilic Vein 2,5 mm ⊗

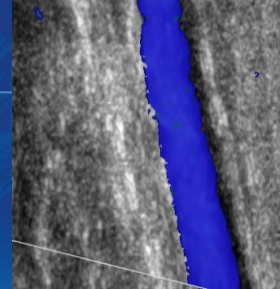
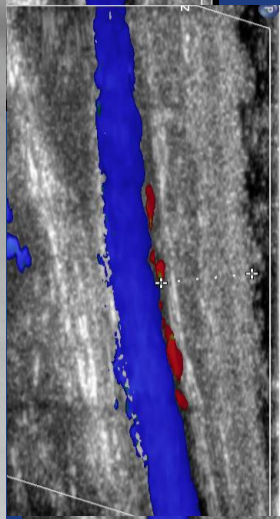
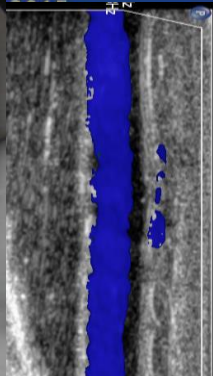
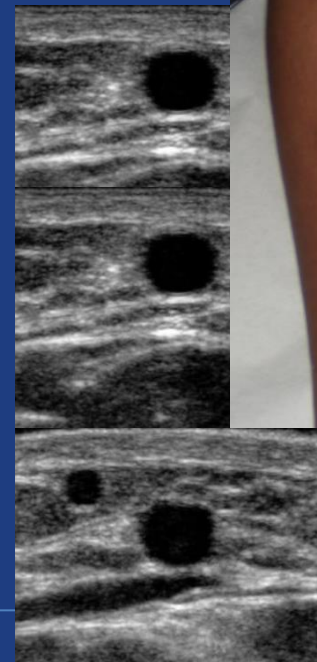
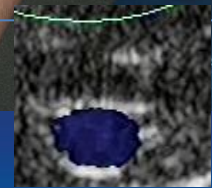
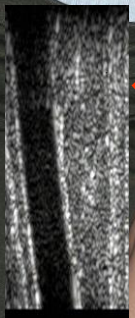
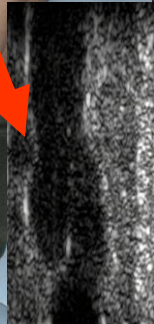
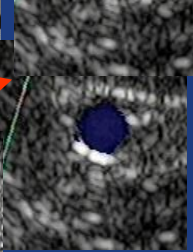
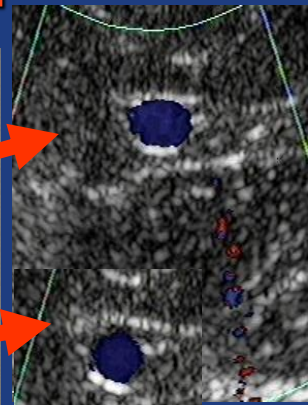


# US overcomes the limitations of clinical examination

# OBESE PATIENT

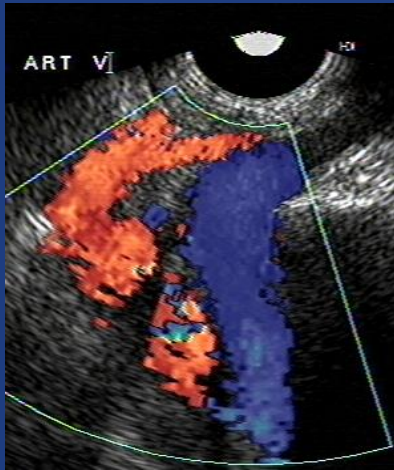
# IN LIPOSCLEROSIS

## IN FAT TISSUE LOST



Preoperative US scanning increases options for AVE  
by identifying veins that are not clinically assessable  
Successful rate similar in obese and non obese



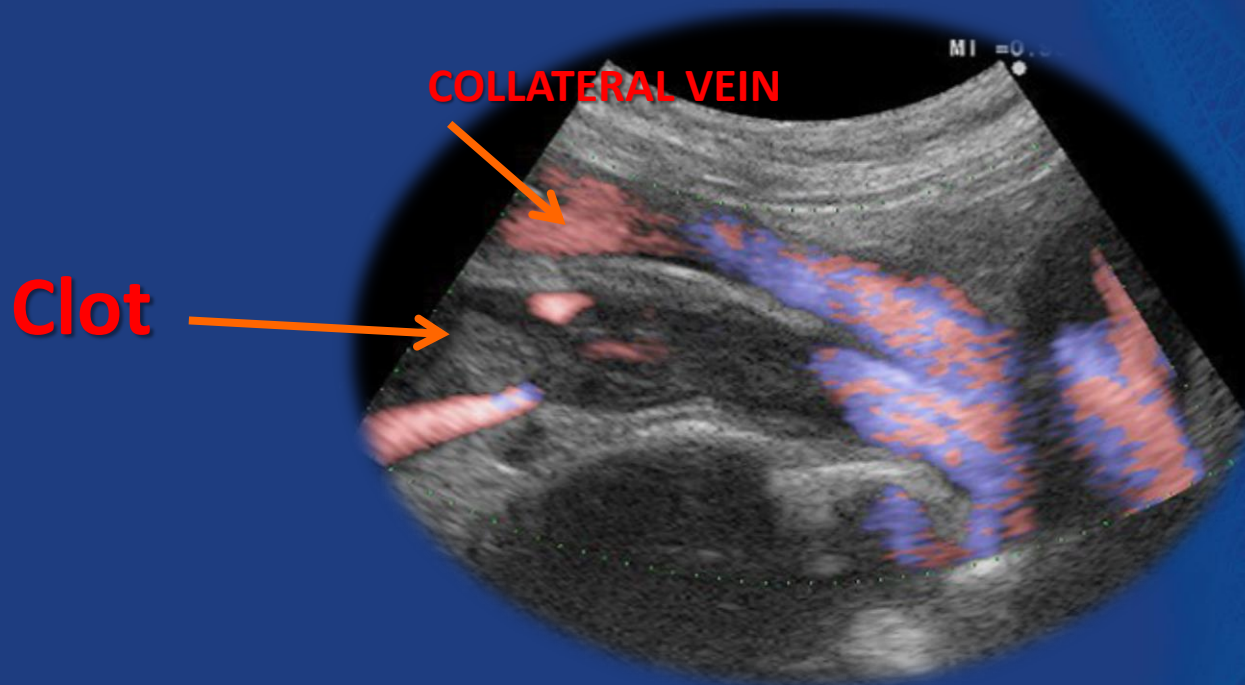


# CENTRAL VEINS

## Venography/US

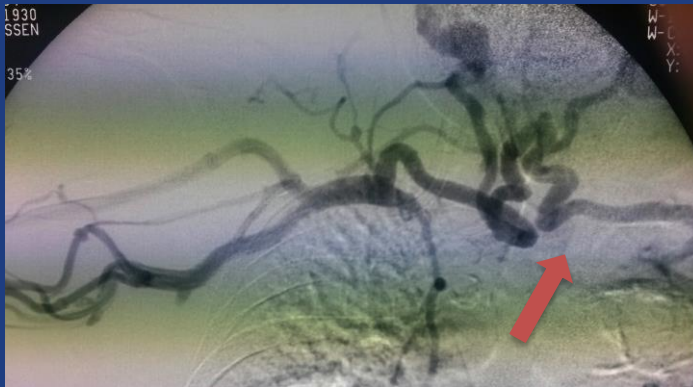
- More accurate in identifying a mild central vein stenosis  
but
- Cannot predict how it will evolve after angioaccess creation  
thus
- Could argue against AVF creation that would have been  
well tolerated

# Thight SCV Stenosis



Stenosis secondary to sc catheter placement

# Occlusion of TVBD



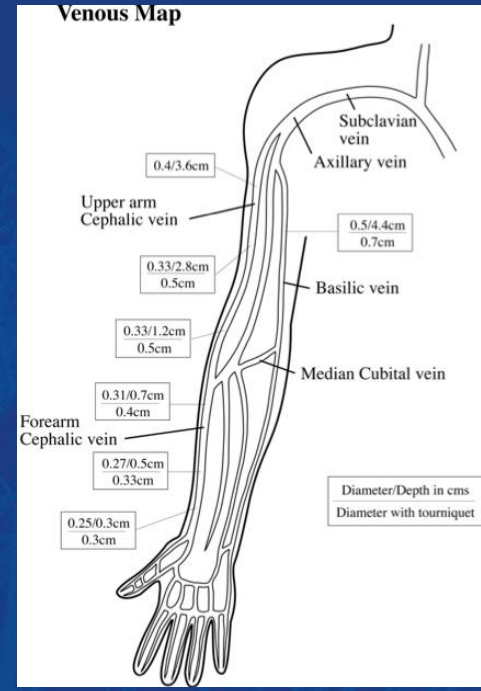
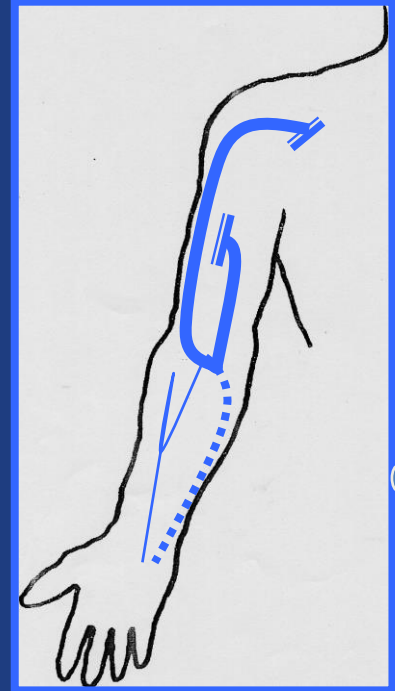
Active collaterality


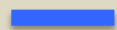
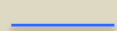
## Significant stenosis of central veins

- active side branches and flow reversal in the internal jugular vein
- disappearance of variations of flow and of vessels size with respiration
- combined with dilatation upstream.



# VENOUS MAPPING SKIN MARKAGE



-  occlusion
-  normal
-  fibrous



# CONCLUSION

**Despite some limitations preventing explorations of CV  
US screening is a highly valuable tool in :**

- **Elderly patients**
- **Children**
- **Diabetic patients**
- **Obese patient**
- **Patients with a history of previous AVF**

# US/VENOGRAPHY



- WHY DO SIMPLE WHY WHEN YOU CAN DO COMPLICATED

# Last but not Least

COST EFFECTIVENESS OF US :70 E  
OUTPERFORM  
VENOGRAPHY:1000 E



WHY DO LOW COST WHEN YOU CAN DO EXPENSIVE