US reporting form of Lower extremity veins & Arteriovenuos fistula

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The Korean Society for Thoracic & Cardiovascular Surgery

국민 건강증진에 큰 역할을 하는 학회 대한심장혈관흉부외과학회

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자료실

제목 검색 검색초기화

No	제목	첨부파일	작성일	조회수
2	[대흉외] 심장혈관흉부외과 의사를 위한 초음파검사 기록지 배포		2024.05.09	34
1	대한심장혈관흉부외과학회 성명서 및 의견서		2024.03.11	264

TOP

Ultrasonographic report for lower extremity vein

대한심장혈관흉부외과학회 초음파위원회

ID: Name: sex/age: /

1. Problems

☐ Tortuous vessels / ☐ Pain / ☐ Cramping / ☐ Feeling of heaviness
☐ Leg edema / ☐ Skin discoloration
☐ C0/1 / ☐ C2 / ☐ C3 / ☐ C4 / ☐ C5 / ☐ C6
☐ Proven PTE or DVT / ☐ Elevated d-dimer / ☐ others:

2. Reflux / Varicosity

- Right
  - ☐ GSV-AK / ☐ GSV-BK / ☐ SSV / ☐ CFV / ☐ PV / ☐ other
    - Diameter: mm
    - Reflux time: sec
- Left
  - ☐ GSV-AK / ☐ GSV-BK / ☐ SSV / ☐ CFV / ☐ PV / ☐ other
    - Diameter: mm
    - Reflux time: sec

3. Perforator

- Right
  - ☐ thigh / ☐ calf
  - ☐ proximal / ☐ mid / ☐ distal
    - Diameter: mm
    - Reflux time: sec
- Left
  - ☐ thigh / ☐ calf
  - ☐ proximal / ☐ mid / ☐ distal
    - Diameter: mm
    - Reflux time: sec

4. Deep vein thrombosis

- Right
  - ☐ CFV / ☐ FV / ☐ PV / ☐ other
- Left
  - ☐ CFV / ☐ FV / ☐ PV / ☐ other

5. other findings

Lower extremity veins

Ultrasonographic report for arteriovenous access for hemodialysis

대한심장혈관흉부외과학회 초음파위원회

ID: Name: sex/age: /

1. Problems
☐ No thrill/bruit / ☐ Decreased thrill/bruit / ☐ Prolonged bleeding
☐ Decreased access flow / ☐ Elevated access pressure
☐ Delayed maturation / ☐ Aneurysm / ☐ Arm edema / ☐ Pain
☐ Pre-op evaluation / ☐ Post-op evaluation / ☐ others:

2. Previous arteriovenous access data
- Op date / Op name:

3. Measurements
- A anastomosis: mm
- V anastomosis: mm
- JAV: mm

- Feeding artery: ☐ radial / ☐ brachial / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min
- Arterial side: ☐ cephalic / ☐ graft / ☐ basilic / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min
- Venous side: ☐ cephalic / ☐ graft / ☐ basilic / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min
- Drained vein: ☐ cephalic / ☐ basilic / ☐ brachial / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min

- Stenosis
  ☐ yes ☐ no

- Thrombosis
  ☐ yes ☐ no

4. other findings

Arteriovenous fistula

Lower extremity veins

Varicose vein and

Deep vein thrombosis

부산대학교병원
Pusan National University Hospital

Venous disease description

CEAP

- Clinical
- Etiologic
- Anatomic
- Pathophysiologic

VCSS

- Venous
- Clinical
- Severity
- Score

CEAP classification

C	E	A	P
Clinical[a]	Etiology	Anatomic	Pathophysiologic[b]
C_0: No signs of venous disease	E_c: congenital	A_s: superficial veins	P_r: reflux
C_1: Telangiectasias or re			
C_2: Varicose veins			
C_{2r}: Varicose veins, rec			
		extravenous	
C_3: Edema	E_n: not identified	A_n: not identified	P_n: not identified
C_4: Skin changes			
C_{4a}: Pigmentation or eczema			
C_{4b}: Lipodermatosclerosis or atrophie blanche			
C_{4c}: Corona phlebectatica			
C_5: Healed ulcer			
C_6: Active ulcer			
C_{6r}: Active ulcer, recurrent			

[a] The designators S (symptomatic) and A (asymptomatic) are further applied to each C classification
[b] Advanced CEAP classification specifies one of 18 specific venous locations in the lower extremity

객관화, 표준화

Venous disease description

CEAP classification

- Clinical
- Etiologic
- Anatomic
- Pathophysiologic

VCSS

- Venous
- Clinical
- Severity
- Score

VSCC

Attribute	Absent = 0	Mild = 1	Moderate = 2	Severe = 3
Pain	None	Occasional	Daily	Limit activities
Varicose veins				tensive (LSV, SSV)
Venous edema				rning, leg
Pigmentation				der (above 1/3)
Inflammation				llulitis
Induration	None	Focal (<5 cm)	<Lower 1/3	Entire lower 1/3
Number of AC	0	1	2	3
Duration of AC	None	<3 months	3 months–1 year	>1 year
Size of AC	None	<2 cm diameter	2–6 cm diameter	>6 cm diameter
Comp therapy	Not used	Intermittent use	Most days	Continually

LSV: long saphenous vein; SSV: short saphenous vein; AC: active ulceration; lower 1/3: lower 1/3 of the leg.

Quality of Life

Ultrasonographic report for lower extremity vein

대한심장혈관흉부외과학회 초음파위원회

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☐ Proven PTE or DVT / ☐ Elevated d-dimer / ☐ others:

2. Reflux / Varicosity
- Right
☐ GSV-AK / ☐ GSV-BK / ☐ SSV / ☐ CFV / ☐ PV / ☐ other

VCSS

1. Problems

☐ Tortuous vessels / ☐ Pain / ☐ Cramping / ☐ Feeling of heaviness

☐ Leg edema / ☐ Skin discoloration

☐ C0/1 / ☐ C2 / ☐ C3 / ☐ C4 / ☐ C5 / ☐ C6

CEAP

☐ Proven PTE or DVT / ☐ Elevated d-dimer / ☐ others:

- Reflux time: sec

4. Deep vein thrombosis
- Right
☐ CFV / ☐ FV / ☐ PV / ☐ other
- Left
☐ CFV / ☐ FV / ☐ PV / ☐ other

5. other findings

PNUH 부산대학교병원 Pusan National University Hospital

Clinical (C) class	
C0	No visible or palpable signs of venous disease
C1	Telangiectasia or reticular veins
C2	Varicose veins
C2r	Recurrent varicose veins
C3	Oedema
C4	Changes in skin and subcutaneous tissue secondary to CVD
C4a	Pigmentation or eczema
C4b	Lipodermatosclerosis or atrophie blanche
C4c	Corona phlebectatica
C5	Healed ulcer
C6	Active venous ulcer
C6r	Recurrent venous ulceration

S: symptomatic, including ache, pain, tightness, skin irritation, heaviness, and muscle cramps, and other complaints attributable to venous dysfunction

A: asymptomatic

C1 : telangiectasia

C1: reticular vein

C2 : varicose vein

C3 : edema

C4a : pigmentation and eczema

C6 : active ulcer

C4b : Lipodermatosclerosis or atrophie blanche

C4b : Lipodermatosclerosis or atrophie blanche

C4b : Lipodermatosclerosis or atrophie blanche

C4c : Corona phlebectatica

C5 : healed ulcer

C6 : active ulcer

C6 : active ulcer

C6 : active ulcer

Etiological (E) class

Ep	Primary
Es	Secondary
Esi	Secondary – intravenous
Ese	Secondary – extravenous
Ec	Congenital
En	None identified

Ultrasonographic report for lower extremity vein

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  - ☐ thigh / ☐ calf
  - ☐ proximal / ☐ mid / ☐ distal
    - Diameter: mm
    - Reflux time: sec
- Left
  - ☐ thigh / ☐ calf
  - ☐ proximal / ☐ mid / ☐ distal
    - Diameter: mm
    - Reflux time: sec

4. Deep vein thrombosis

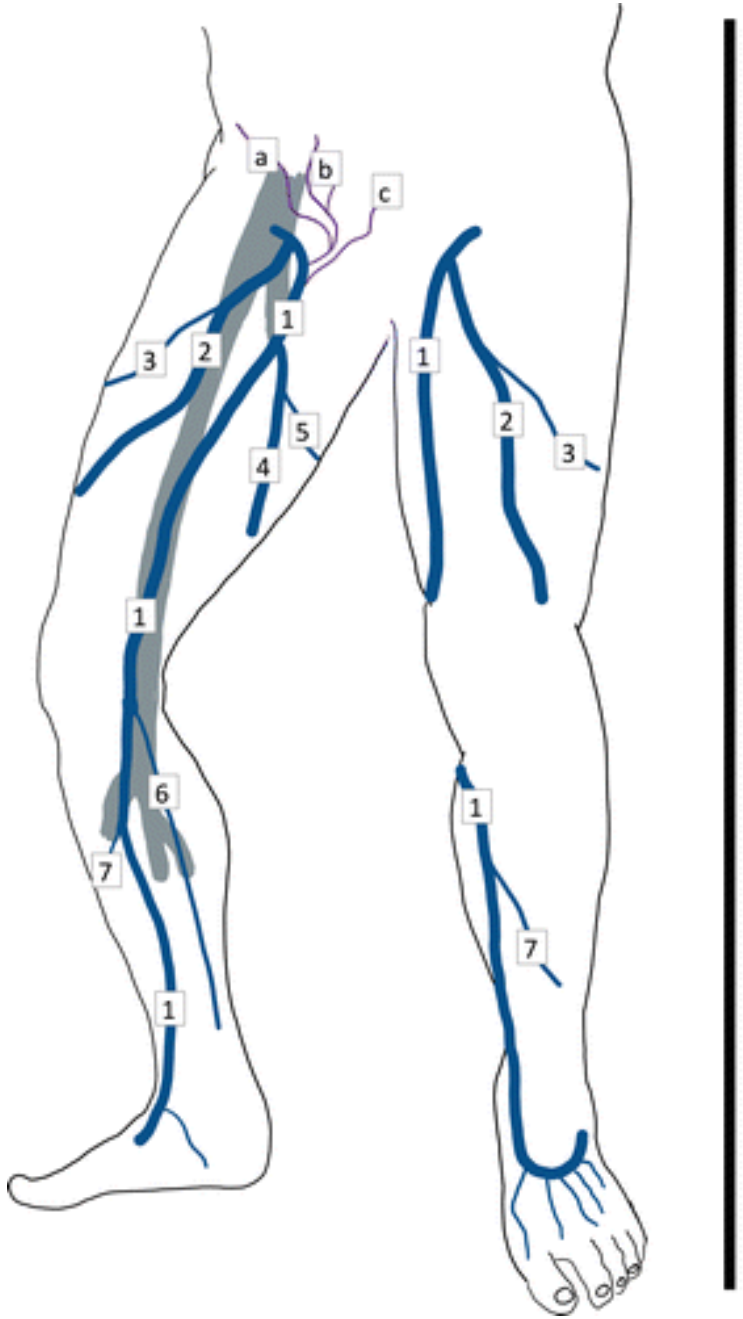
- Right
  - ☐ CFV / ☐ FV / ☐ PV / ☐ other
- Left
  - ☐ CFV / ☐ FV / ☐ PV / ☐ other

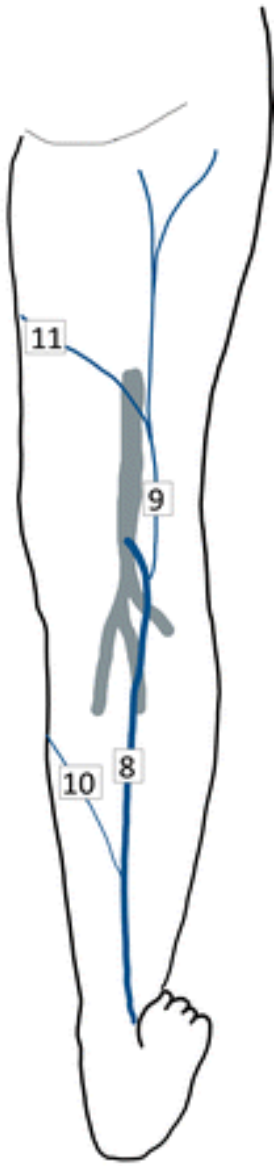
5. other findings

Anatomical (A) class

As	Superficial
Ad	Deep
Ap	Perforators
An	No identifiable venous location

Anatomical classification	Segment number*	New anatomical site†	Description
As (Superficial)	1	Tel	Telangiectasia
	1	Ret	Reticular veins
	2	GSVa	Great saphenous vein, above knee
	3	GSVb	Great saphenous vein, below knee
	4	SSV	Small saphenous vein
	–	AASV	Anterior accessory saphenous vein
	5	NSV	Non-saphenous vein
Ad (Deep)	6	IVC	Inferior vena cava
	7	CIV	Common iliac vein
	8	IIV	Internal iliac vein
	9	EIV	External iliac vein
	10	PELV	Pelvic vein
	11	CFV	Common femoral vein
	12	DFV	Deep femoral vein
	13	FV	Femoral vein
	14	POPV	Popliteal vein
	15	TIBV	Crural (Tibial) vein
	15	PRV	Peroneal vein
	15	ATV	Anterior tibial vein
	15	PTV	Posterior tibial vein
	16	MUSV	Muscular veins
	16	GAV	Gastrocnemius vein
	16	SOV	Soleal vein
Ap (Perforator)	17	TPV	Thigh perforator vein
	18	CPV	Calf perforator vein

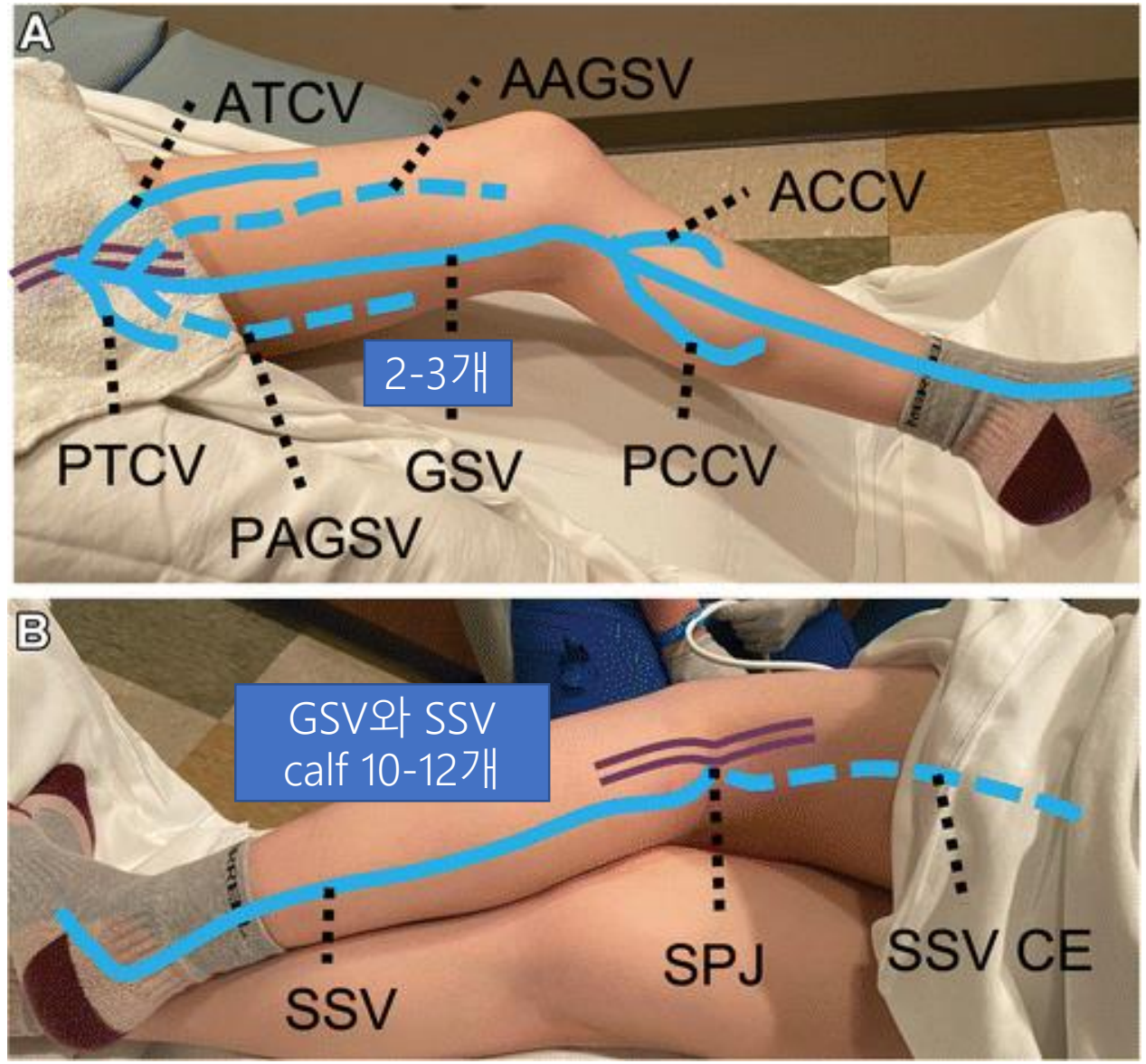


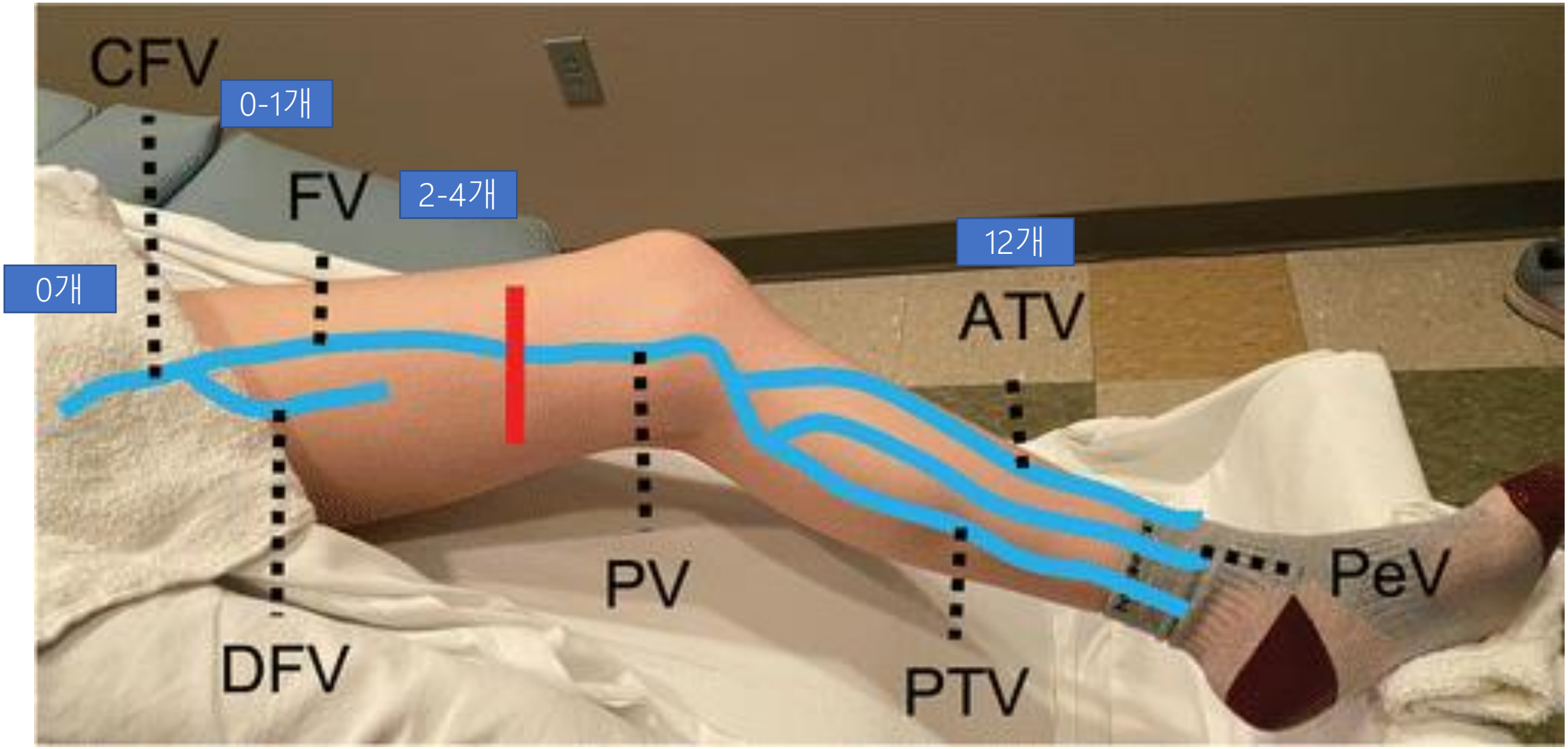


GSV *(1)*
AAGSV *(2)*
anterior thigh circumflex vein *(3)*
posterior accessory GSV *(4)*
posterior thigh circumflex vein *(5)*
posterior calf circumflex vein *(6)*
anterior calf circumflex vein *(7)*
SSV *(8)*
cranial extension *(9)*
intersaphenous vein *(10)*
posterior thigh circumflex vein *(11)*

Connections to the abdominal and pelvic veins are labeled with letters
superficial circumflex iliac vein *(a)*
superficial inferior epigastric vein *(b)*
superficial external pudendal vein *(c)*

Part of the deep veins of the right lower extremity are not labeled but are depicted underneath in gray.





Varicose Veins of the Lower Extremity: Doppler US Evaluation Protocols, Patterns, and Pitfalls

2. Reflux / Varicosity

- Right

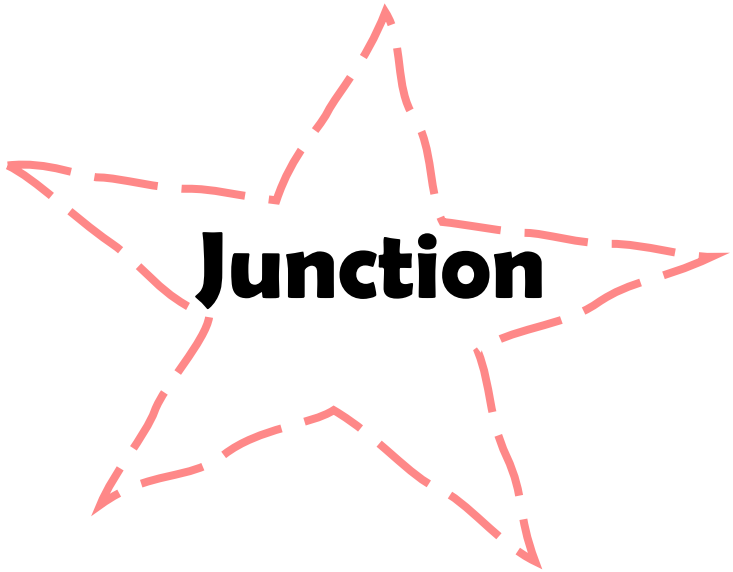
☐ GSV-AK / ☐ GSV-BK / ☐ SSV / ☐ CFV / ☐ PV / ☐ other

- Diameter: mm
- Reflux time: sec

- Left

☐ GSV-AK / ☐ GSV-BK / ☐ SSV / ☐ CFV / ☐ PV / ☐ other

- Diameter: mm
- Reflux time: sec



3. Perforator

- Right

☐ thigh / ☐ calf

☐ proximal / ☐ mid / ☐ distal

- Diameter: mm
- Reflux time: sec

- Left

☐ thigh / ☐ calf

☐ proximal / ☐ mid / ☐ distal

- Diameter: mm
- Reflux time: sec

*Pathophysiological (P) class**

Pr	Reflux
Po	Obstruction
Pr,o	Reflux and obstruction
Pn	No pathophysiology identified

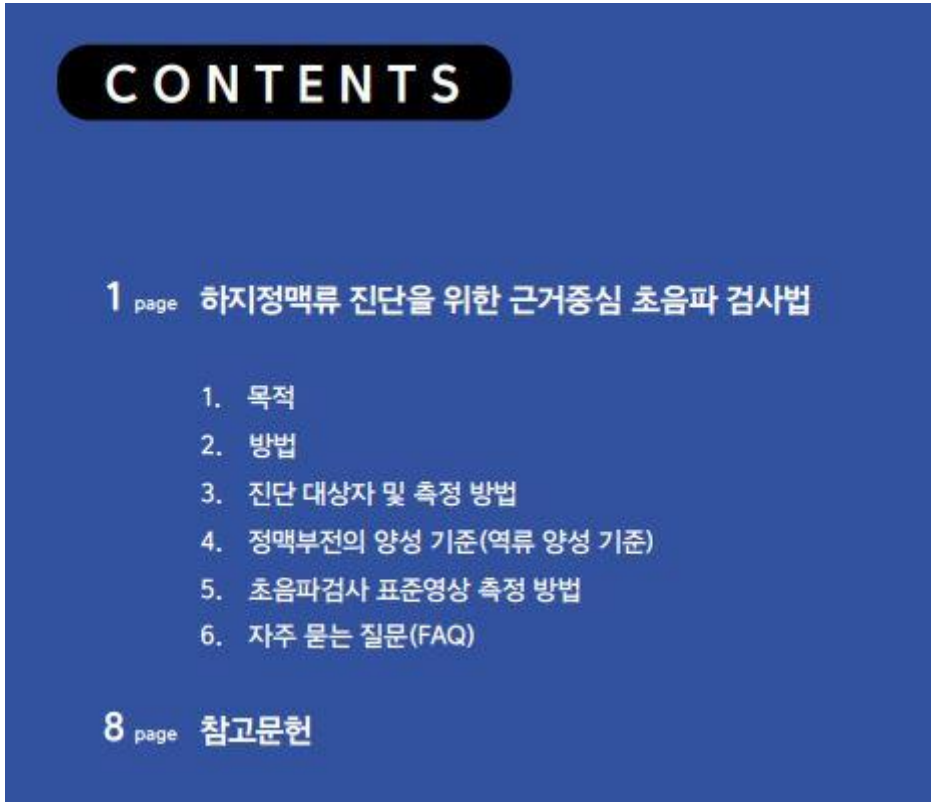
Example S C3 C2 C4b C6

A patient has painful swelling of the leg, and varicose veins, lipodermatosclerosis, and active ulceration. Duplex scanning on May 17, 2004, showed axial reflux of the great saphenous vein above and below the knee, incompetent calf perforator veins, and axial reflux in the femoral and popliteal veins. There are no signs of postthrombotic obstruction.

Ep

$$C_{2,3,4b,6,S},\ E_{p},\ A_{s,p,d},\ P_{r}$$

하지정맥류 진단을 위한 근거중심 초음파 검사법



5. 초음파검사 표준영상 측정 방법

5-1. 정확한 표준 영상을 얻기 위해 초음파 탐촉자는 **High Frequency (5-16MHz) 선형탐촉자(Linear probe)**를 사용할 것을 권고한다. [7,12,16,21,22,25,26]

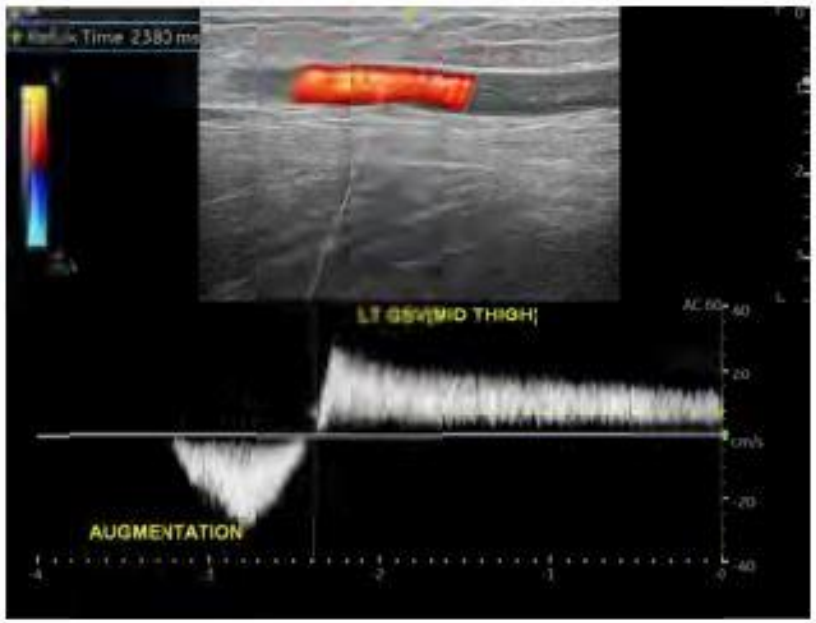
5-2. 하지정맥 초음파 검사 시 검사하고자 하는 혈관에 대해 **종단면 (Longitudinal View)**으로 측정할 것을 권고한다. [20,21,22,23,24,25,26,27,28]

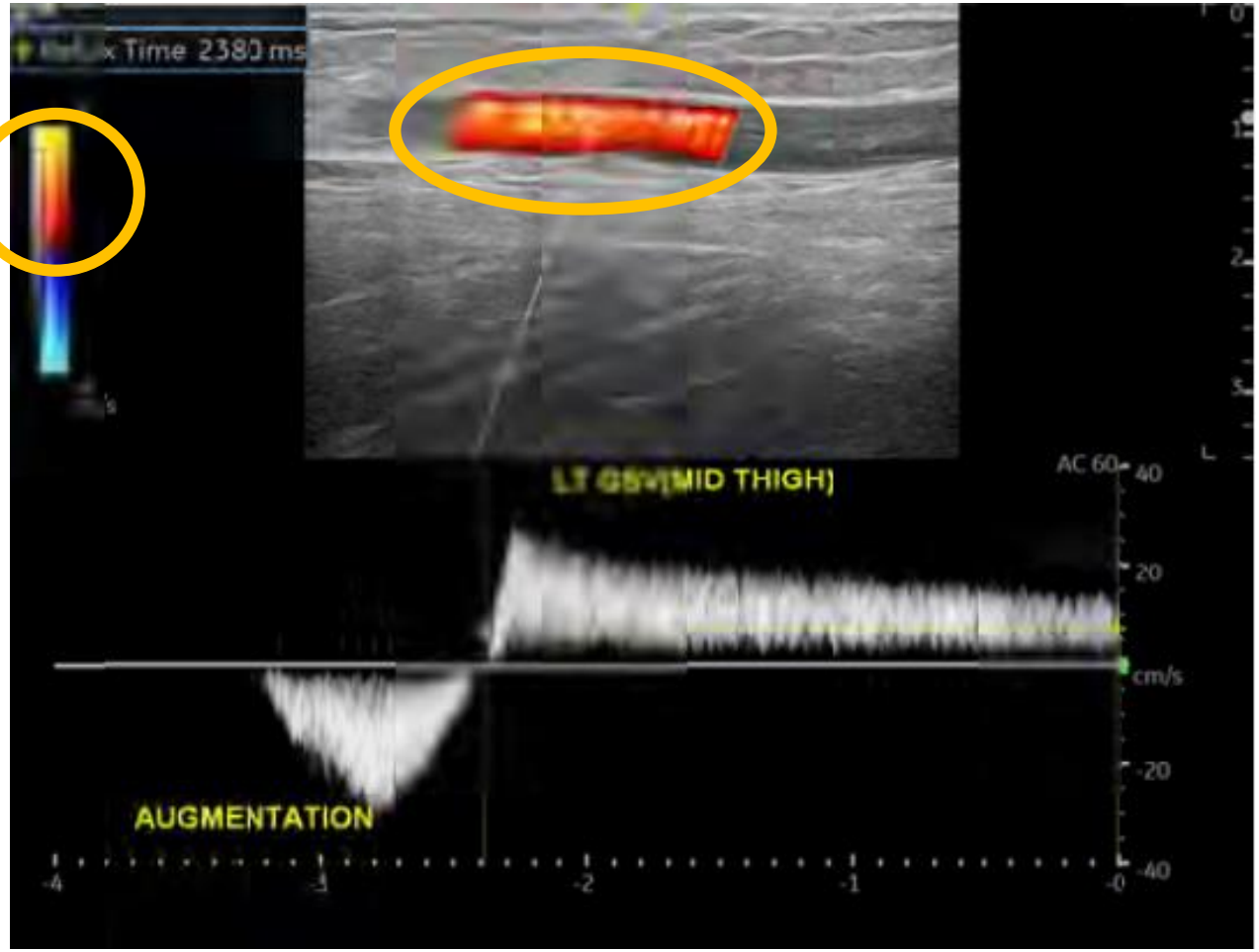
5-3. 측정하고자 하는 해당 혈관의 이름과 위치를 반드시 **문자로 명시** 할 것을 권고한다. [21,22,23,24,26]

5-4. 정맥부전의 특징인 혈류방향 변화는 종아리 압박으로 발생하는 증강 (Augmentation) 파형과 역행성 혈류 (Retrograde flow)에 의한 역류파형이 baseline(가로축)을 기준으로 서로 반대방향으로 위치하여 **혈류의 방향성이 잘 나타날 수 있도록 측정**할 것을 권고한다. 가급적 증강파형이 가로축의 아래로, 역행성 혈류 파형이 가로축의 위에 위치하도록 측정하고 기록한다. [21,23,24,26]

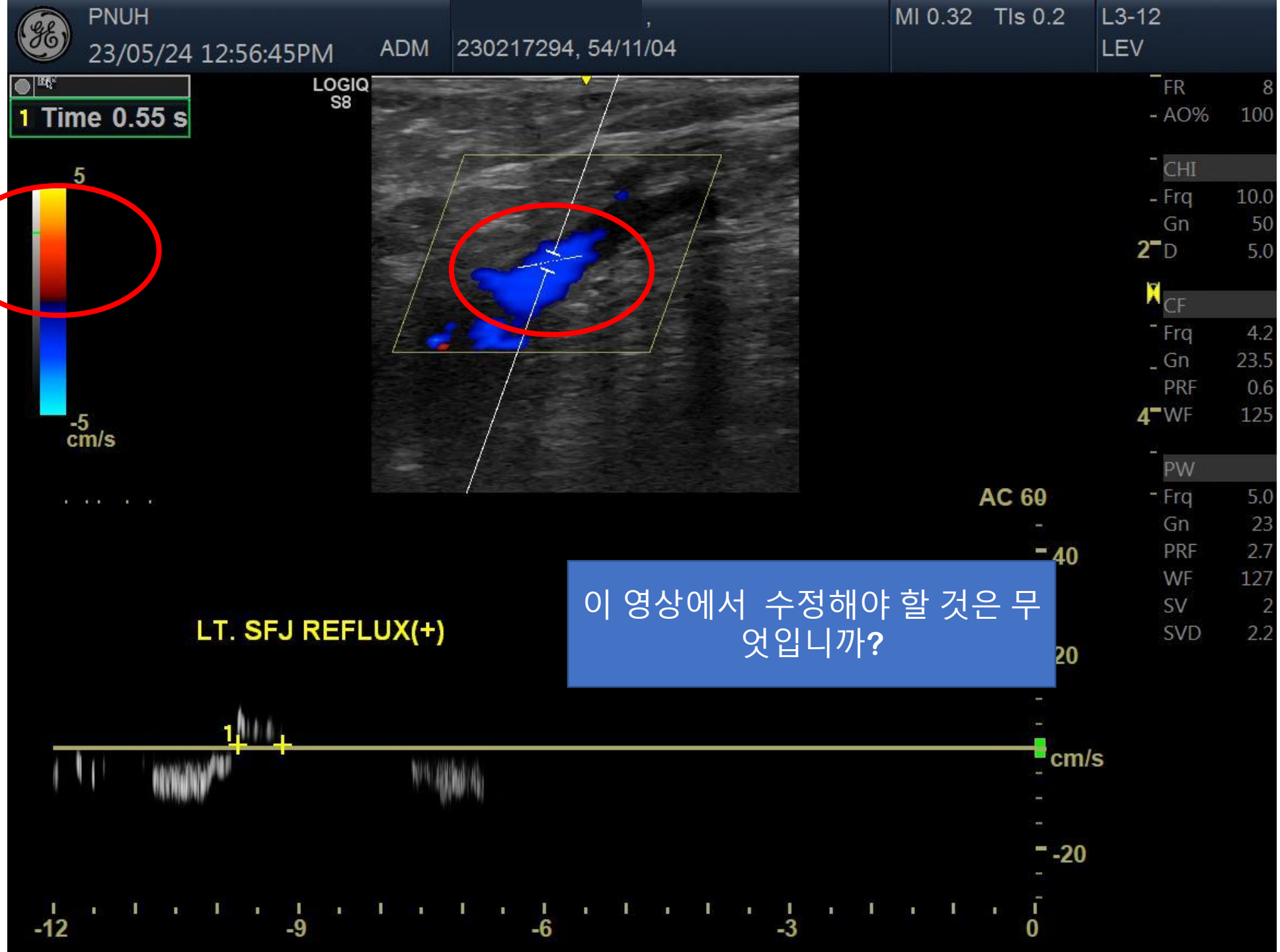
5-5. **컬러도플러(Color Doppler)**도 함께 사용하여 역류를 좀 더 객관적으로 표현하도록 권고한다 [21,22,23,24,26]

5-6. 초음파 영상에 **역류 구간을 표시**한 후 **역류시간**을 **초(seconds)** 또는 **밀리초(milliseconds)**로 **명시하여 표기**할 것을 권고한다. [21,22,23,24,26]

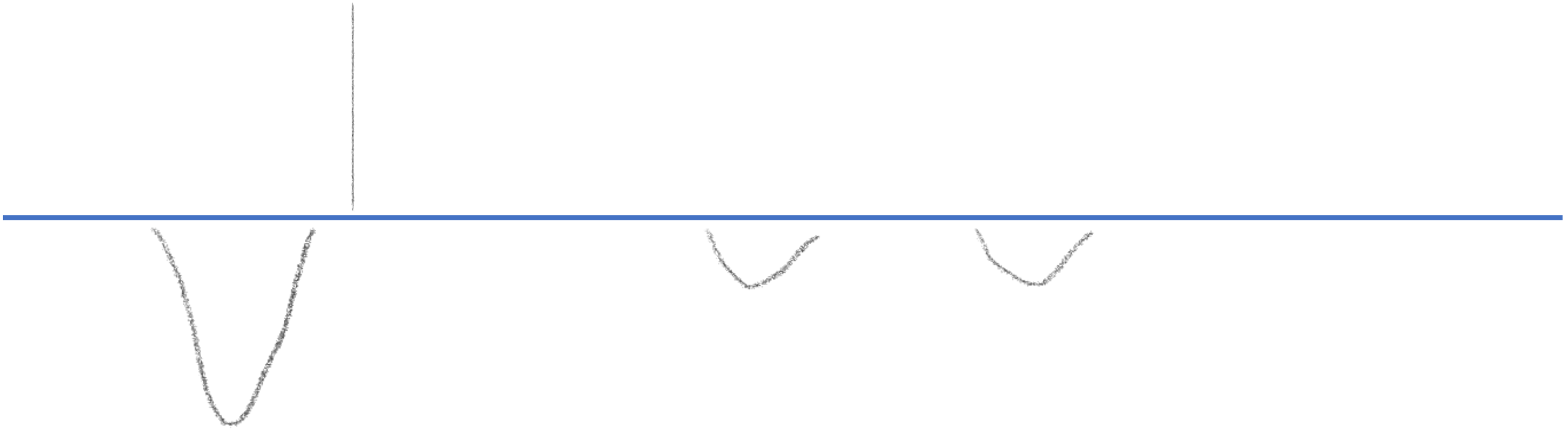




1. **Vein**은 **longitudinal**
2. **Color** 통일
3. **SV: vein**의 한가운데
4. **PW**에서 **mirroring**없도록
5. **Augmentation**이 확실히 표시

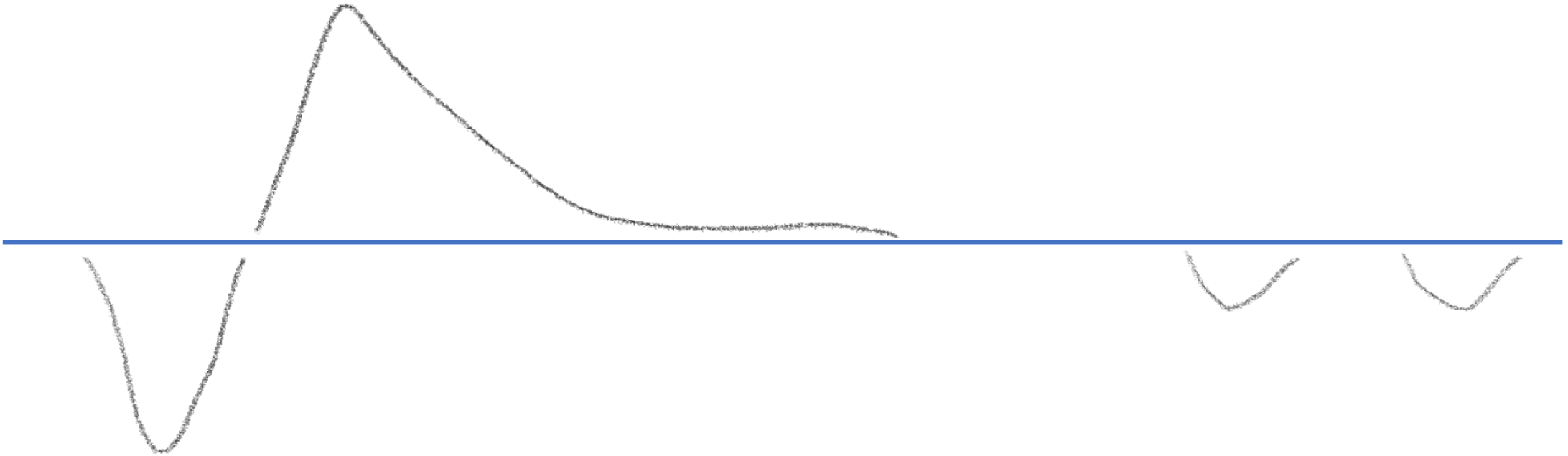

PNUH
23/05/24 12:56:45PM
ADM
230217294, 54/11/04
MI 0.32 TIs 0.2
L3-12
LEV
1 Time 0.55 s
LOGIQ S8
5
-5
cm/s
FR 8
AO% 100
CHI
Frq 10.0
Gn 50
D 5.0
CF
Frq 4.2
Gn 23.5
PRF 0.6
WF 125
PW
Frq 5.0
Gn 23
PRF 2.7
WF 127
SV 2
SVD 2.2
AC 60
40
20
-20
cm/s
LT. SFJ REFLUX(+)
이 영상에서 수정해야 할 것은 무엇입니까?
-12
-9
-6
-3
0

Release

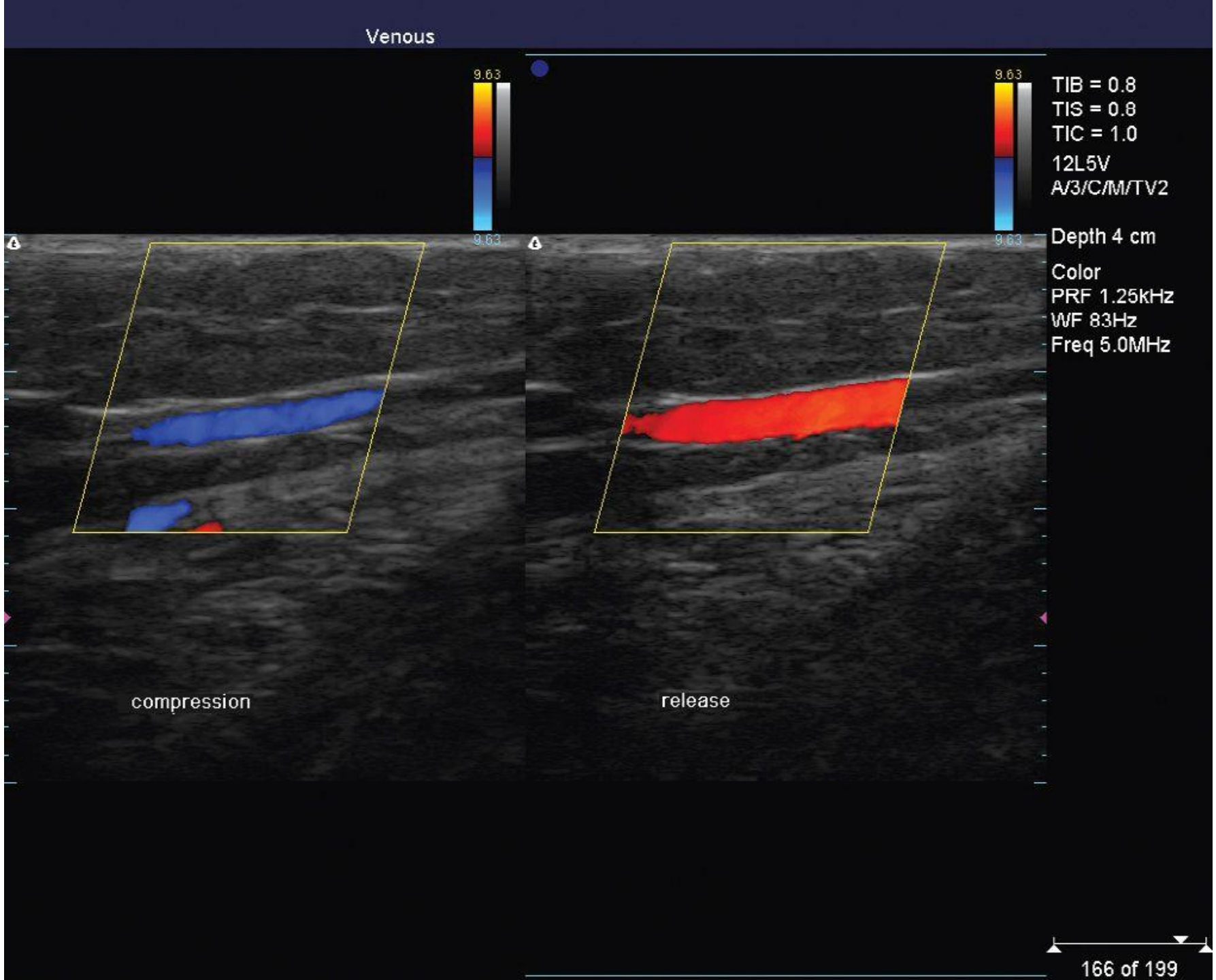


Squeeze

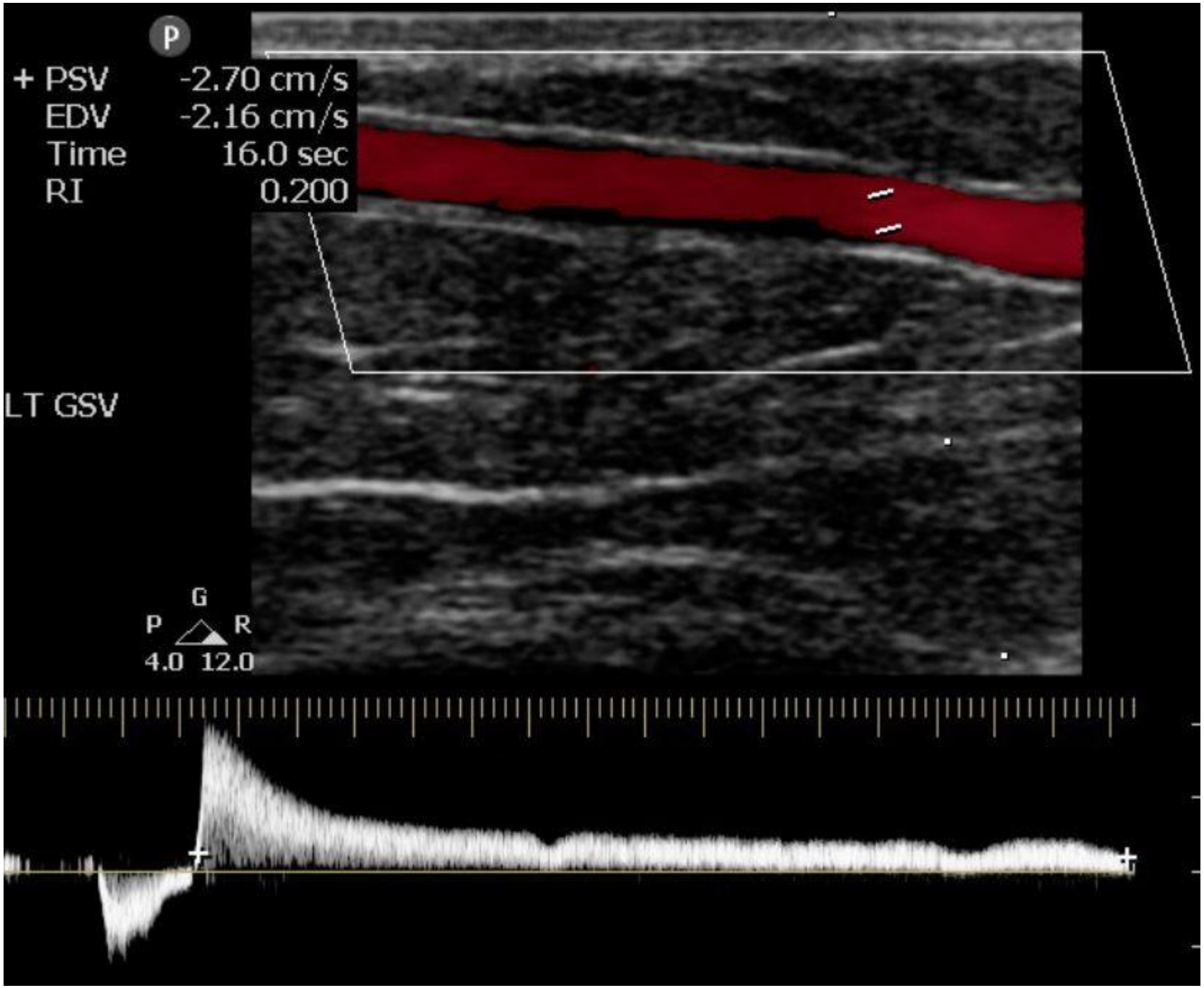
Release

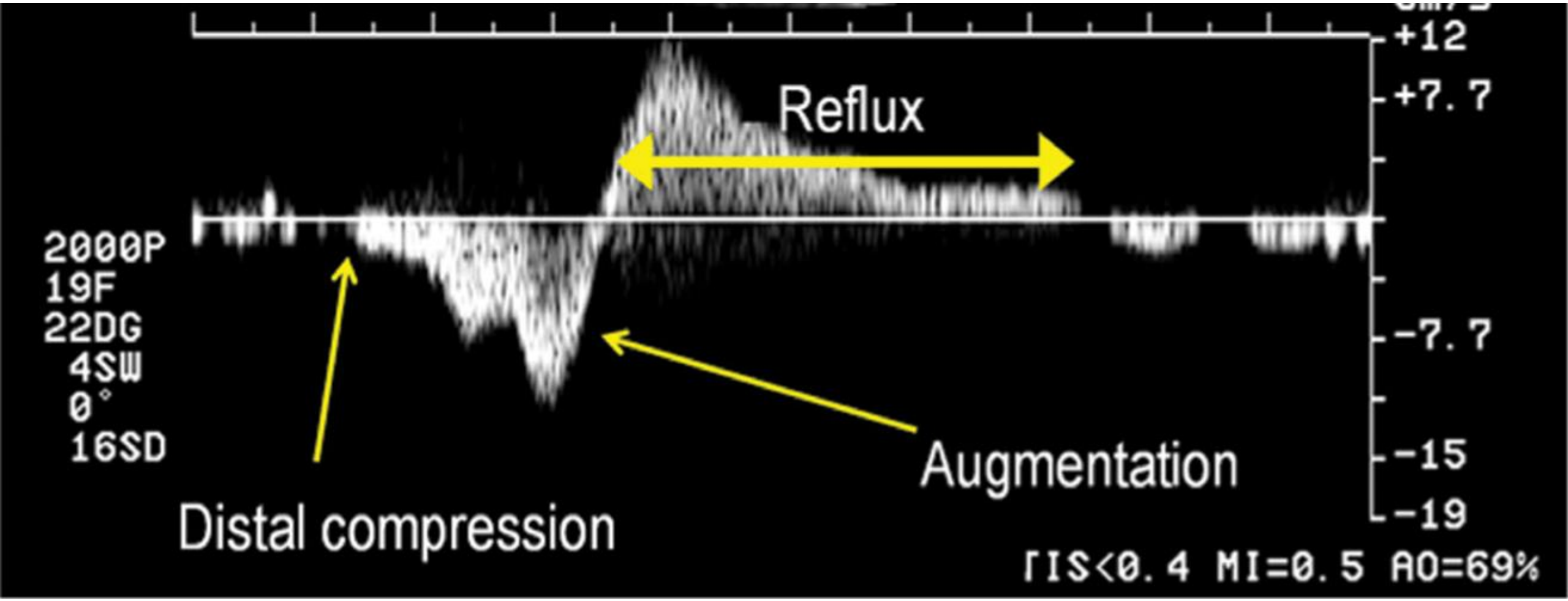


Squeeze


Venous
9.63
9.63
TIB = 0.8
TIS = 0.8
TIC = 1.0
12L5V
A/3/C/M/TV2
Depth 4 cm
Color
PRF 1.25kHz
WF 83Hz
Freq 5.0MHz
compression
release
166 of 199

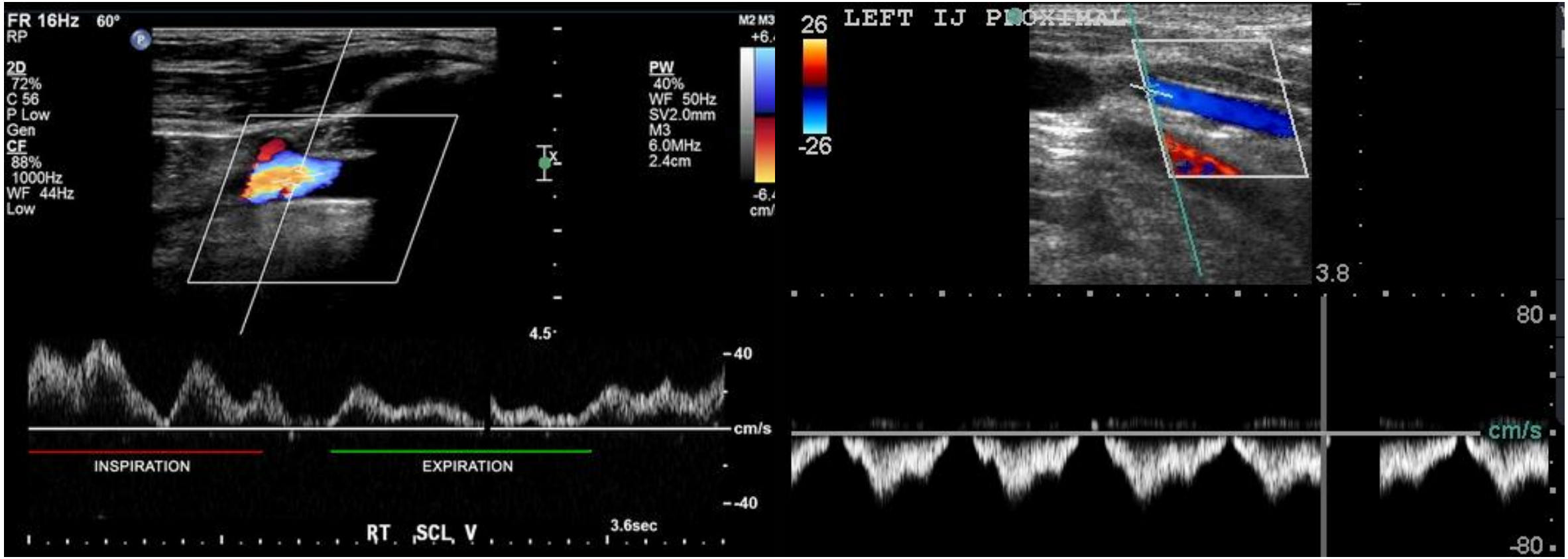
GSV





Deep veins

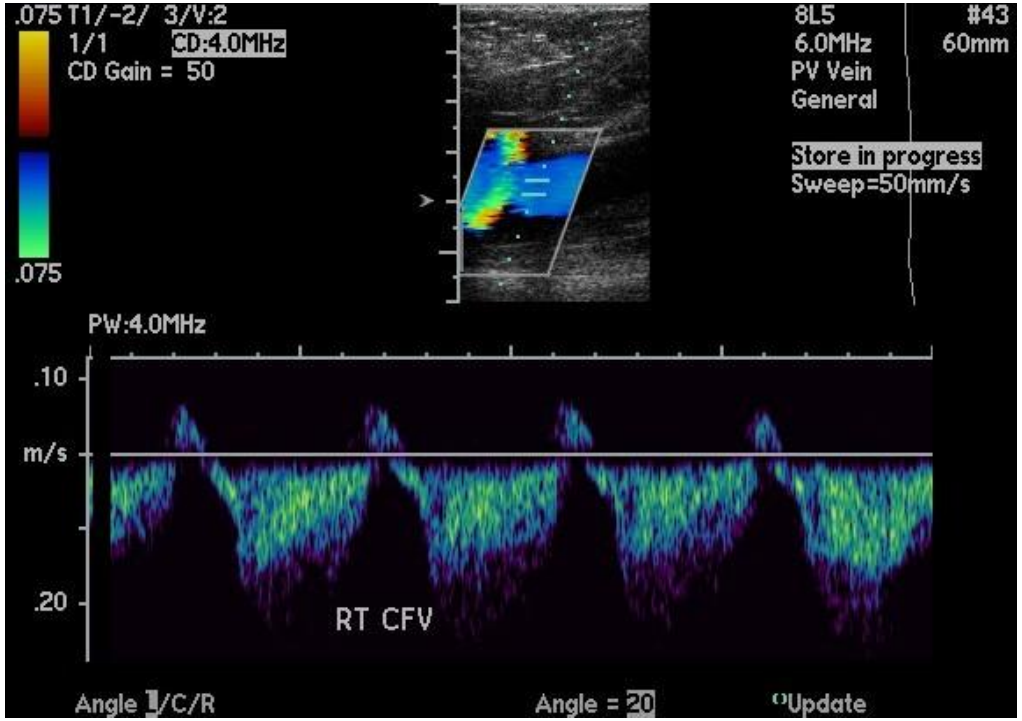
Respiratory variation

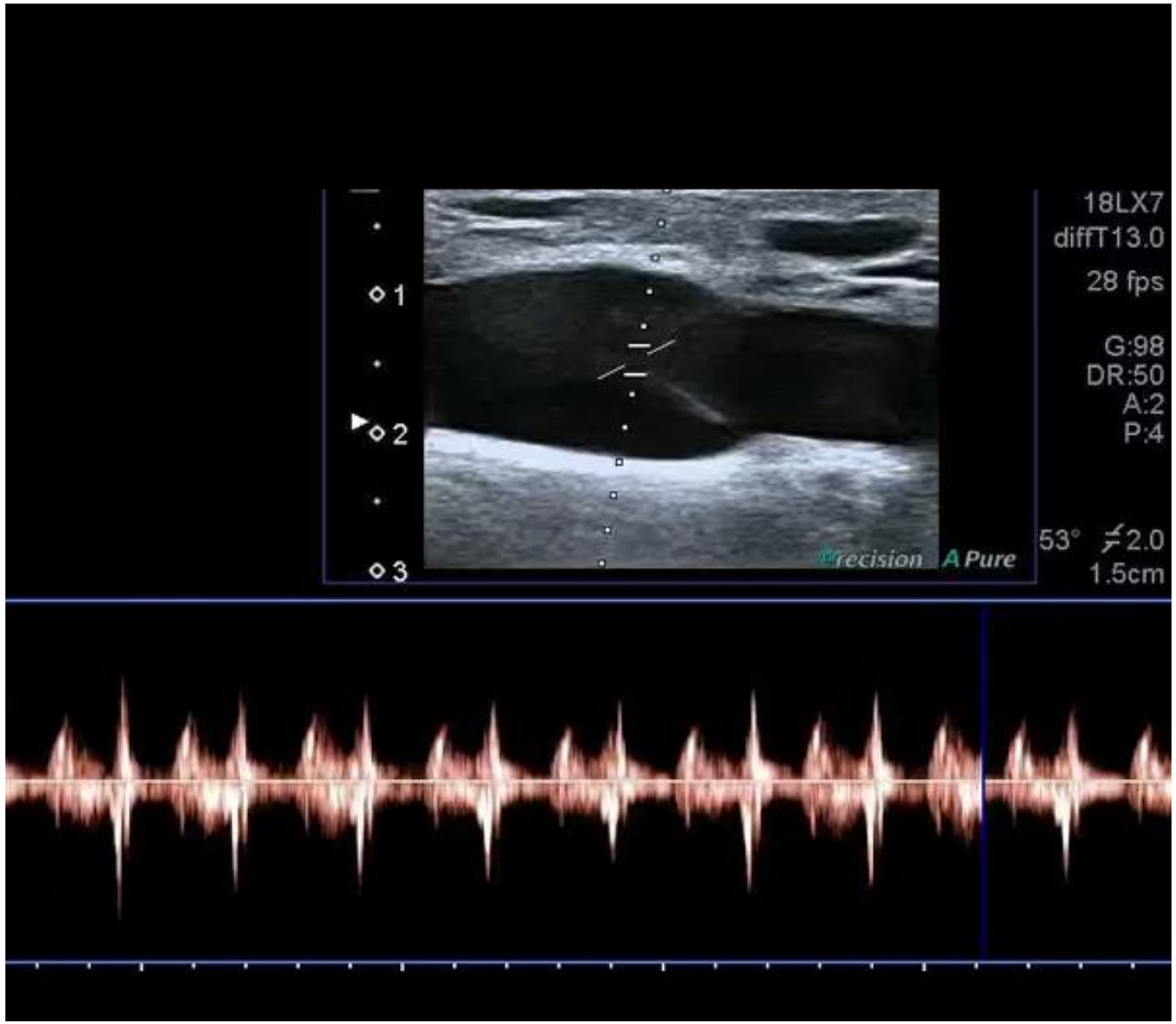


Pulsatile FEMORAL veins

r/o Congestive heart failure

➔ Need heart evaluation





4. Deep vein thrombosis

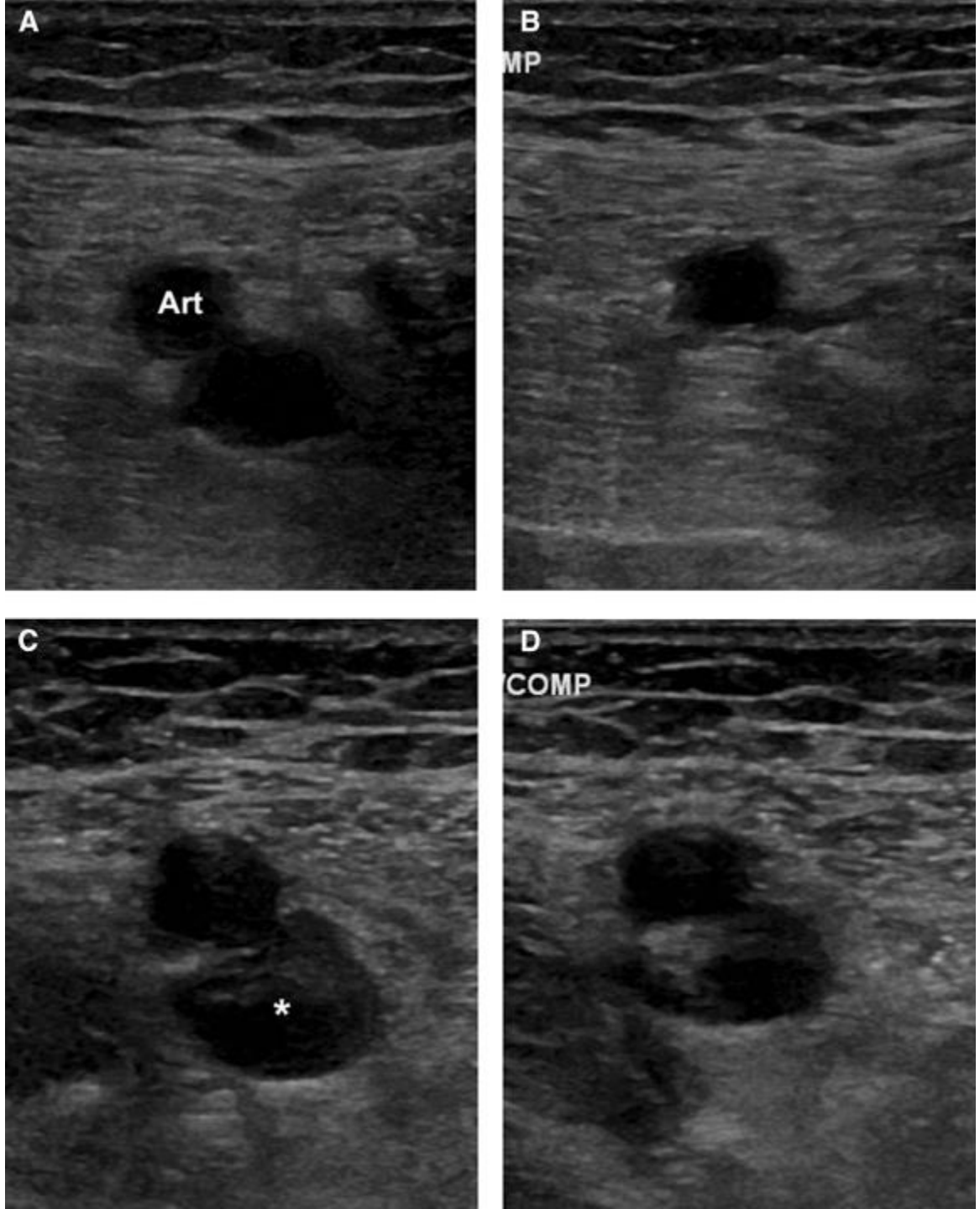
- Right

☐ CFV / ☐ FV / ☐ PV / ☐ other

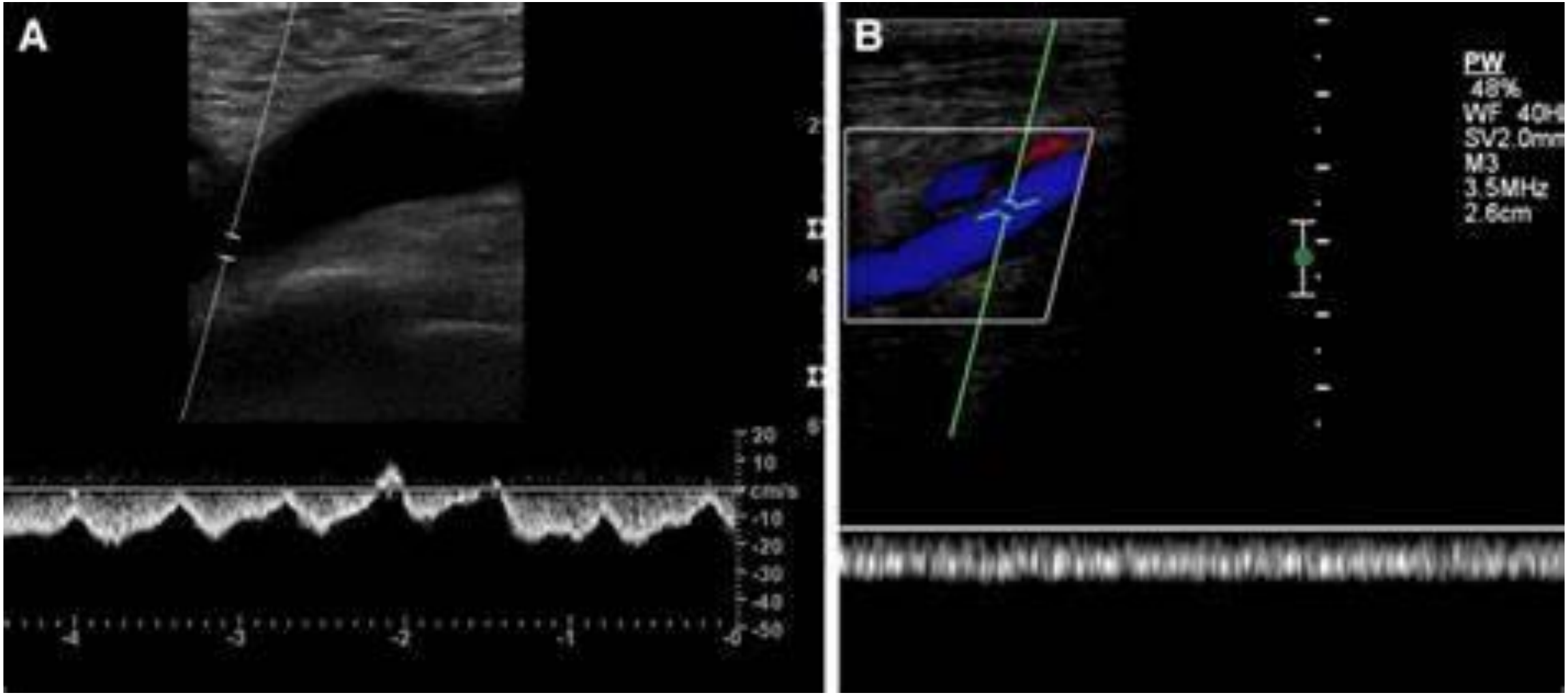
- Left

☐ CFV / ☐ FV / ☐ PV / ☐ other

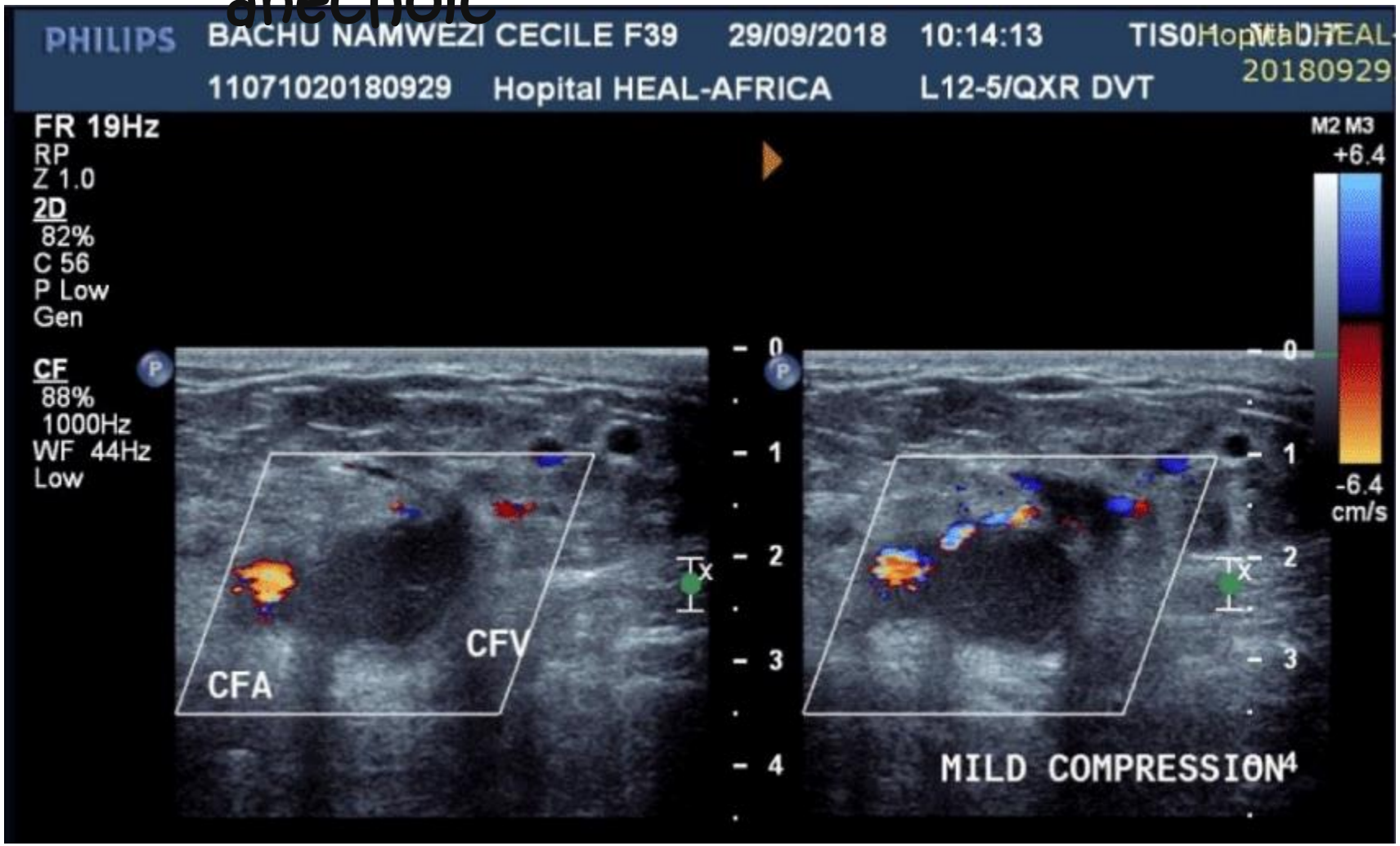
Deep vein thrombosis



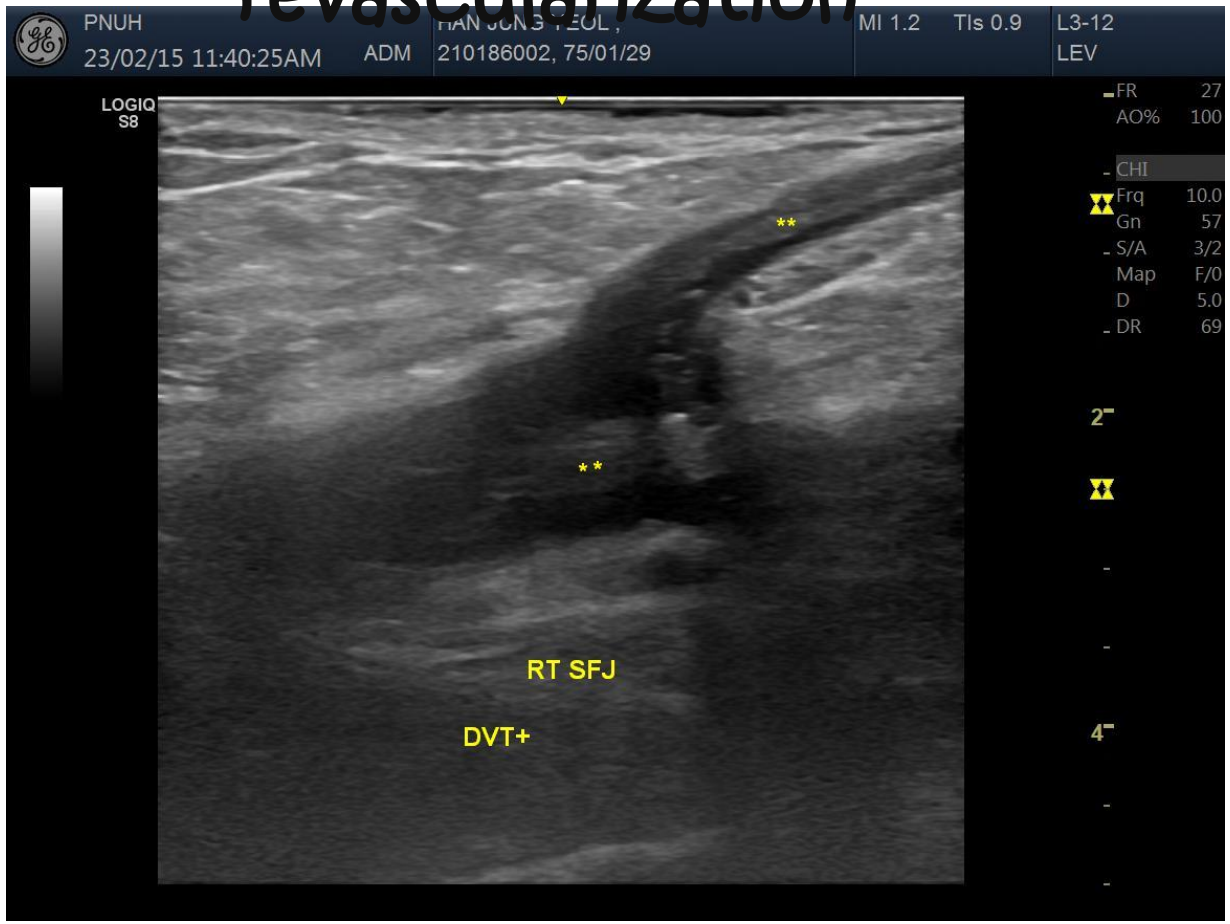
Loss of phasic flow pattern

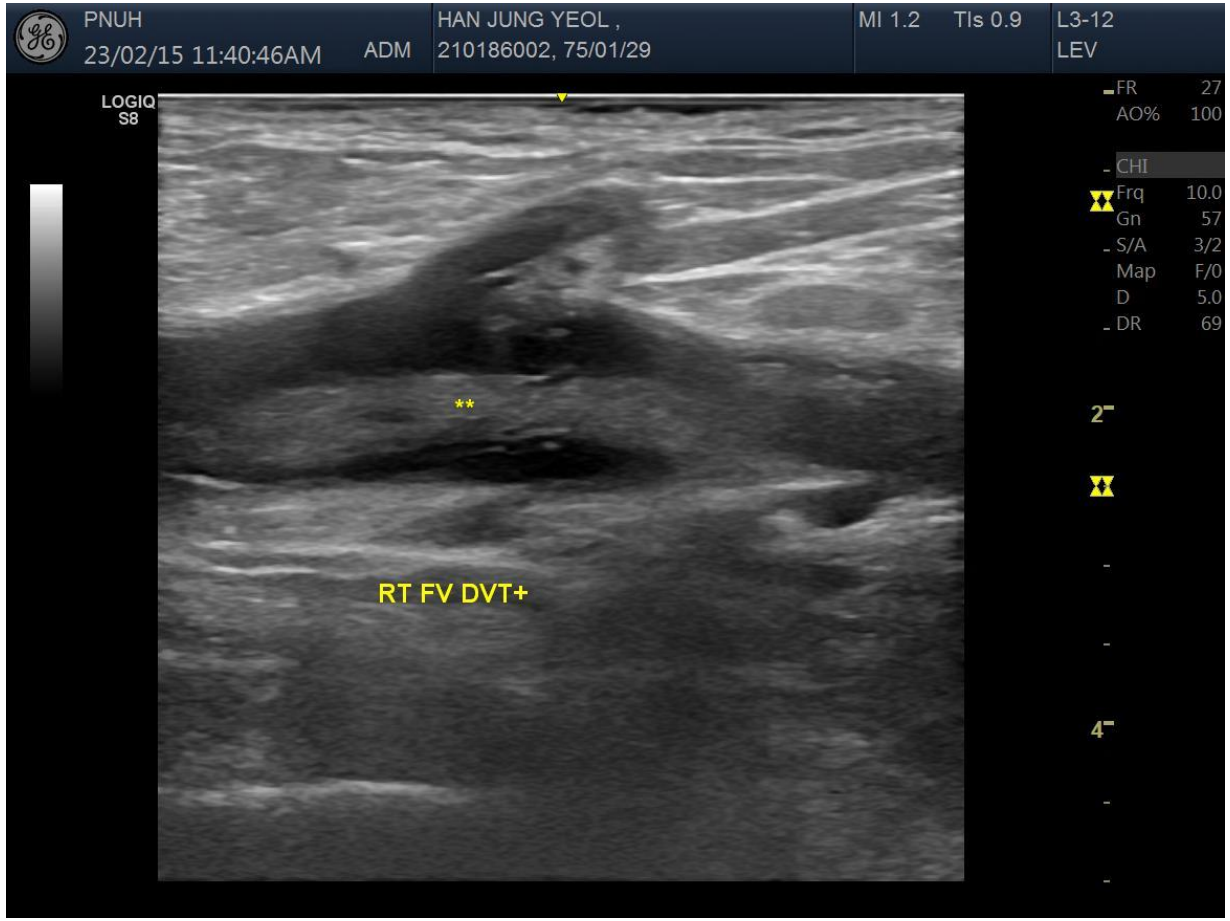


Acute - hypoechoic or anechoic

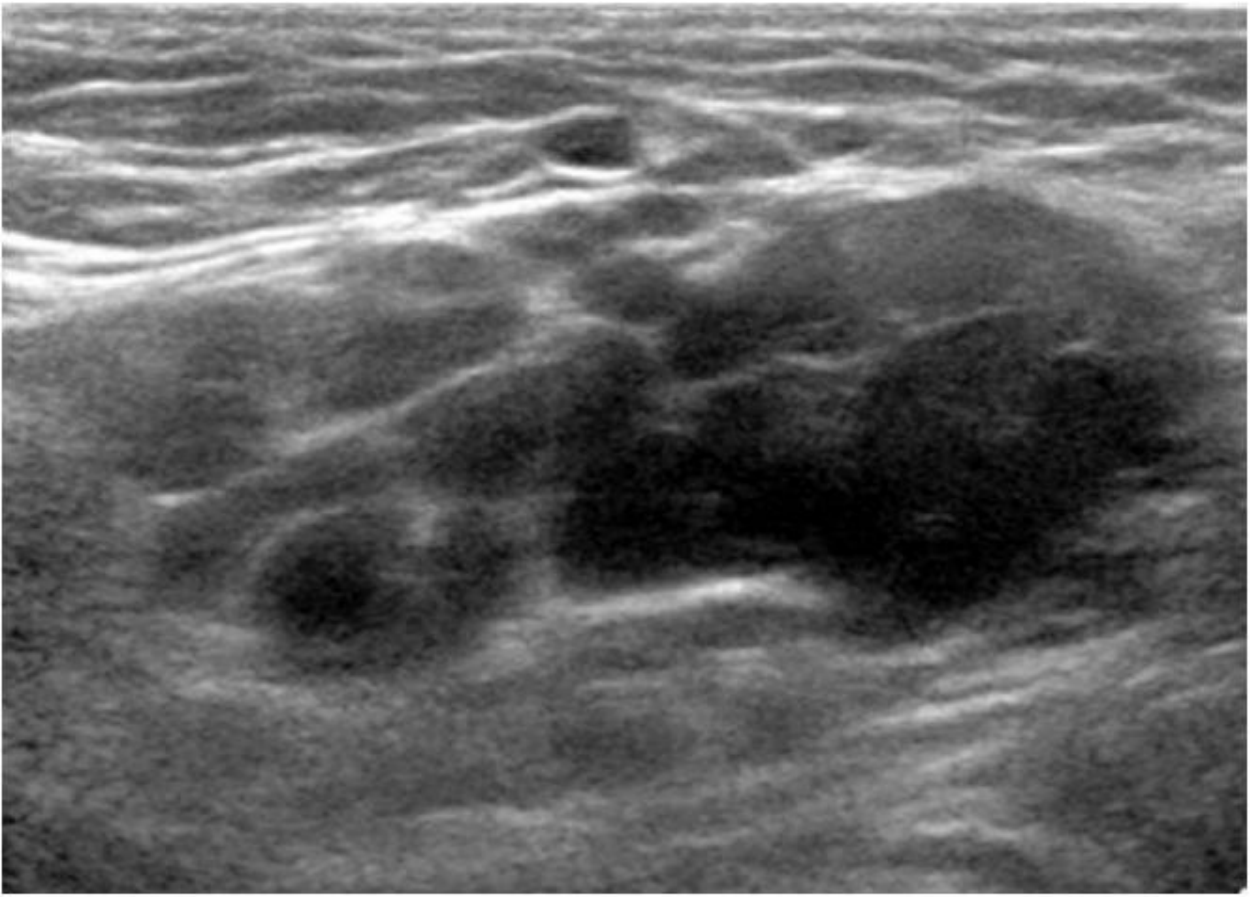


Chronic - hyperechoic with peripheral revascularization

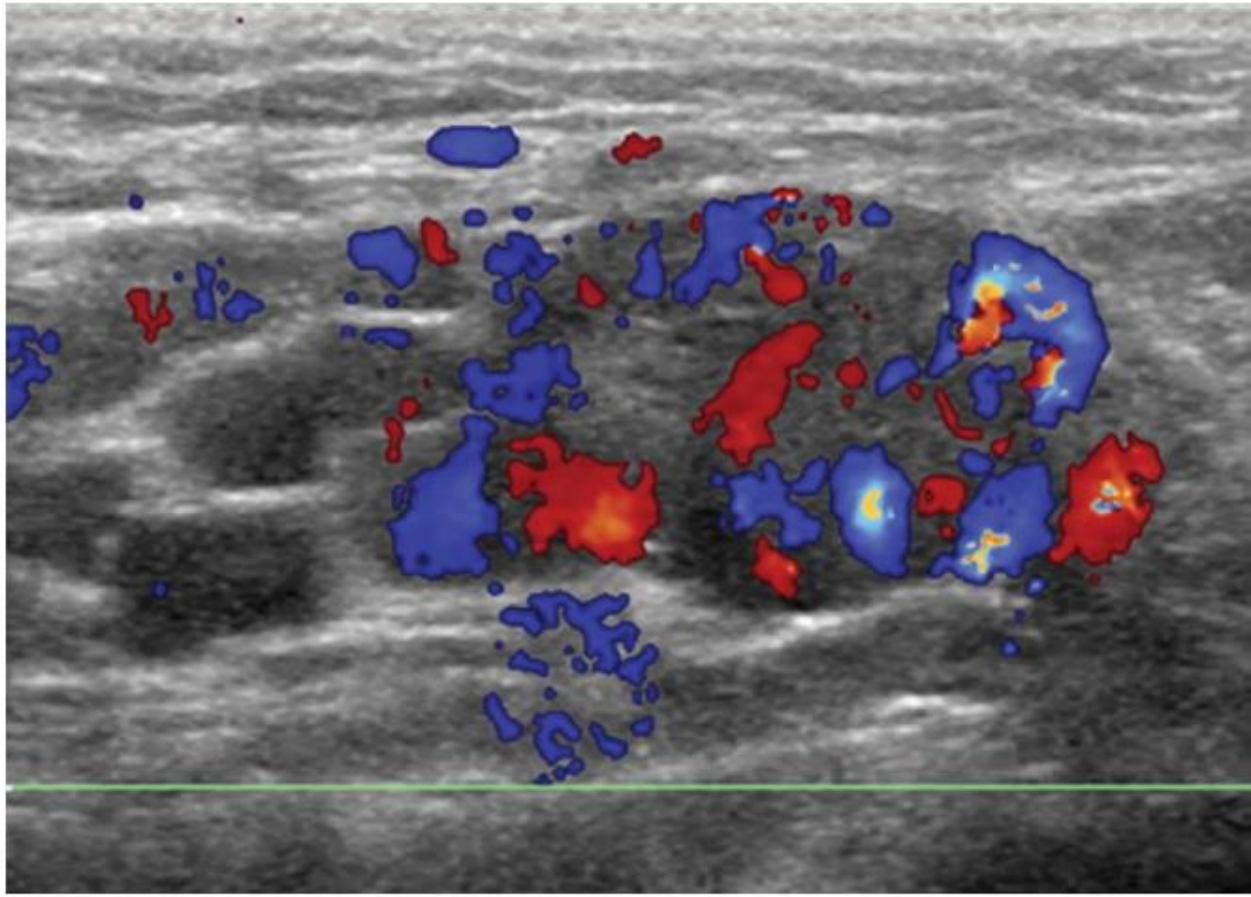




Chronic - hyperechoic with peripheral revascularization



A



B

POCUS

- At 2-4cm intervals

- **P**oint-**O**f-Care **C**ompression **U**ltra**S**ound (POCUS)

  2-point US : CFV, PV

  sensitivity 91%, specificity 98% Medicine (Baltimore). 2019 May; 98(22): e15791.

Take-Home message

일단 멈춤

Arteriovenous fistula

Ultrasonographic report for arteriovenous access for hemodialysis

대한심장혈관흉부외과학회 초음파위원회

ID: Name: sex/age: /

1. Problems
☐ No thrill/bruit / ☐ Decreased thrill/bruit / ☐ Prolonged bleeding
☐ Decreased access flow / ☐ Elevated access pressure
☐ Delayed maturation / ☐ Aneurysm / ☐ Arm edema / ☐ Pain
☐ Pre-op evaluation / ☐ Post-op evaluation / ☐ others:

2. Previous arteriovenous access data
- Op date / Op name:

3. Measurements
- A anastomosis: mm
- V anastomosis: mm
- JAV: mm

- Feeding artery: ☐ radial / ☐ brach
  - Diameter: mm
  - Volume-flow: ml/min
- Arterial side: ☐ cephalic / ☐ graft
  - Diameter: mm
  - Volume-flow: ml/min
- Venous side: ☐ cephalic / ☐ graft / ☐ basilic / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min
- Drained vein: ☐ cephalic / ☐ basilic / ☐ brachial / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min

- Stenosis
  ☐ yes ☐ no

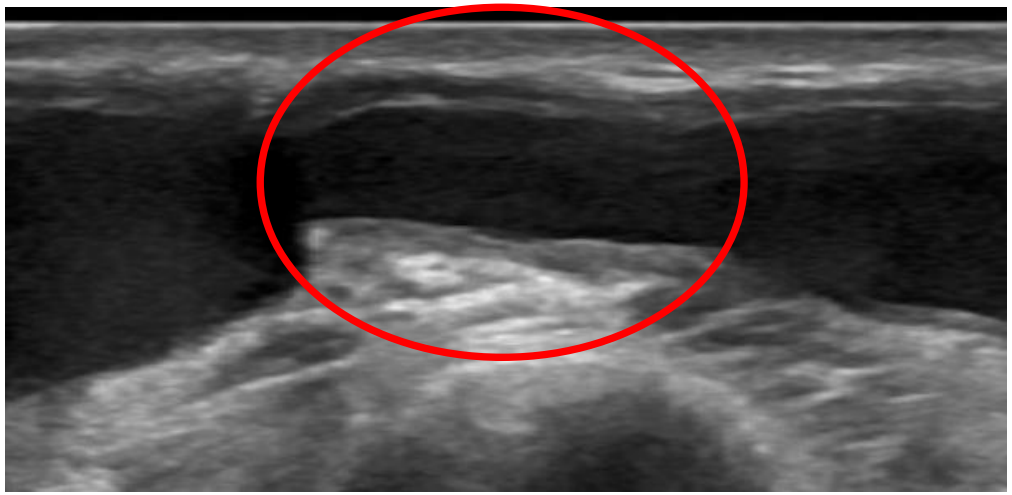
- Thrombosis
  ☐ yes ☐ no

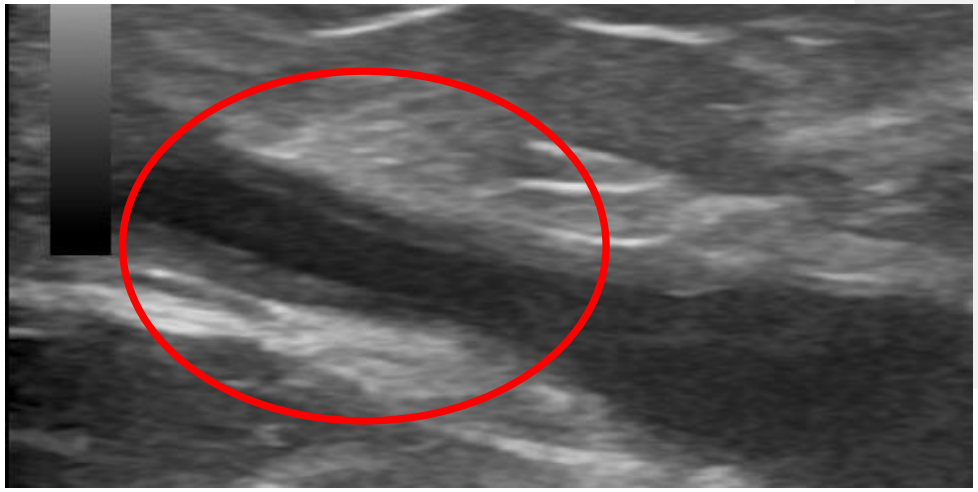
4. other findings

1. Problems
☐ No thrill/bruit / ☐ Decreased thrill/bruit / ☐ Prolonged bleeding
☐ Decreased access flow / ☐ Elevated access pressure
☐ Delayed maturation / ☐ Aneurysm / ☐ Arm edema / ☐ Pain
☐ Pre-op evaluation / ☐ Post-op evaluation / ☐ others:

Vascular Ultrasound

- High-resolutional image **more than your expectation**





KDOQI guideline

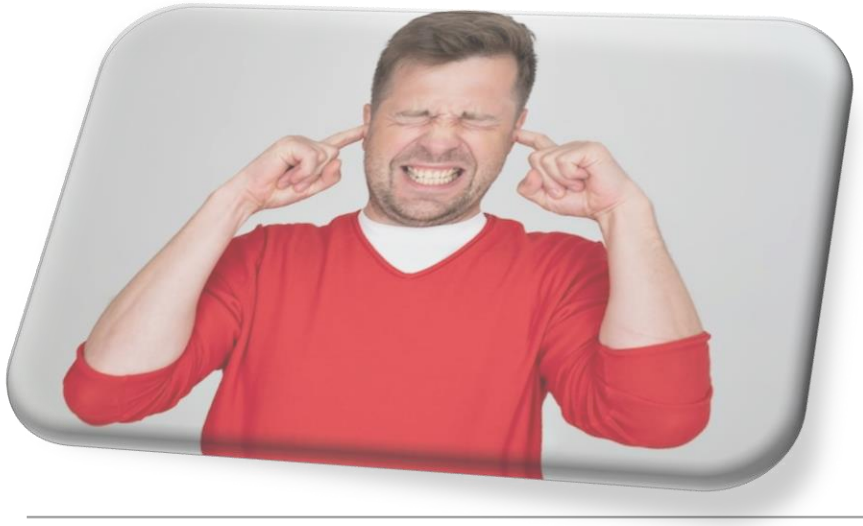
Guideline 13. AV Access Flow Dysfunction Monitoring/Surveillance

AVF, AVG의 개통성의 개선을 위해서 monitoring외에 추가적인 surveillance를 하는것에 대한 권고사항을 만드는 것은 근거가 부족하다.

즉, Surveillance소견은 보조적이며, 이 소견만으로 어떠한 조치를 취해서는 안 된다.

Monitoring

- Look
- Feel with your fingers
- Listen with a stethoscope



Clinical Indicator

- Physical exam
- Dialysis

Clinical indicator

신체검사

- 한쪽 사지의 부종
- 부위별로 현저하게 다르게 느껴지는 박동 및 떨림의 변화
- 비정상적인 잡음
- 팔을 올릴 때 허탈이 되지않는 동정맥루
- 팔을 올릴 때 정맥부의 과도한 허탈

투석시

- 이전에는 문제가 없었으나, 새롭게 발생한 천자곤란
- 혈전이 흡입됨
- 목표한 혈류에 도달하는 것이 불가능함
- 투석시 3회 연속 평소보다 천자부위 지혈 지연
- 투석시간의 연장없이 동일한 투석처방에서 설명되지 않는 Kt/V의 감소

Monitoring

- Look
- Feel with your fingers
- Listen with a stethoscope

Clinical Indicator

- Physical exam
- Dialysis

US scan start

5. Scan순서

- Anastomosis5
- Juxta-anastomosis stenosis
- Arterial needle puncture site
- Middle
- Venous needle puncture site
- Venous drainage route
  - Forearm – to perforator, to UCV, to Bs V
  - Upper arm- to prox. CV- CAS- Scl., or Axillary vein

3. Measurements

- A anastomosis: mm
- V anastomosis: mm
- JAV: mm

- Feeding artery: ☐ radial / ☐ brachial / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min
- Arterial side: ☐ cephalic / ☐ graft / ☐ basilic / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min
- Venous side: ☐ cephalic / ☐ graft / ☐ basilic / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min
- Drained vein: ☐ cephalic / ☐ basilic / ☐ brachial / ☐ other
  - Diameter: mm
  - Volume-flow: ml/min

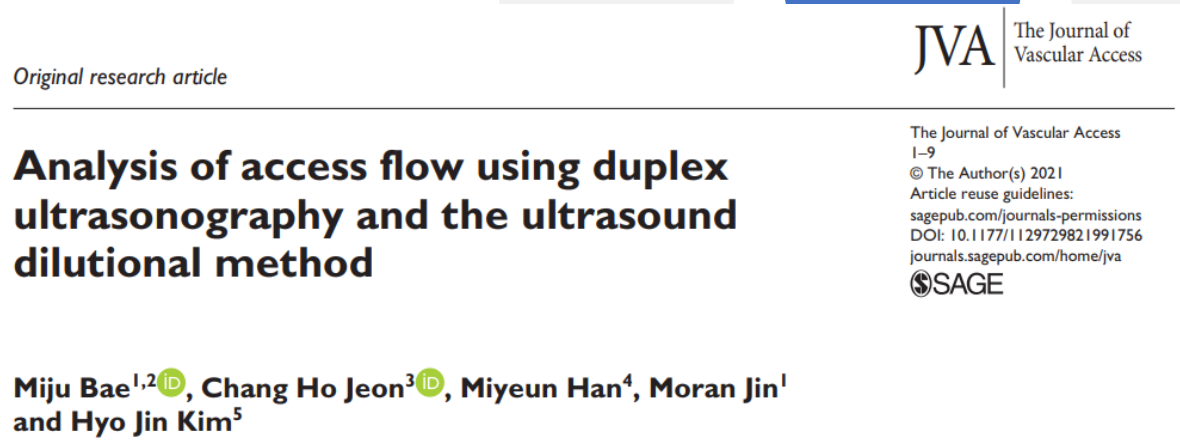
- Stenosis
  - ☐ yes ☐ no

- Thrombosis
  - ☐ yes ☐ no

Flow measurement

- Site:
  - Proximal Brachial artery
  - Fistula
  - Venuos drain route

- Within the same anatomical section of the inflow artery



Original research article

JVA The Journal of Vascular Access

Analysis of access flow using duplex ultrasonography and the ultrasound dilutional method

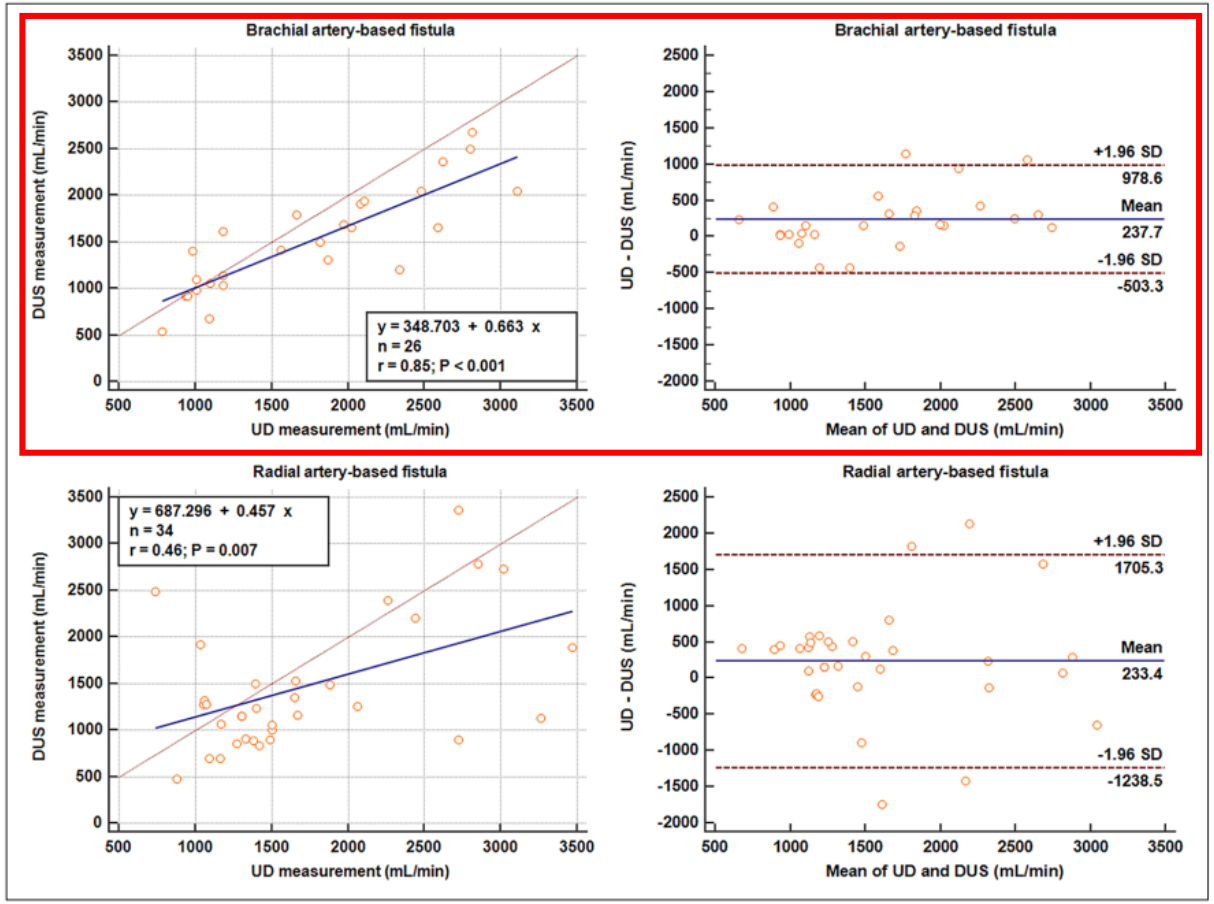
The Journal of Vascular Access
1–9

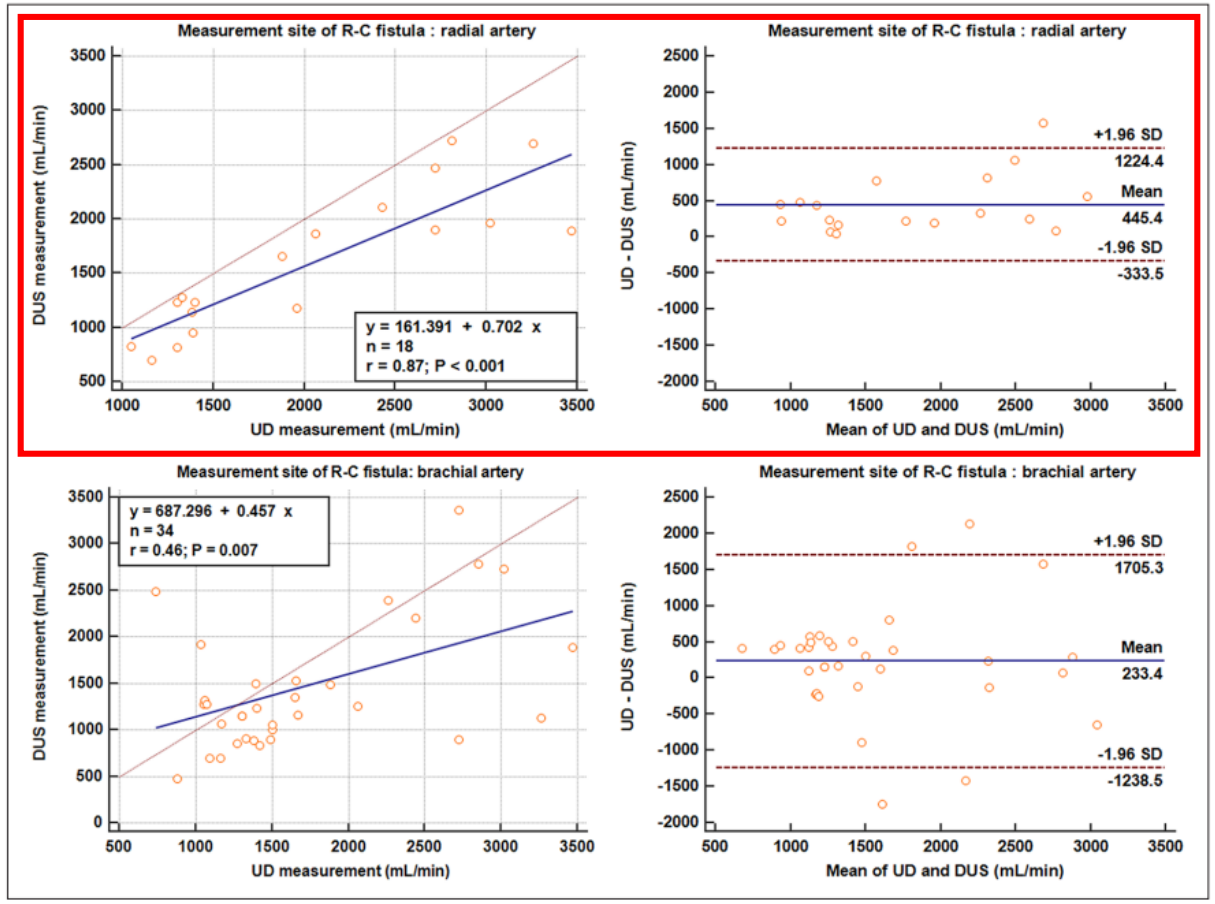
DOI: 10.1177/1129729821991756
journals.sagepub.com/home/jva
SAGE

Miju Bae[1,2], Chang Ho Jeon[3], Miyeun Han[4], Moran Jin[1] and Hyo Jin Kim[5]

Brachial artery에서 측정

RC fs를 RA, BA에서 측정





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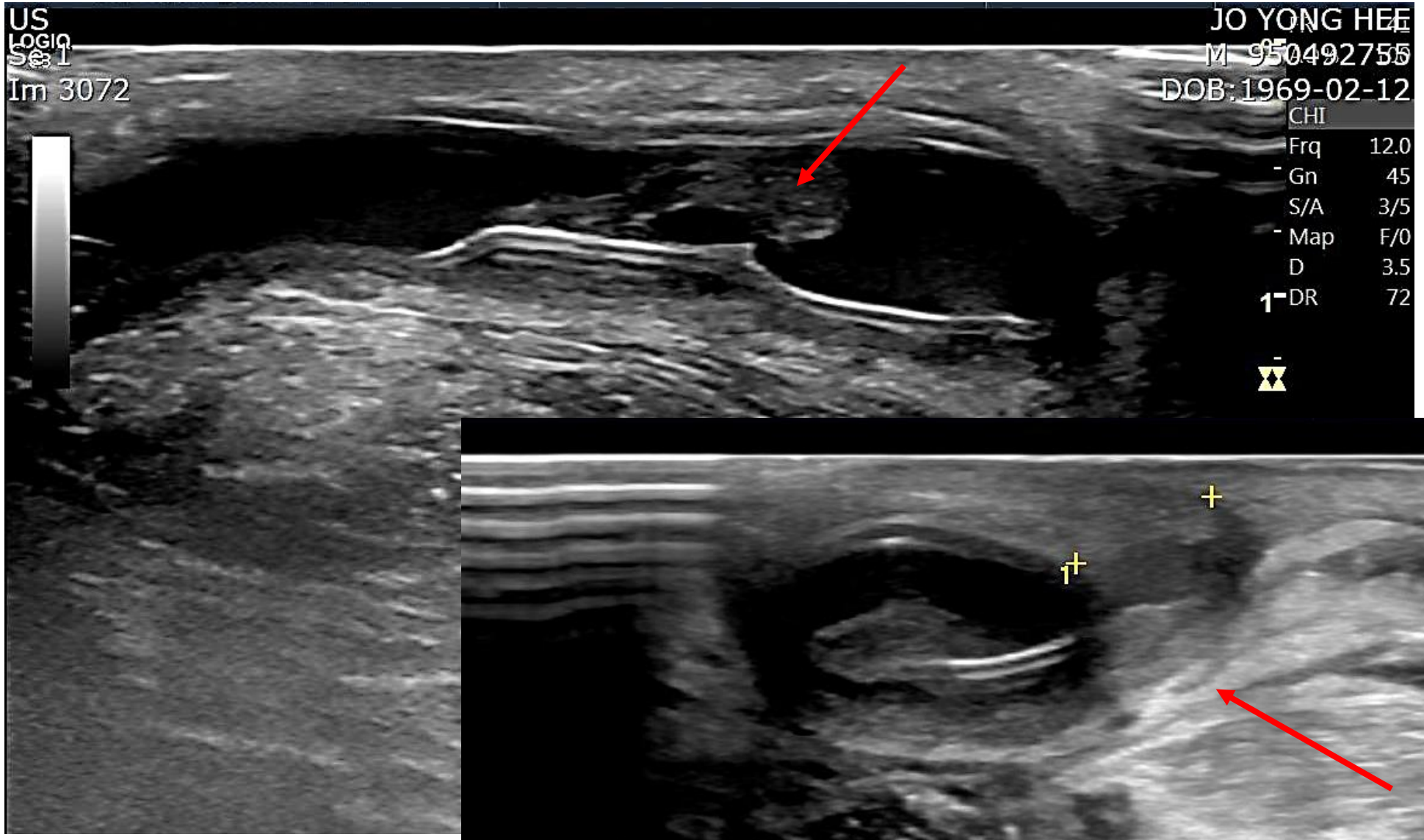
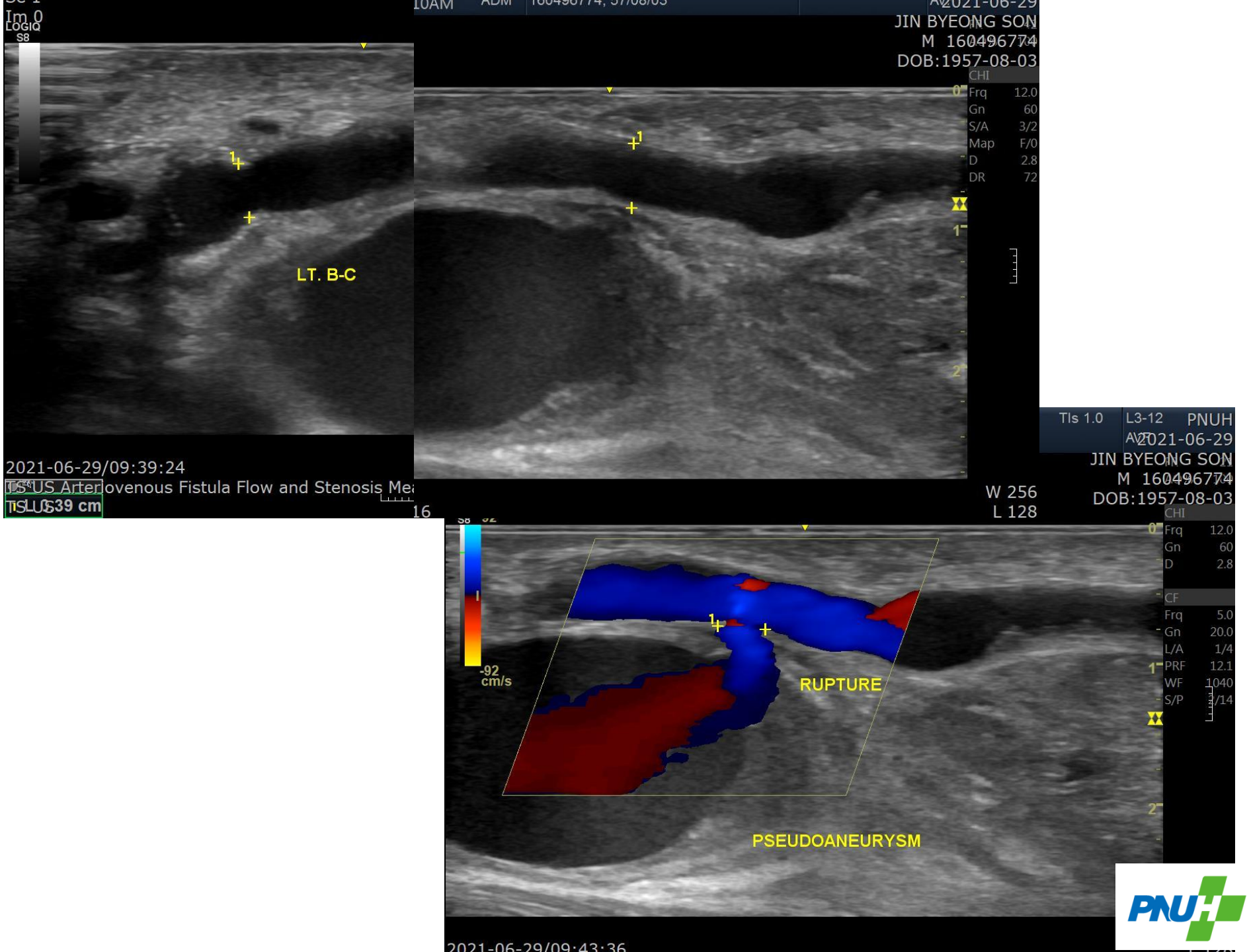
Pusan National University Hospital

혈관 조영술 결과 이상 소견을 보였던 구간의 정확한 재검사

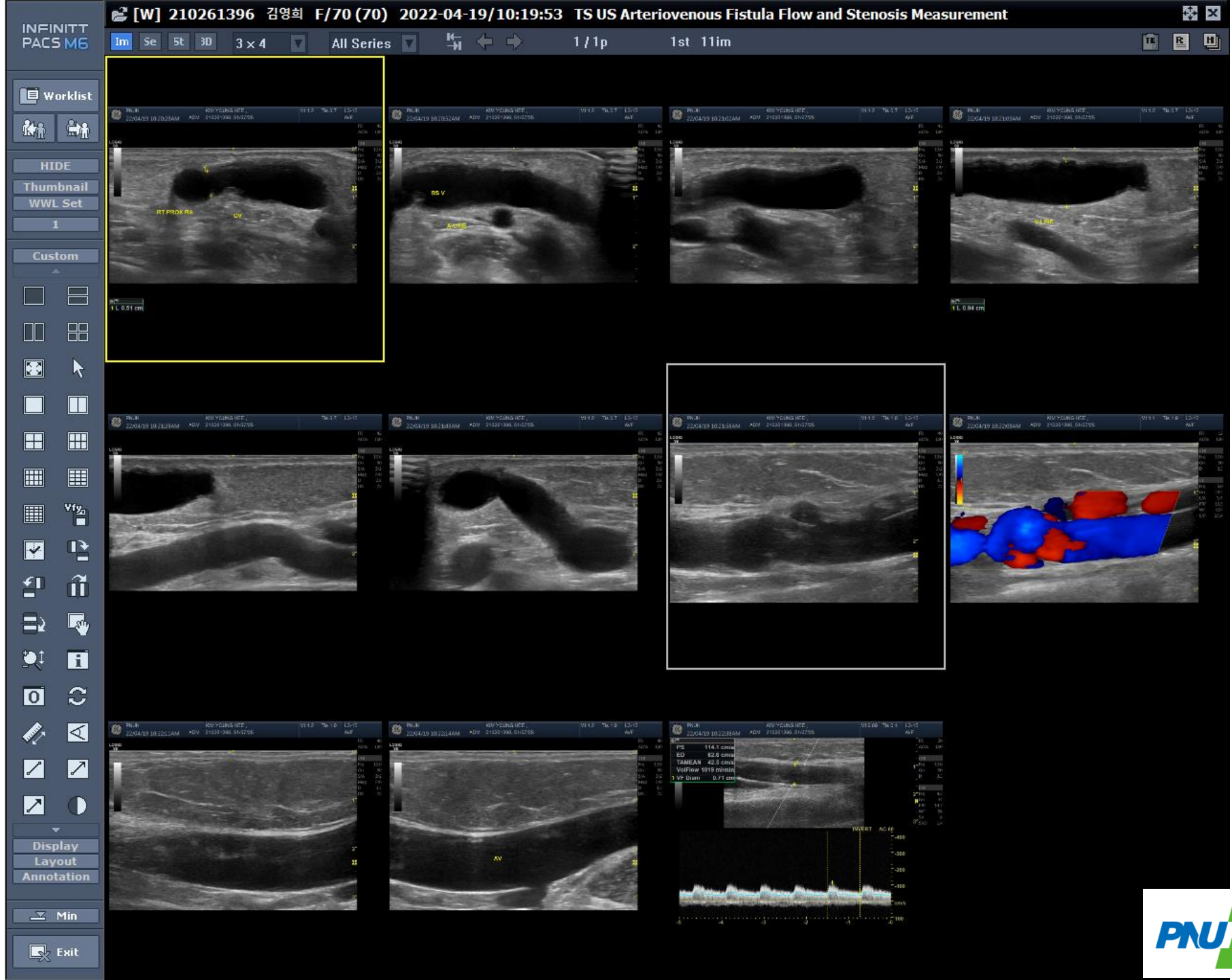
- Stenosis ➔ PSV measurement
- Intimal Hyperplasia
- Obstruction
- Collateral vessles
- Instent re-stenosis
- Rupture with pseudoaneurysm

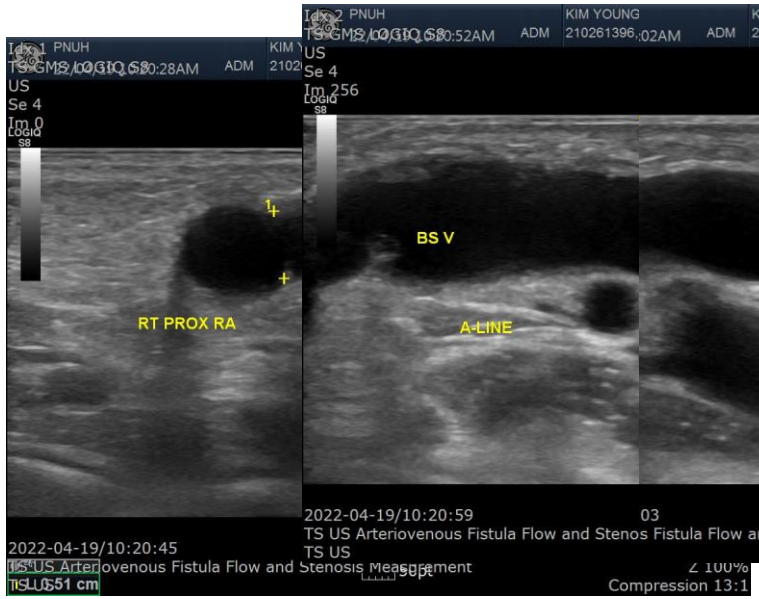


부산대학교병원
Pusan National University Hospital

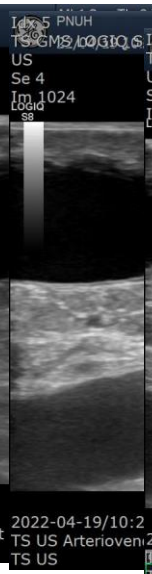


부산대학교병원
Pusan National University Hospital




RT PROX RA
2022-04-19/10:20:45
TS US Arteriovenous Fistula Flow and Stenosis Measurement
TS US

BS V
A-LINE
2022-04-19/10:20:59
TS US Arteriovenous Fistula Flow and Stenos Fistula Flow and Stenosis Measurement
TS US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TS US


V-LINE
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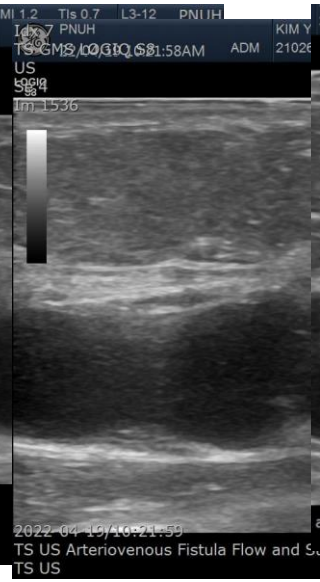
TS US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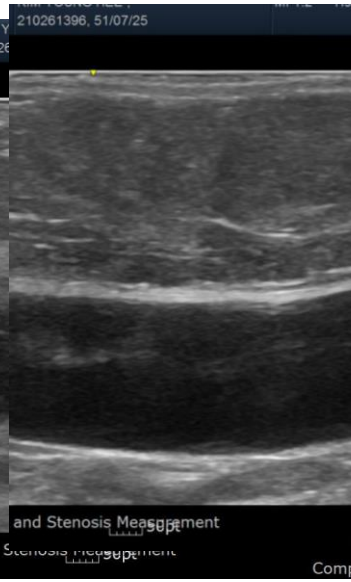
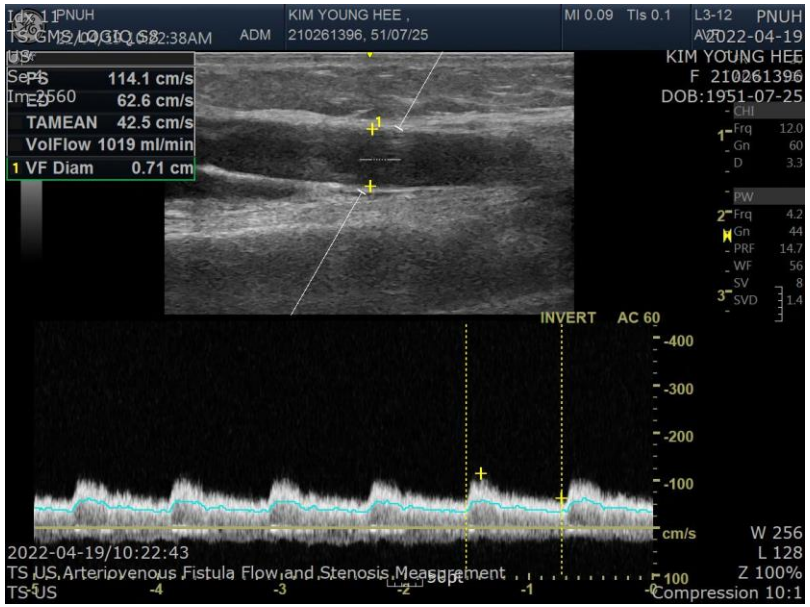
TS US


and Stenosis Measurement


PS 114.1 cm/s
ED 62.6 cm/s
TAMEAN 42.5 cm/s
VolFlow 1019 ml/min
VF Diam 0.71 cm
INVERT AC 60
-400
-300
-200
-100
cm/s
2022-04-19/10:22:43
TS US Arteriovenous Fistula Flow and Stenosis Measurement
TS US
Compression 10:1


2022-04-19/10:22:09
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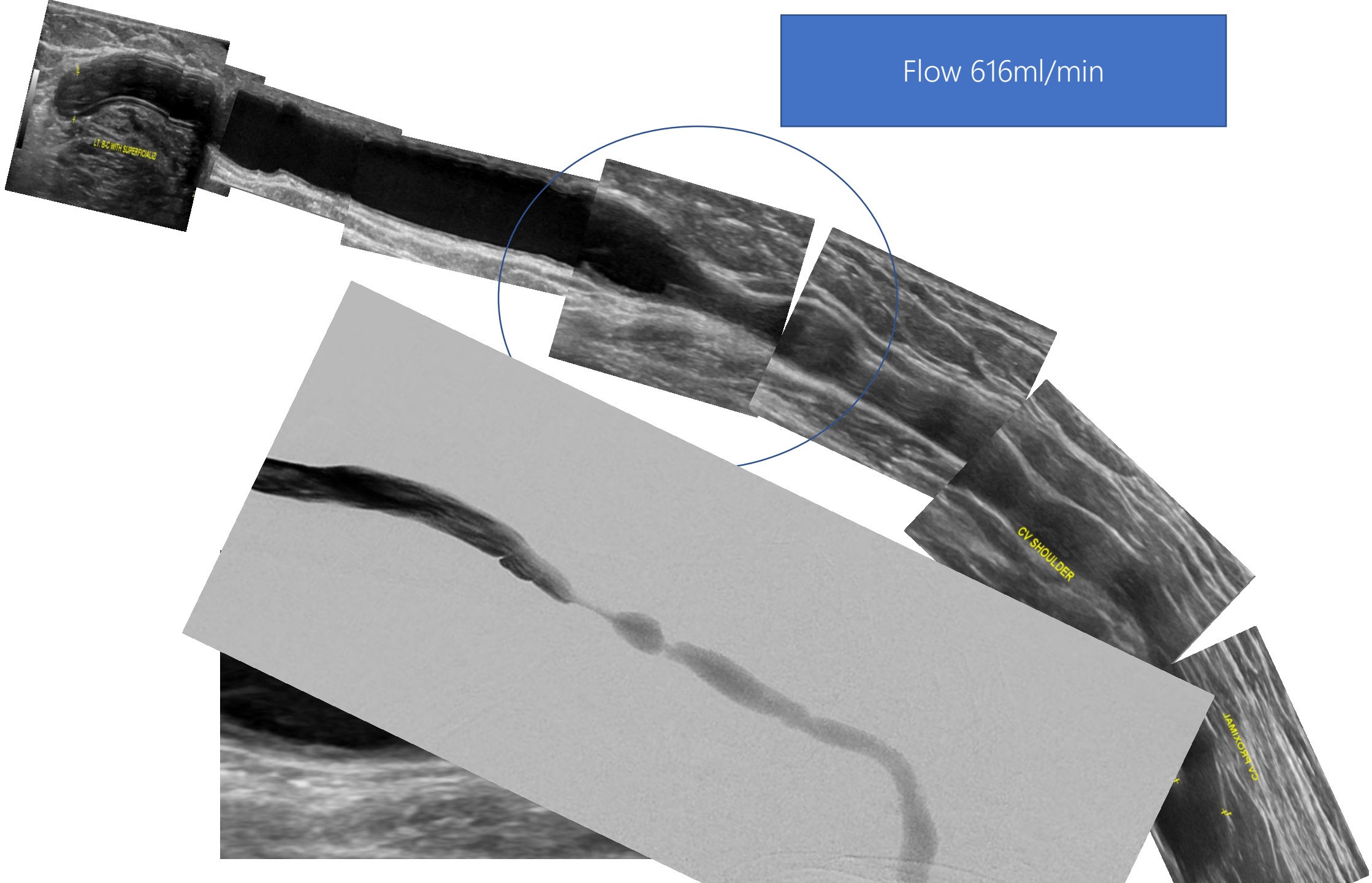
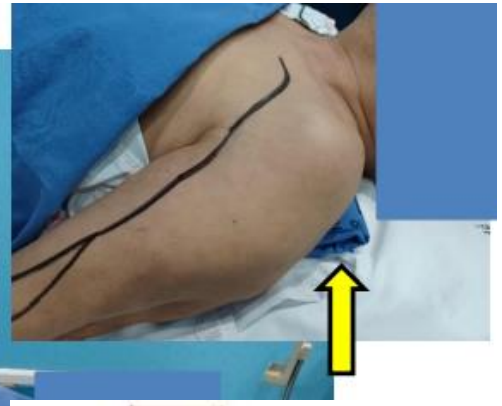
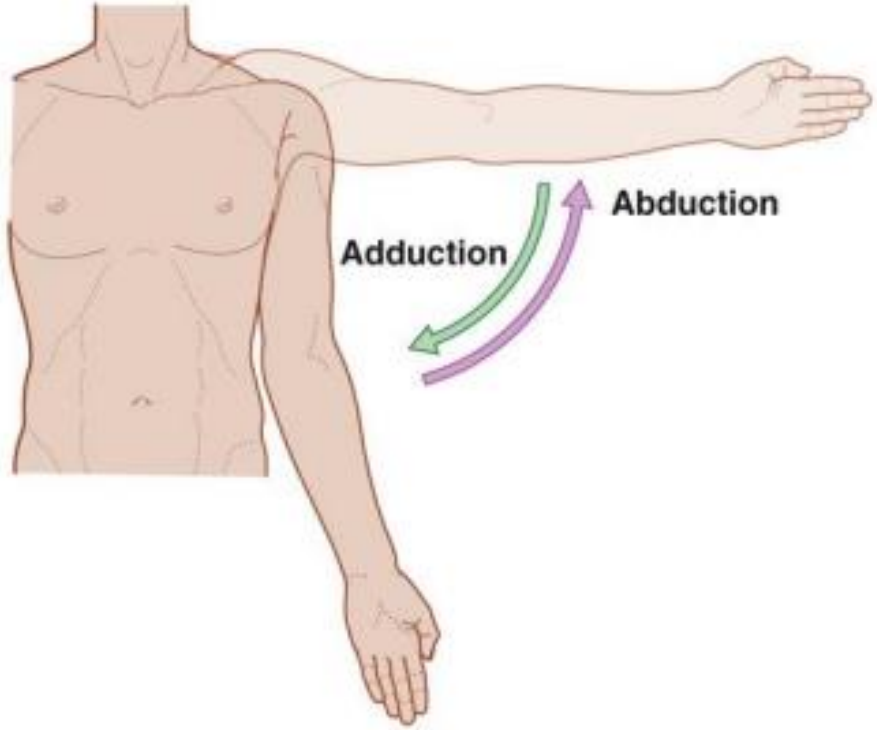
TS US
Compression 10:1

Flow 616ml/min

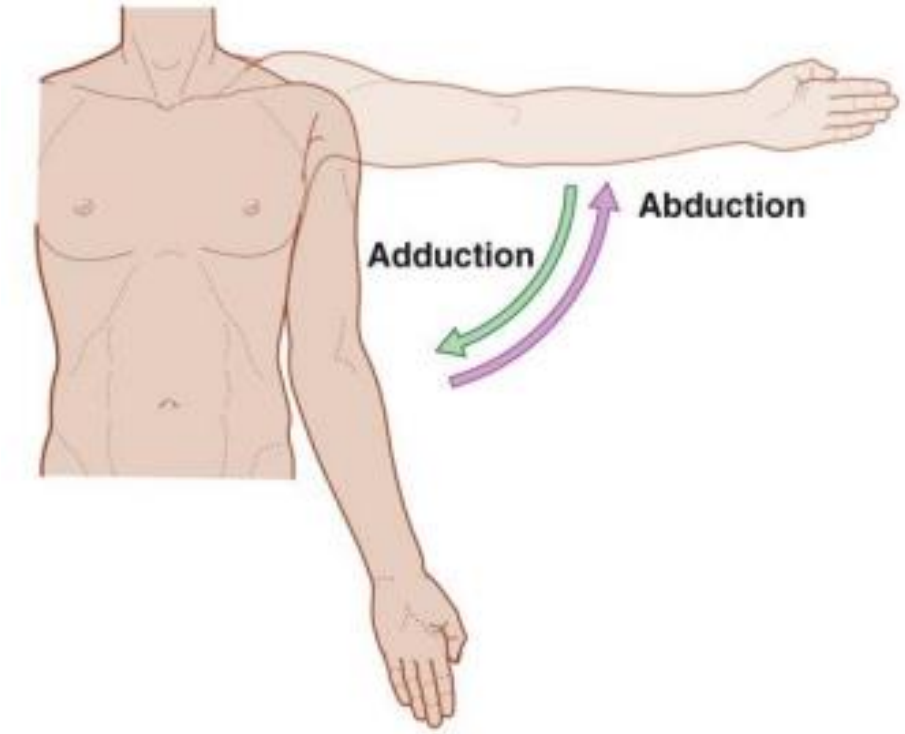


Cephalic arch evaluation

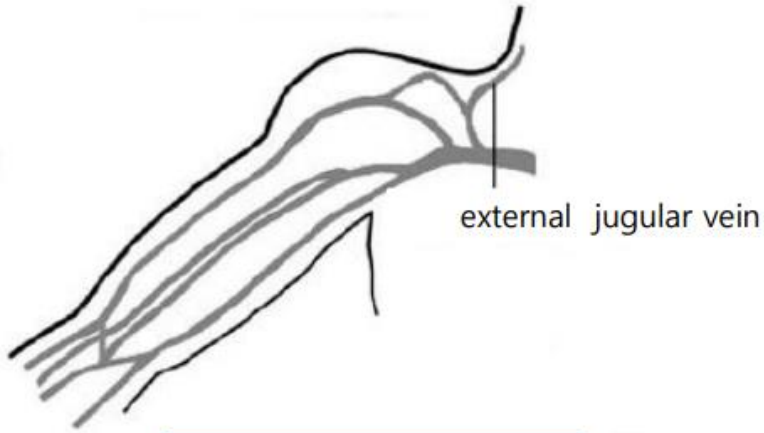




Variations



Parallel type



Supraclavicular type


US Scan for AVF

Take Home message

Monitoring

- Look
- Feel with your fingers
- Listen with a stethoscope

Clinical Indicator

- Physical exam
- Dialysis

US scan start

Arterial anastomosis부터 **probe**의 길이만큼씩 진행

Flow measurement

문제가 있었던 부분을 다시 자세히

모든 영상에는 **indicator**

내 영상을 나만 알수있게 하면 안 된다.

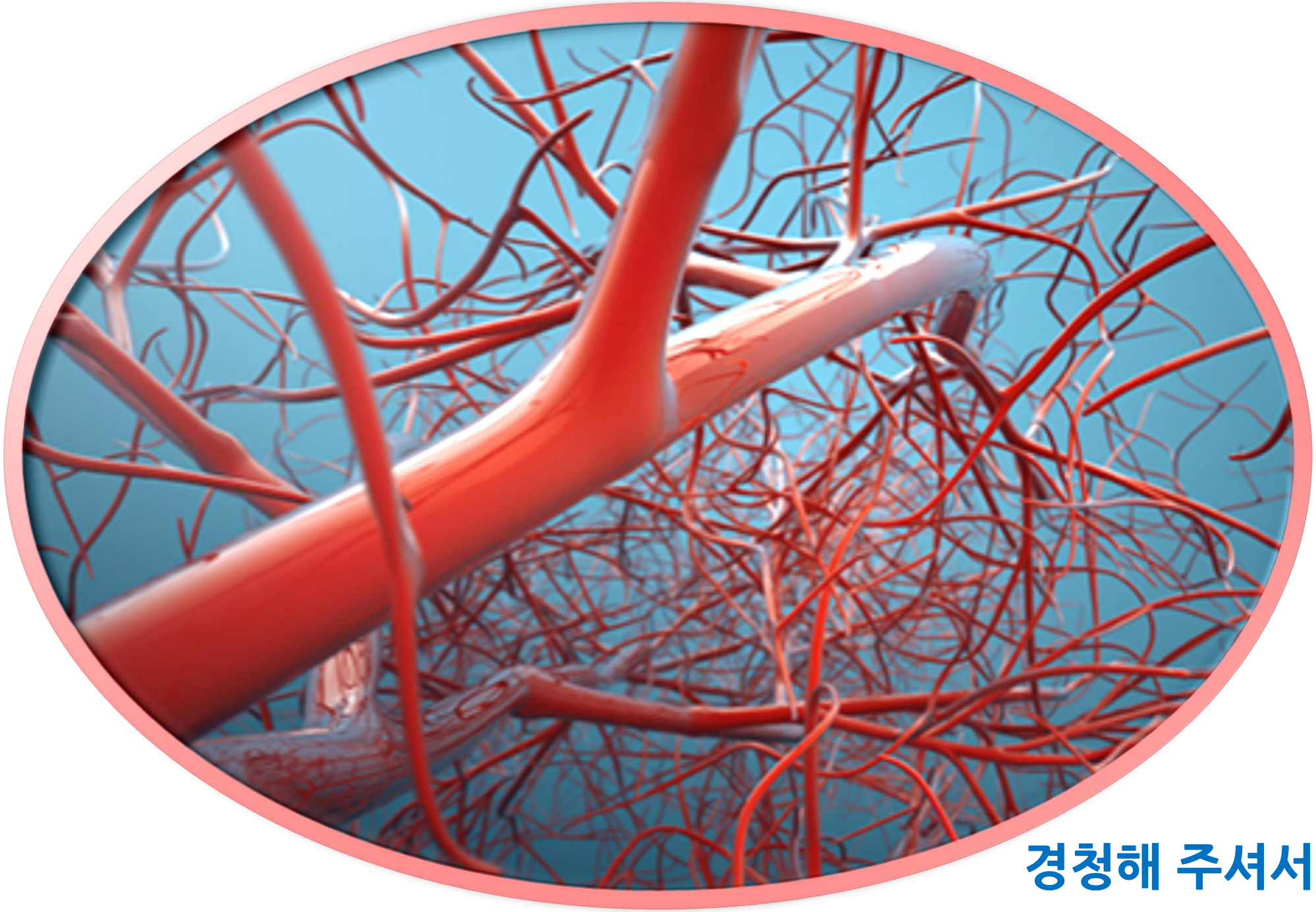
혈액투석로에 대한 초음파 평가는

Angiography보다 더 명확하게 국소적인 문제를 알 수 있다.

과대평가의 가능성

- **What is the appropriate intervention when stenosis is detected by surveillance in the absence of clinical indicators?**

DO NOTHING



경청해 주셔서 감사합니다.