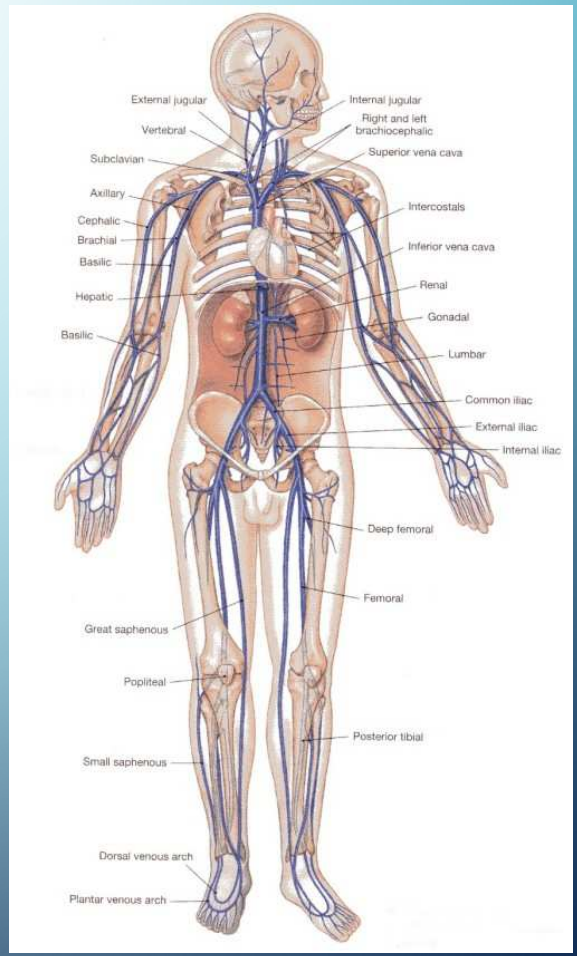
ULTRASOUND VENOGRAPHY

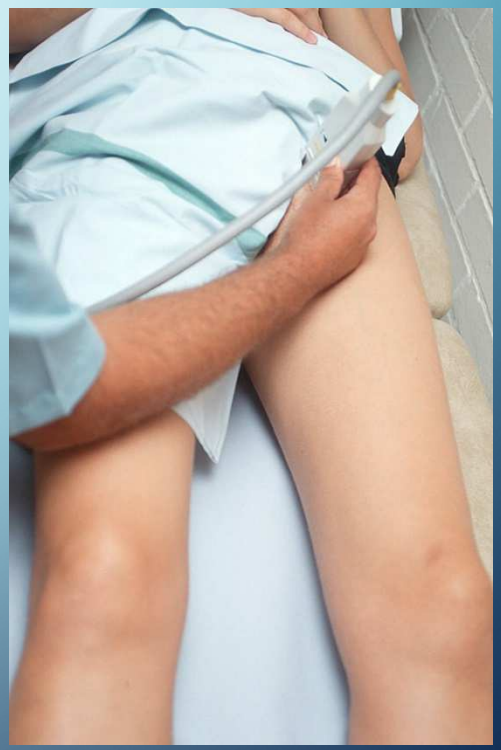
SCAN PROTOCOL

- Linear array transducer for thigh and calf veins
  - 5MHz-9MHz
- Curvilinear transducer for pelvic and abdominal veins
  - 2MHz-6MHz



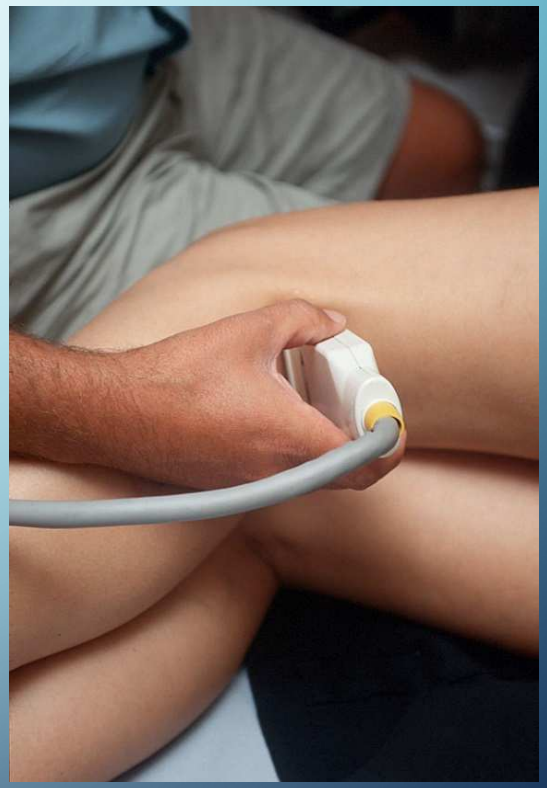
SCAN PROTOCOL
ILIO-FEMORAL SEGMENT

- Patient supine - trunk slightly elevated
- Common femoral vein - Valsalva response
  - abnormal : scan iliac veins
  - normal : proceed distally
- Femoral veins
  - scan both in longitudinal and transverse planes
  - look for complete colour “fill-in” of the vessels
  - compression (look out for incompressible segments!)



SCAN PROTOCOL POPLITEAL SEGMENT

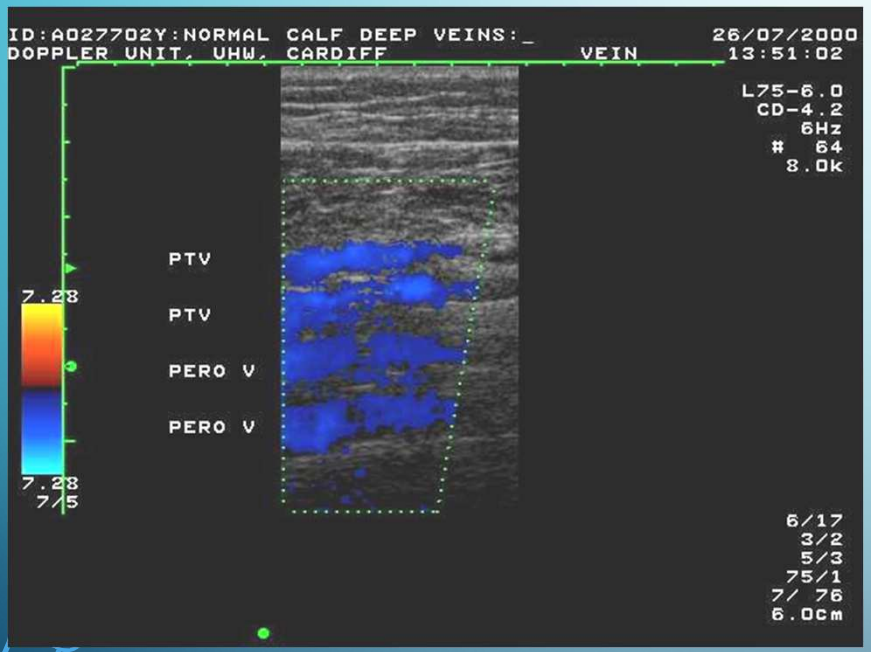
- Lateral decubitus with slight knee bend
  - scan both in longitudinal and transverse planes
  - look for complete colour “fill-in”
  - compression

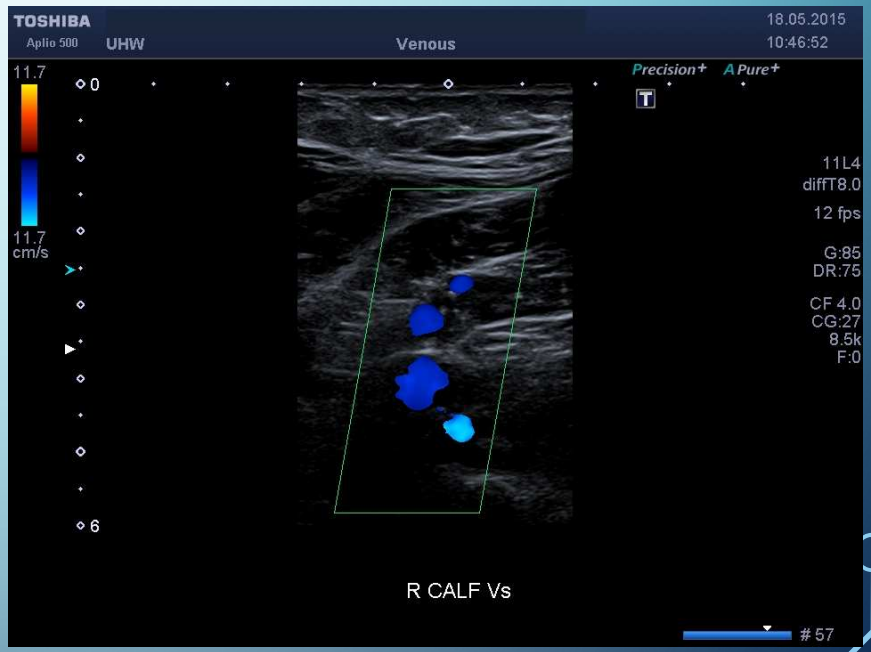


SCAN PROTOCOL THE CALF VEINS

- Most easily visualised with leg dependant
- Scan in sitting position
- Starting in mid calf scan proximally and distally
- Scan predominantly in longitudinal plane but transverse can also be useful

THE CALF VEINS



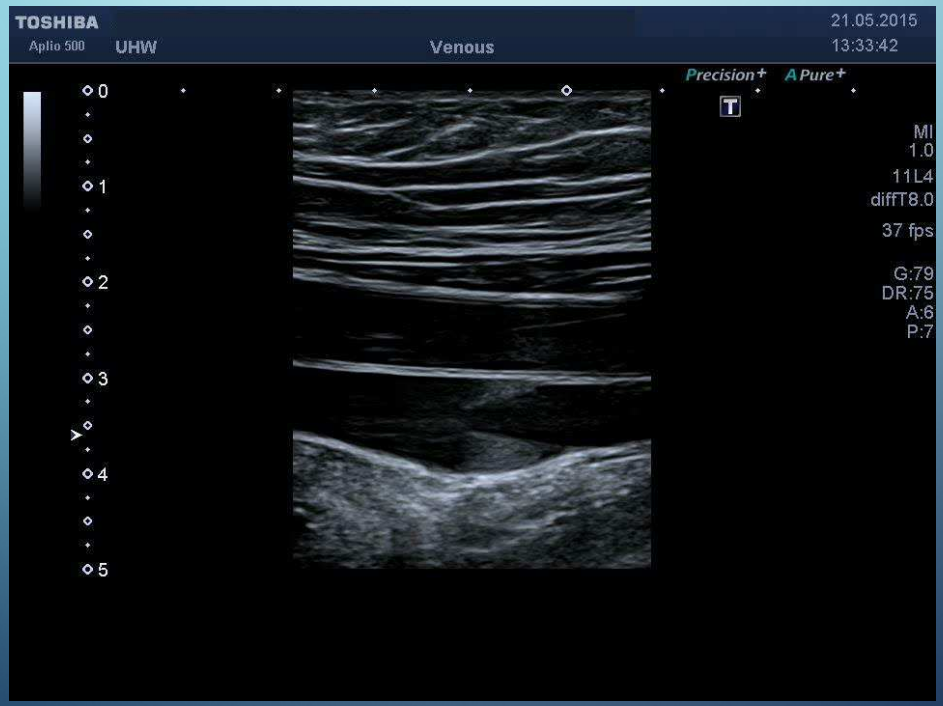


SCANNING TIPS

- Positive anatomical identification
  - Deep veins
    - lie deep to the facia between the muscle fascia
    - accompanied by an artery and are paired distal to the knee
  - Muscular veins
    - lie within the muscle and do not run in the facial planes
    - accompanied by a small artery and are paired
  - Superficial veins
    - usually lie between the deep and superficial fascia
    - not accompanied by an artery
  - Perforating veins
    - connect deep to superficial system
    - do not run in the fascial planes

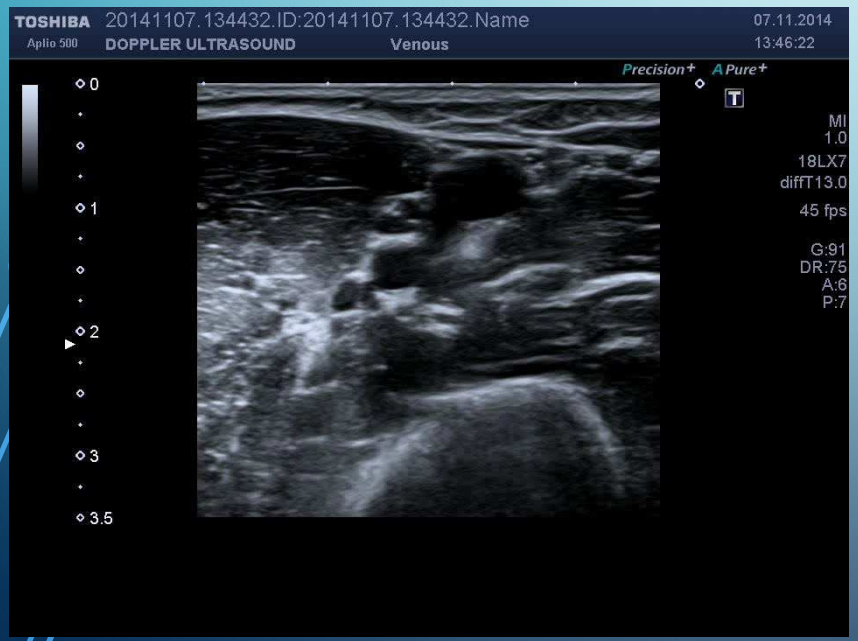
NORMAL VEINS
B-MODE APPEARANCE

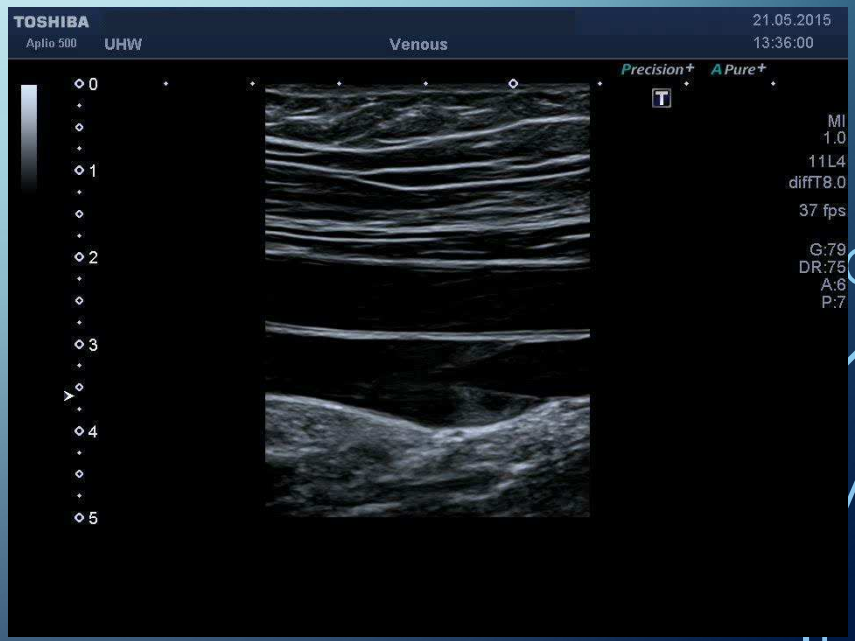
- Vein lumen is echo free
- Interior surface of the vein wall is smooth
- The wall itself should be thin with no structure
- Valves when seen should be free to move



NORMAL VEINS COMPRESSIBILITY

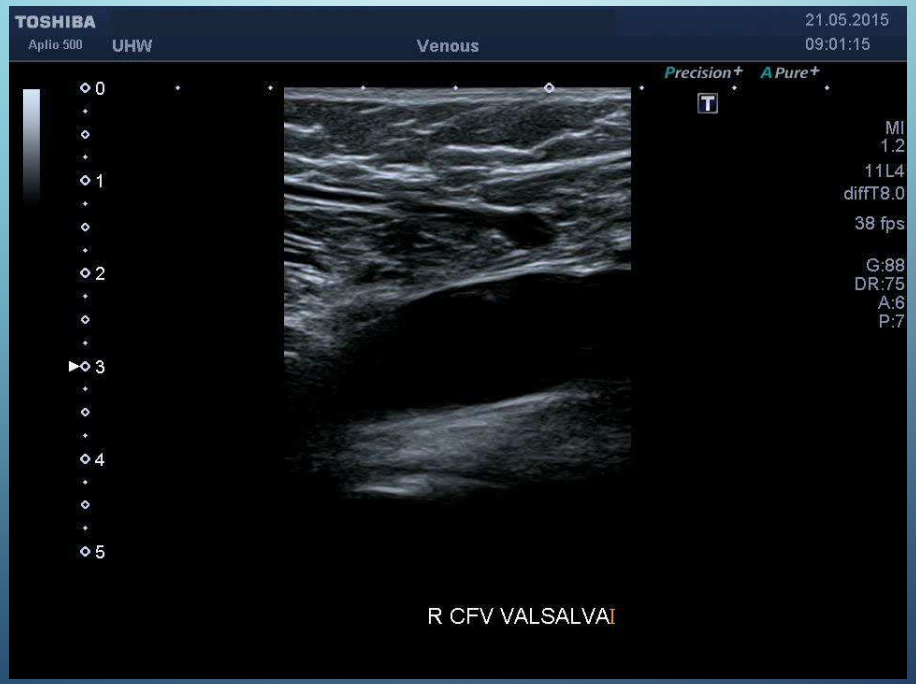
- Uniform compressibility
- Complete apposition of anterior & posterior wall
- Minimal probe pressure
- Note - Incompressible segments





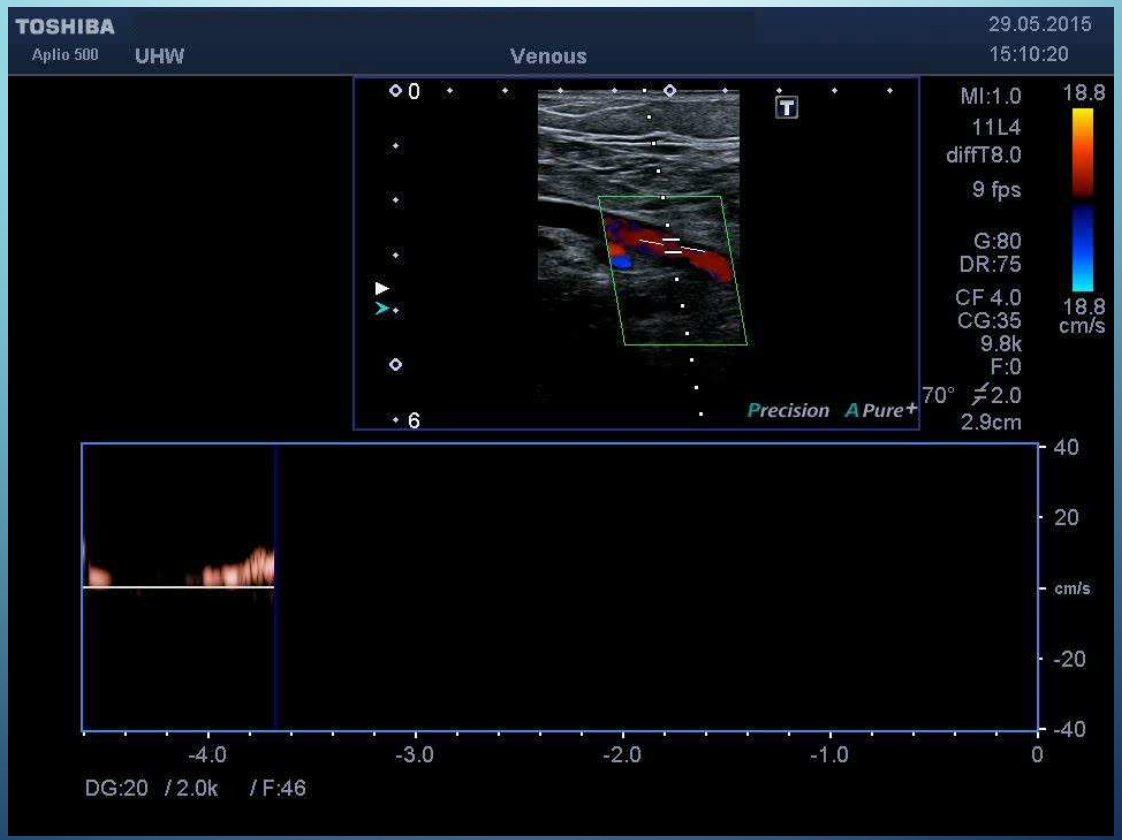
NORMAL VEINS RESPIRITORY CHANGES

- Diameter of large veins increase with deep inspiration or valsalva
- Venous system proximal to point of examination is patent



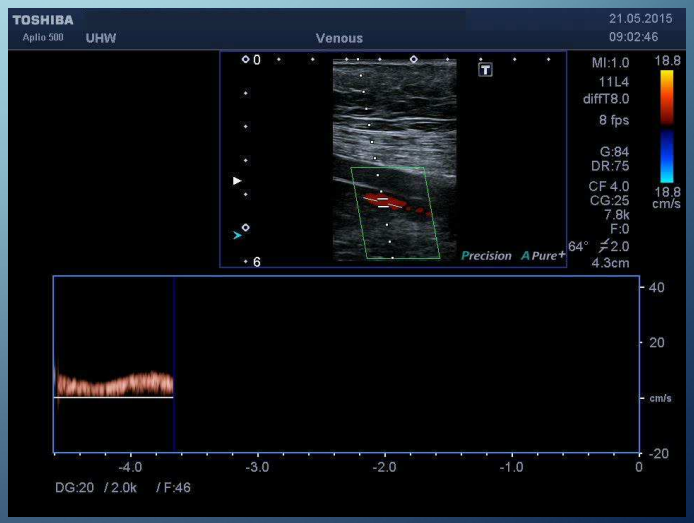
NORMAL VEINS FLOW PARAMETERS

- Spontaneous flow with respiration
- Phasic flow with respiration



NORMAL VEINS AUGMENTATION

- Manual compression of the extremity distal to site of examination should increase venous flow
- Confirms patency between examination and compression site
- Absent or delayed & weak response suggest a substantial obstruction distal to examination site
- Partial obstruction or minor clot may not alter the augmentation response



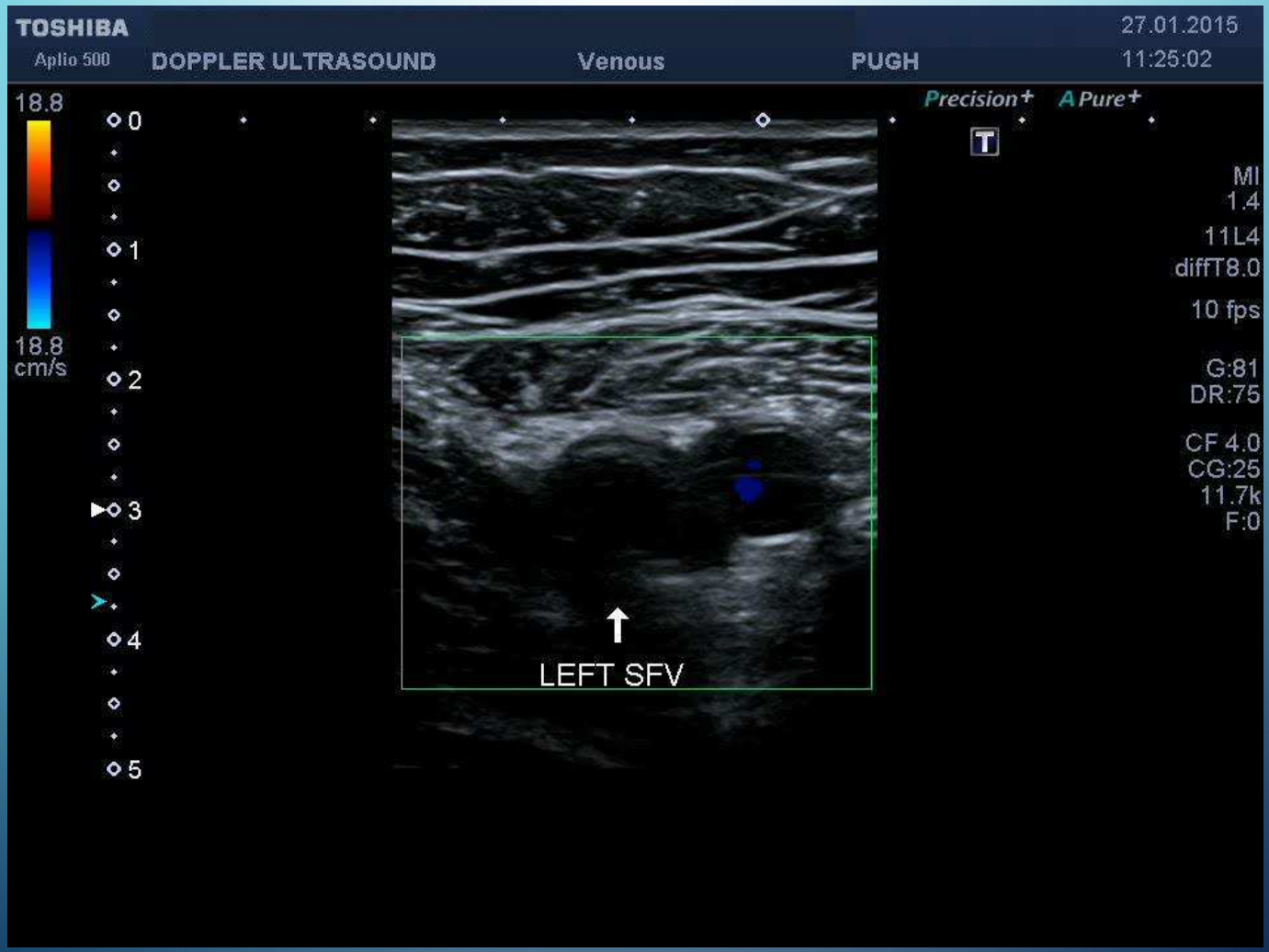
NORMAL VEINS
VALSALVA MANOEUVRE

- Valsalva should result in abrupt cessation in flow
- Demonstrates the patency of the venous system from the point of examination to the thorax
- Useful in documenting the patency of the iliac veins
- Abnormal response to valsalva occurs only in *MAJOR* obstructions

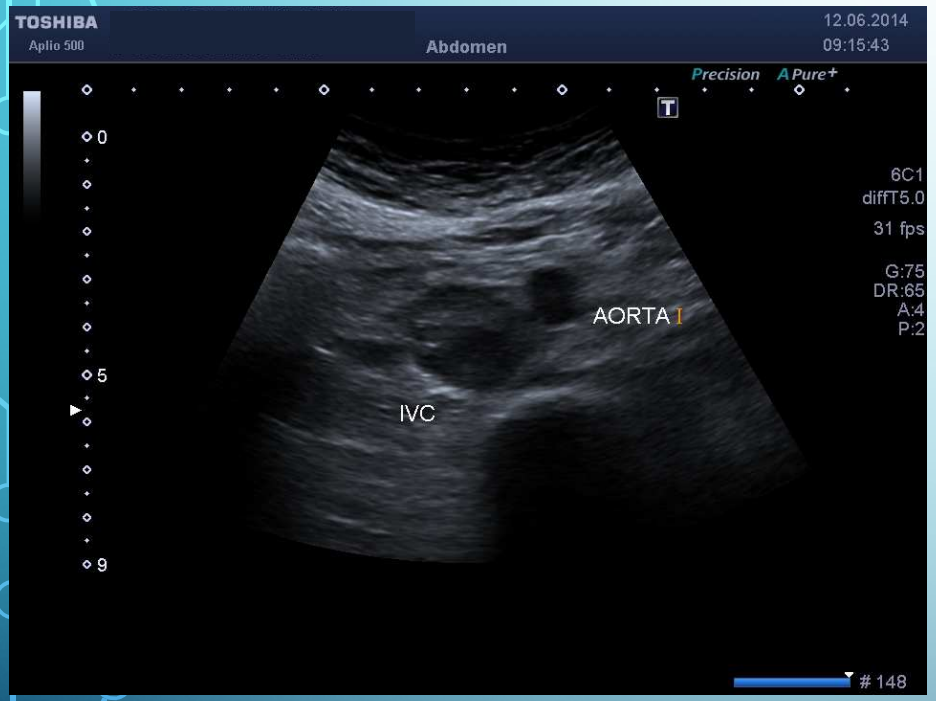
RECENT (ACUTE) THROMBUS

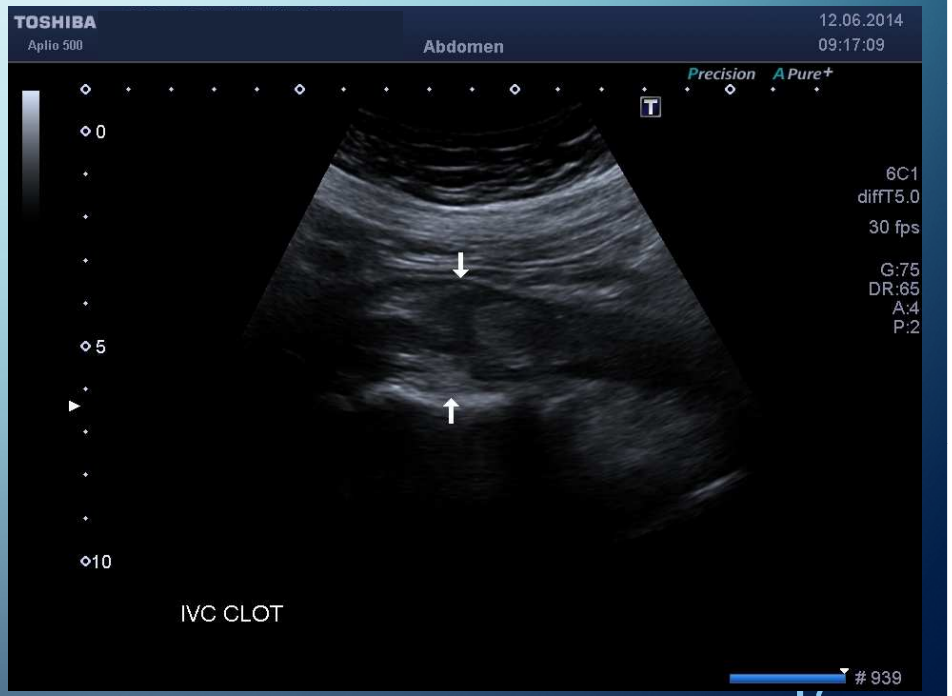
- Low echogenicity intraluminal material producing flow and colour void
  - very recent clot may be almost completely anechoic
- Venous distention
  - most important criterion of acute clot
- Loss of compressibility
  - not so important with CDI

ACUTE DVT

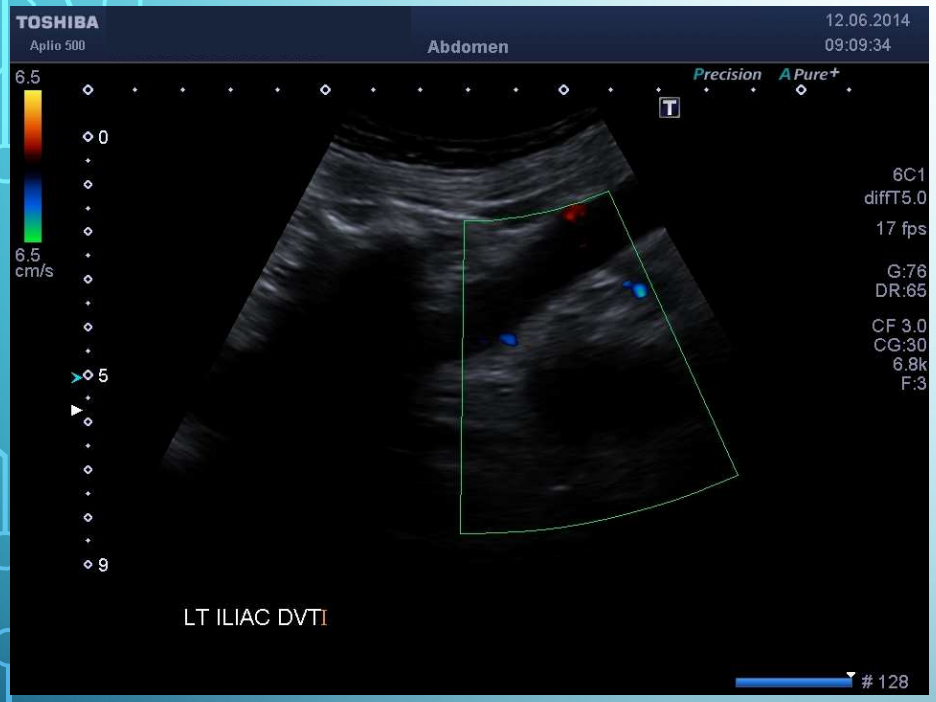

TOSHIBA
Aplio 500
DOPPLER ULTRASOUND
Venous
PUGH
27.01.2015
11:25:02
18.8
18.8
cm/s
0
1
2
3
4
5
Precision+
A Pure+
T
MI
1.4
11L4
diffT8.0
10 fps
G:81
DR:75
CF 4.0
CG:25
11.7k
F:0
LEFT SFV

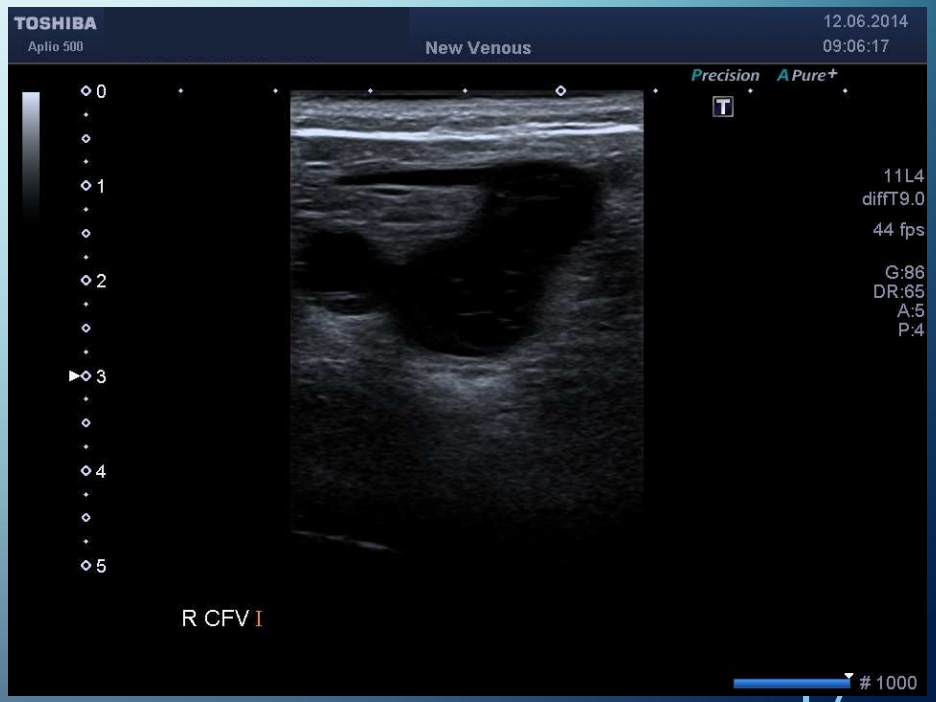
ACUTE DVT


TOSHIBA
Aplio 500
Abdomen
12.06.2014
09:15:43
Precision
A Pure+
6C1
diffT5.0
31 fps
G:75
DR:65
A:4
P:2
AORTA
IVC
148

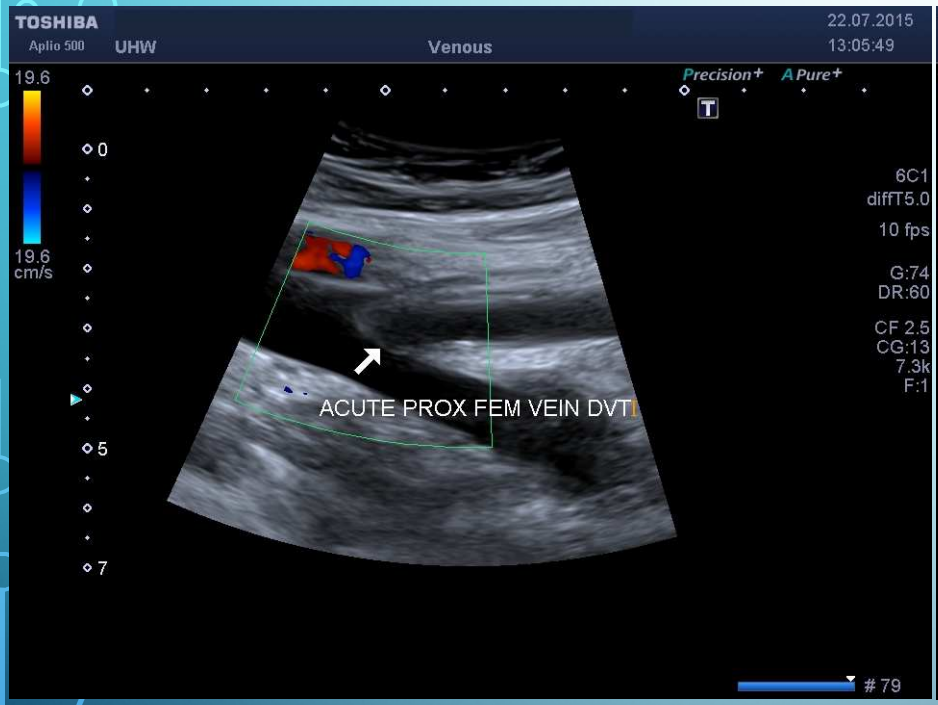

TOSHIBA
Aplio 500
Abdomen
12.06.2014
09:17:09
Precision
A Pure+
6C1
diffT5.0
30 fps
G:75
DR:65
A:4
P:2
IVC CLOT
939

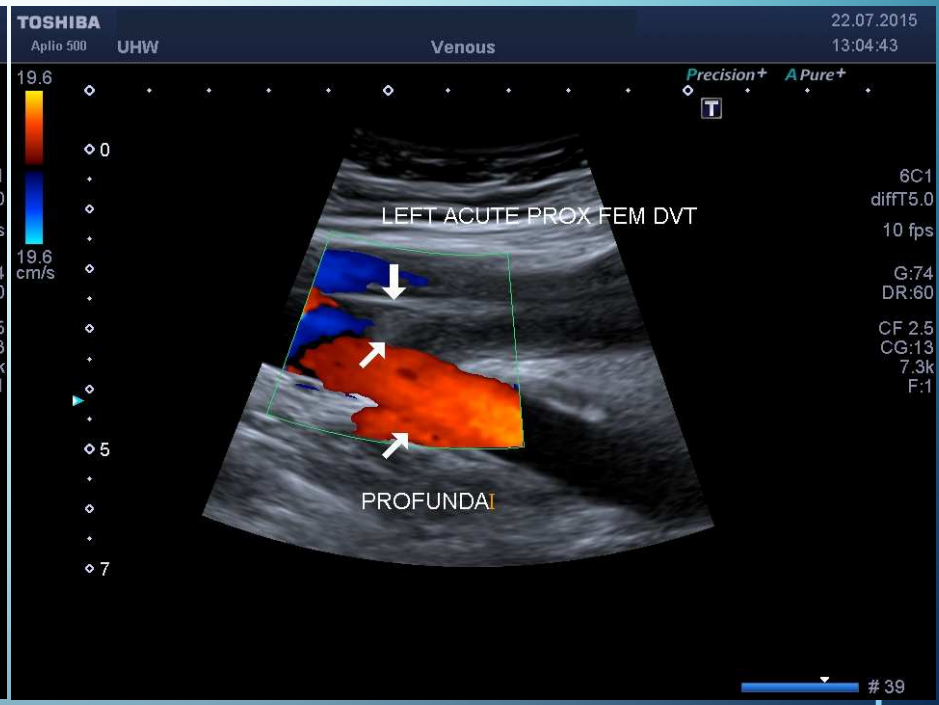
ACUTE DVT


TOSHIBA
Aplio 500
Abdomen
12.06.2014
09:09:34
Precision
A Pure+
6.5
6.5
cm/s
0
5
9
6C1
diffT5.0
17 fps
G:76
DR:65
CF 3.0
CG:30
6.8k
F:3
LT ILIAC DVTI
128

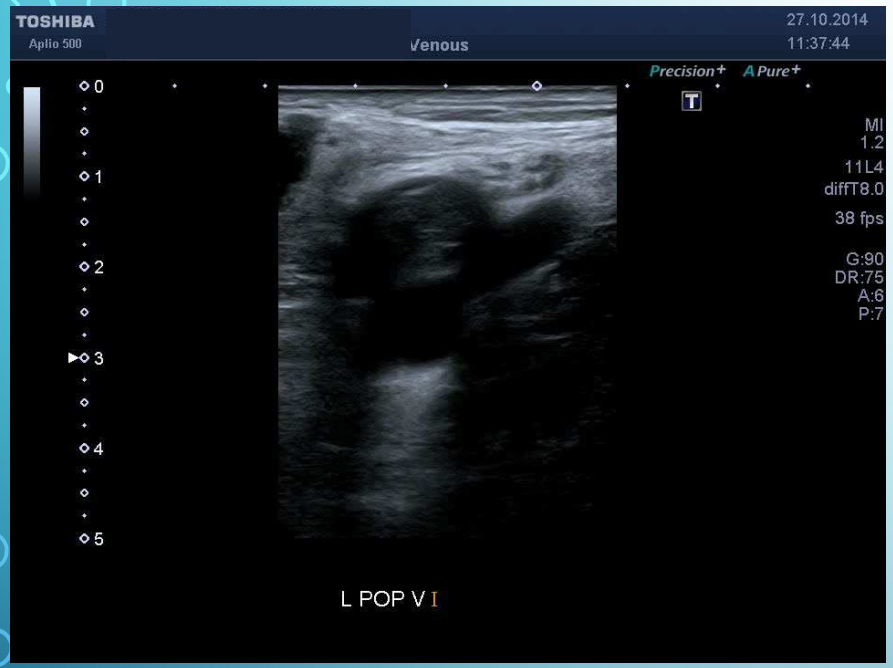

TOSHIBA
Aplio 500
New Venous
12.06.2014
09:06:17
Precision
A Pure+
0
1
2
3
4
5
11L4
diffT9.0
44 fps
G:86
DR:65
A:5
P:4
R CFV I
1000

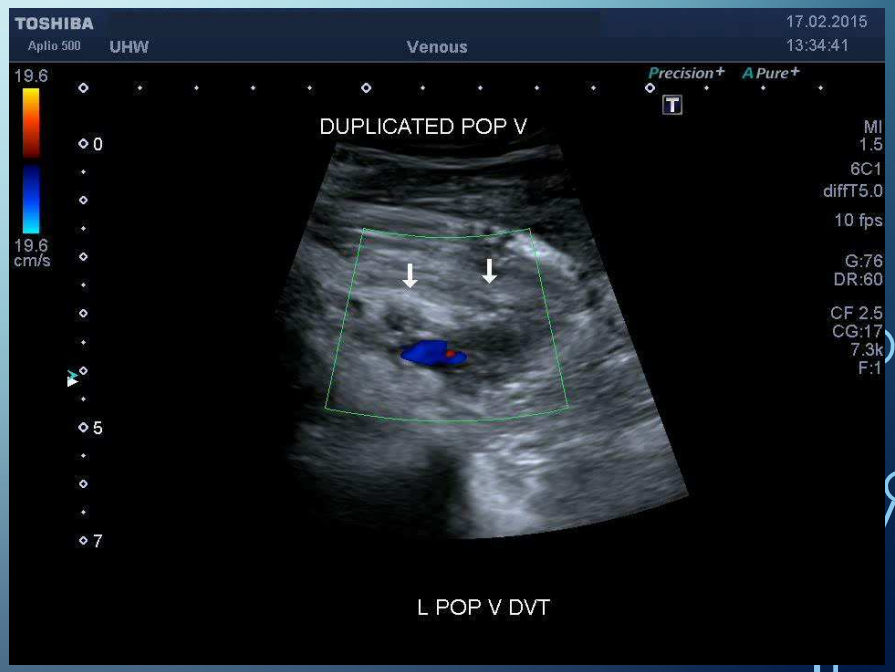
ACUTE DVT


TOSHIBA
Aplio 500
UHW
Venous
22.07.2015
13:05:49
Precision+
A Pure+
19.6
19.6
cm/s
6C1
diffT5.0
10 fps
G:74
DR:60
CF 2.5
CG:13
7.3k
F:1
ACUTE PROX FEM VEIN DVT
79


TOSHIBA
Aplio 500
UHW
Venous
22.07.2015
13:04:43
Precision+
A Pure+
19.6
19.6
cm/s
6C1
diffT5.0
10 fps
G:74
DR:60
CF 2.5
CG:13
7.3k
F:1
LEFT ACUTE PROX FEM DVT
PROFUNDAI
39

ACUTE DVT


TOSHIBA
Aplio 500
Venous
27.10.2014
11:37:44
Precision+
A Pure+
MI
1.2
11L4
diffT8.0
38 fps
G:90
DR:75
A:6
P:7
L POP V I


TOSHIBA
Aplio 500
UHW
Venous
17.02.2015
13:34:41
19.6
19.6
cm/s
Precision+
A Pure+
DUPLICATED POP V
MI
1.5
6C1
diffT5.0
10 fps
G:76
DR:60
CF 2.5
CG:17
7.3k
F:1
L POP V DVT

ACUTE DVT

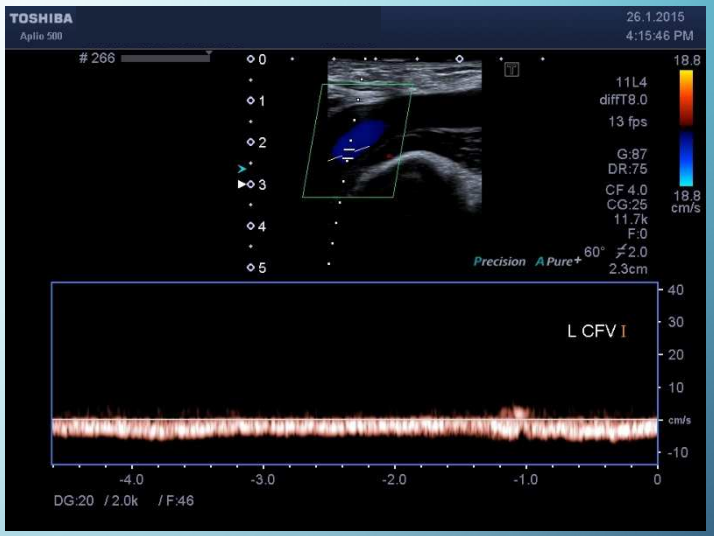

TOSHIBA
Aplio 500
UHW
Venous
09.03.2015
09:51:10
8.3
0
8.3
cm/s
6
Precision+
A Pure+
T
MI
1.0
11L4
diffT8.0
11 fps
G:81
DR:70
CF 4.0
CG:35
9.5k
F:0
DVT
R CALF Vs

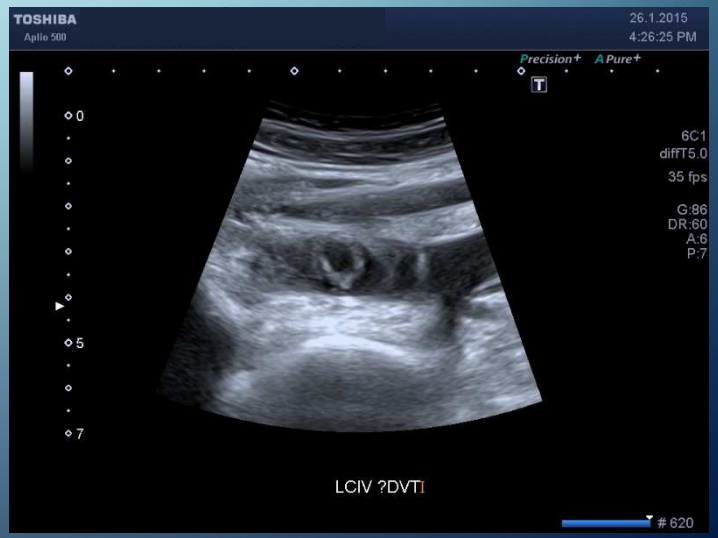
PROBLEMATIC AREAS

- Isolated iliac DVT
- Isolated calf vein DVT
- Duplication of femoral & popliteal veins
- Partially occlusive clot
- Chronic vs. acute DVT

ISOLATED ILIAC DVT

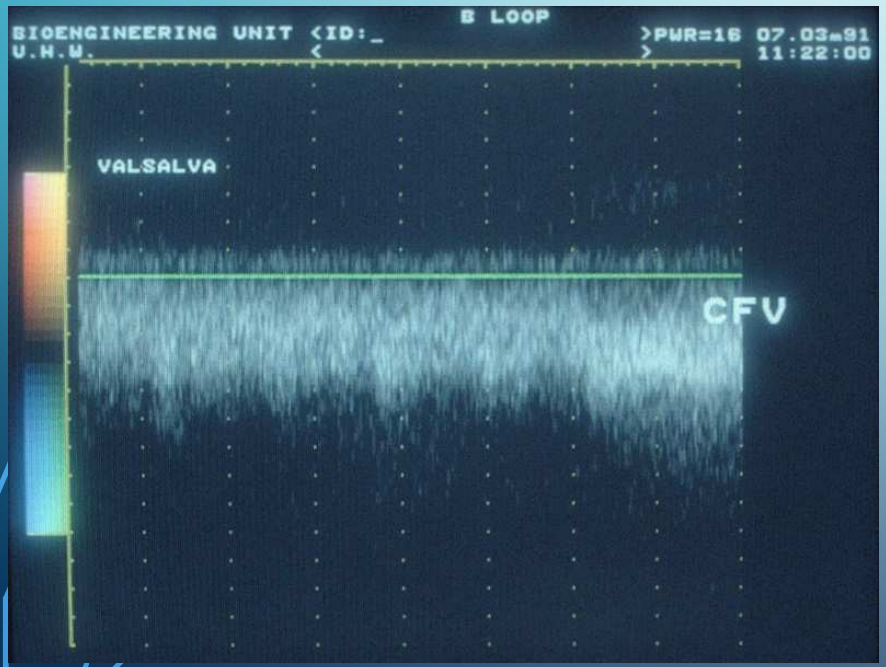
- Isolated iliac DVT occurs in <1% of general DVT population
- High risk groups
  - pregnancy
  - malignancy
  - pelvic surgery

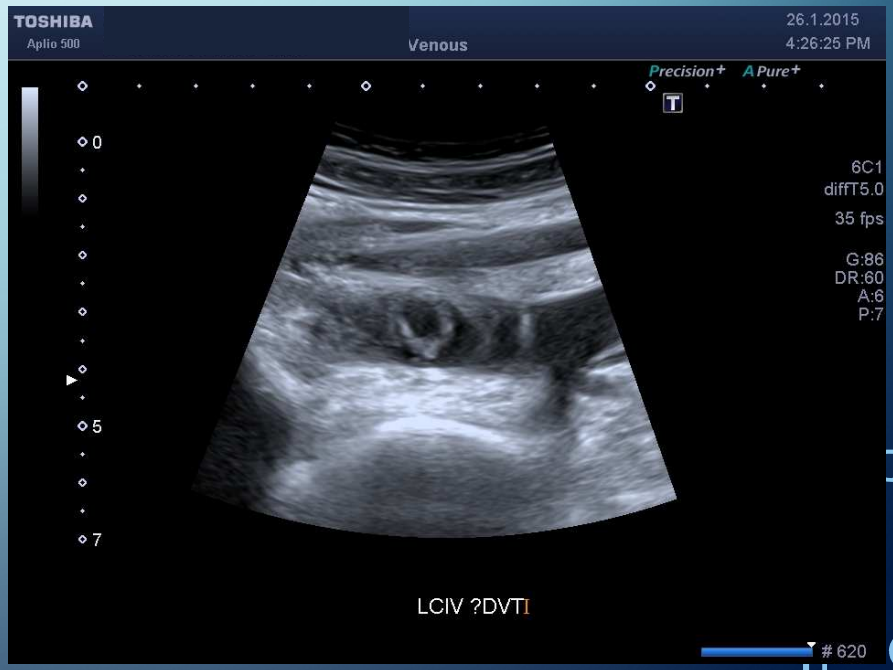




ISOLATED ILIAC DVT

- Indirect assessment
  - flow pattern (phasicity)
  - response to Valsalva
- Direct imaging



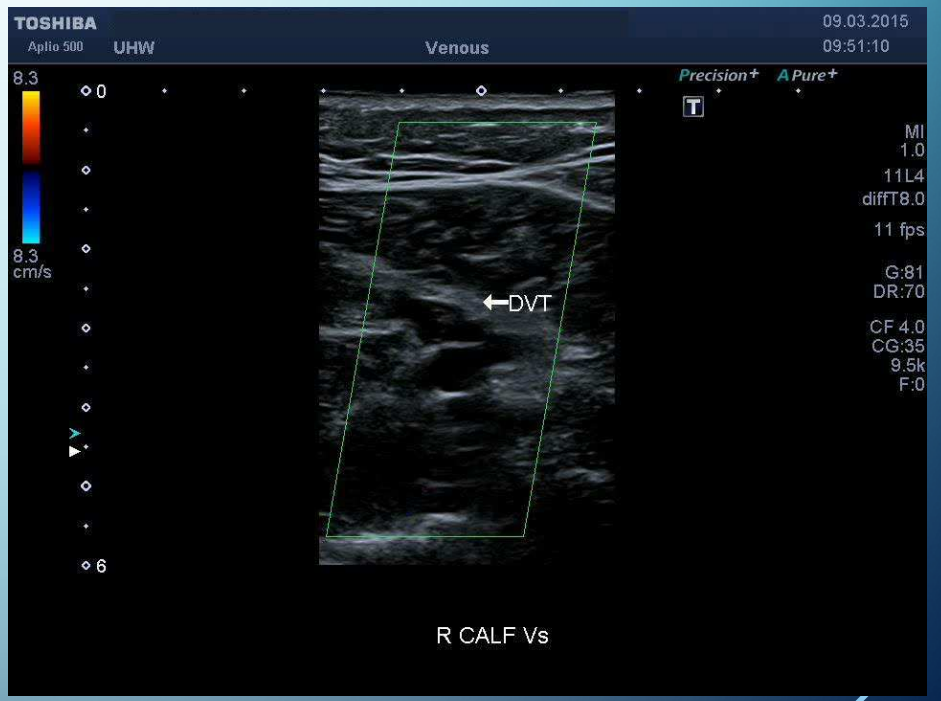


HOW SHOULD WE DIAGNOSE ISOLATED ILIAC DVT?

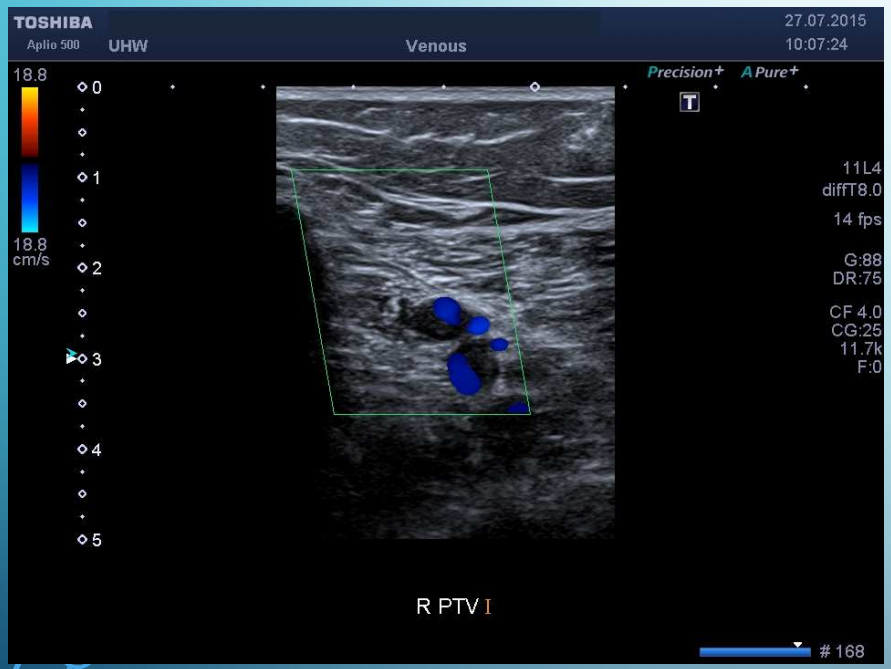
- Look for phasicity of femoral waveform
- Perform a Valsalva manoeuvre if unsure
- Remember
  - indirect assessment suggestive but not definitive
  - spontaneous flow pattern may still persist in the presence of clot - particularly partially occlusive clot
  - can still maintain normal response to valsalva in the presence of clot - again particularly partially occlusive clot
- Iliac veins should be scanned, especially in high risk patients
- Scanning of iliac veins should be possible in majority of cases

ISOLATED CALF VEIN DVT

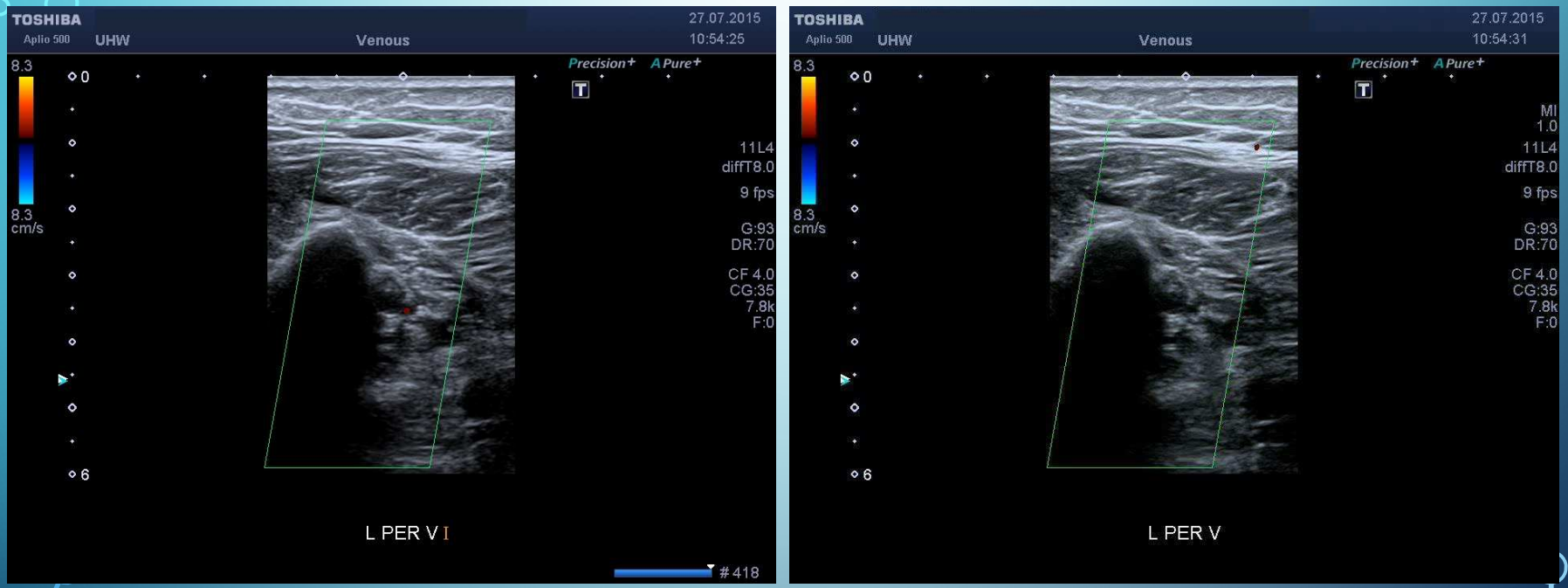
- Isolated calf vein DVT only occurs in 15% of positive DVT studies
- Calf vein DVT important because
  - potential to propagate (~20% of cases within 72hr)
  - potential to embolise and cause PE (low risk)
  - post thrombotic syndrome



ISOLATED CALF VEIN DVT



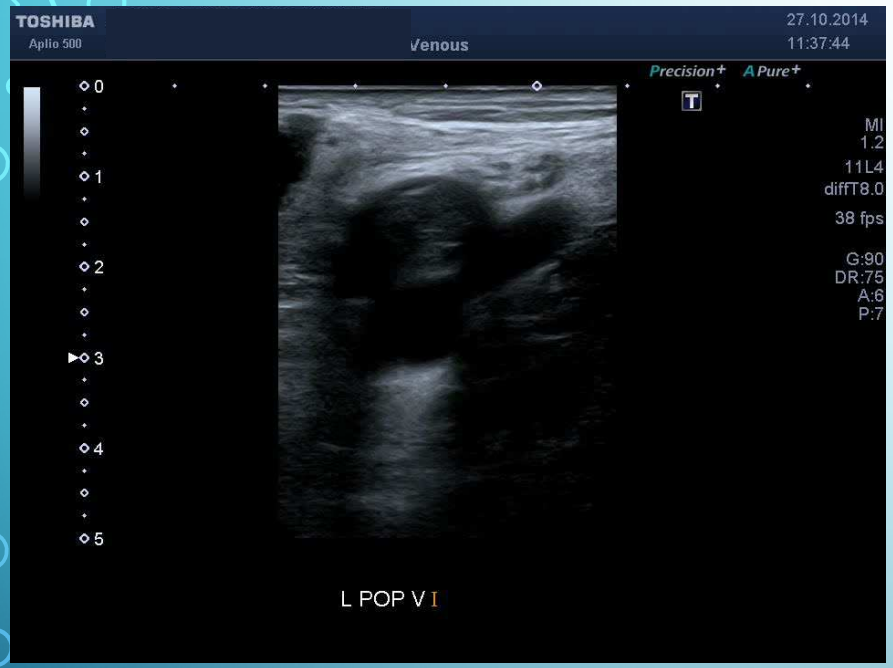
ISOLATED CALF VEIN DVT

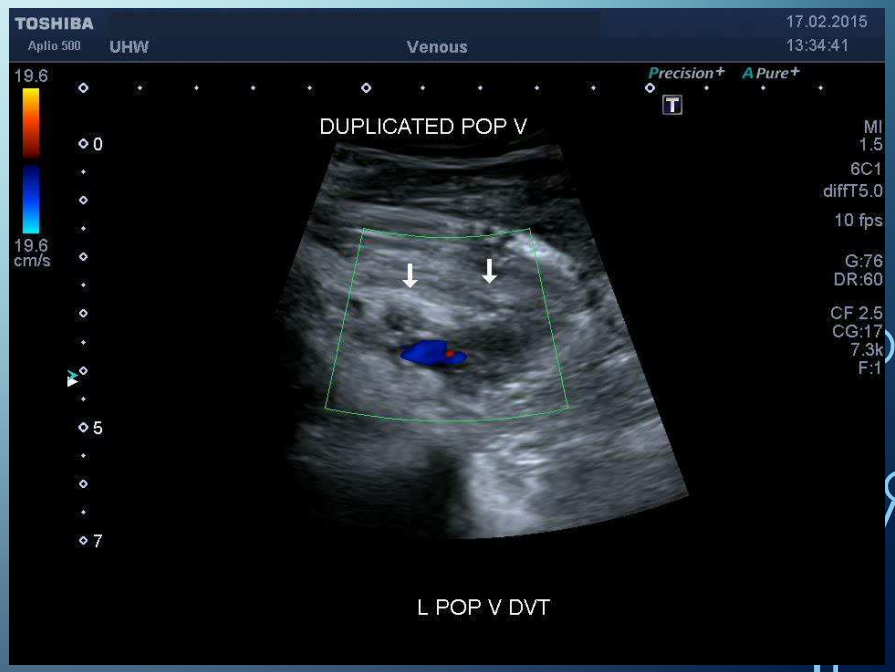


DUPLICATIONS

- Duplication of the femoral vein occurs in ~20% of the population
- Duplication of the popliteal vein higher
- DVT can occur in one or both branches of the vein
- Duplication best seen in transverse plane

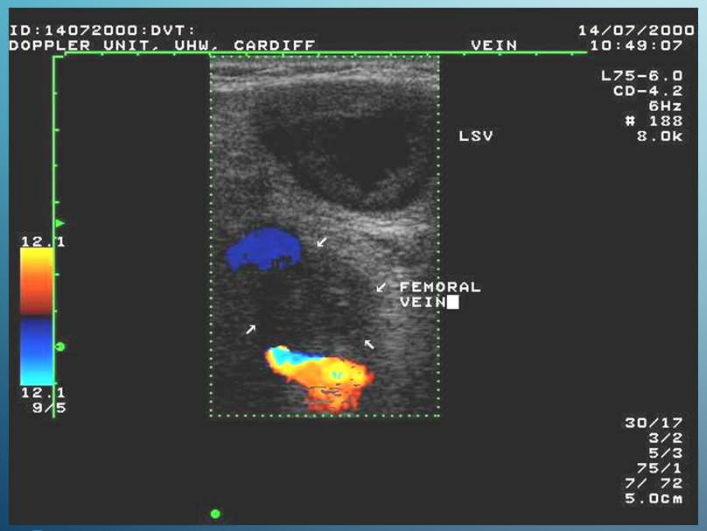
DUPLICATIONS

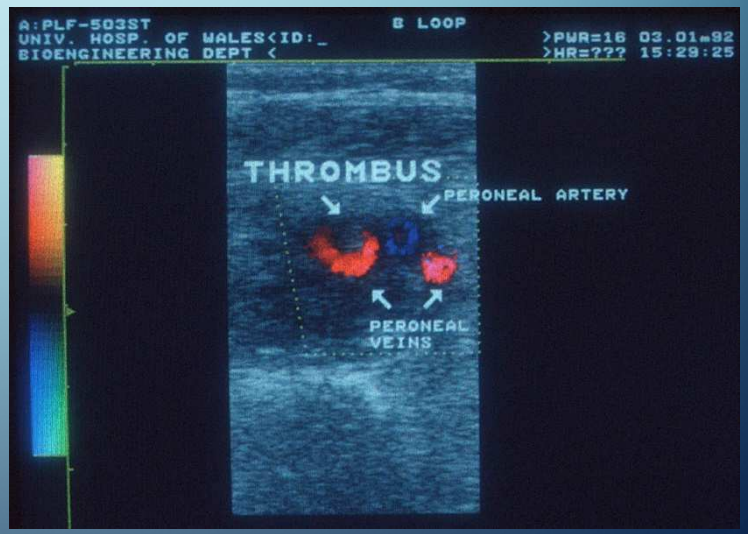




PARTIALLY OCCLUSIVE CLOT

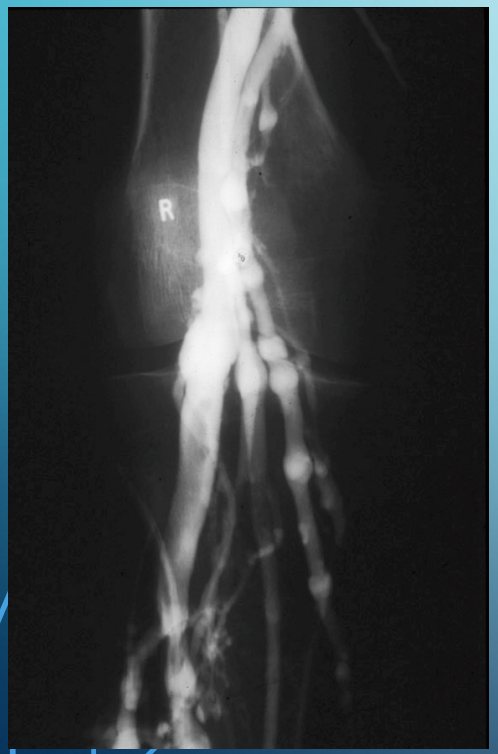
- Isolated partially occlusive DVT is a rare occurrence (high risk cases)
- Problematic because it does not necessarily change the flow pattern
- Best seen in transverse plane and on colour flow

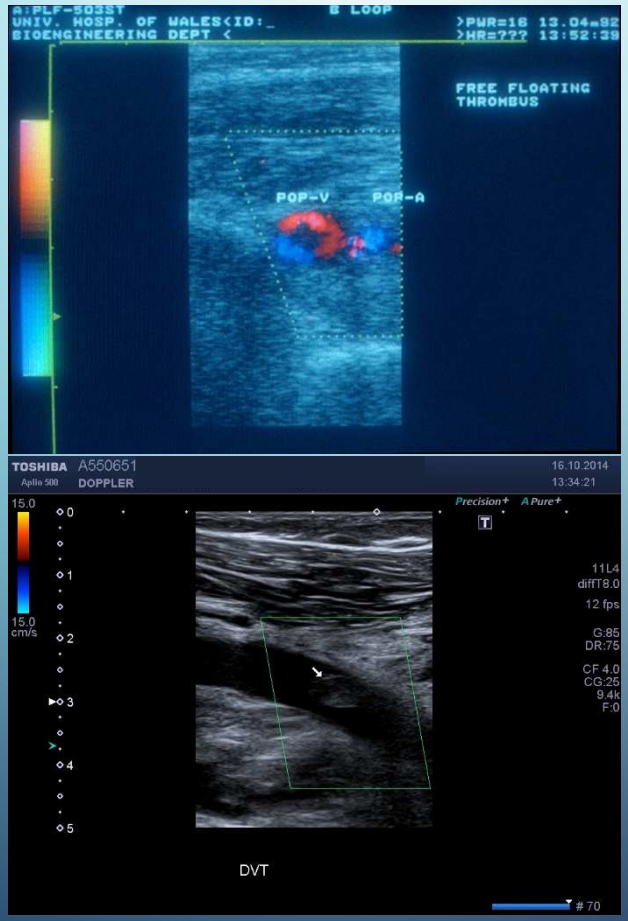




PARTIALLY OCCLUSIVE CLOT

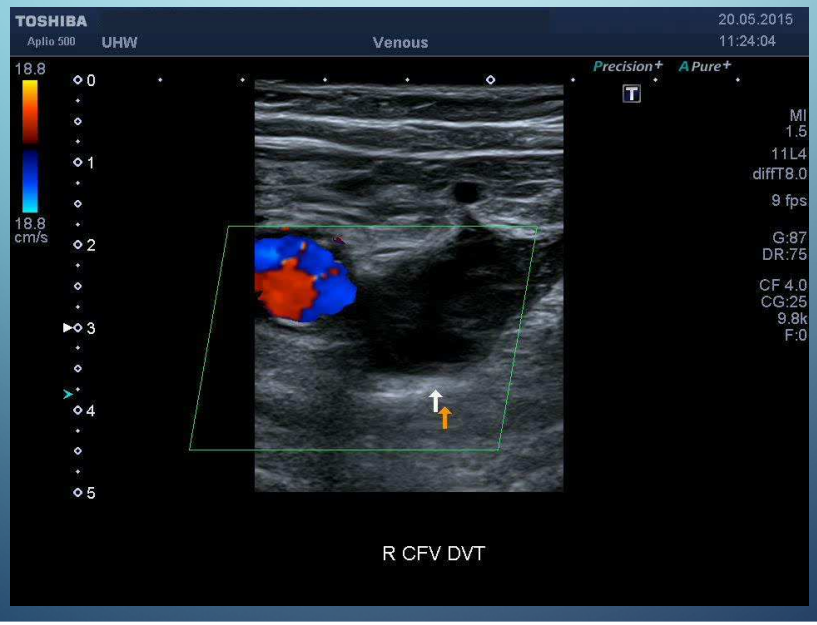
- Adhere to the wall or appear as free floating
- Best demonstrated on colour image





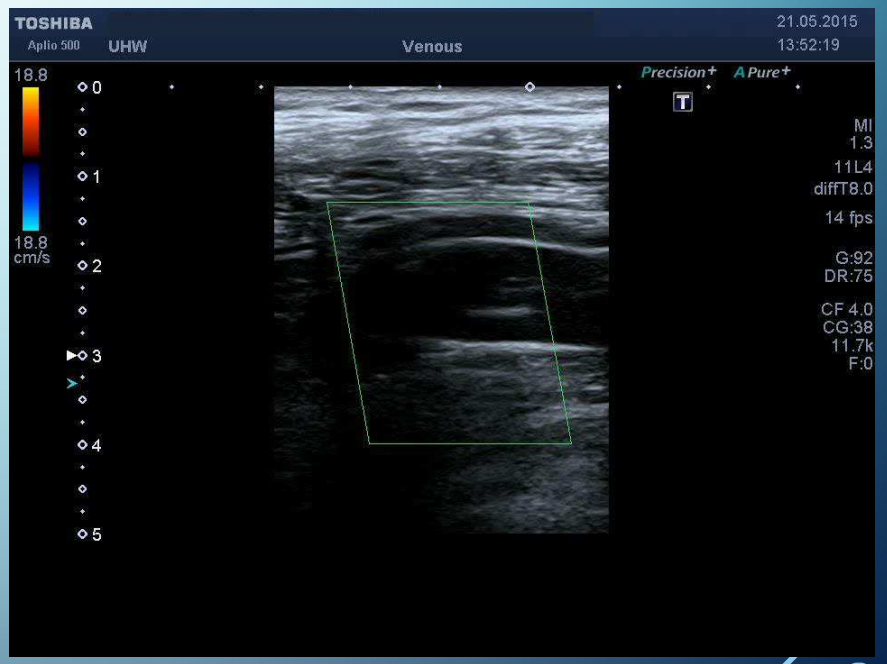
ACUTE VS CHRONIC DVT

- Acute DVT
  - venous distension (probably the most important diagnostic criterion for acute DVT)
  - low echogenicity intraluminal material producing flow and colour void (very recent clot may be completely anechoic)
  - compressibility - non discriminatory



ACUTE VS CHRONIC DVT

- Chronic DVT
  - eccentric linear recanalisation of vessel
  - collateralisation
  - venous reflux
  - “tatty” vessels (vein wall thickening)
  - no venous distention (for occlusive clot)
  - compressibility - non discriminatory
  - more echoic clot (non-specific)

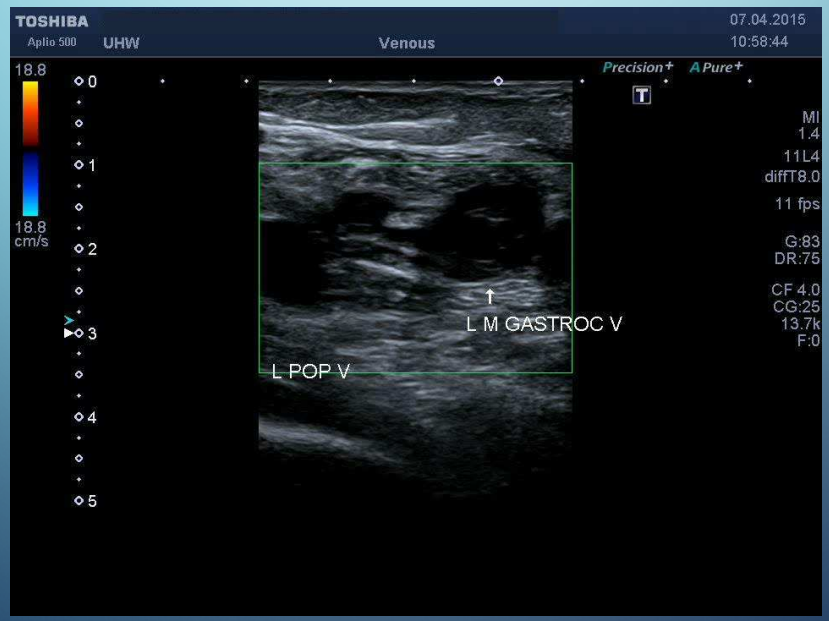


ACUTE VS CHRONIC (SUMMARY)

- Acute
  - venous distention
- Chronic
  - venous reflux
  - eccentric linear recanalisation
  - collateralisation
- Non-specific
  - echogenicity
    - completely echolucent - acute
  - vein wall thickening

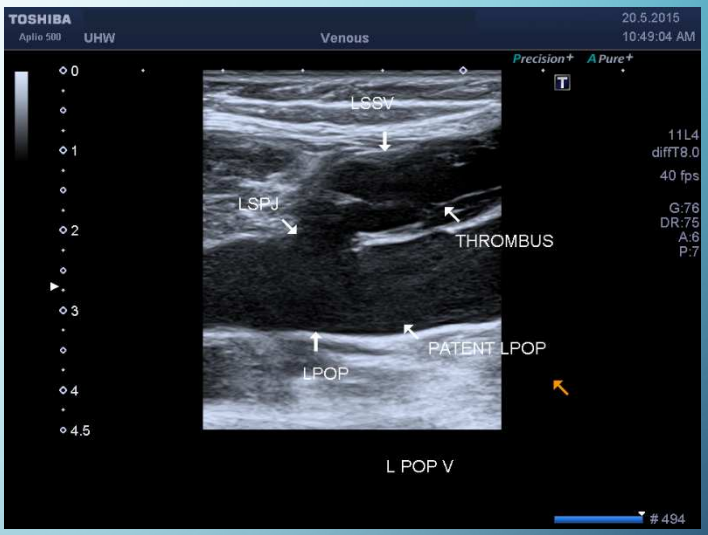
MUSCULAR VEIN THROMBOSIS

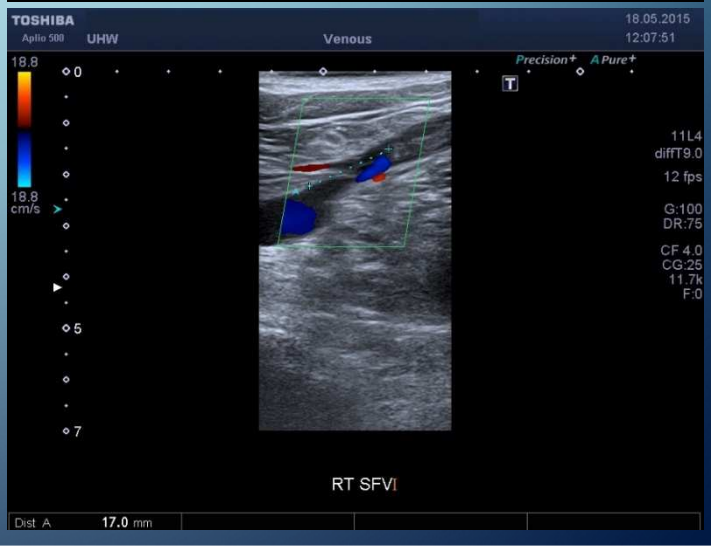
- Thrombosis of in muscular veins not uncommon
  - Gastrocnemius most common
  - Soleal also possible
- Paired with a small artery
  - confused for paired deep veins
  - can propagate into deep system



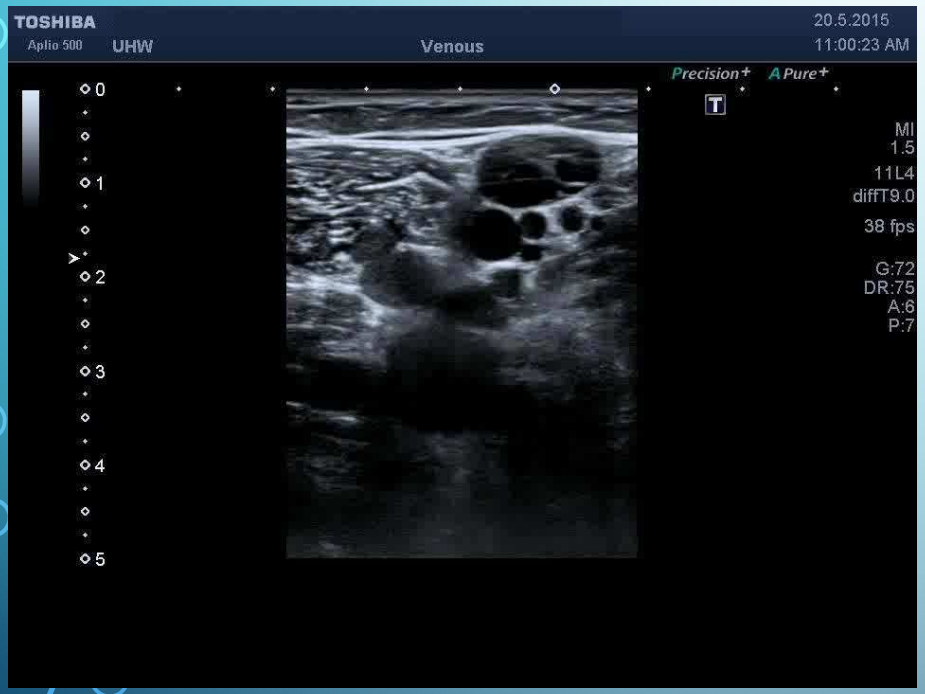
SUPERFICIAL THROMBO-PHLEBITIS

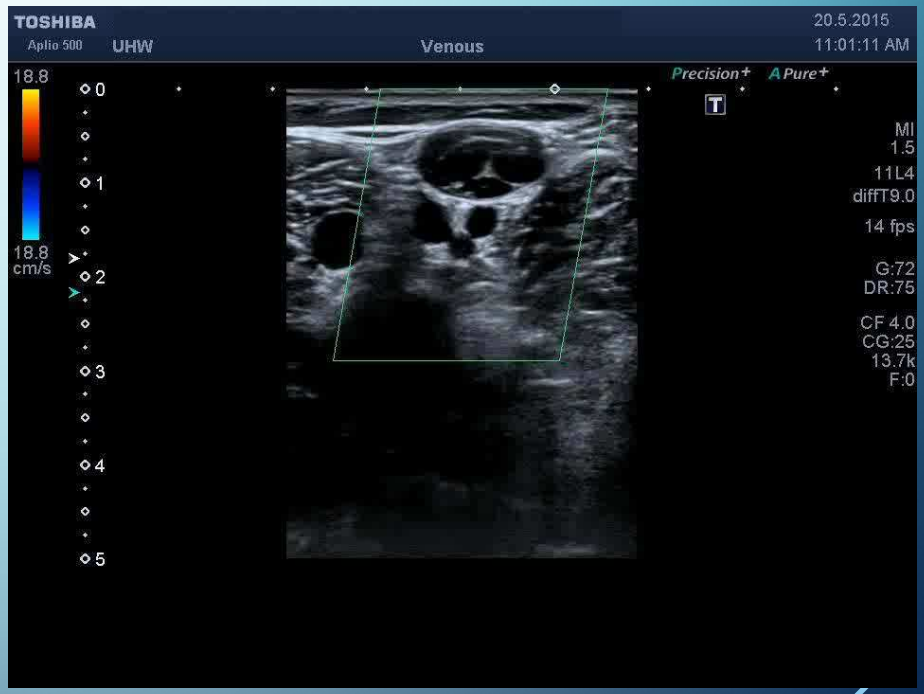
- Superficial thrombo-phlebitis common
  - cause of pain and swelling
  - raises D-dimer value
  - can propagate into deep system



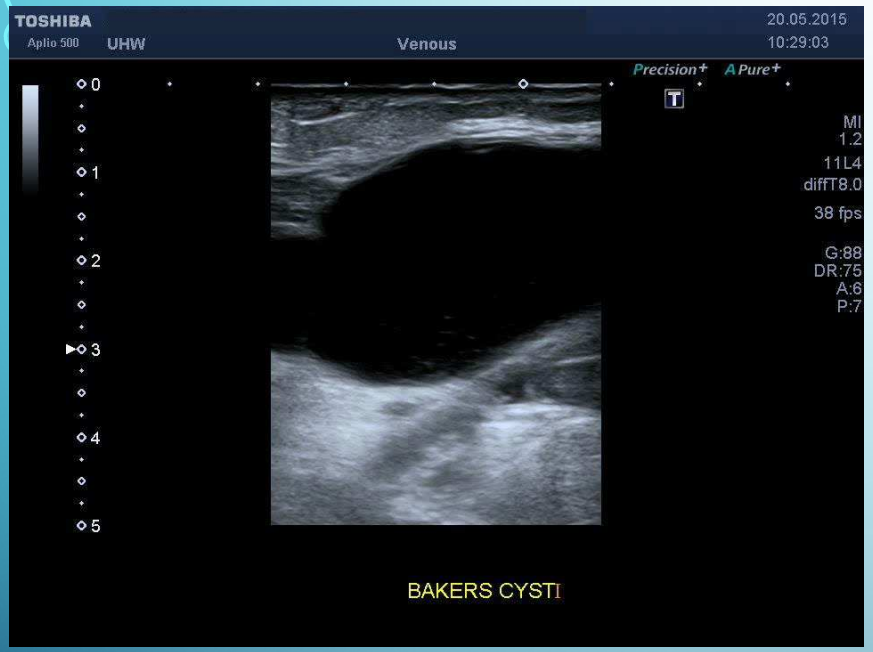


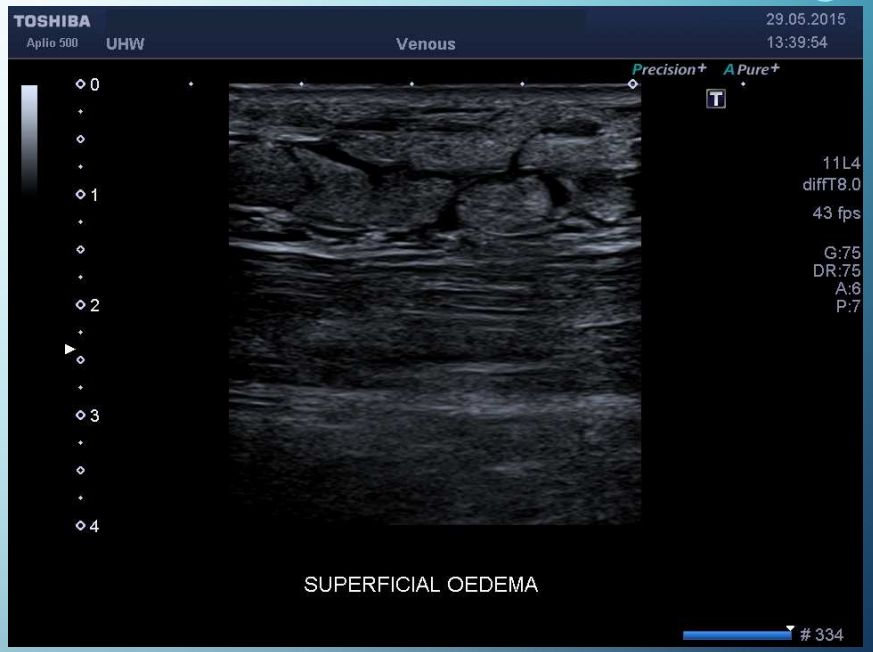
SUPERFICIAL THROMBO-PHLEBITIS





OTHER PATHOLOGIES





CHALLENGES OF COLOUR DOPPLER VENOGRAPHY

Practical

- Oedema
- Obesity
- Pain
- Wounds/dressings
- Immobility
- Scanner setting
- Chronic venous disease

COMPLICATIONS – A WORD OF CAUTION

- Venous duplex ultrasonography causing acute pulmonary embolism: a brief report
  - Schroder et al; J. Vasc. Surg. 15; 1082; 1992
- I prefer using CDI
  - less likely to break of clot
  - better diagnostic accuracy
    - see partial filling
    - don't have to worry about incompressible segments

THANK YOU FOR YOUR ATTENTION