週邊血管超音波在急重症醫學的應用

陳國智雙和醫院急診醫學科

陳國智 醫師

醫用超音波學會指導醫師
WINFOCUS director / instructor

急診 / 重症 / 介入 / 急性疼痛

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急診醫學會超音波委員會主委
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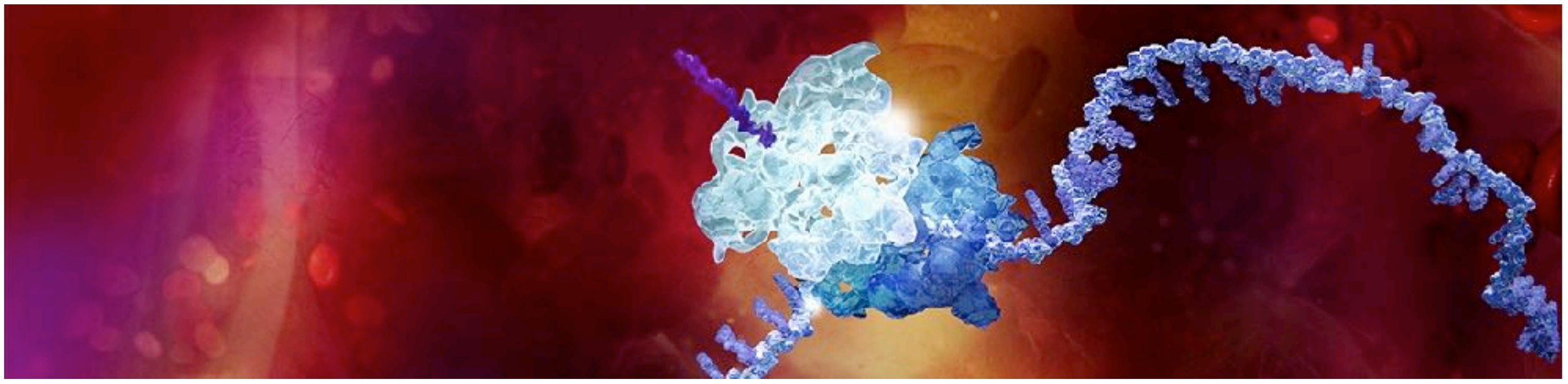
Excel *ACS patients outcome by* using cutting edge *DAPT in acute phase*

AstraZeneca

BRILINTA
ticagrelor tablets

DAPT with aspirin & P2Y12 inhibitor
is the cornerstone therapy for STEMI ~ 2020 Taiwan STEMI Guideline

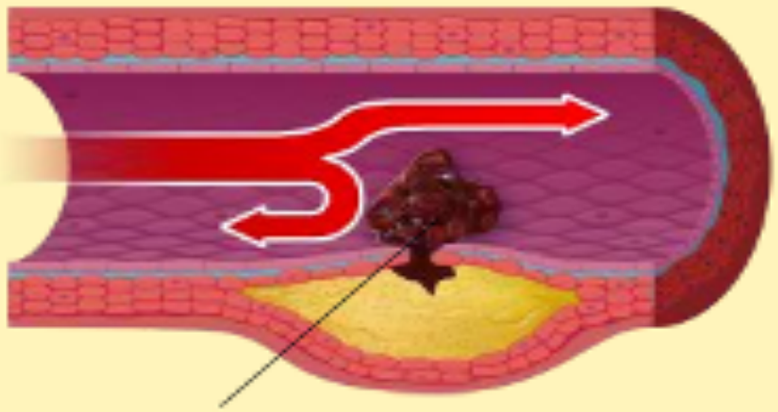


ACS and Coronary Artery Occlusion

AstraZeneca

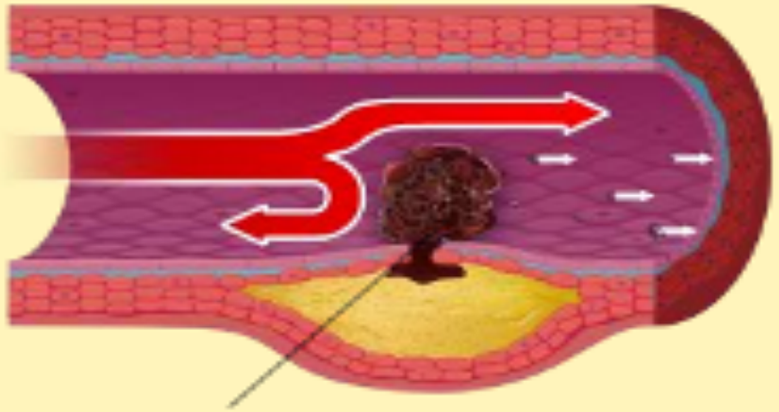
ACSs Precipitated by Coronary Artery Thrombosis

Unstable Angina



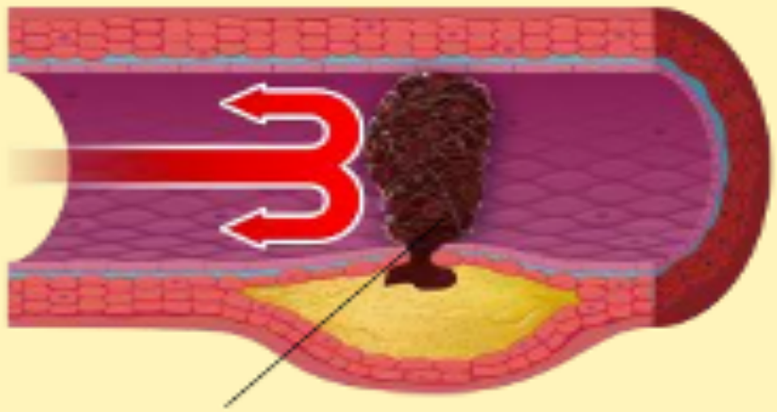
- Thrombus causes subtotal occlusion

NSTEMI

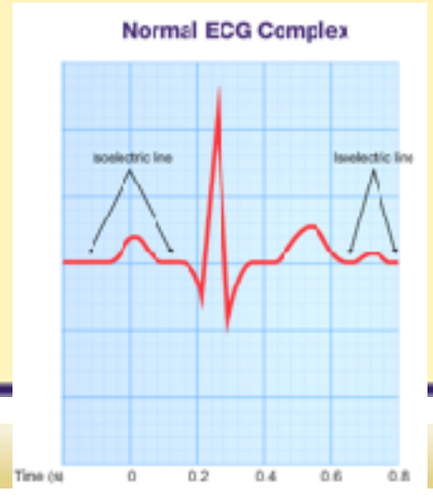


- Thrombus causes subtotal occlusion
- Platelet aggregates may cause **embolization** of smaller arteries downstream (white arrows)

STEMI



- Thrombus causes complete occlusion



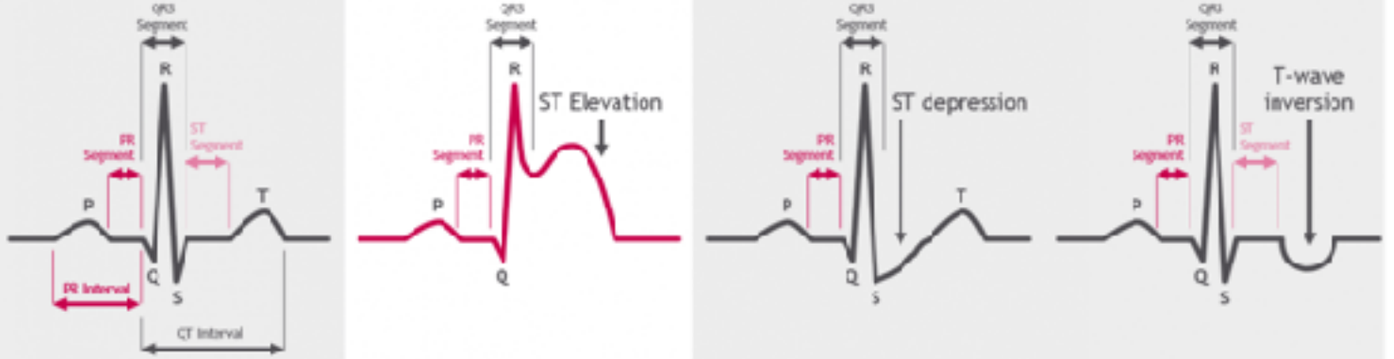
ACS – clinical distinction

ACS Type	Clinical Characteristics	
	Biomarker of Cardiac Cell Death* Released?	ST-Segment Elevation?
STEMI	Yes	Yes
NSTEMI	Yes	No
UA	No	No

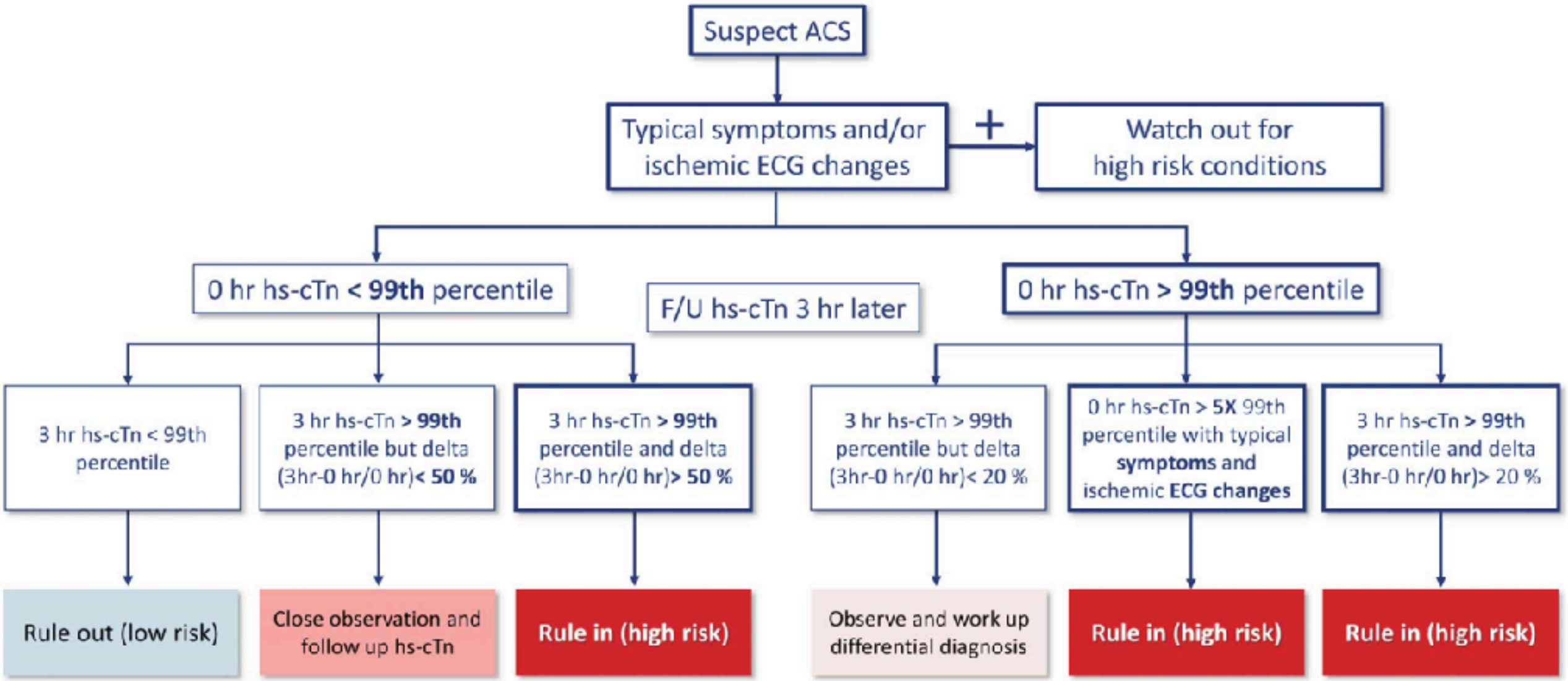
* Biomarkers of cardiac cell death include creatine kinase muscle-brain (CK-MB), myoglobin, and troponins I and T.

Diagnosis of STEMI: ECG change

- ST-segment elevation with pathological Q-wave formation
- Sometimes T-wave inversion may be found but it is a non-specific feature
- ST-segment elevation indicates full thickness cardiac muscle injury, pathological Q-wave indicates muscle necrosis and T-wave inversion indicates muscle ischaemia



2020 Taiwan STEMI Guideline



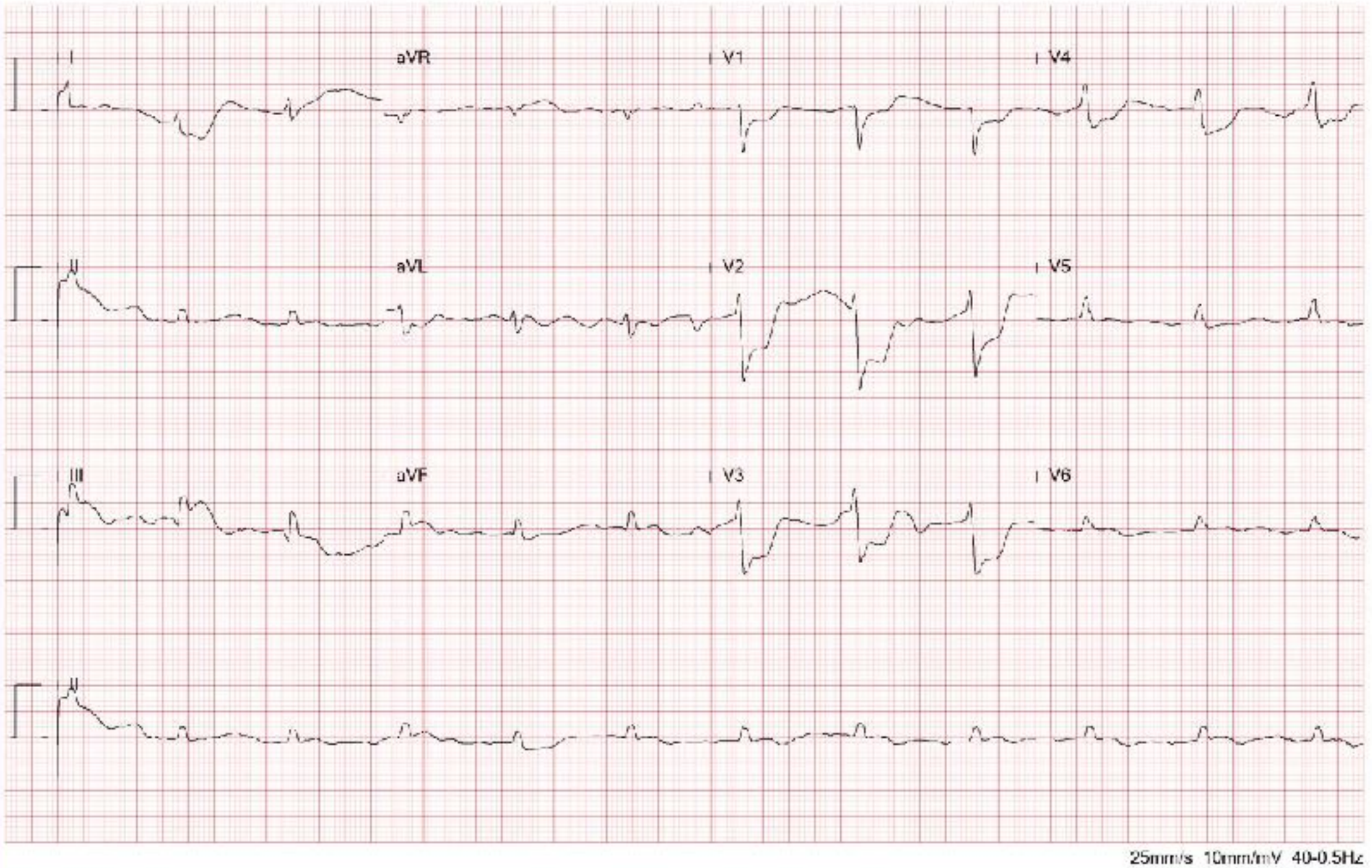
55M, chest pain, BP 80/59 mmHg

Patient ID: 14138647
Order Number:
Age:
Sex: O
Name:
Comment:

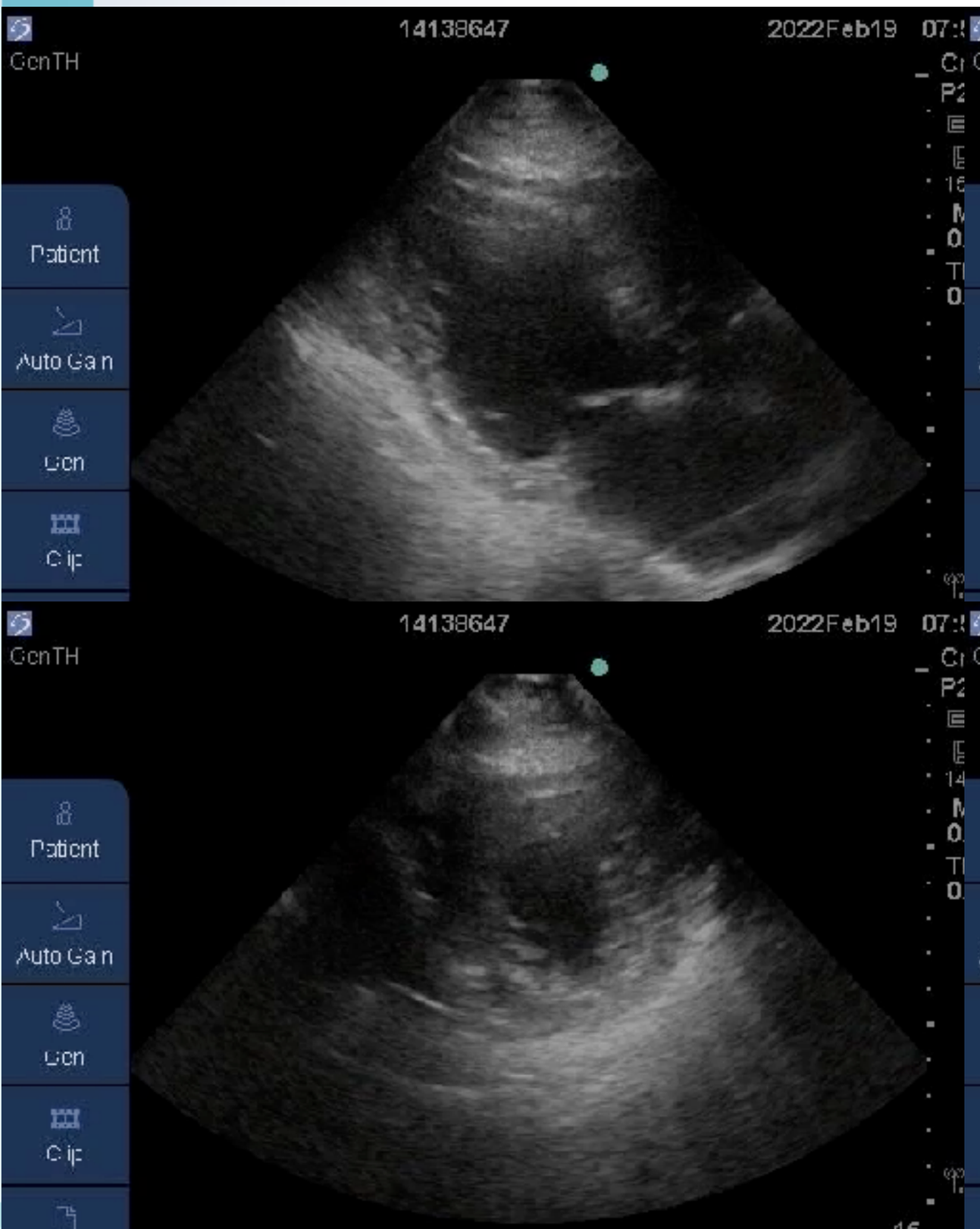
2022/02/19 07:45:24

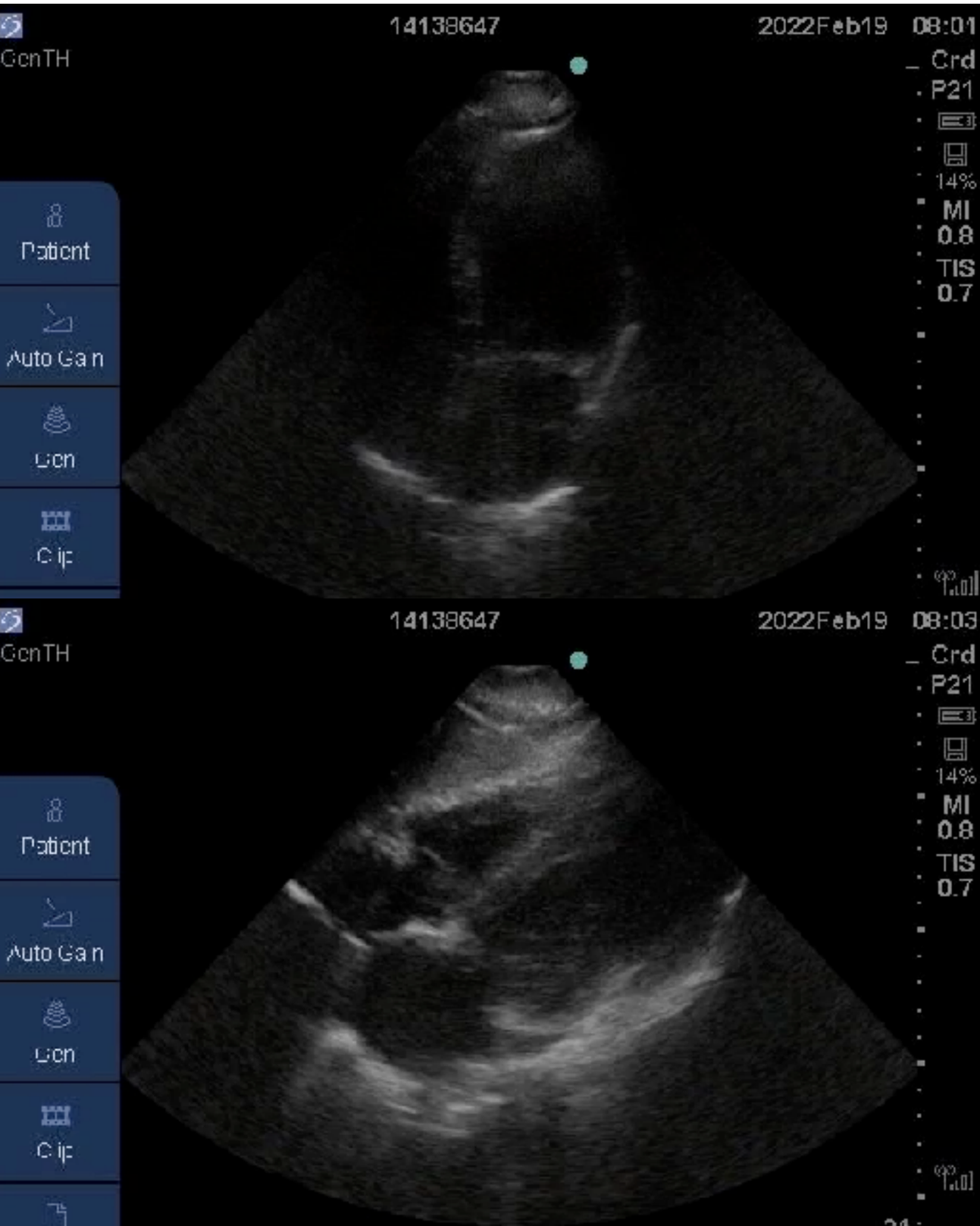
Vent rate:	68 BPM
PR int:	267 ms
QRS dur:	129 ms
QT/QTc:	363 / 389 ms
P-R-T axes:	-52 80 114

Age not entered, assumed to be 60 years old for purpose of ECG interpretation
Sinus or ectopic atrial rhythm...P axis (45,135)
Prolonged PR interval...PR >210, V-rate 50- 90
Nonspecific intraventricular conduction delay...QRSd >115mS, not LBBB/RBBB
Inferoposterior infarct, acute (RCA)...ST>.1 inf, <-.1 ant
Probable RV involvement, suggest recording right precordial leads
Baseline wander in lead(s) II,aVR



55M, chest pain, BP 80/59 mmHg



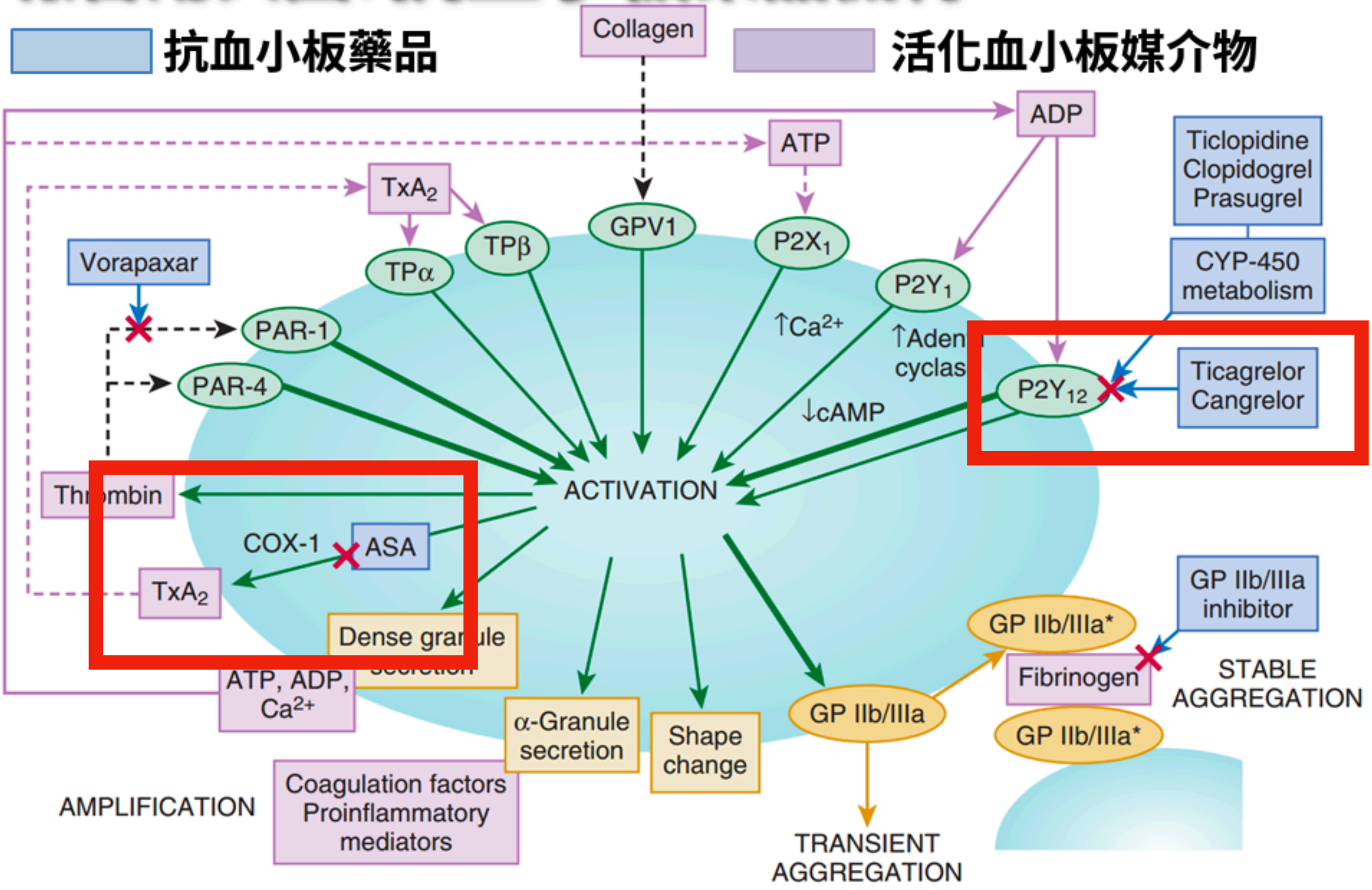


STEMI

報告用大圖: 抗血小板藥品機轉

the New England Journal of Stupid

抗血小板藥品　　活化血小板媒介物



資料來源: Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, 10e

抗血小板藥品完全攻略比較表

the New England Journal of Stupid

速效劑量要熟記、術前停藥要注意、研究結果有差異、小心使用衡利弊

	Clopidogrel (Plavix)	Prasugrel (Effient)	Ticagrelor (Billanta)	Cangrelor (Kengreal)
劑型	口服	口服	口服	靜脈注射
劑量 (速效/每日劑量)	300~600 mg ST/75 mg QD	60 mg ST/10 mg QD	180 mg ST/90 mg BID	30 mcg/kg IVB 之後 4 mcg/kg/min IVF
腎功能劑量調整	不需調整 (CKD stage 5 使用需權衡利弊)	不需調整	不需調整	不需調整
主要研究結果	CURE P: ACS (NSTEMI/UA) I: Clopidogrel + ASA C: ASA O: 心因性死亡、MI、中風↓2.1%重大出血↑1%	TRITON-TIMI 38 P: ACS + PCI I: Prasugrel C: Clopidogrel O: 心因性死亡、MI、中風↓2.2%重大出血↑0.6%	PLATO P: ACS I: Ticagrelor C: Clopidogrel O: 心因性死亡、MI、中風↓1.9%重大出血無顯著差異	CHAMPION PHOENIX P: PCI I: Cangrelor C: Clopidogrel O: 48 小時死亡、MI、缺血相關血管成型術、支架栓塞↓1.2%重大出血無顯著差異
$P2Y_{12}$ 受體	不可逆結合	不可逆結合	可逆結合	可逆結合
手術前停藥	5 天	7 天	5 天	1 小時
作用起始時間	2~6 小時	30 分鐘	30 分鐘	2 分鐘
作用時間長度	3~10 天	7~10 天	3~5 天	1~2 小時
Adenosine 再回收	不會抑制	不會抑制	會抑制 (呼吸困難↑5%，因此停藥↑0.8%)	會抑制

高雄市第二代自動判讀
緊急救護12導程心電圖系統

事故現場

報案

消防分隊

救護車出勤

EMTP依自動判讀結果轉送就近或適當醫院(心導管醫院)

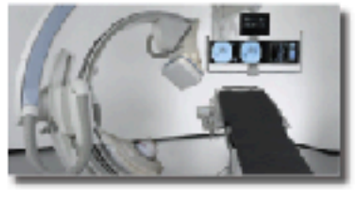
ECG透過GPRS回傳

到院前緊急救護中心

Server

自動轉發ECG至高雄榮總心臟專科醫師手機

提早啟動導管室



適當醫院
(心導管醫院)

就近醫院

Courtesy 高雄榮總

高雄市救護車上給予DAPT

Courtesy 高雄榮總

2020 Taiwan STEMI guideline

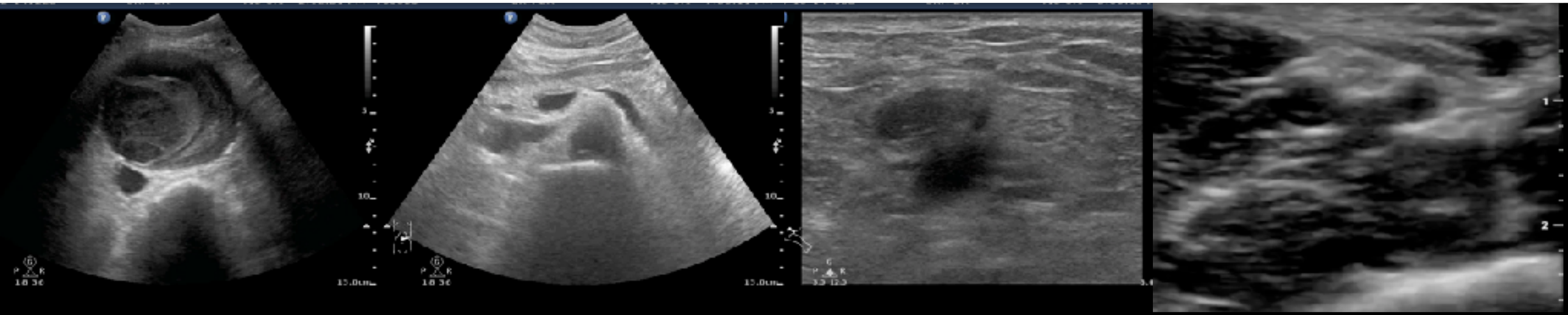
Antiplatelet therapy	
Ticagrelor (180 mg loading dose, 90 mg twice daily), **prasugrel (60 mg loading dose, 10 mg daily dose)*, or clopidogrel** (300-600 mg loading dose, 75 mg daily dose) is recommended in STEMI patients undergoing primary PCI unless contraindicated and **ticagrelor or prasugrel* is preferred to clopidogrel.**	**(COR I, LOE B)**
Clopidogrel rather than ticagrelor or prasugrel may be considered in patients with increased bleeding risk features.	**(COR IIa, LOE C)**
Reduced dose of **prasugrel (20 mg loading dose, 3.75 mg daily dose)*** may be considered in STEMI patients undergoing PCI based on Asian data.	**(COR IIa, LOE B)**

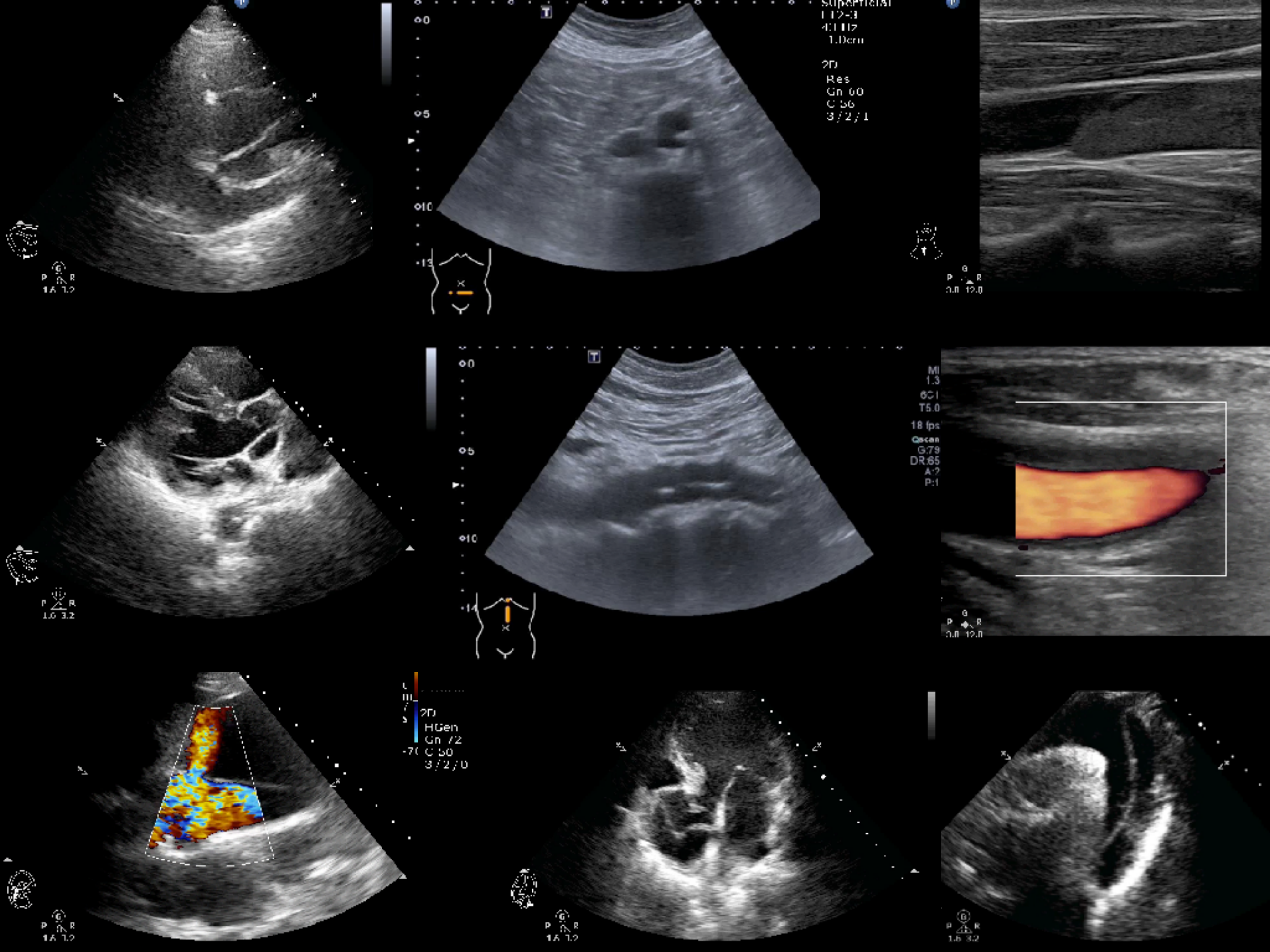
***Prasugrel 60 mg loading + 10 mg daily dose is not approved in Taiwan.**
Approved prasugrel dose in Taiwan: 20 mg loading + 3.75 mg daily dose.

2020 Focused Update of the 2012 Guidelines of the Taiwan Society of Cardiology for the Management of ST-Segment Elevation Myocardial Infarction. Li YH, et al., Acta Cardiol Sin 2020;36:265-307.

Vascular POCUS

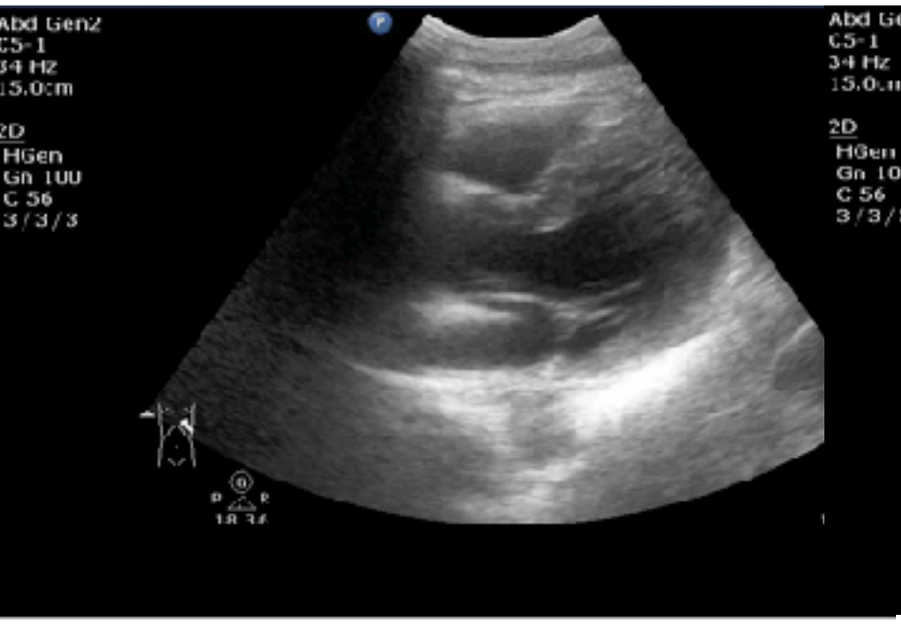
AAA **AD** **DVT** **Line**




2D
Res
Gn 60
C 56
3 / 2 / 1
MI
1.3
T5.0
18 fps
G:79
DR:65
2D
HGen
Gn 72
C 50
3 / 2 / 0

懷疑AD時的POCUS:PAC

CTA仍是最重要的檢查

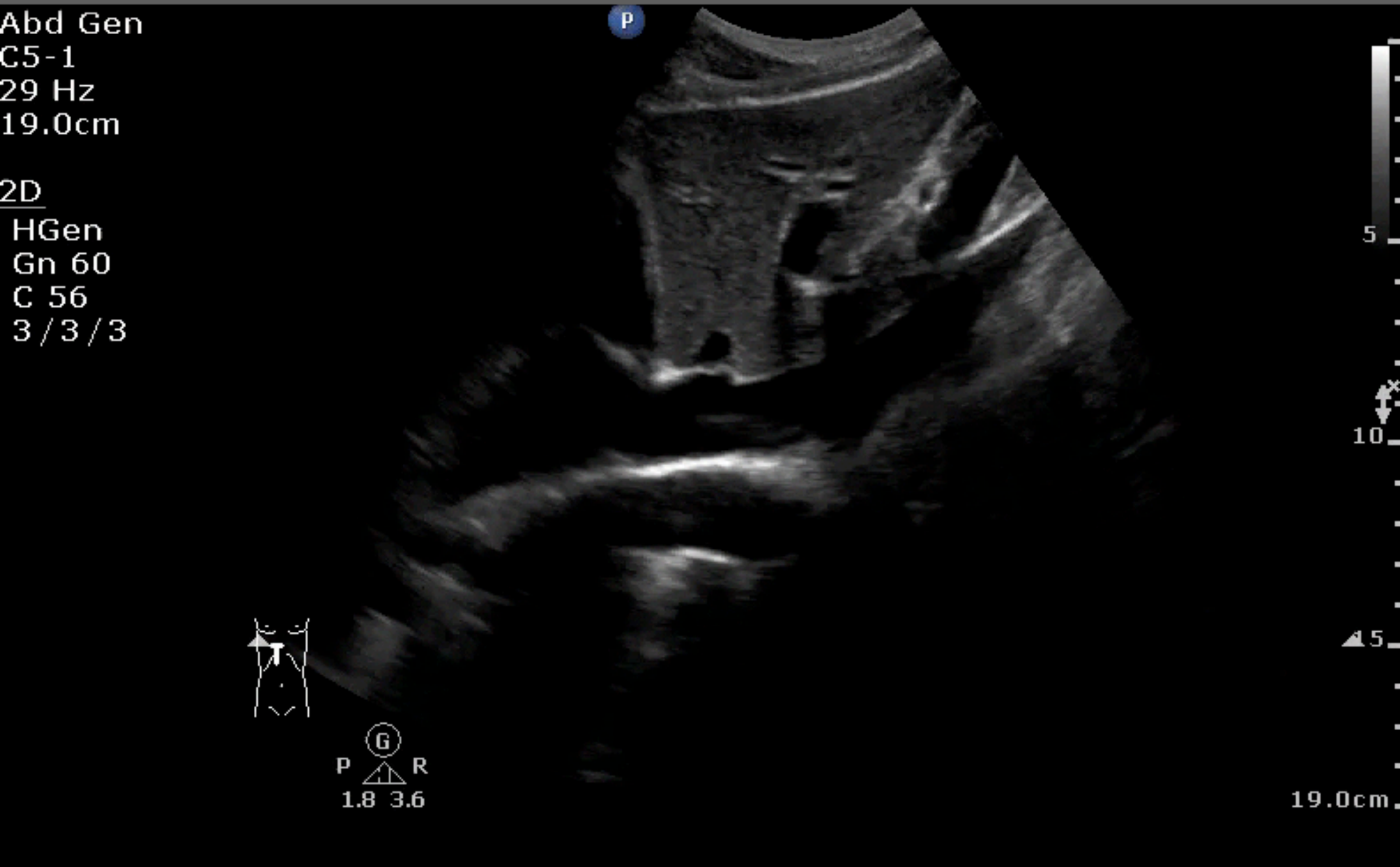


Pericardium

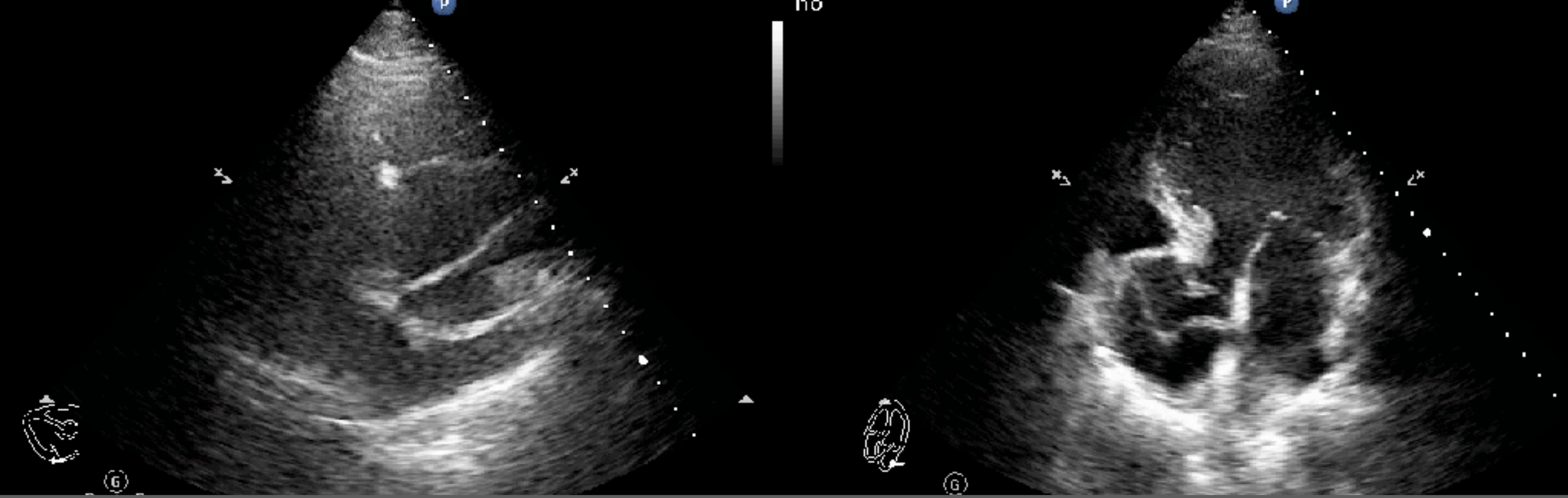
ABD Aorta

CCA

小心Mirror artifact



Chest pain & L leg pain



如何區分動脈和靜脈系統？

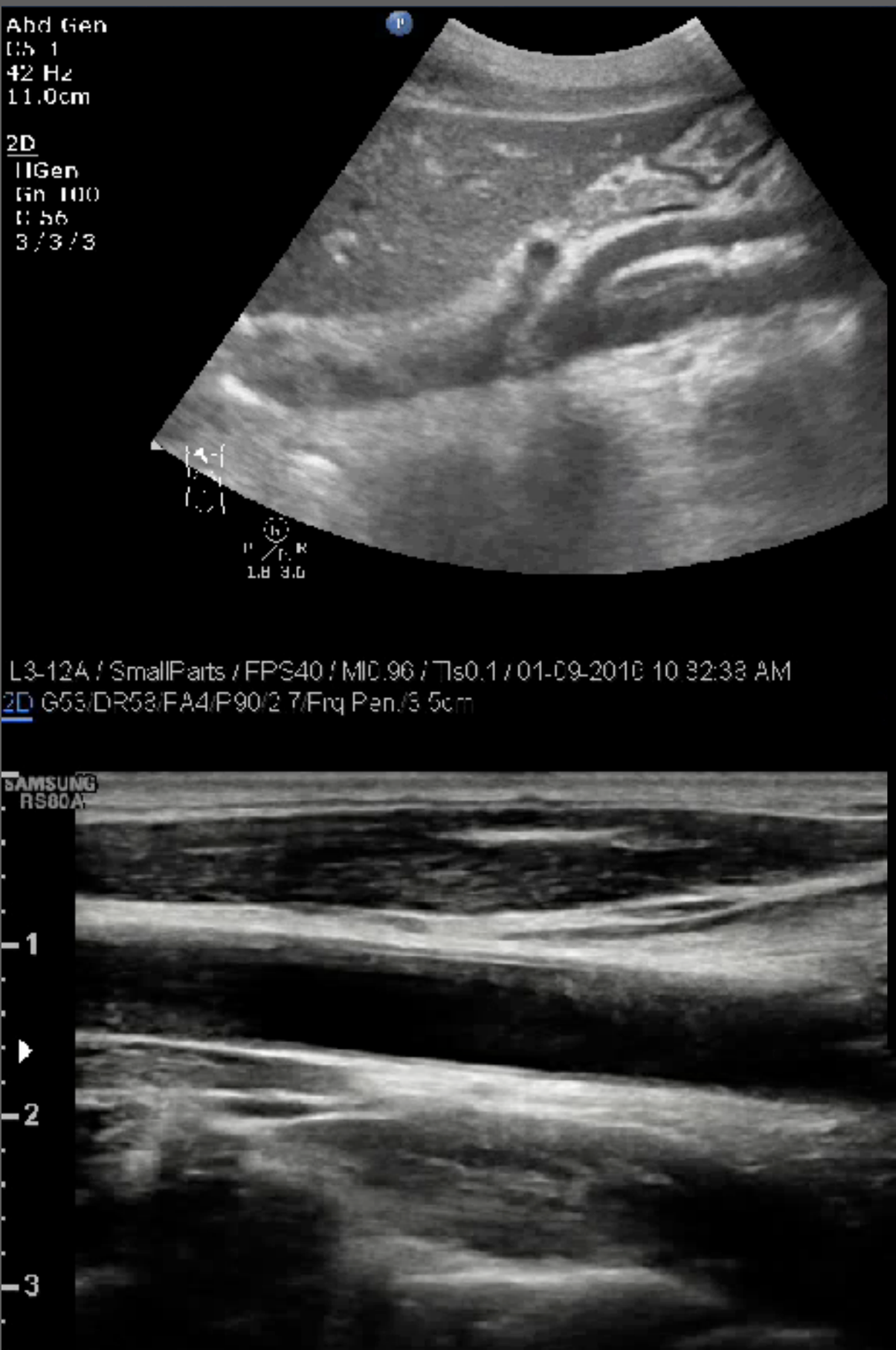
分支

壁厚

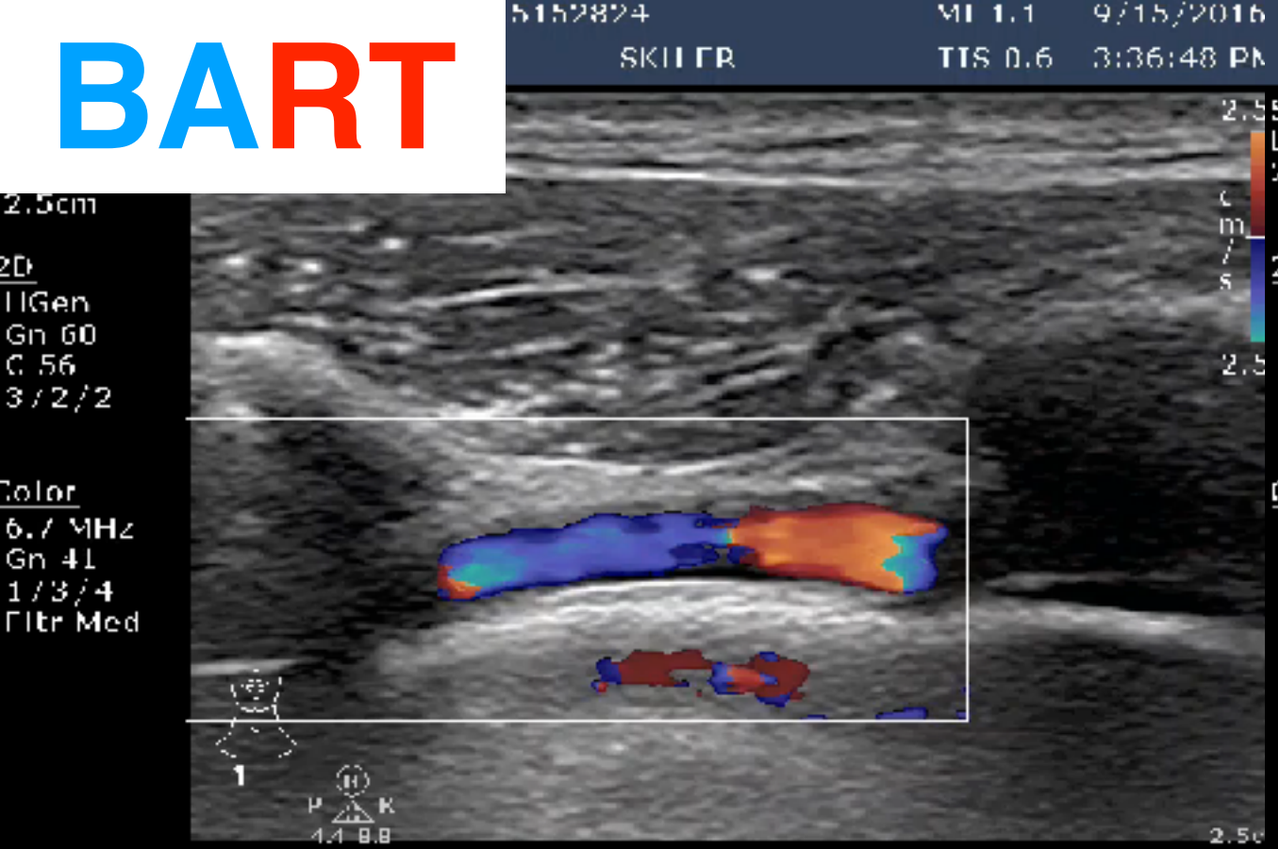
變異

內膜

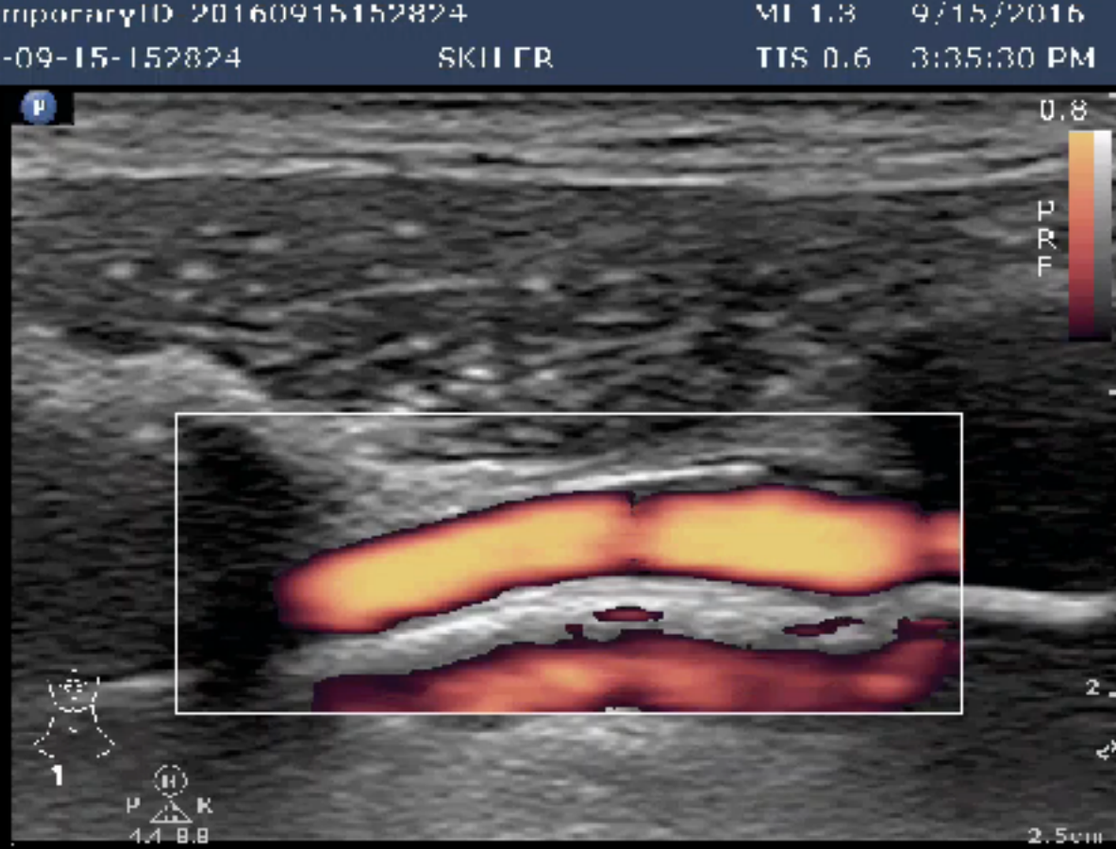
加壓



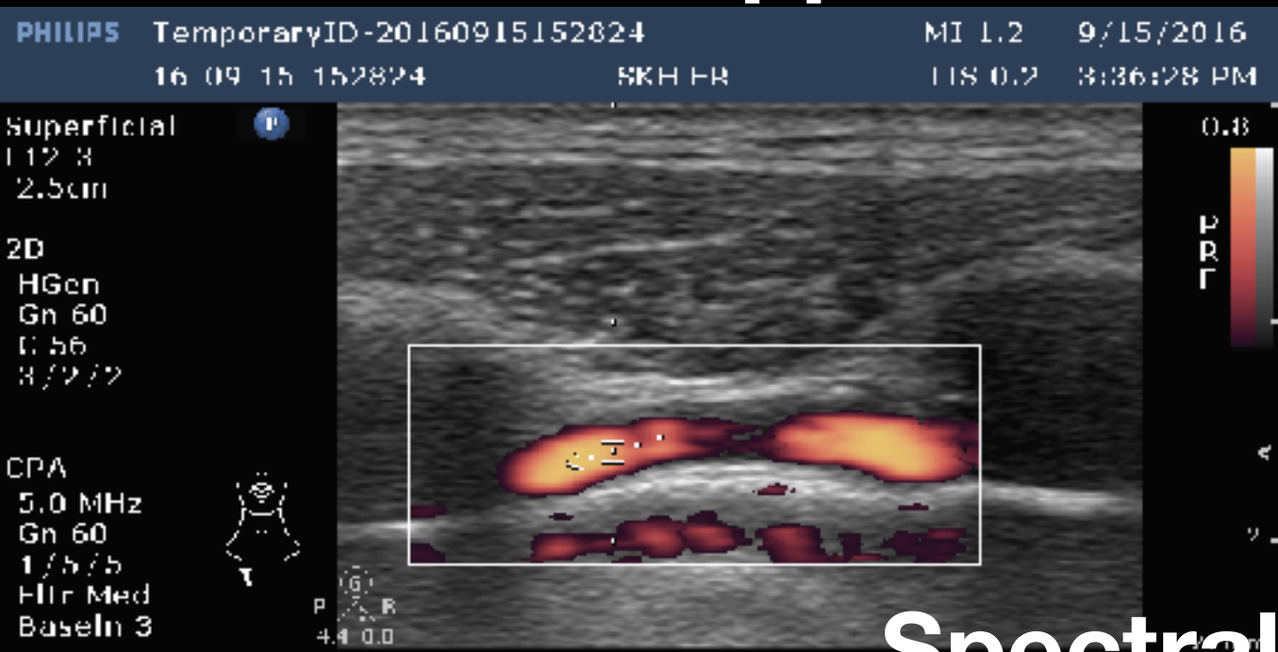
BART

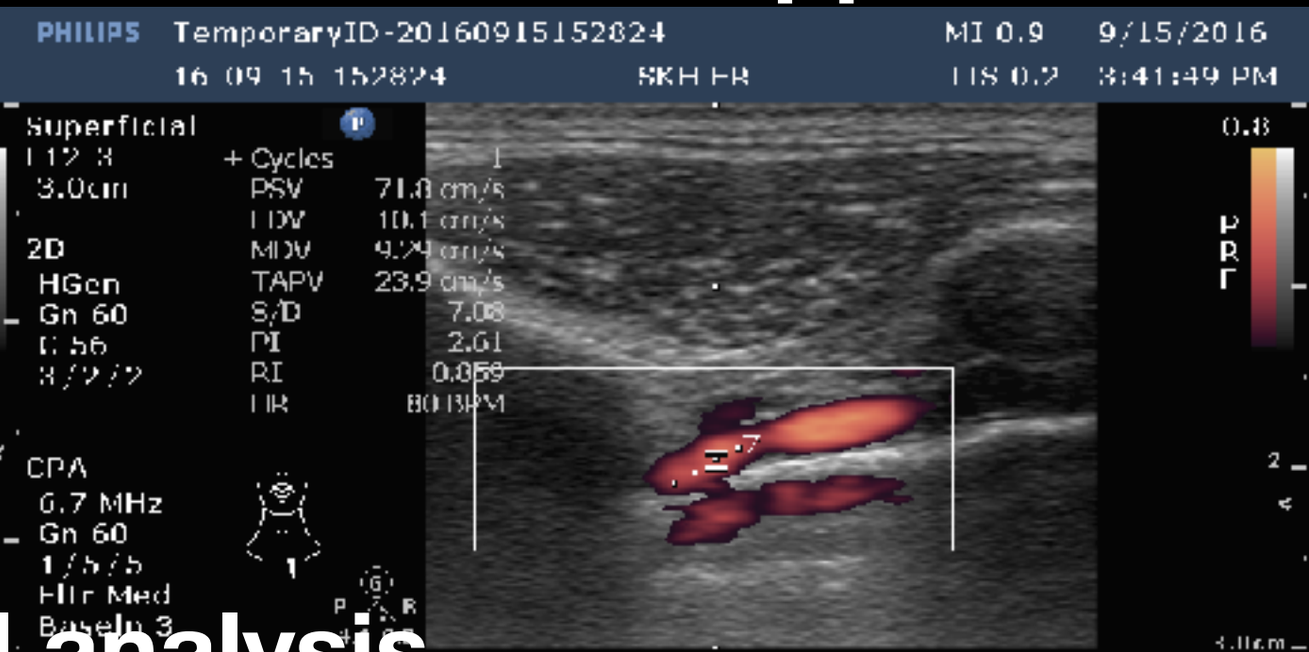


Color Doppler



Power Doppler

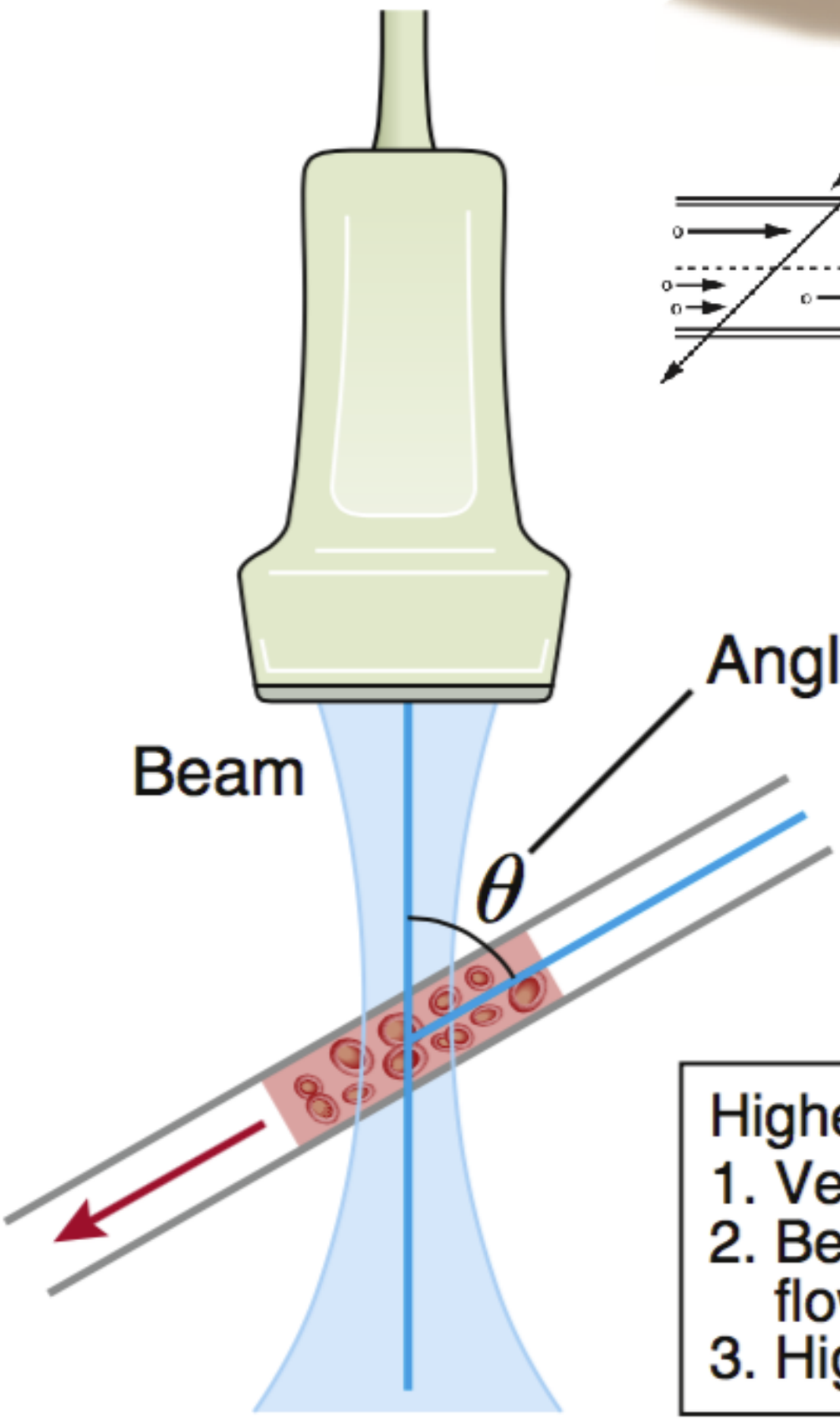


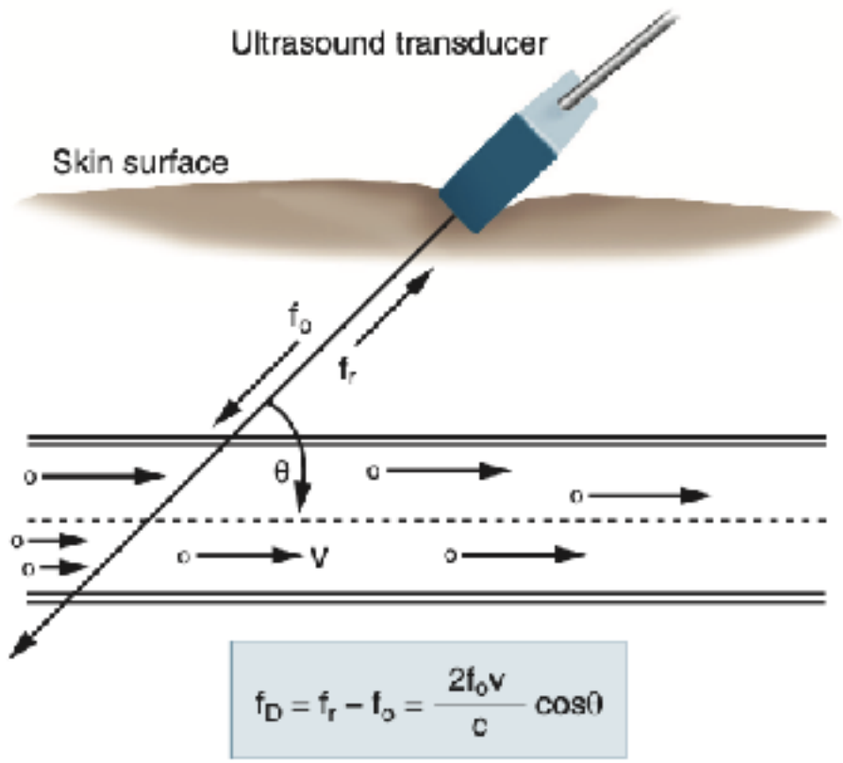


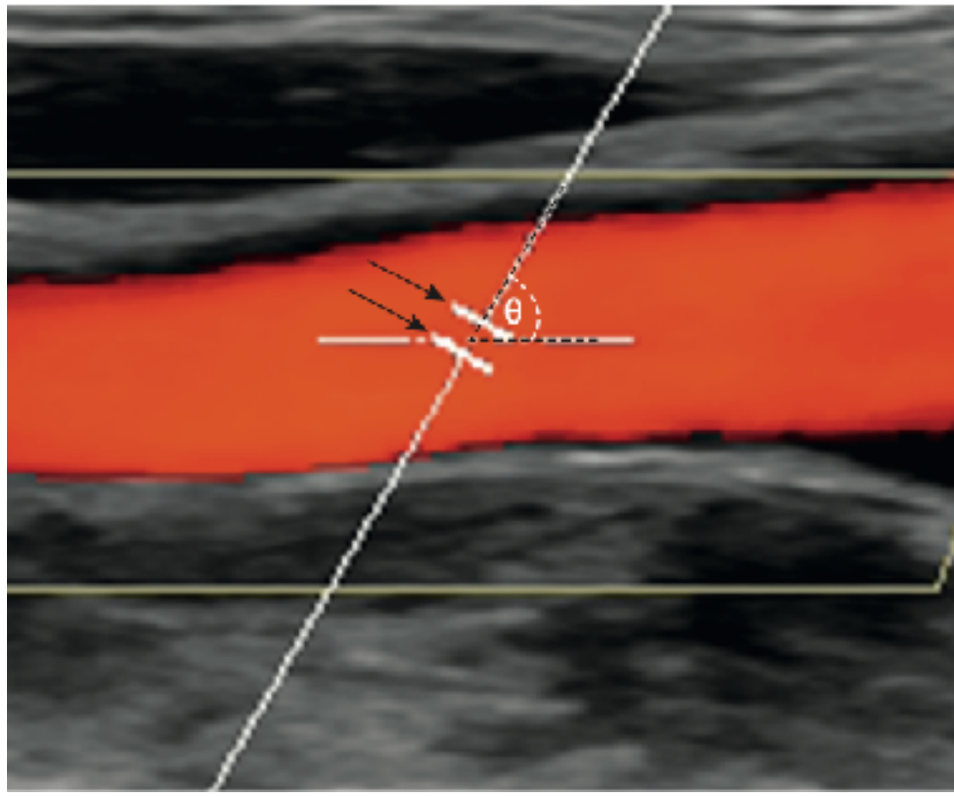
Spectral analysis

Vascular Setting

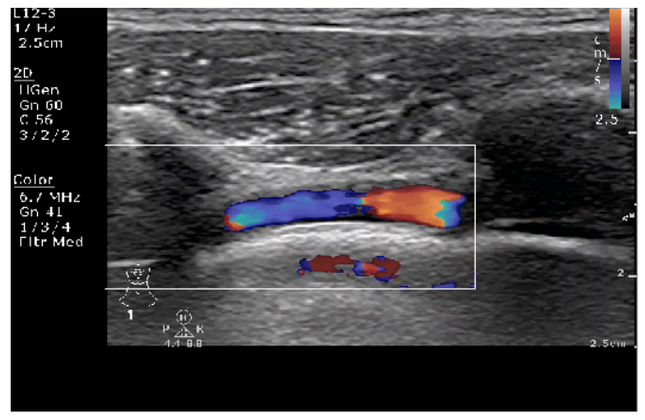
B M C D S





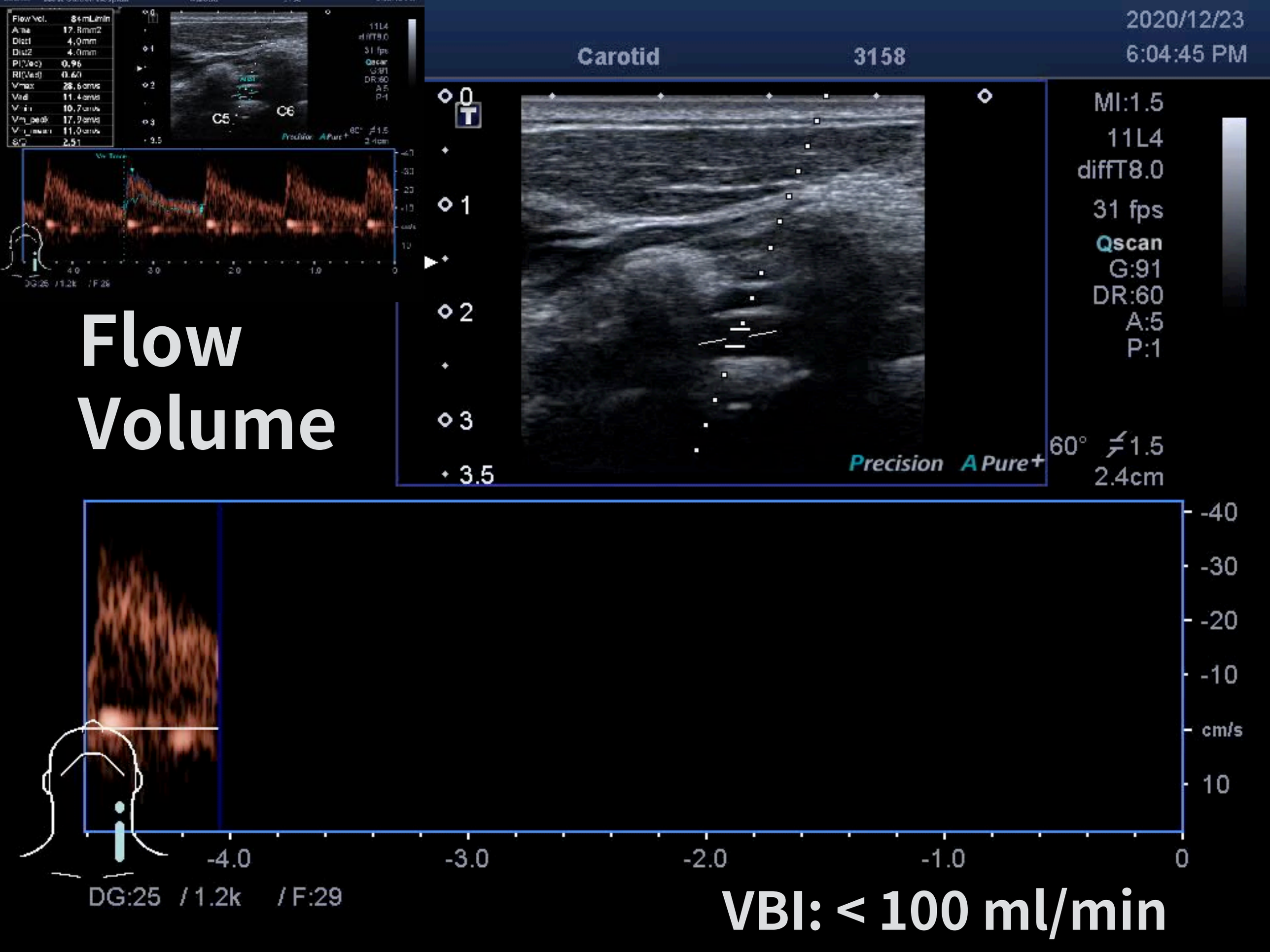


30 ~ 60°



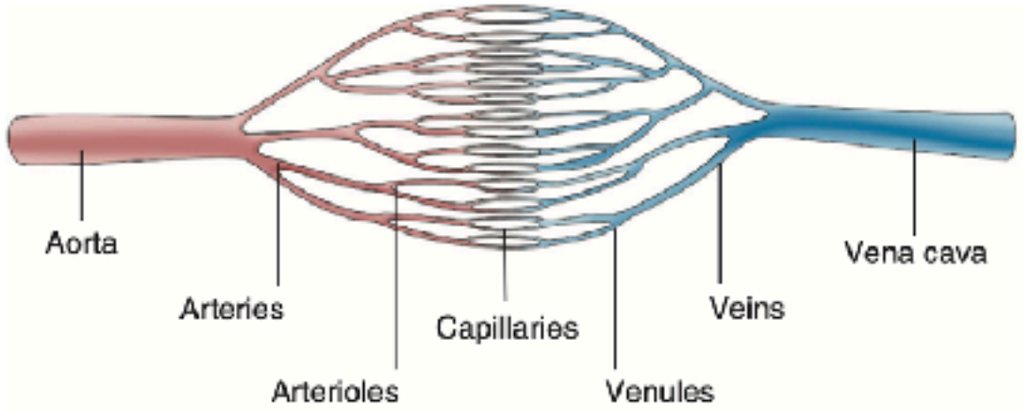
Higher Doppler frequency obtained if:

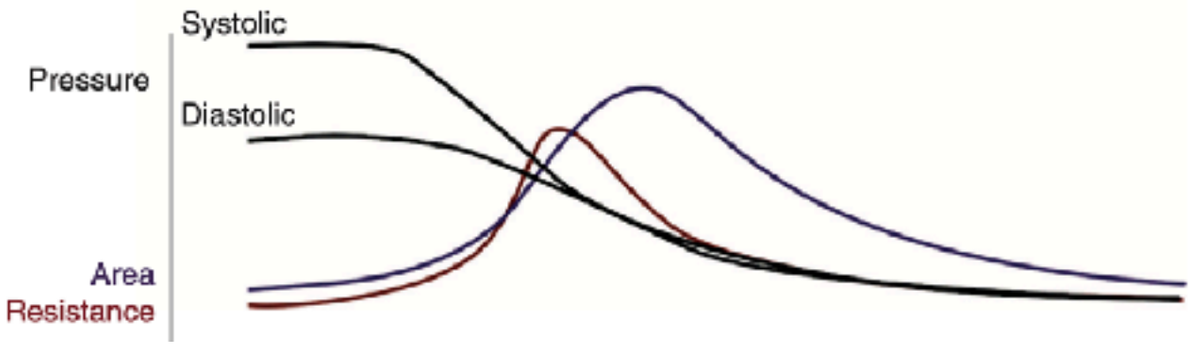
1. Velocity is increased
2. Beam is aligned parallel to flow direction
3. Higher frequency is used

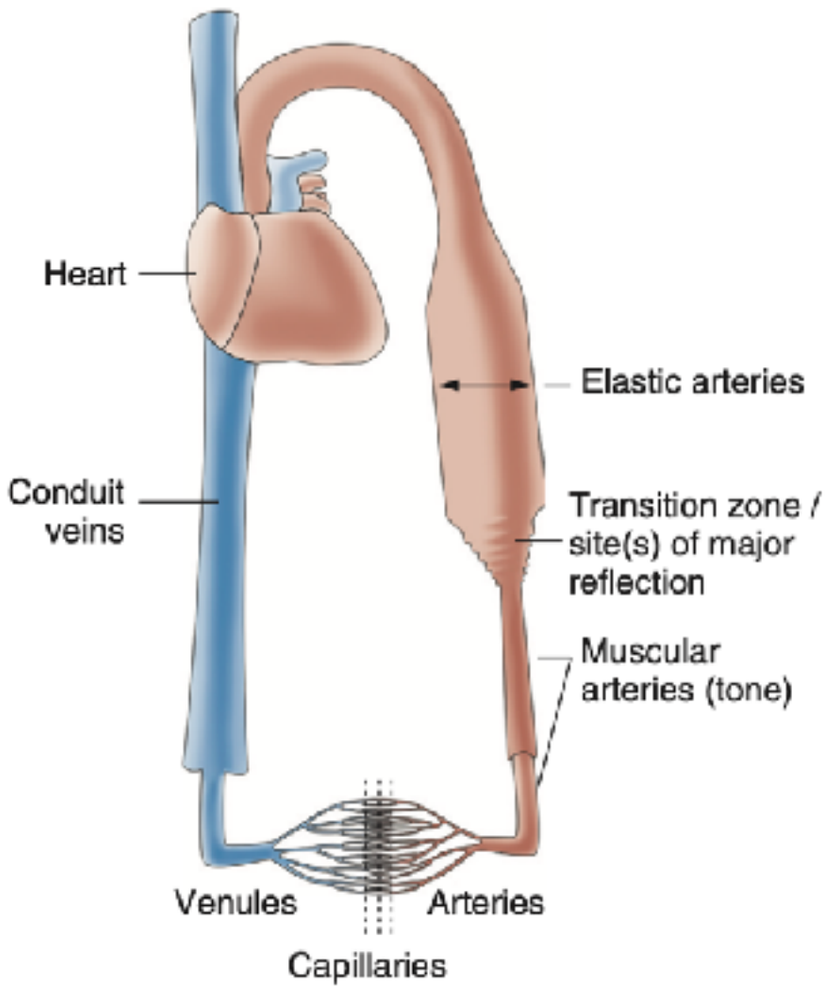


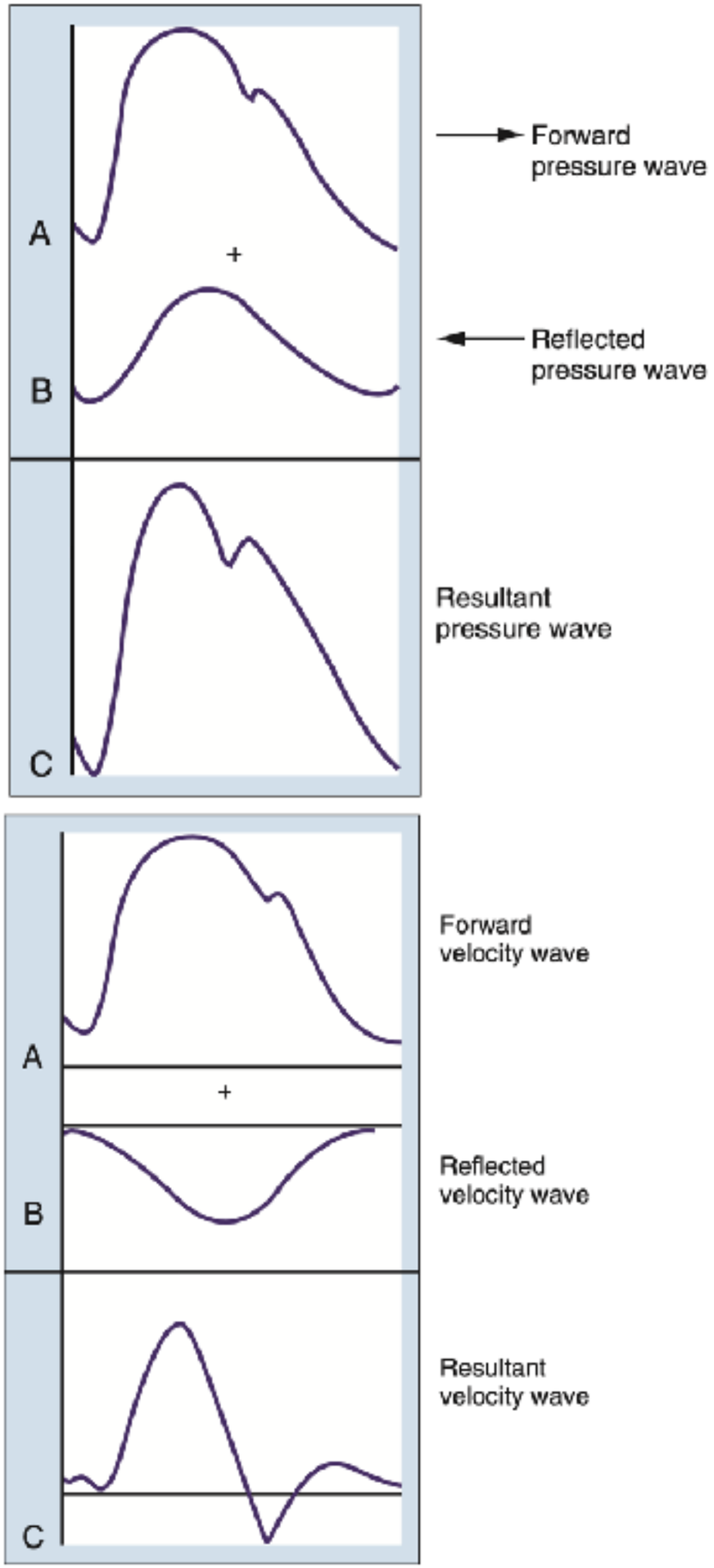
Flow Volume

VBI: < 100 ml/min



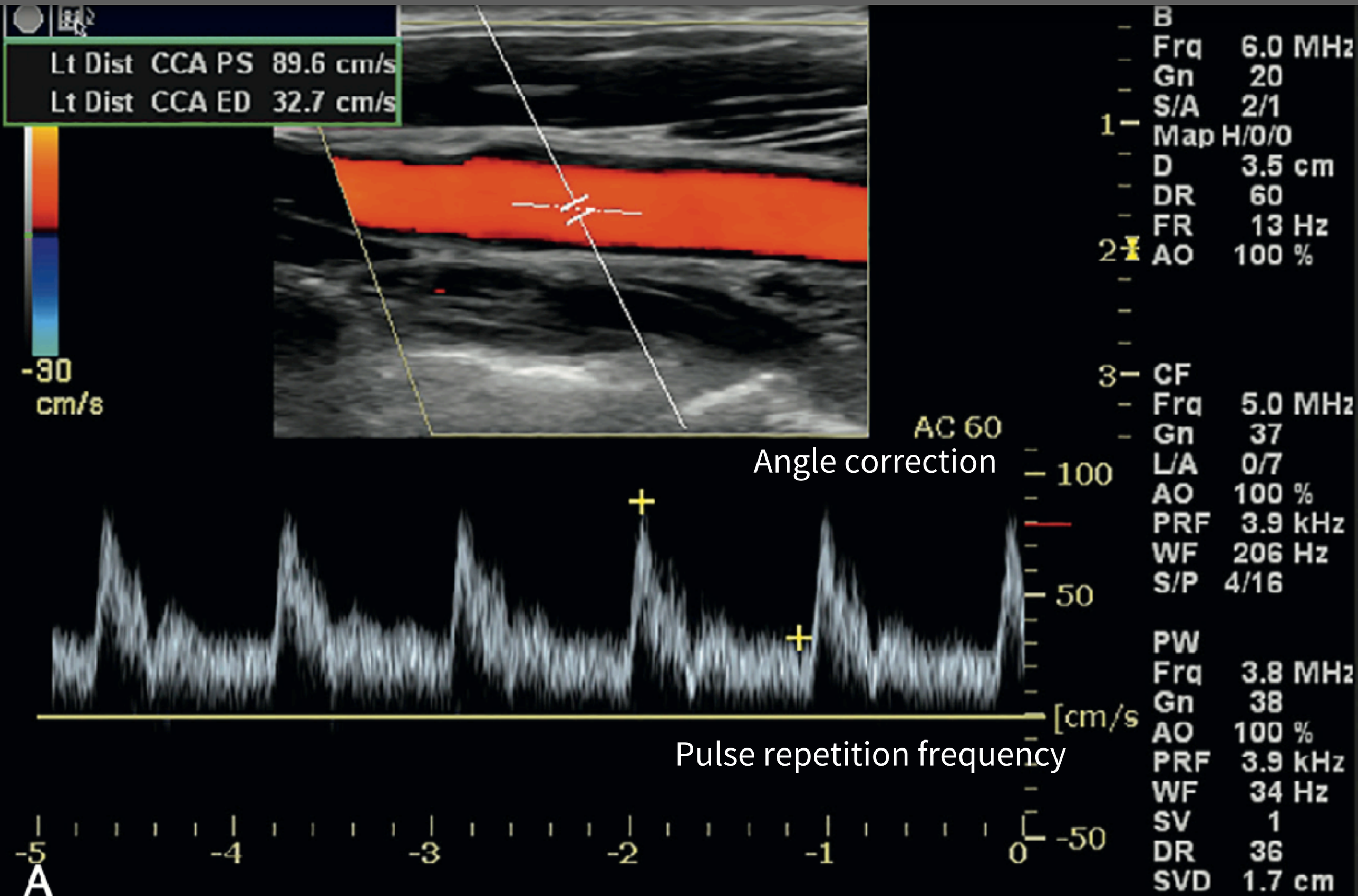






Introduction to vascular sonography_7th ed.

這張圖有那些重要的訊息？

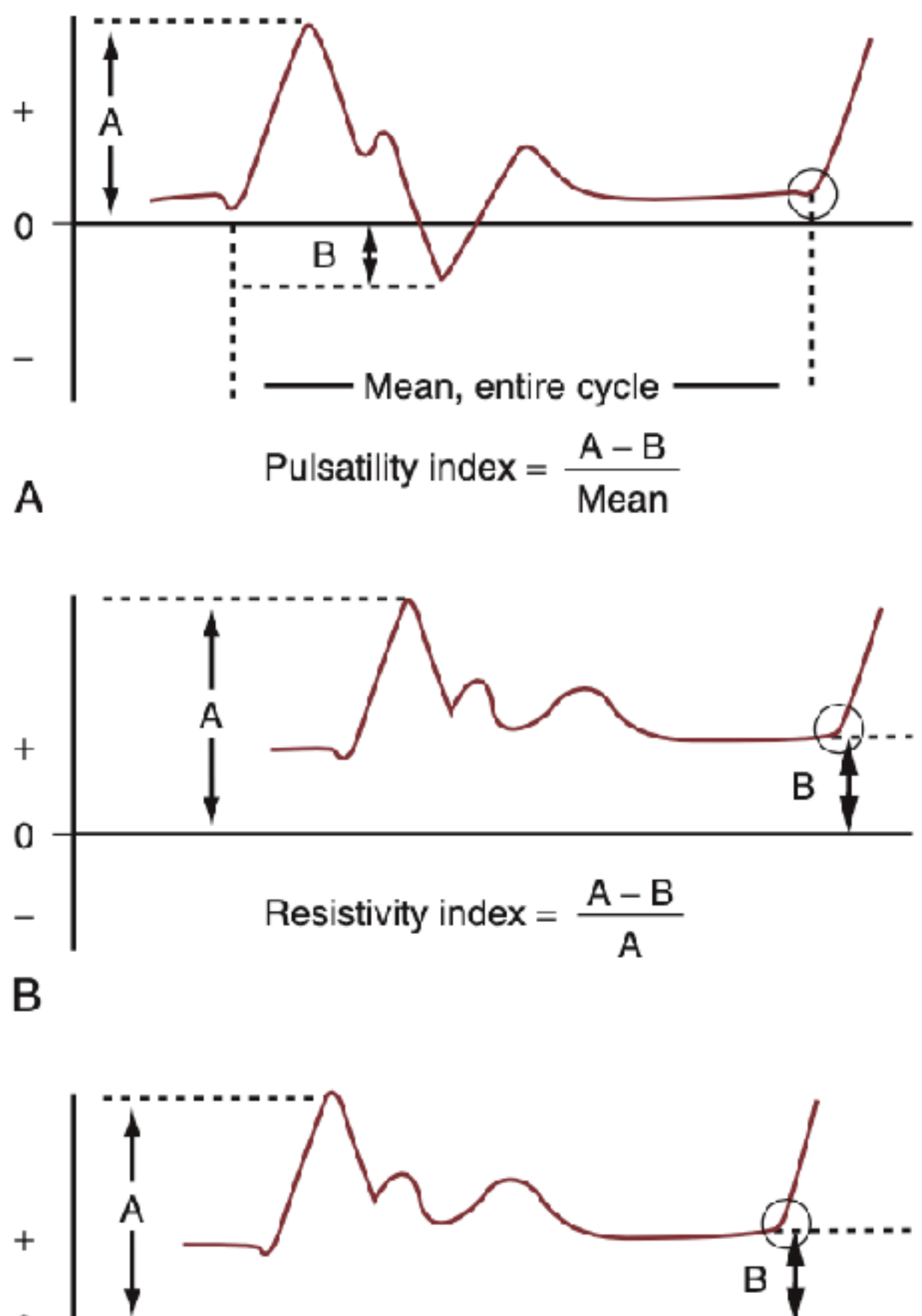


Pulsatility Measurement

正常波形分析

生理狀態變異

心臟功能影響



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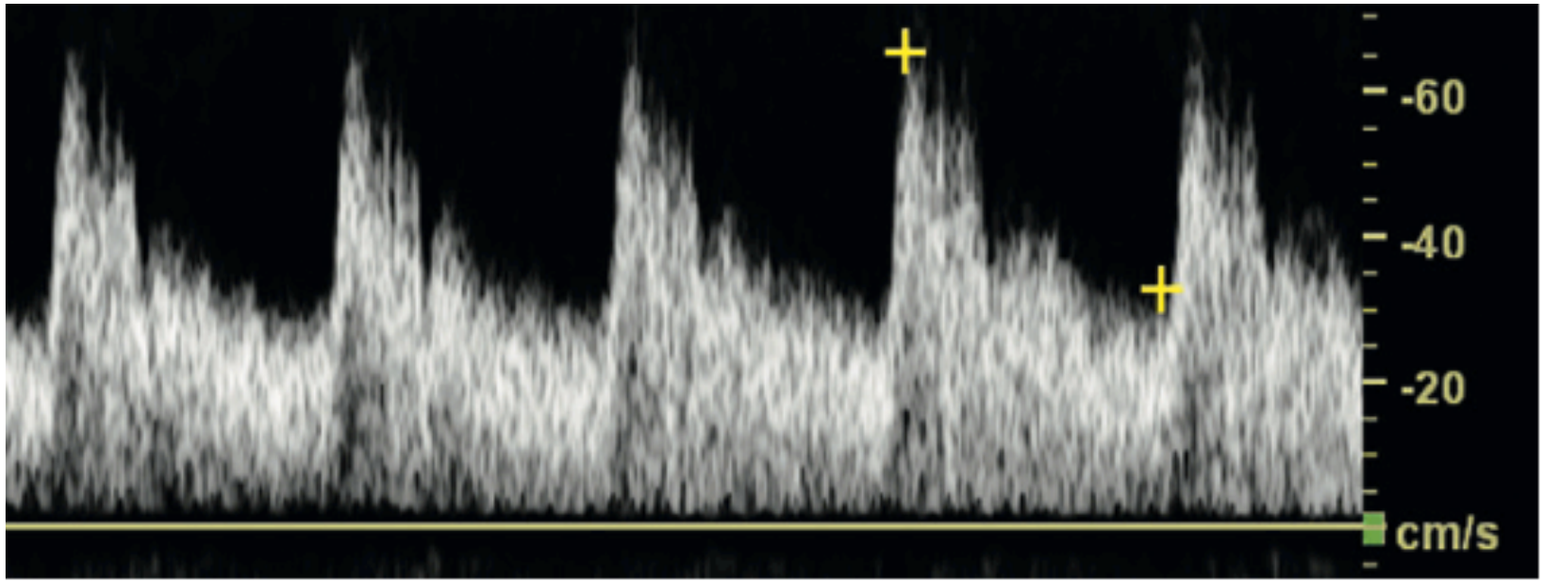
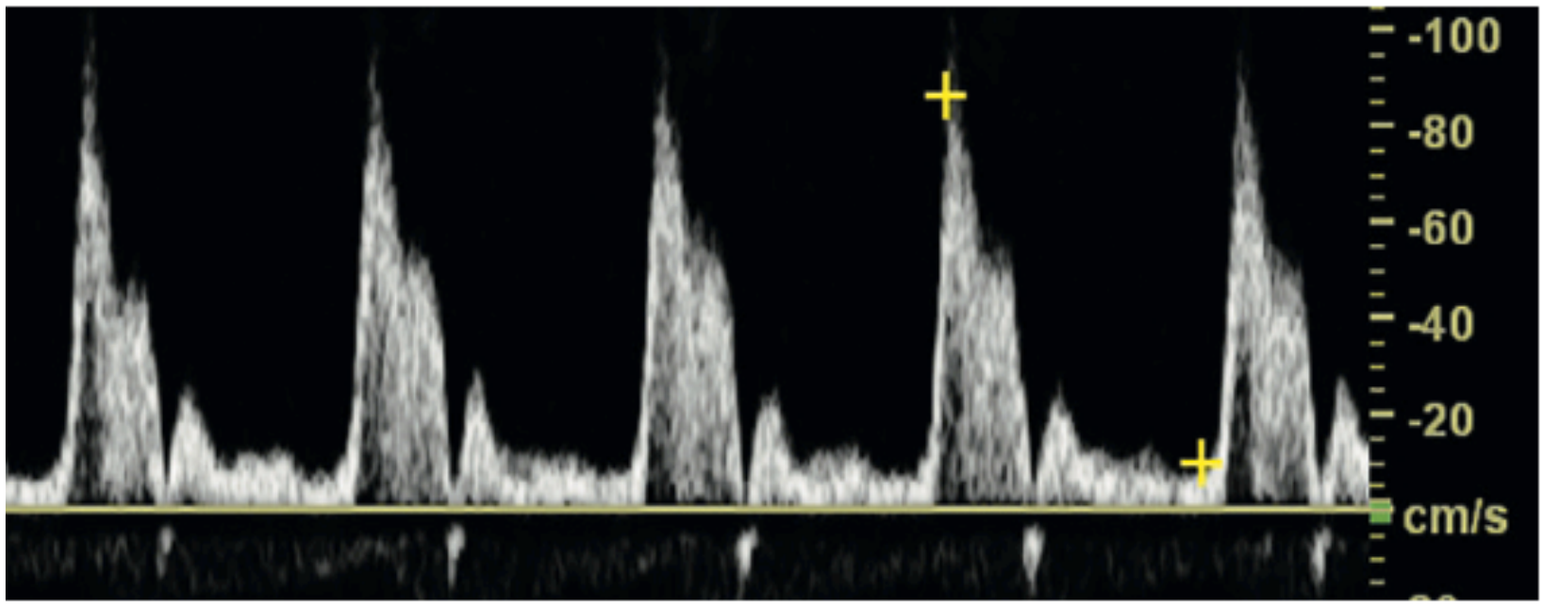
Pulsatility

低



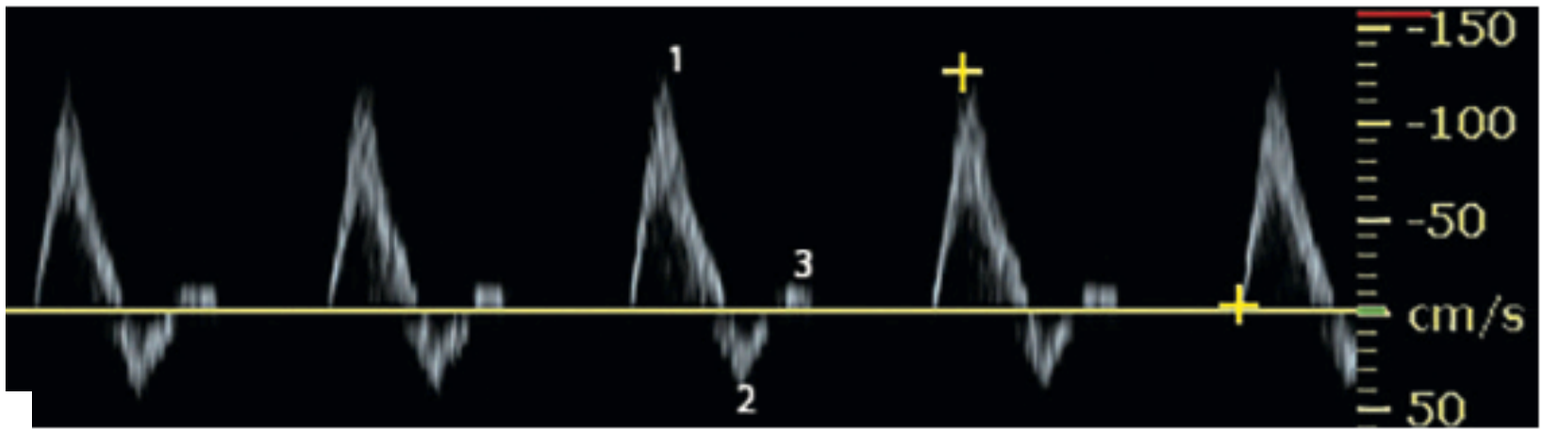
A

中



B

高

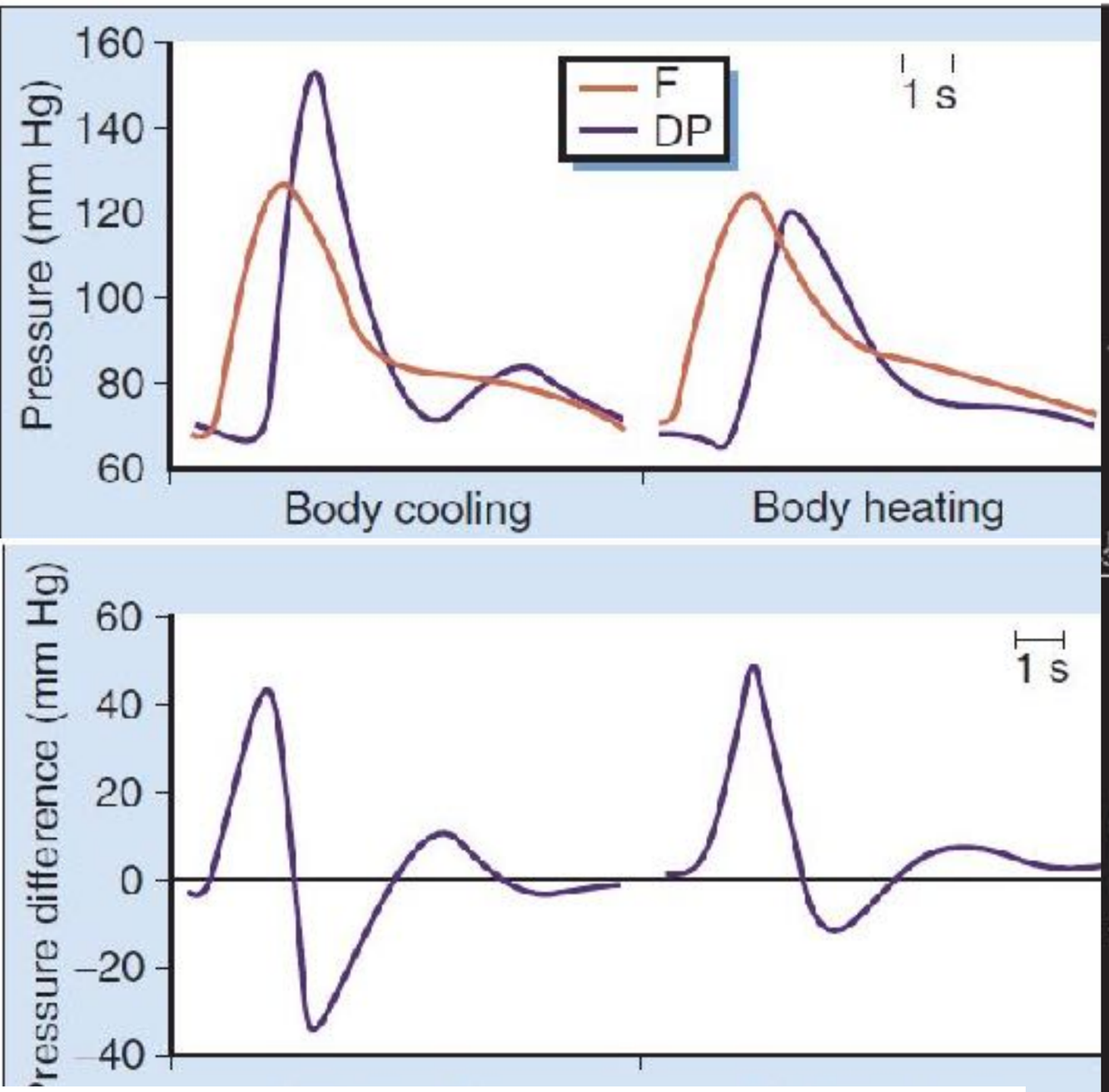


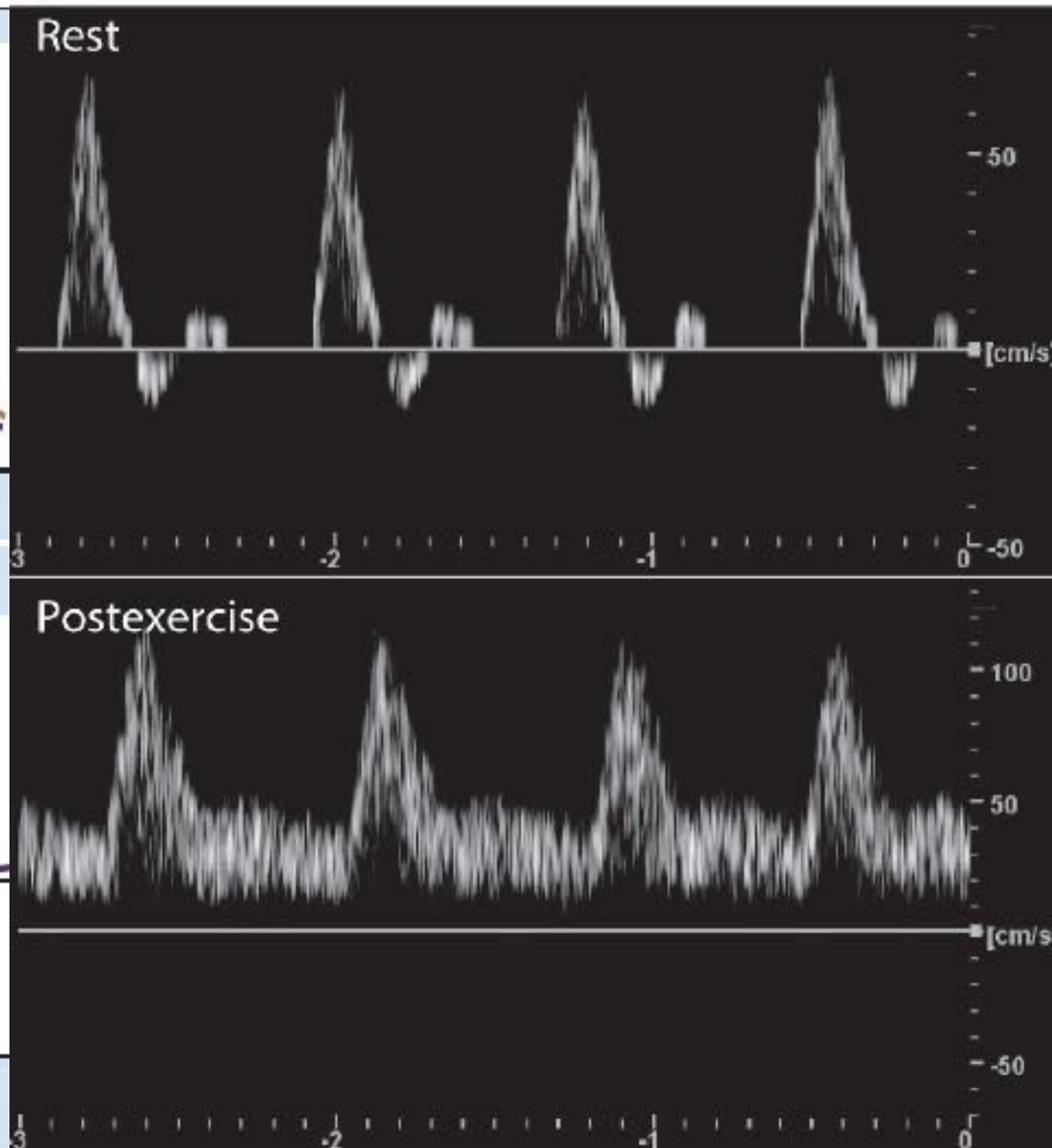
C

Introduction to vascular sonography_7th ed.

生理狀態的影響

溫度上升，阻力下降，血流增加





Introduction to vascular sonography_7th ed.

RA

TIS: 0.01, MI: 0.06, Vascular: Access

TIS: 0.11, MI: 0.19, Vascular: Access

At rest

Run 6K

100 cm/s

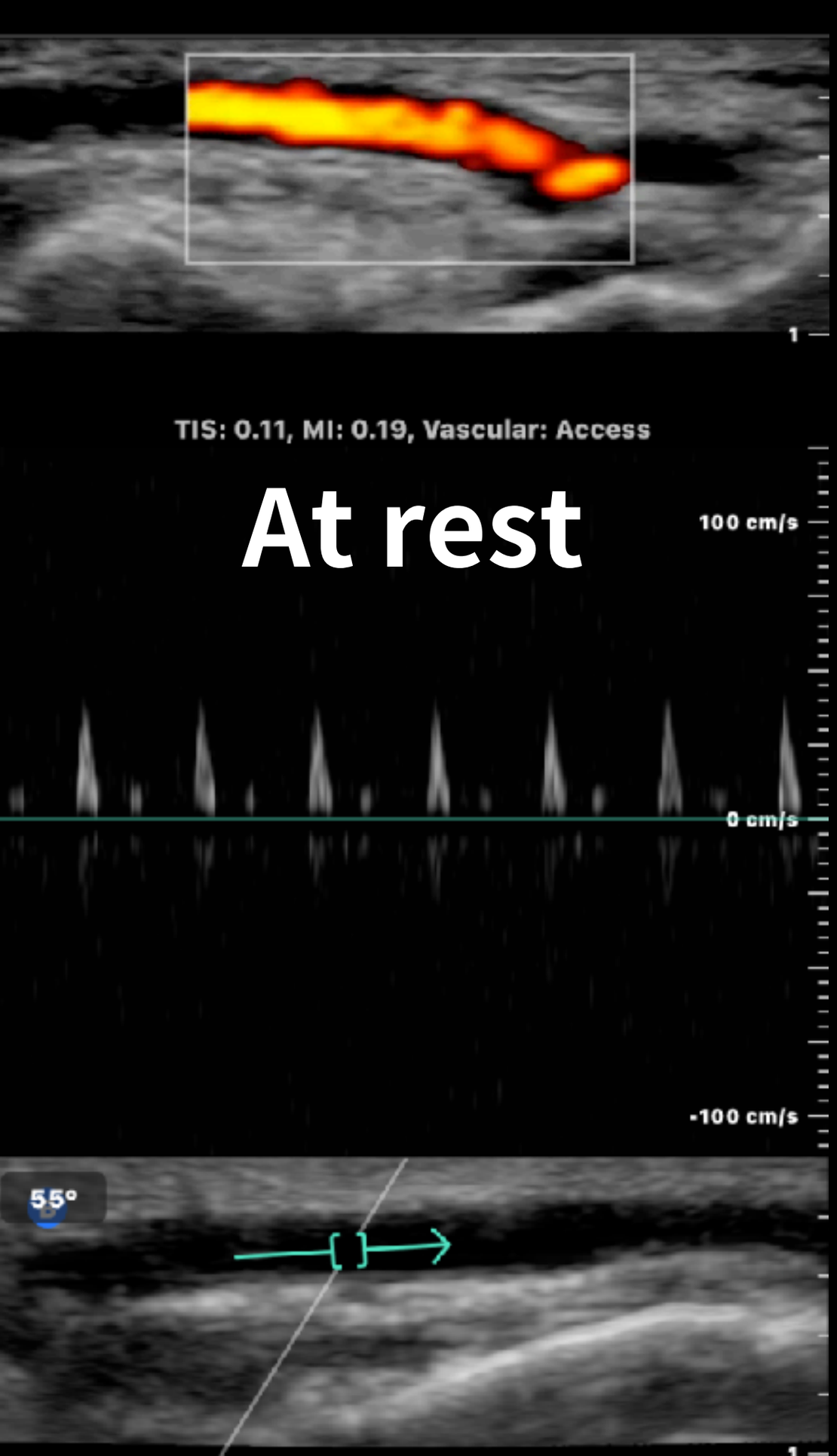
0 cm/s

-100 cm/s

55°

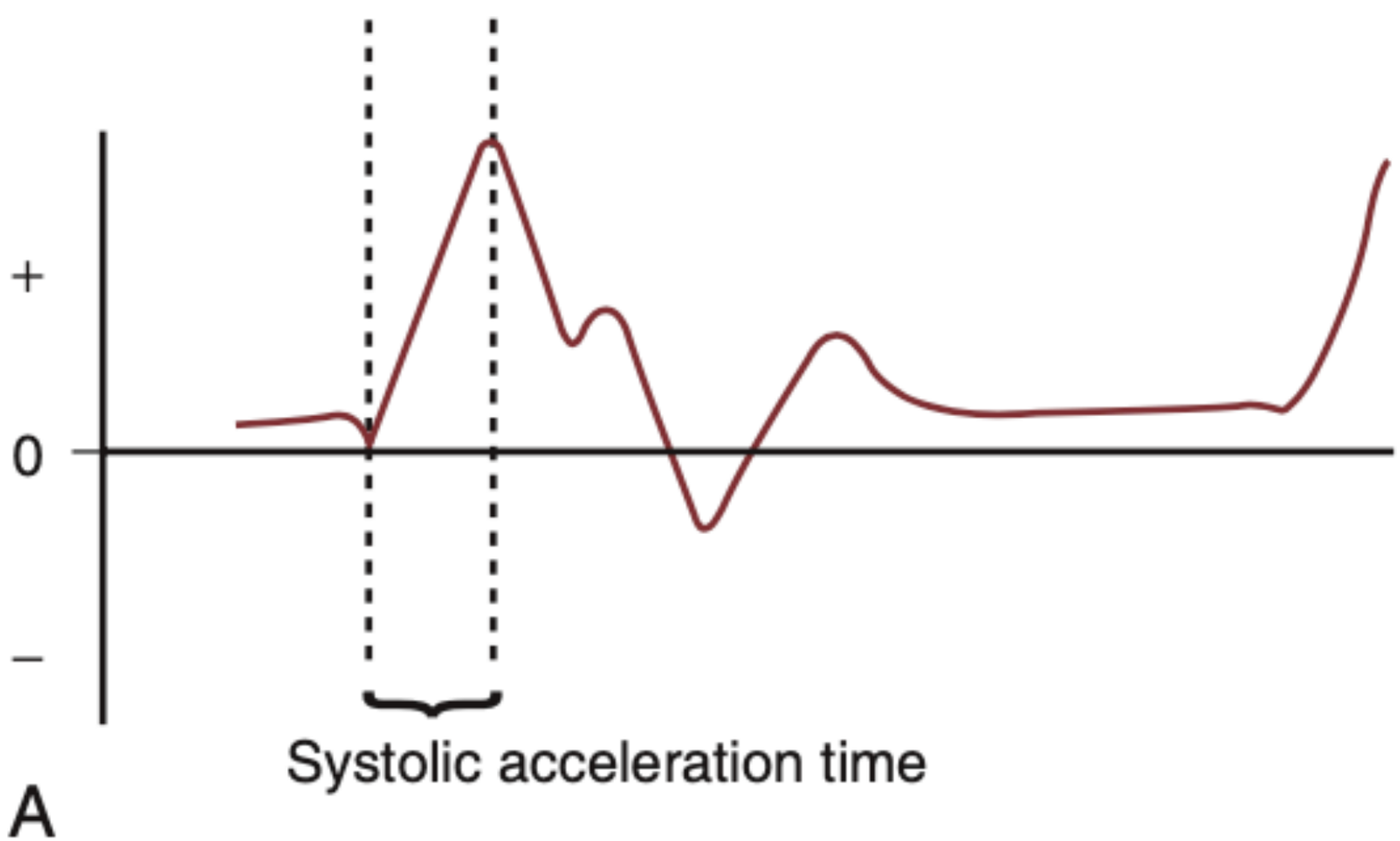
52°

DPA

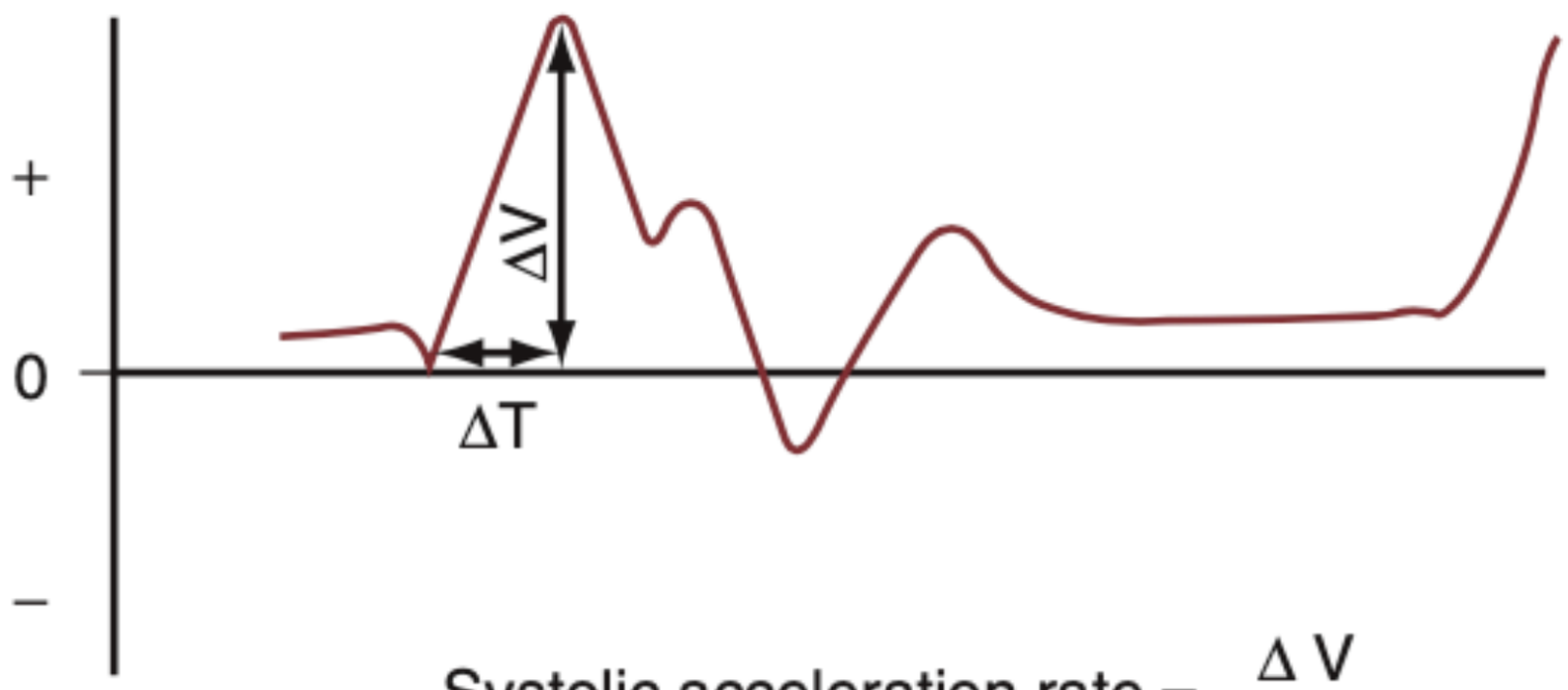


At rest

Run 6K



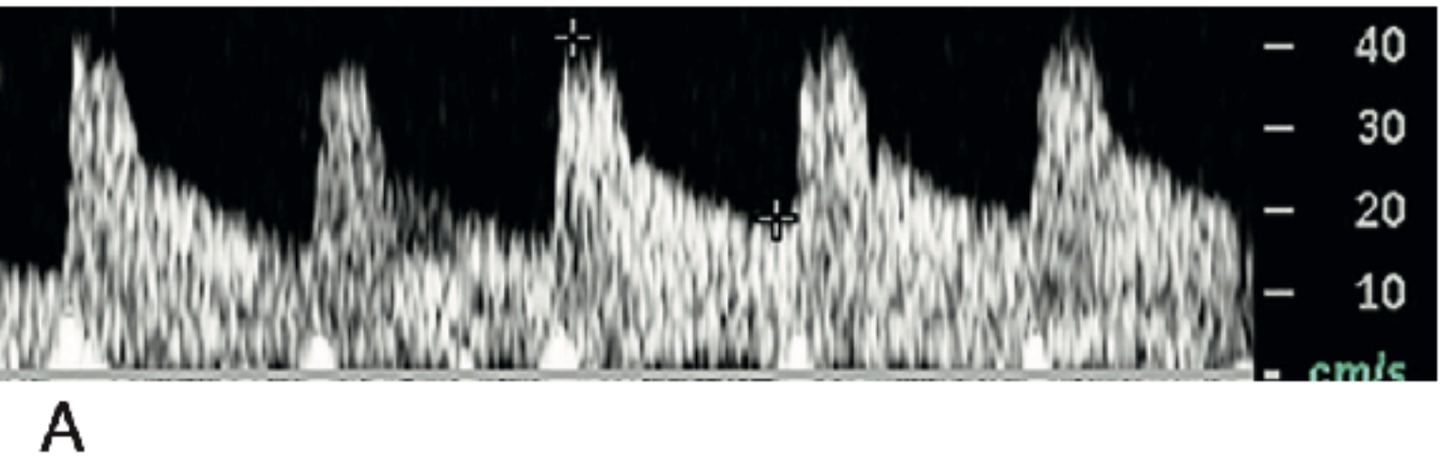
A



$$\text{Systolic acceleration rate} = \frac{\Delta V}{\Delta T}$$

B

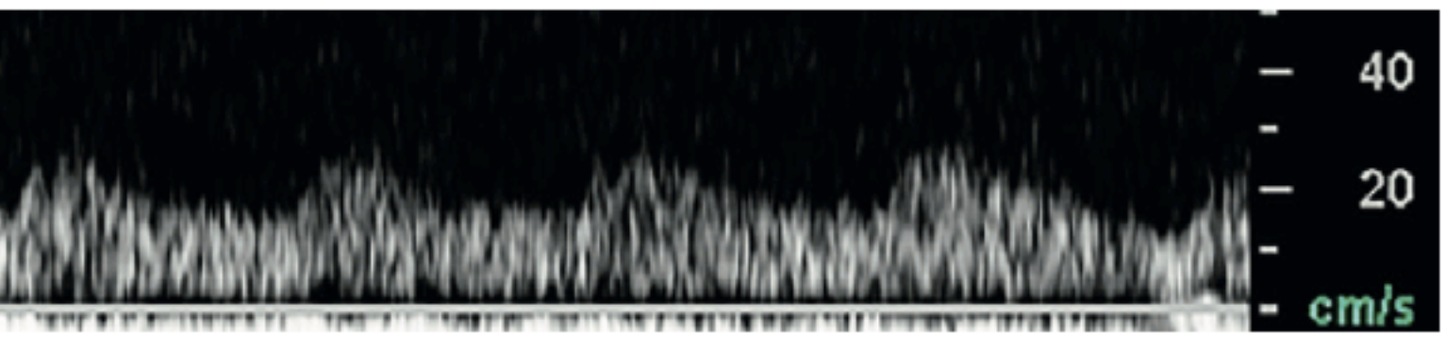
Acceleration & Damping



A

AT: 0.03s

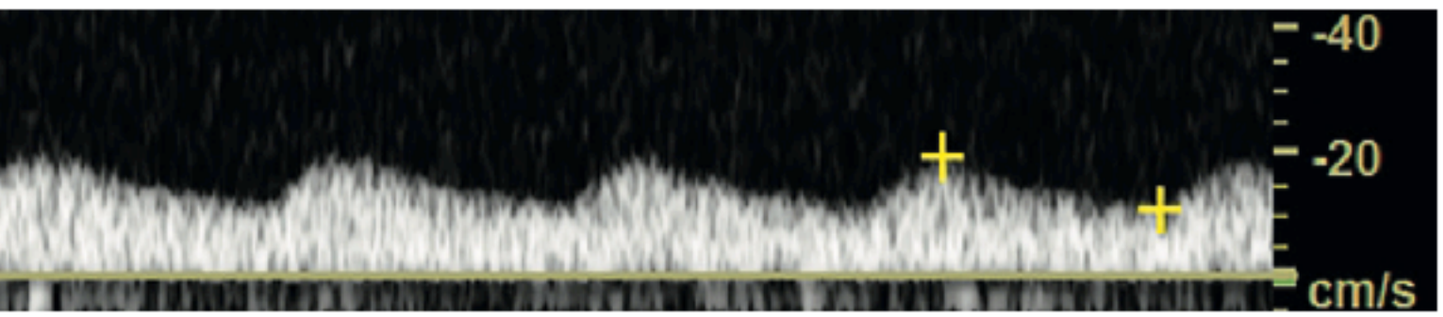
Normal RA of RK



B

AT: 0.15s

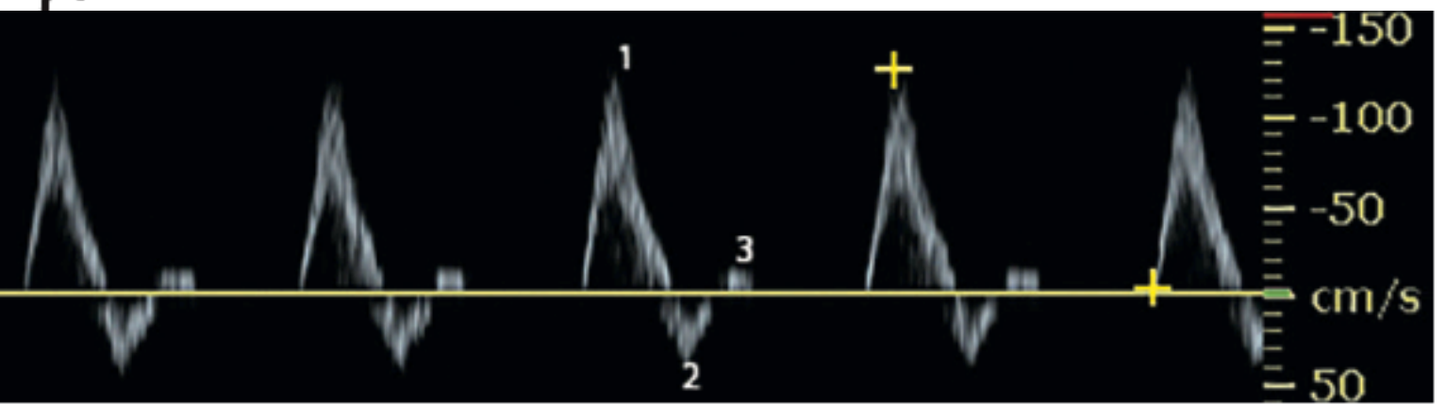
RA stenosis of LK



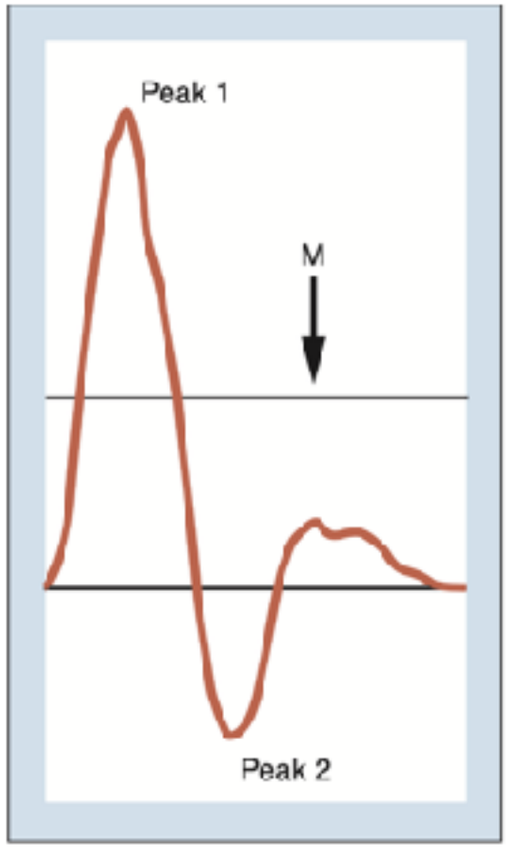
AT: damped/delayed

Dorsalis pedis a.

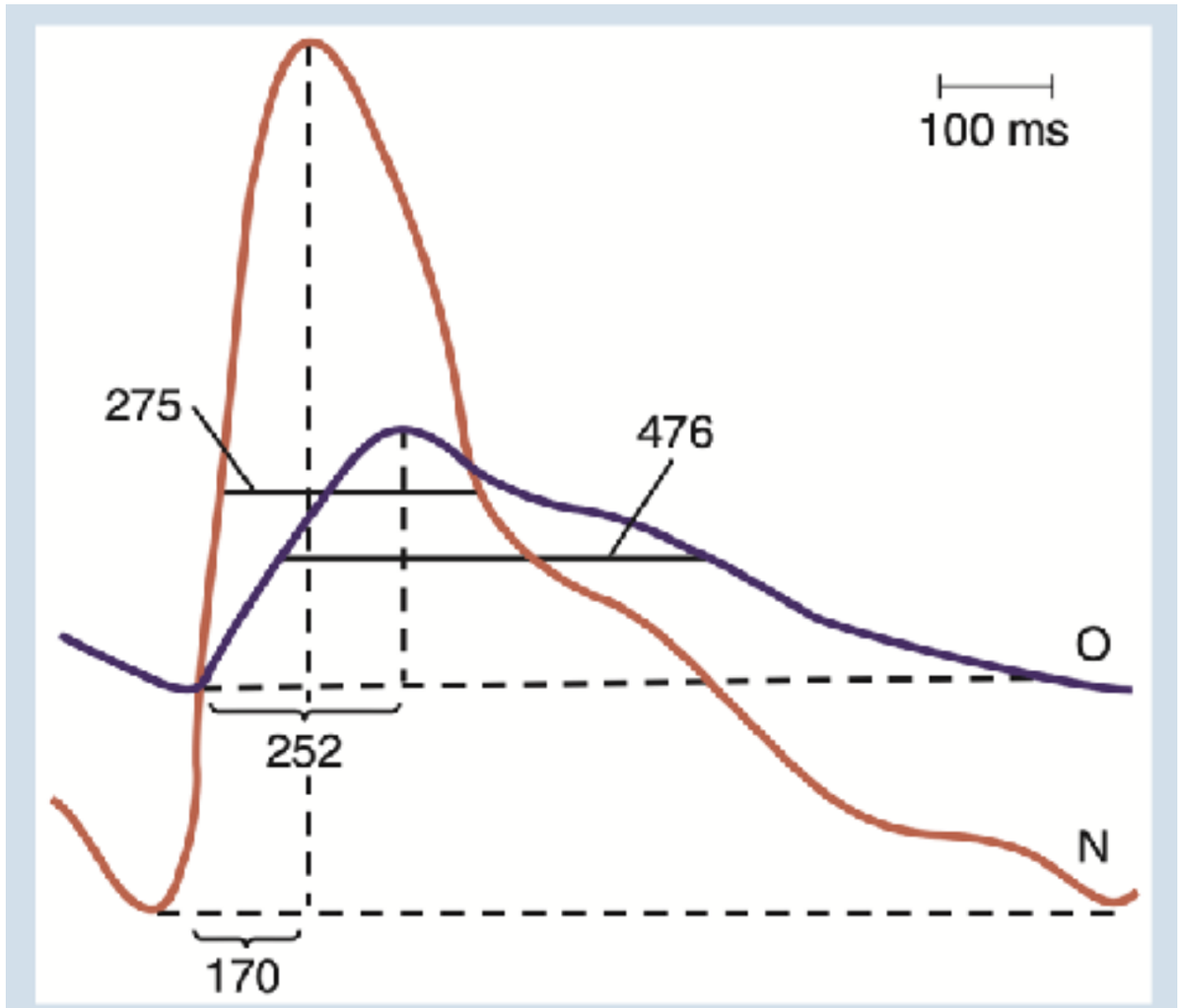
(Severe ischemia)

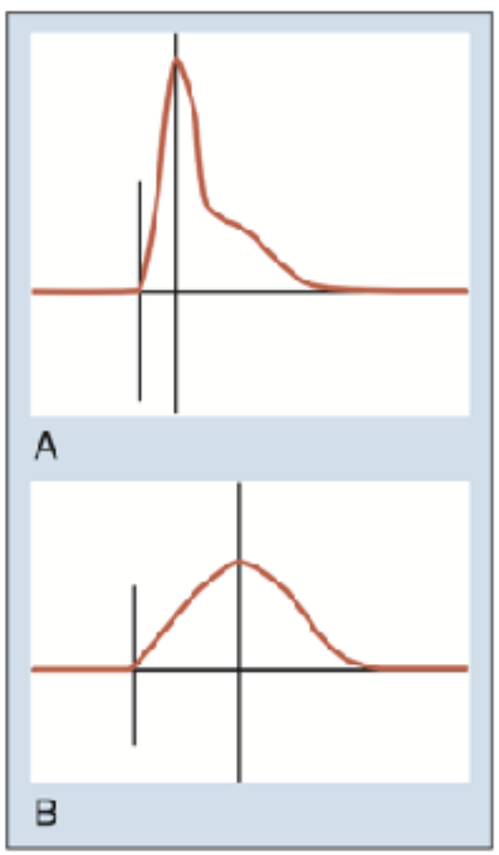


Normal waveform



Pulsatility Index (PI)





Acceleration Time (AT)

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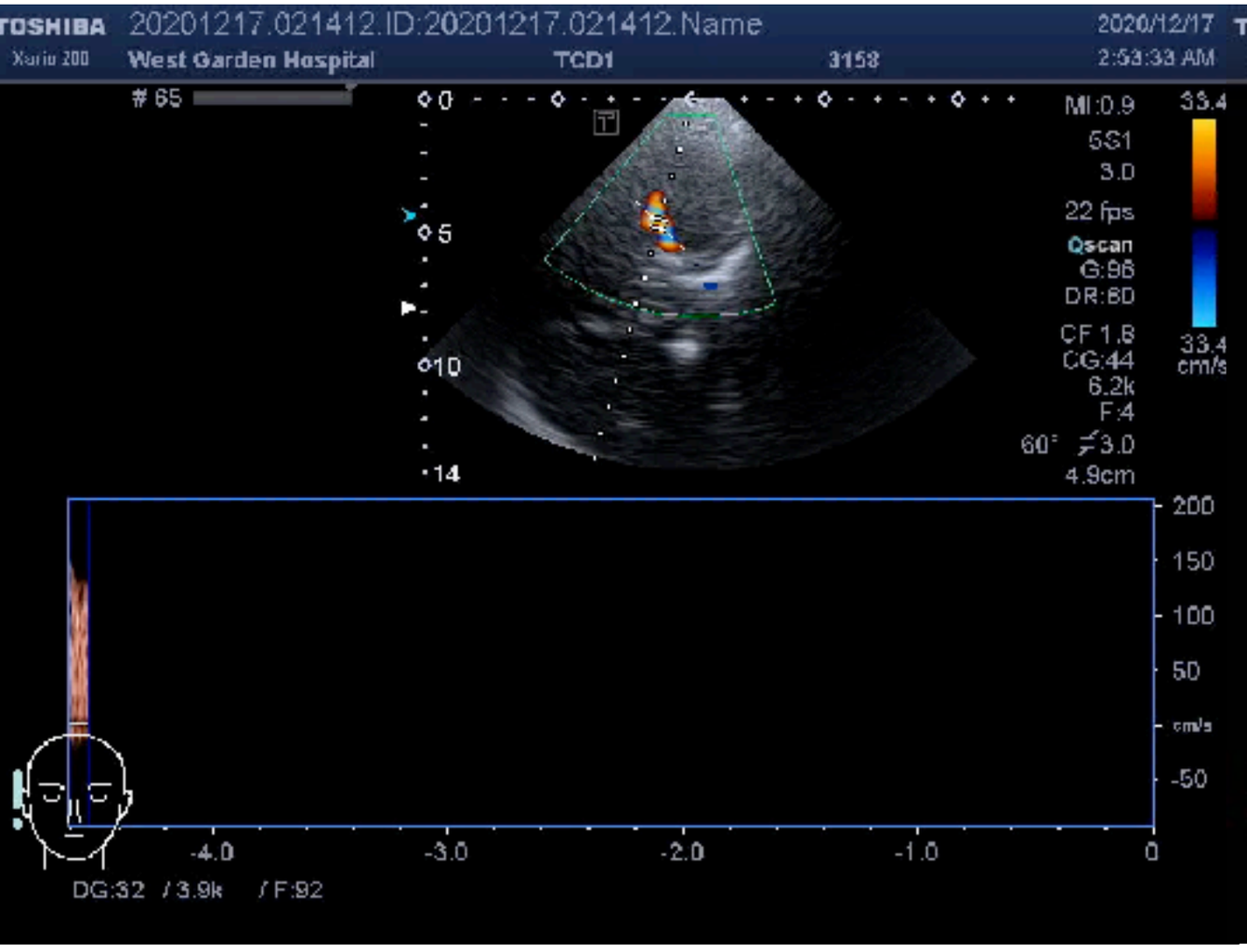
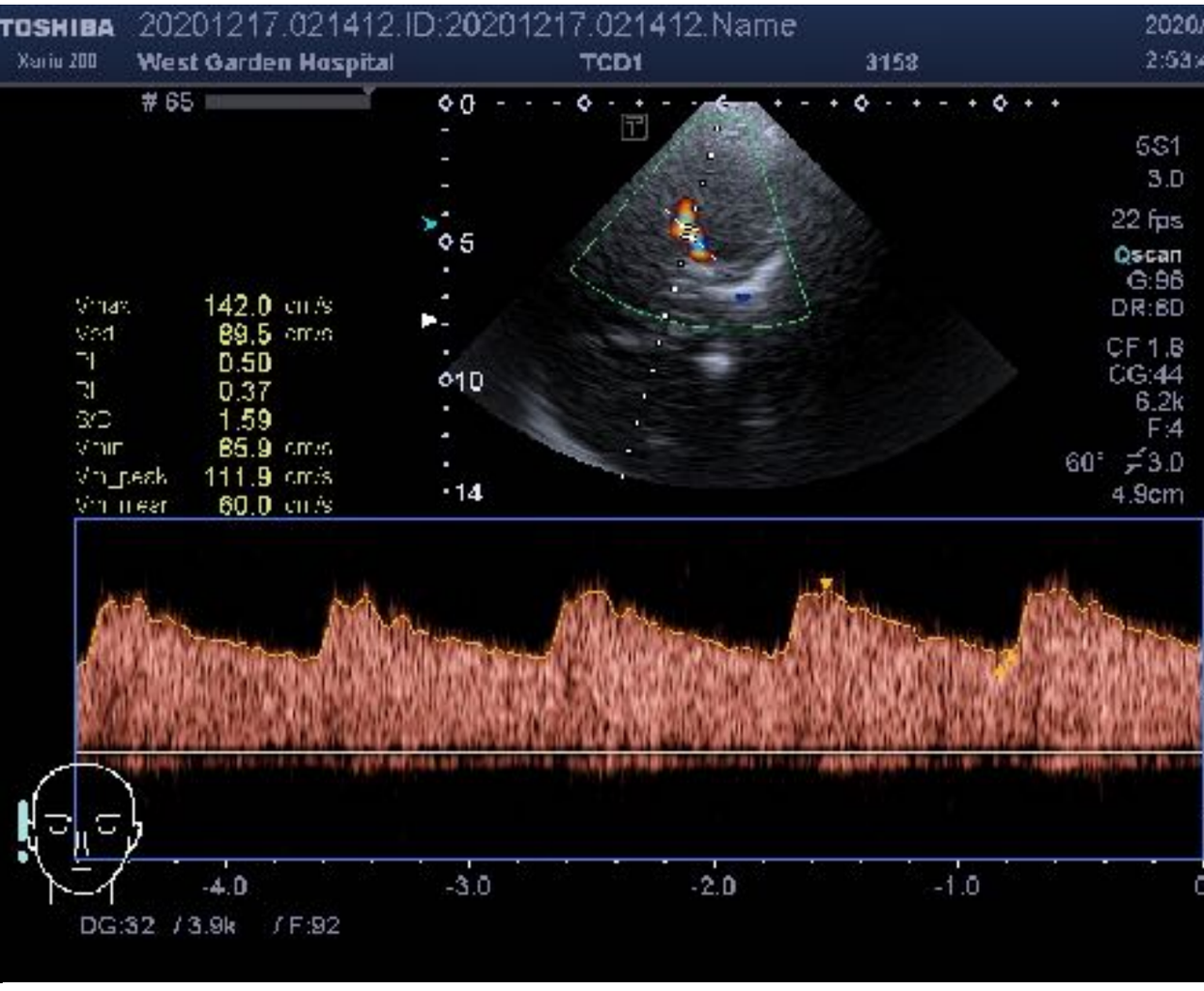
Middle cerebral artery

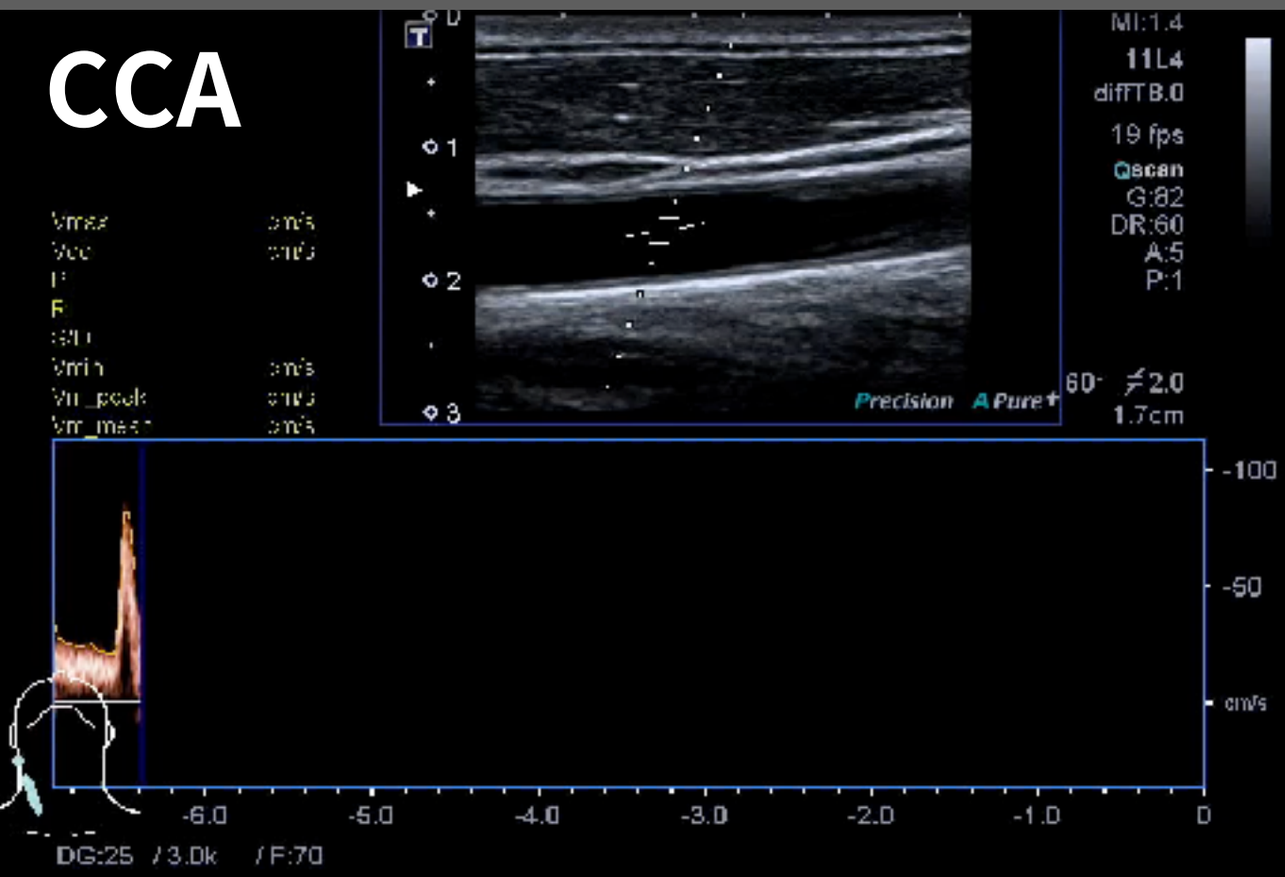
非常重要血管 - 低阻力



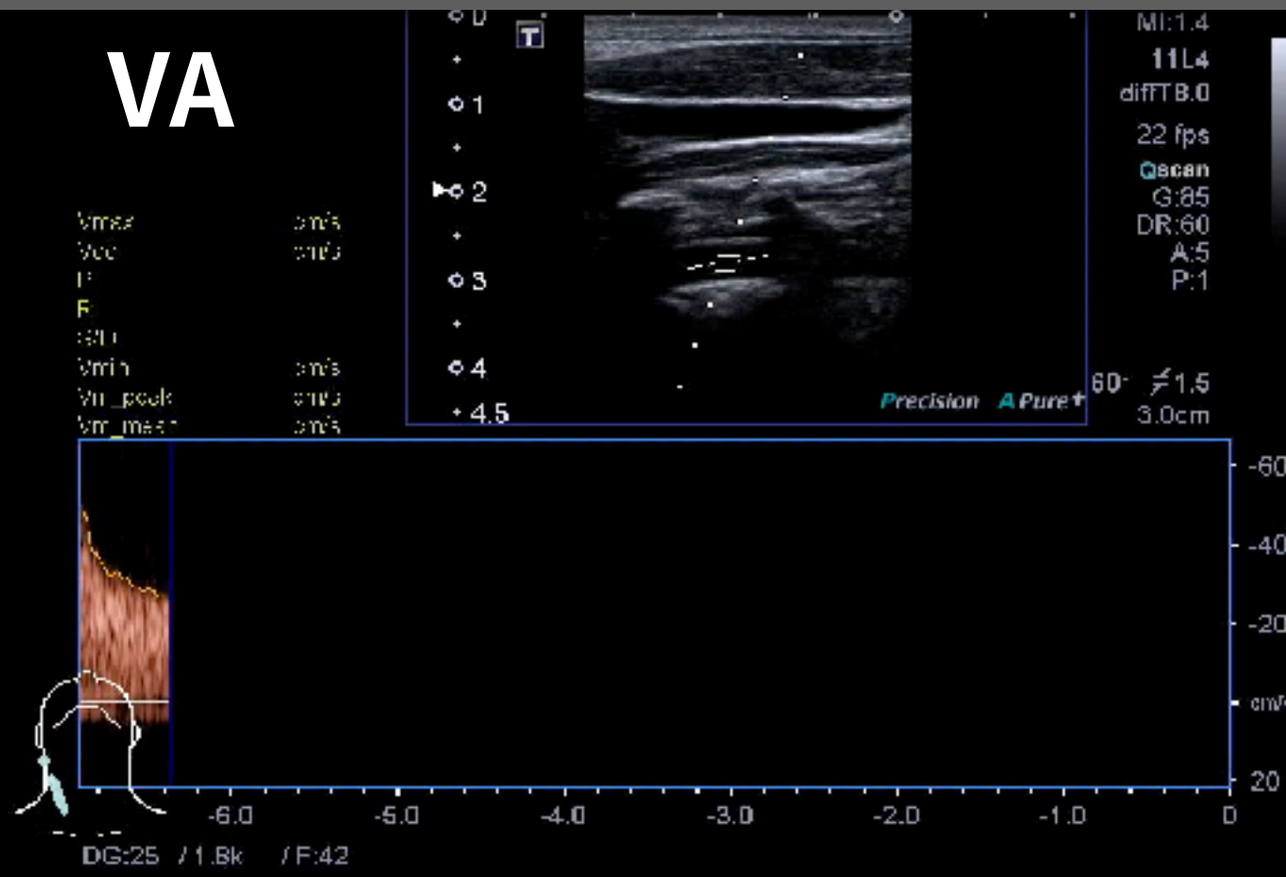


Carotid & Vertebral artery

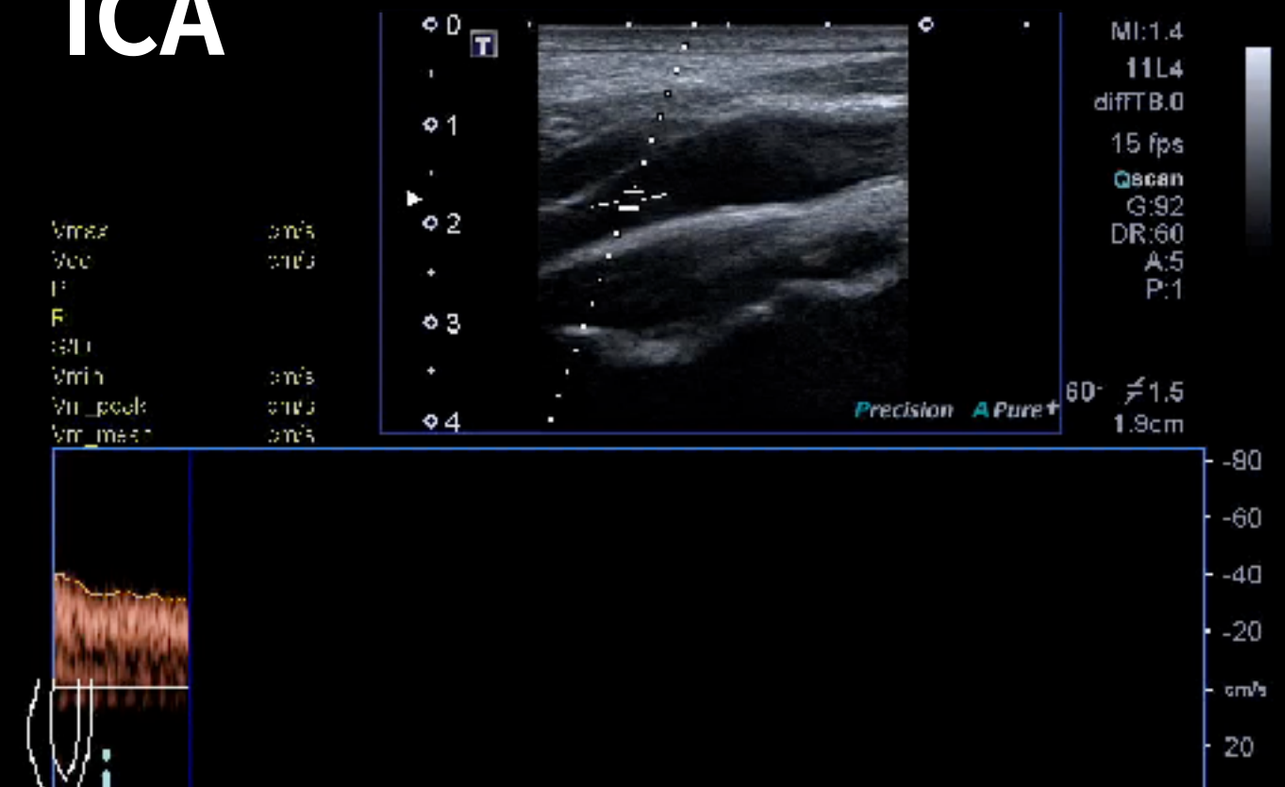
CCA



VA



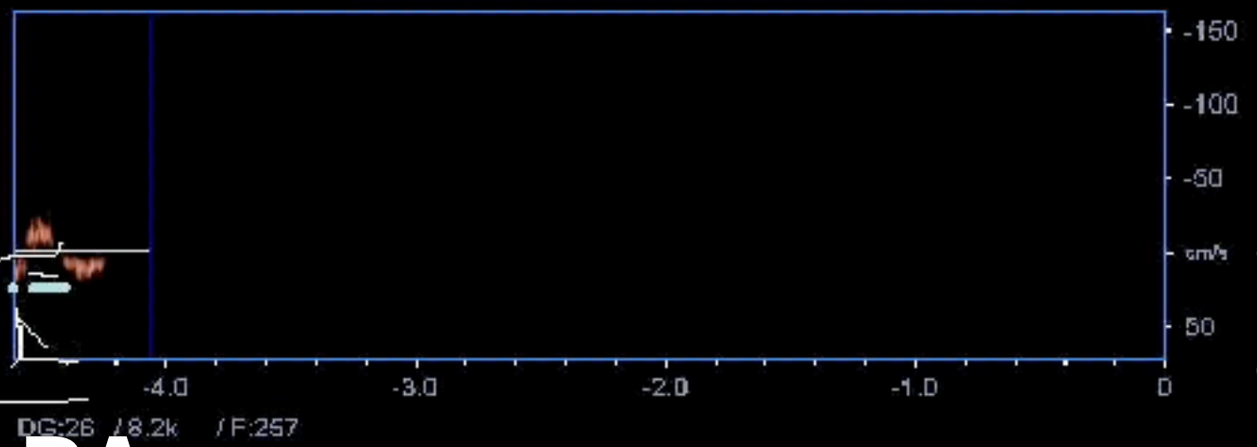
ICA



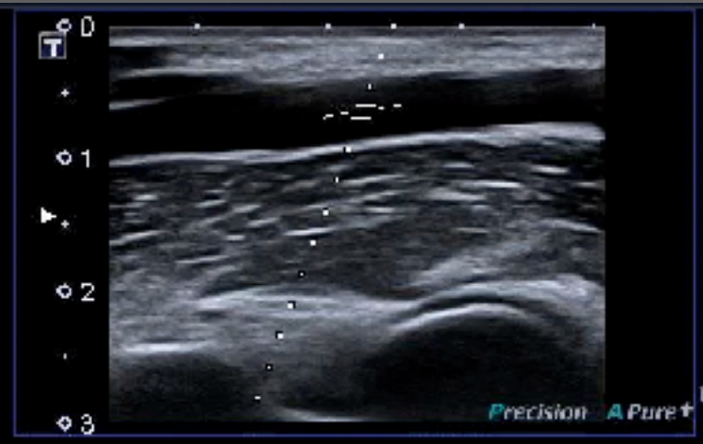
ECA

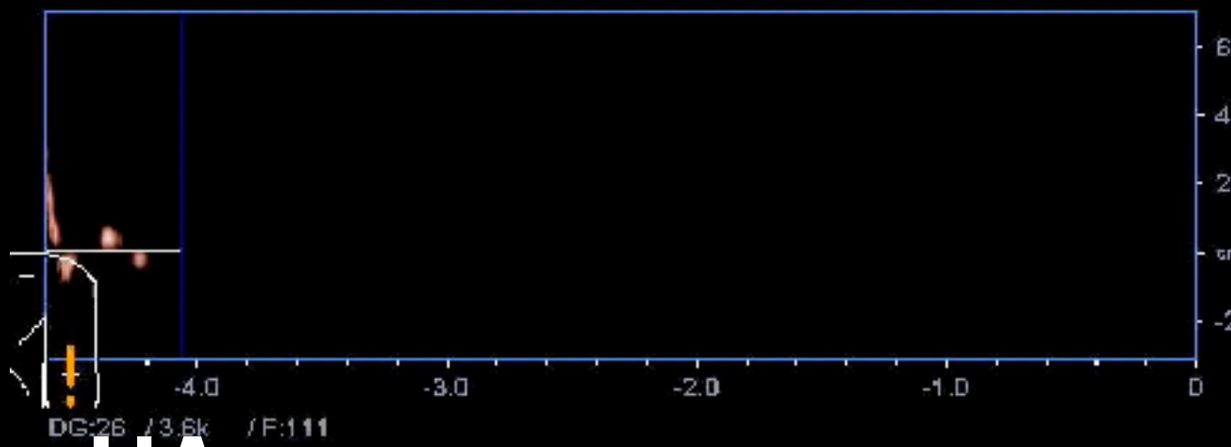
Upper extremity

AA

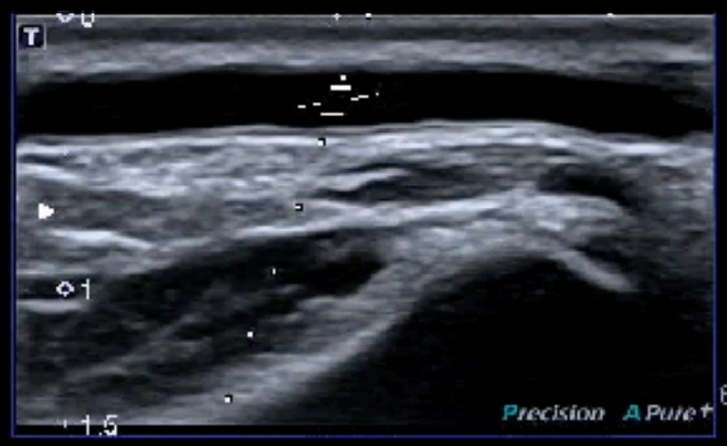


BA





RA

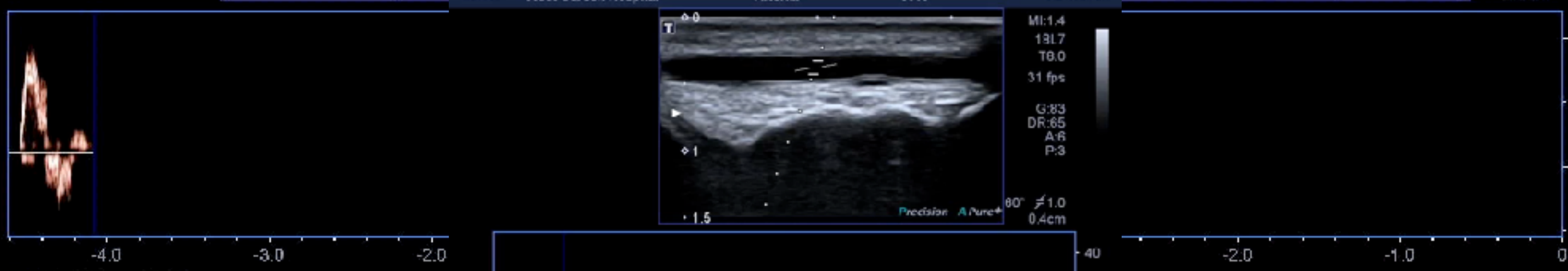


UA

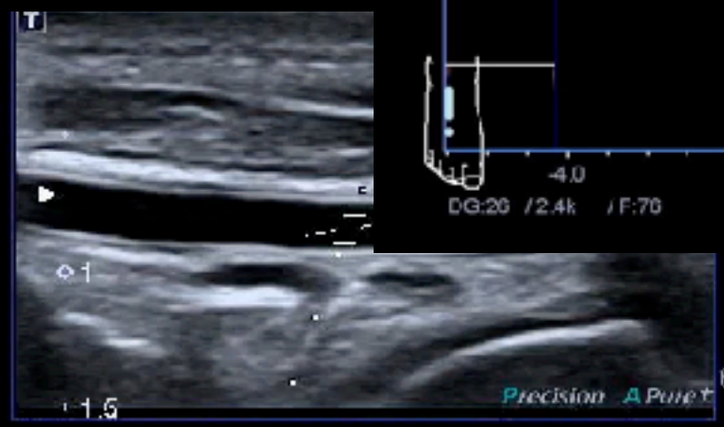
Lower extremity

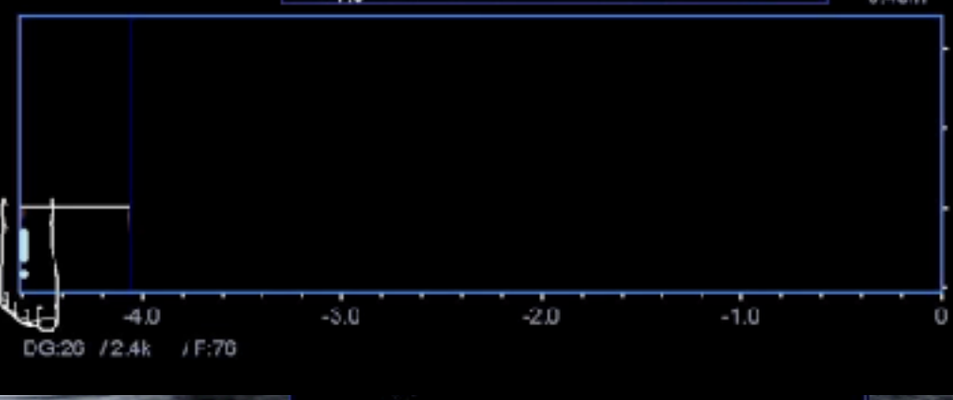
EIA

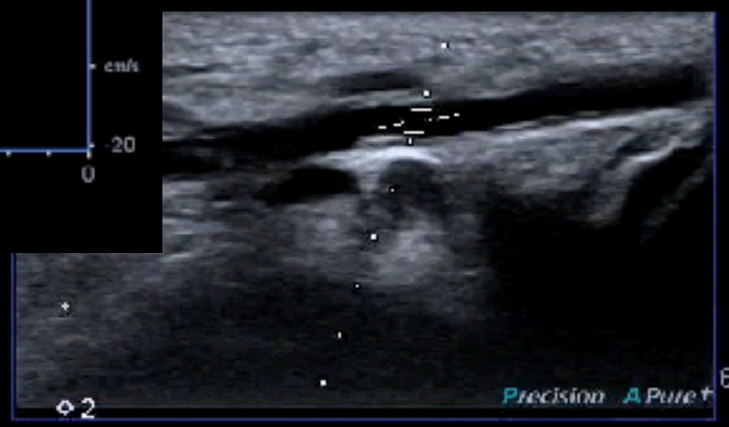
PA



ATA

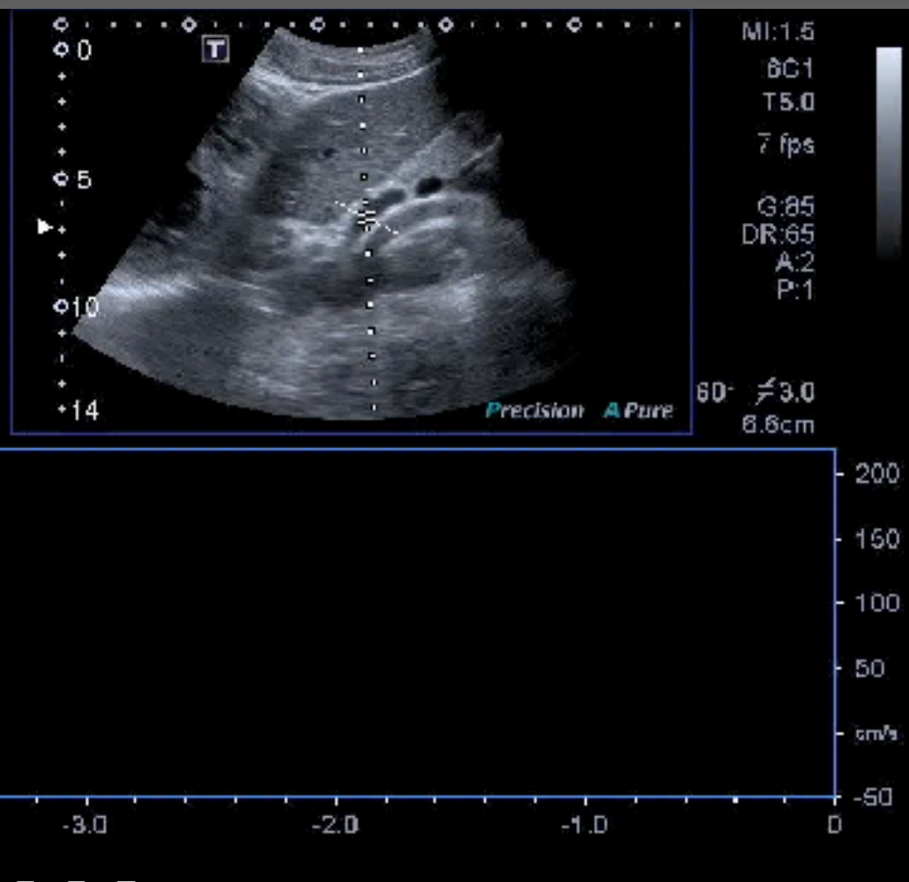




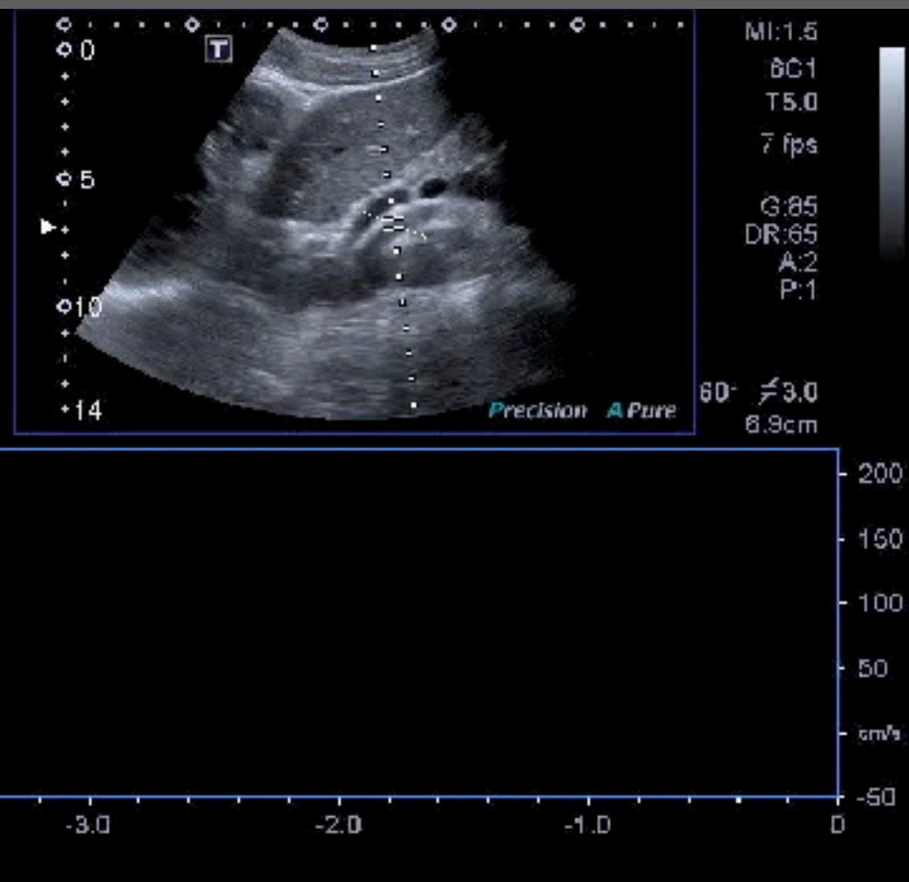


Abdominal vessels

CA



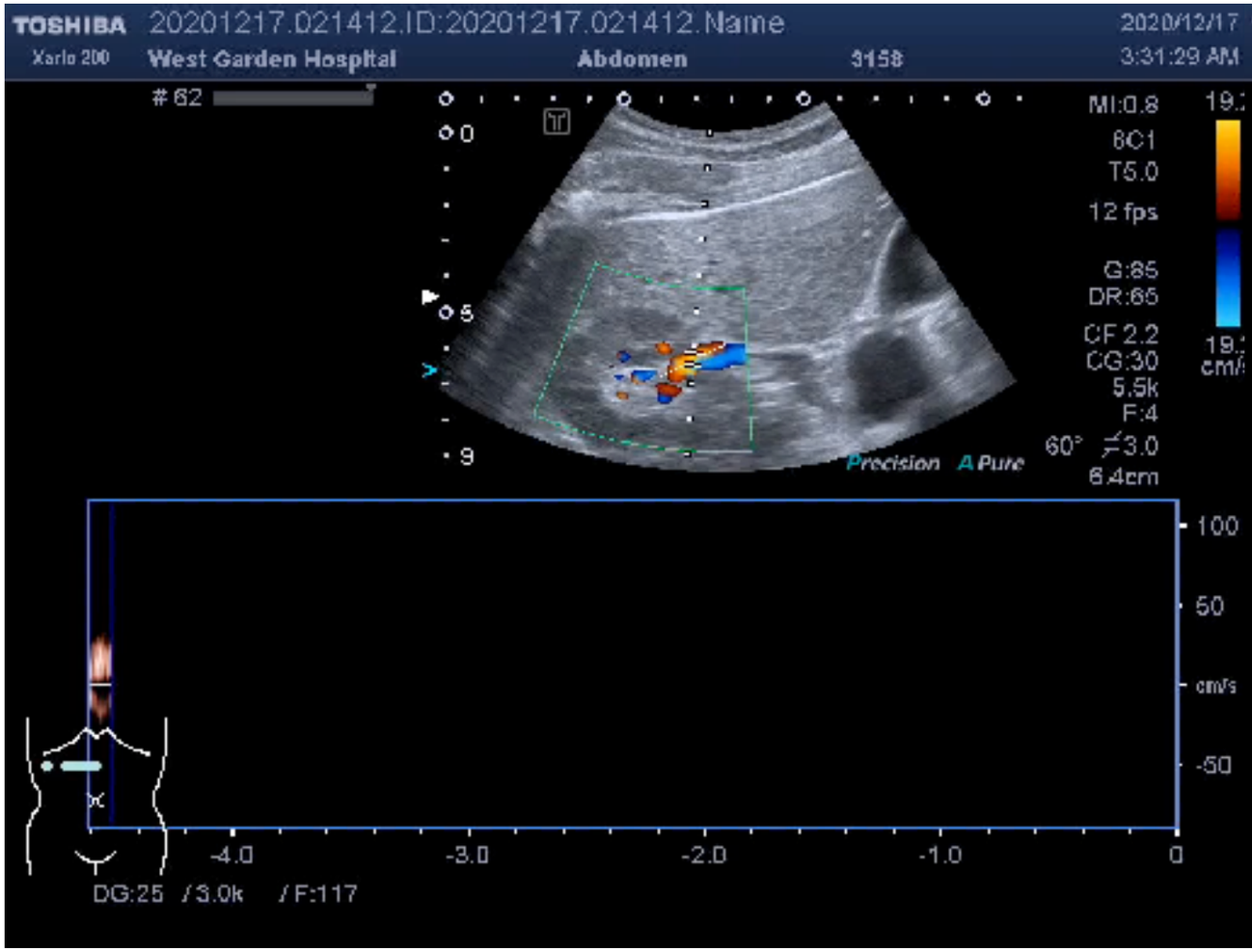
SMA

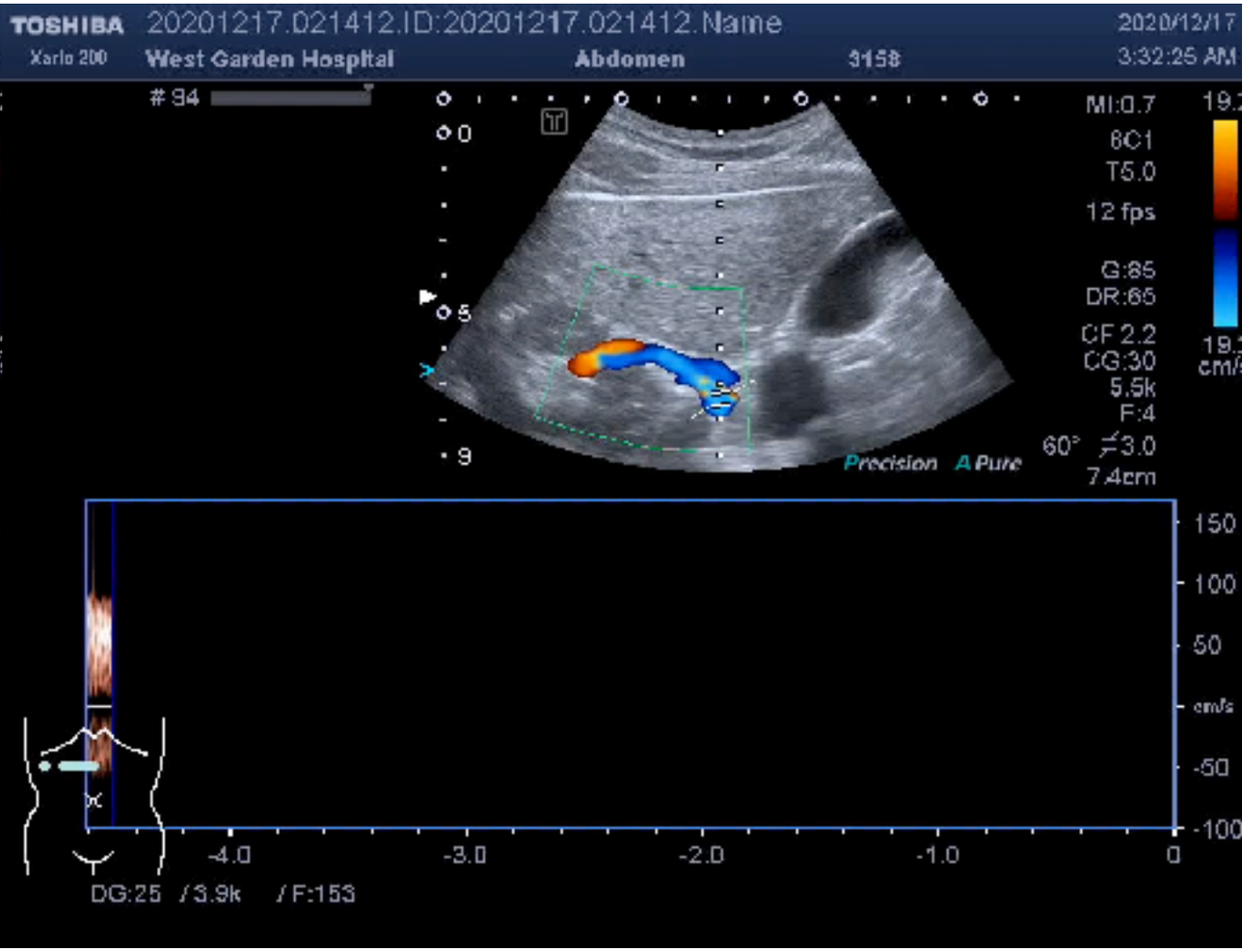


CA to SMA

RA

Renal vessels





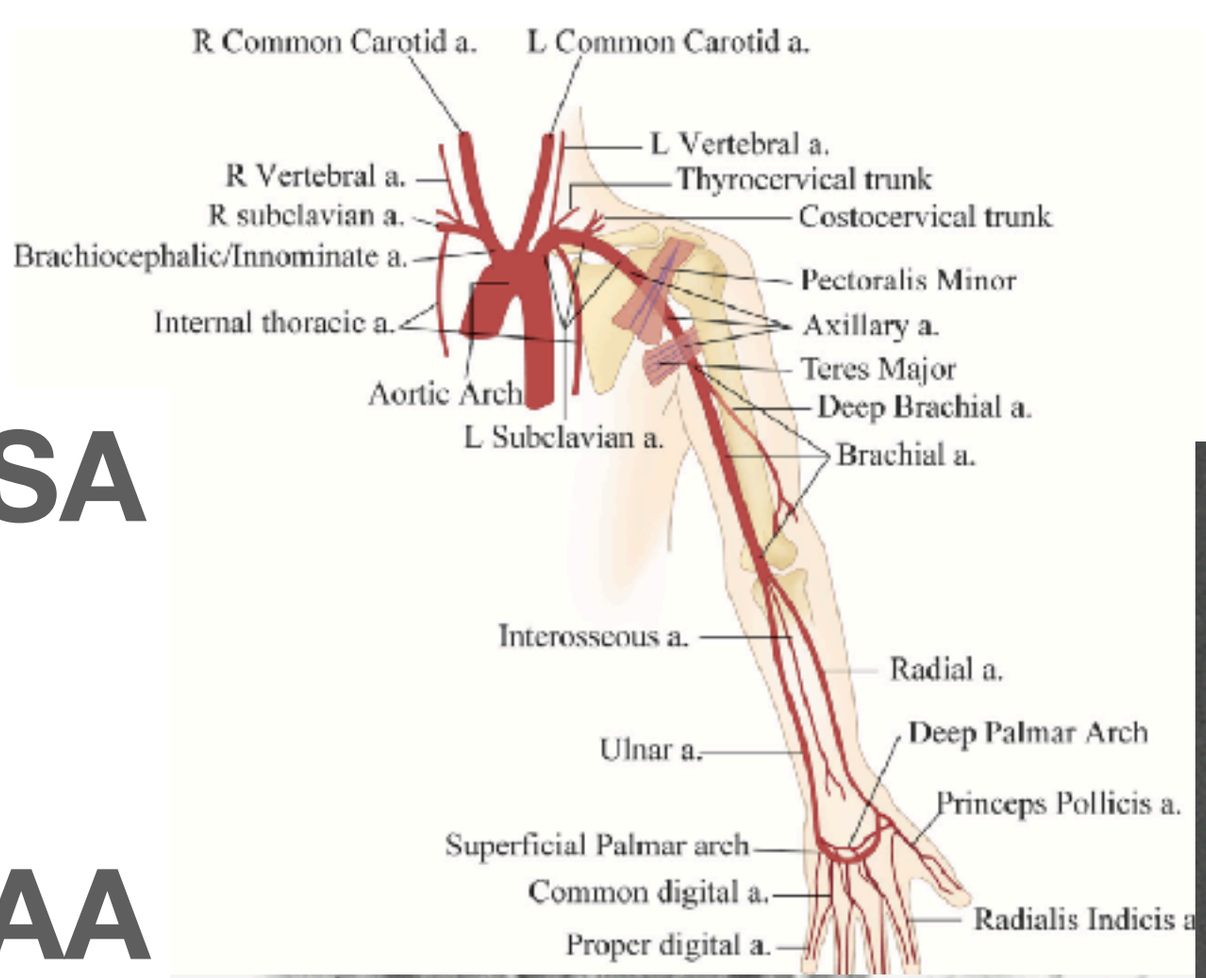
SA

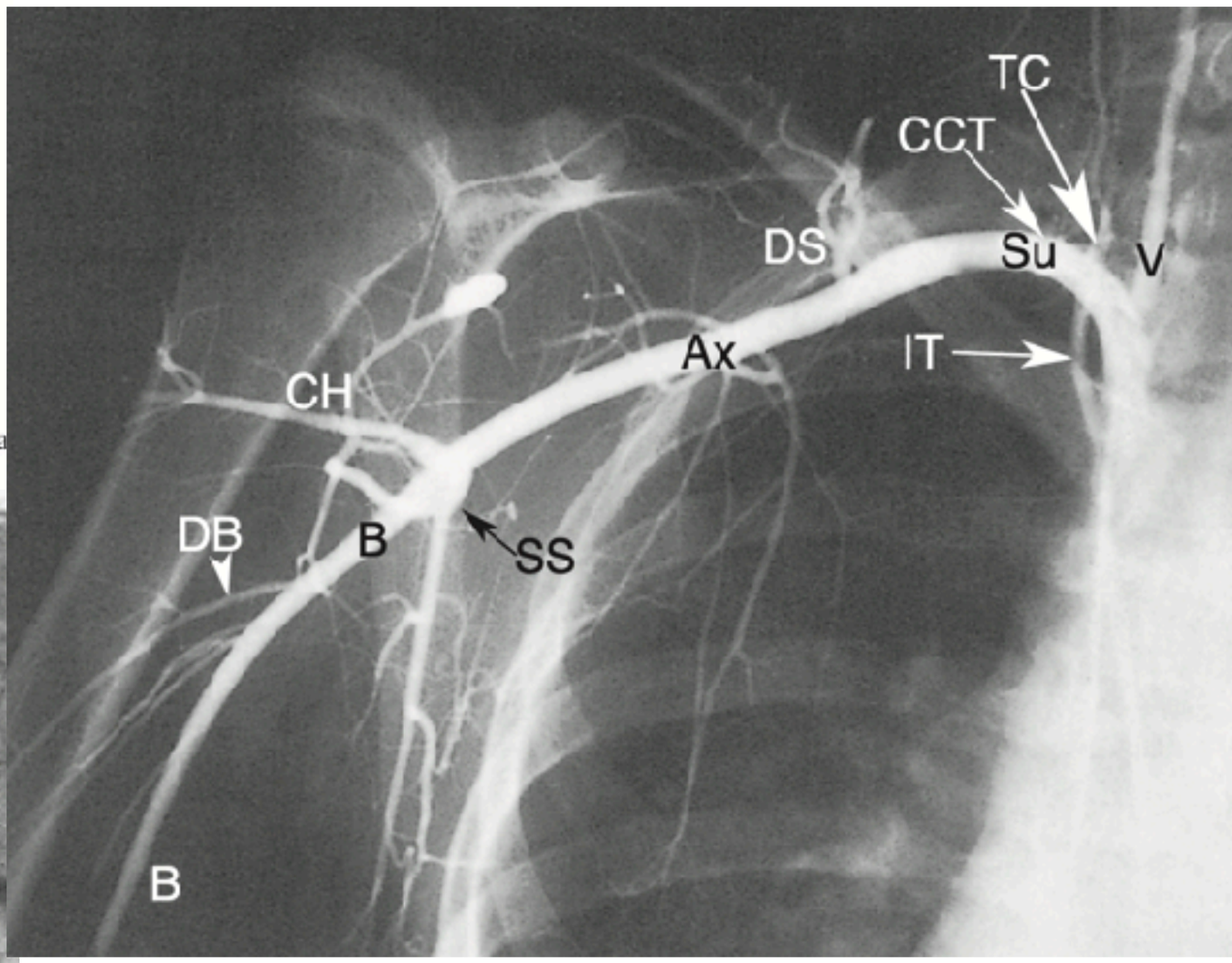
AA

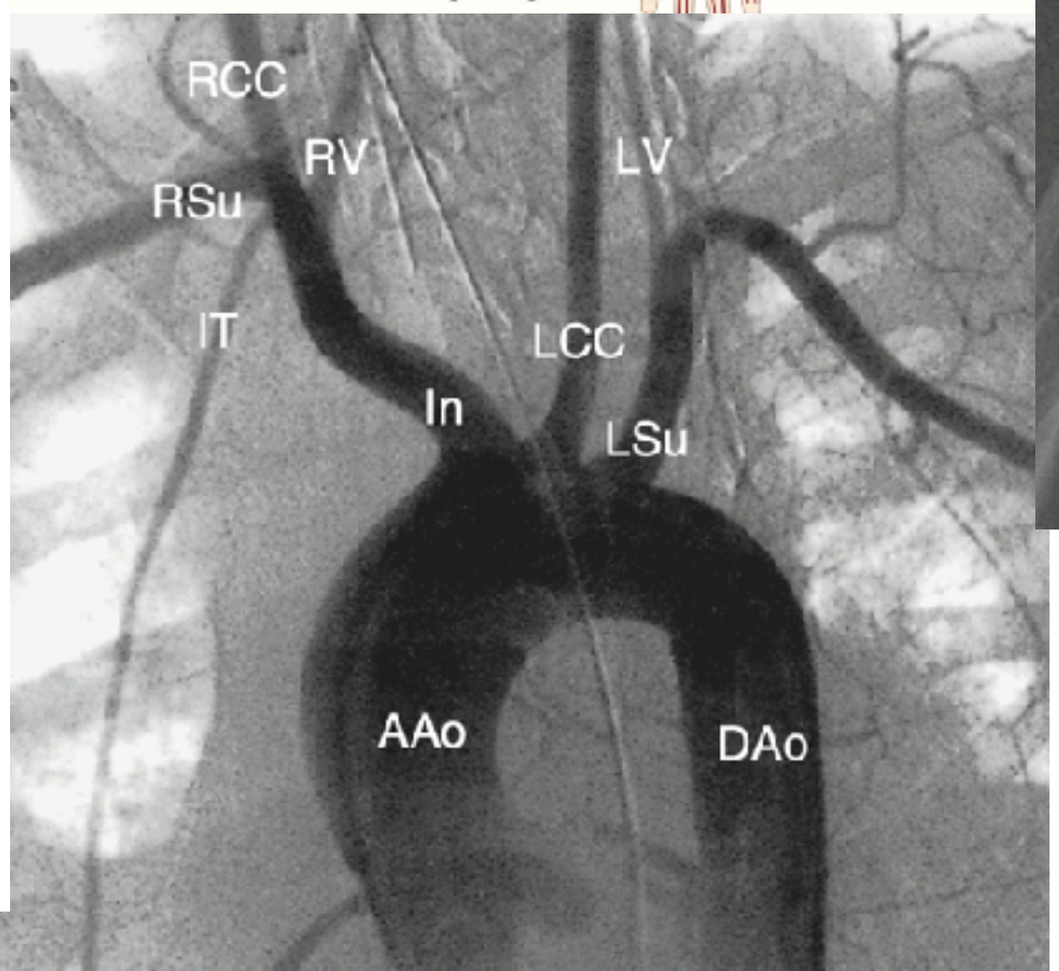
BA

RA

UA







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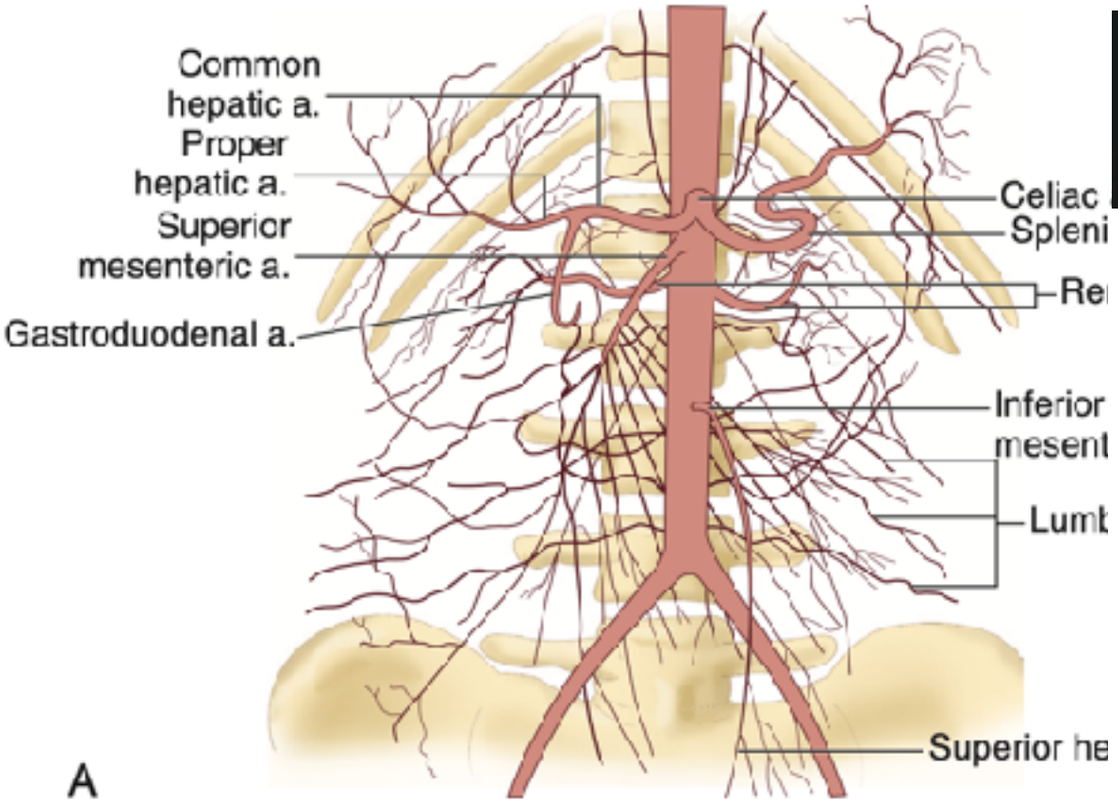


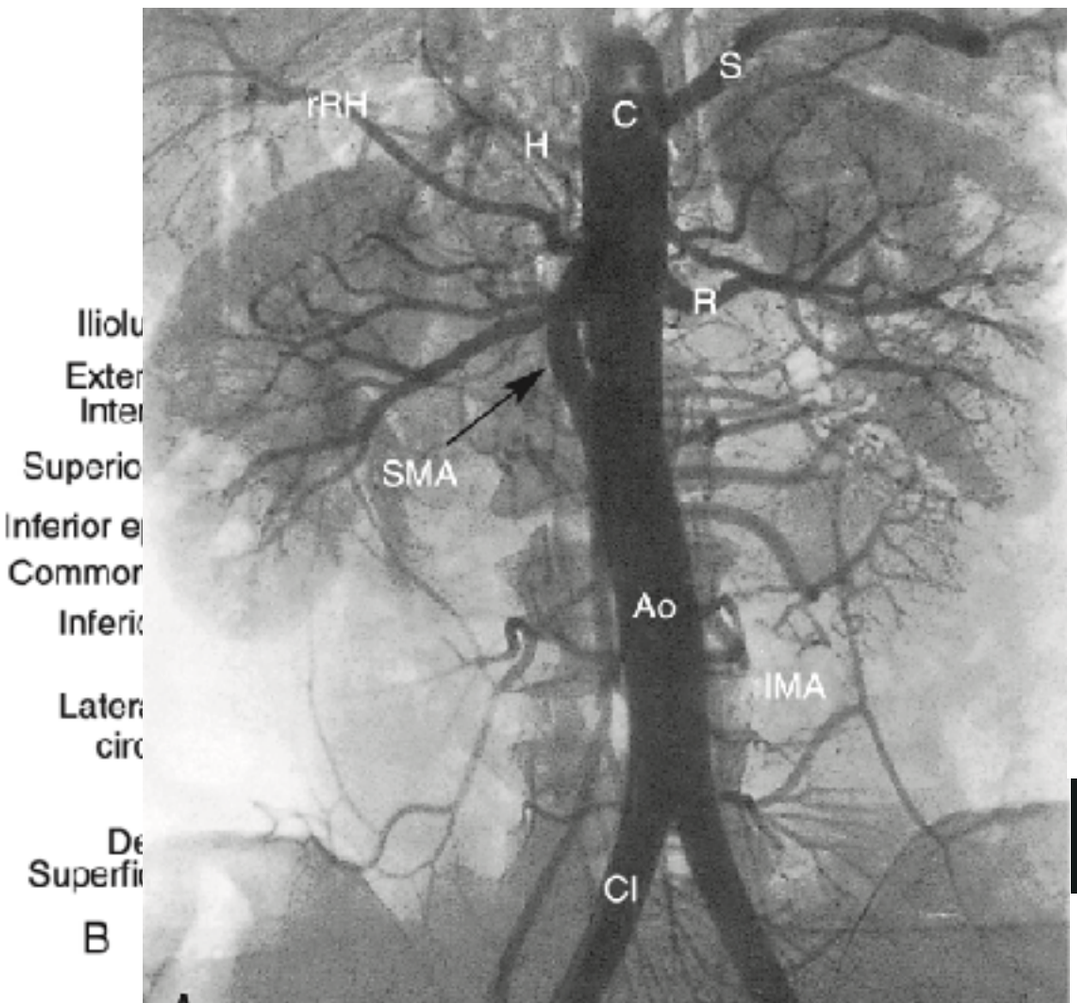
CA

SMA

RA

CIA

EIA



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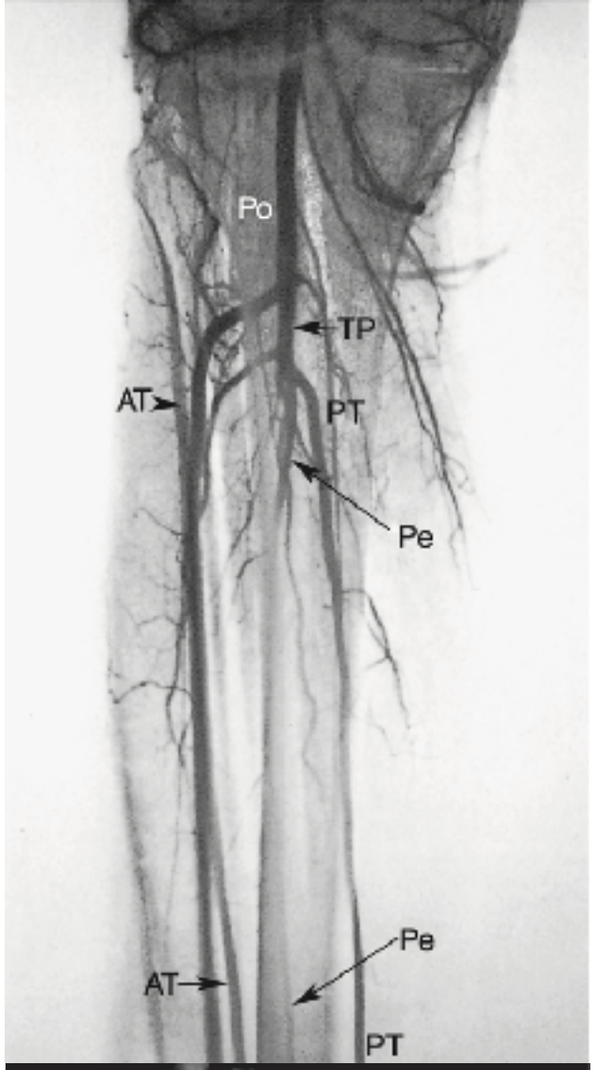
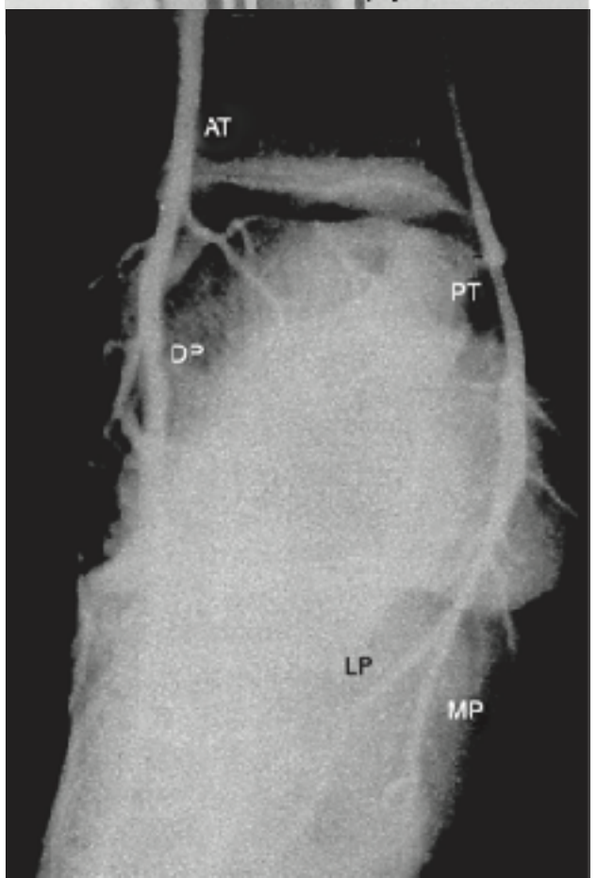
C





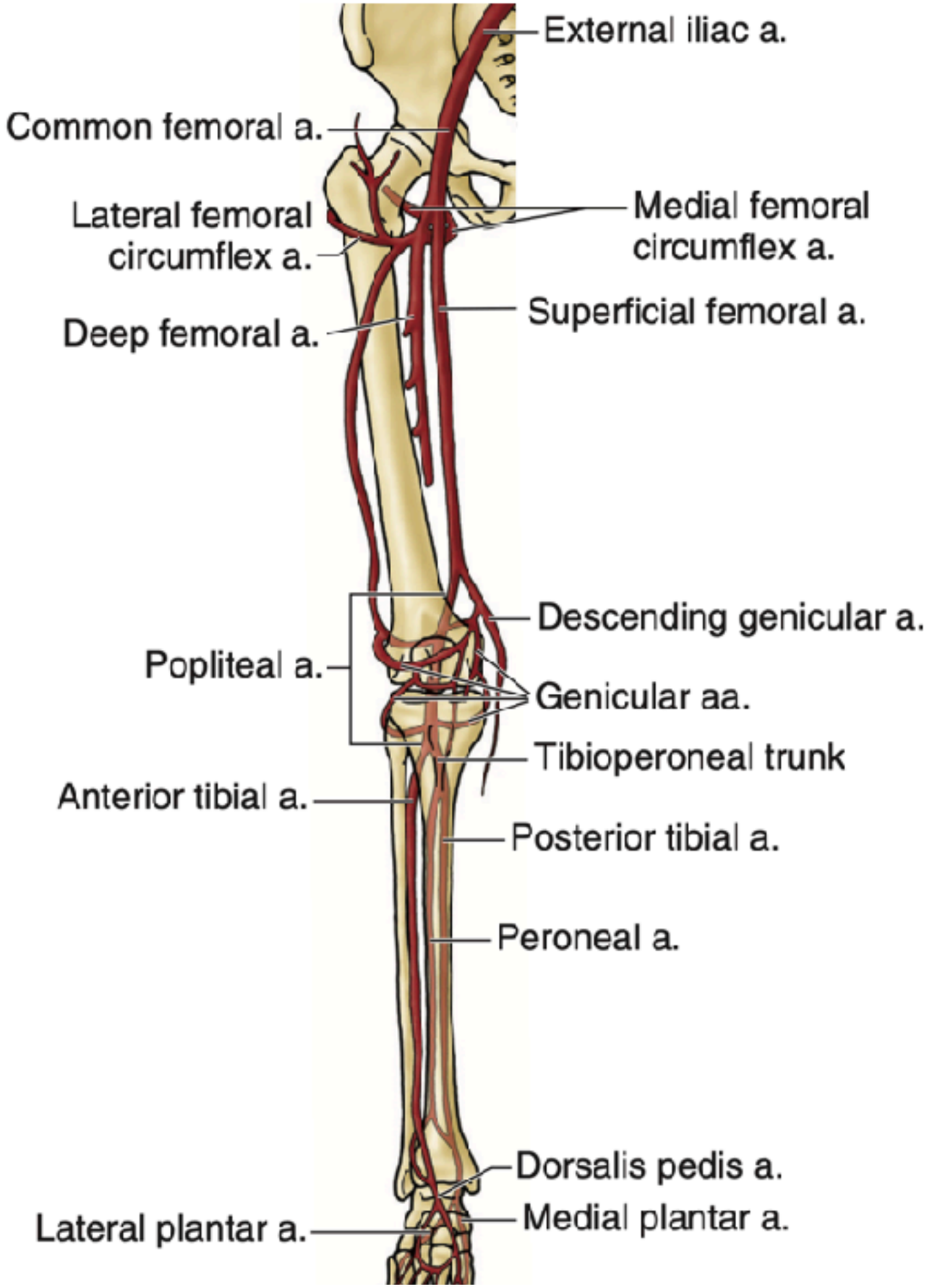
CFA

SFA

PA

ATA

PTA



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C

Ankle-Brachial Index

Range of ABI	Level of PAD
0.9–1.3	No significant PAD
0.7–0.9	Mild PAD
0.5–0.7	Moderate PAD
<0.5	Severe PAD
<0.3	Critical PAD

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Resting ABI

Abnormal

Segmental Systolic Pressures

Pulse Volume Recording

Treadmill Exercise

Duplex Sonography, if indicated

Ankle Pressure > 200 mmHg

or

Brachial Pressure > 200 mmHg

Toe-Brachial Index

Pulse Volume Recording

Femoral/Popliteal CW Doppler

AT / PI

Duplex Sonography, if indicated

Normal

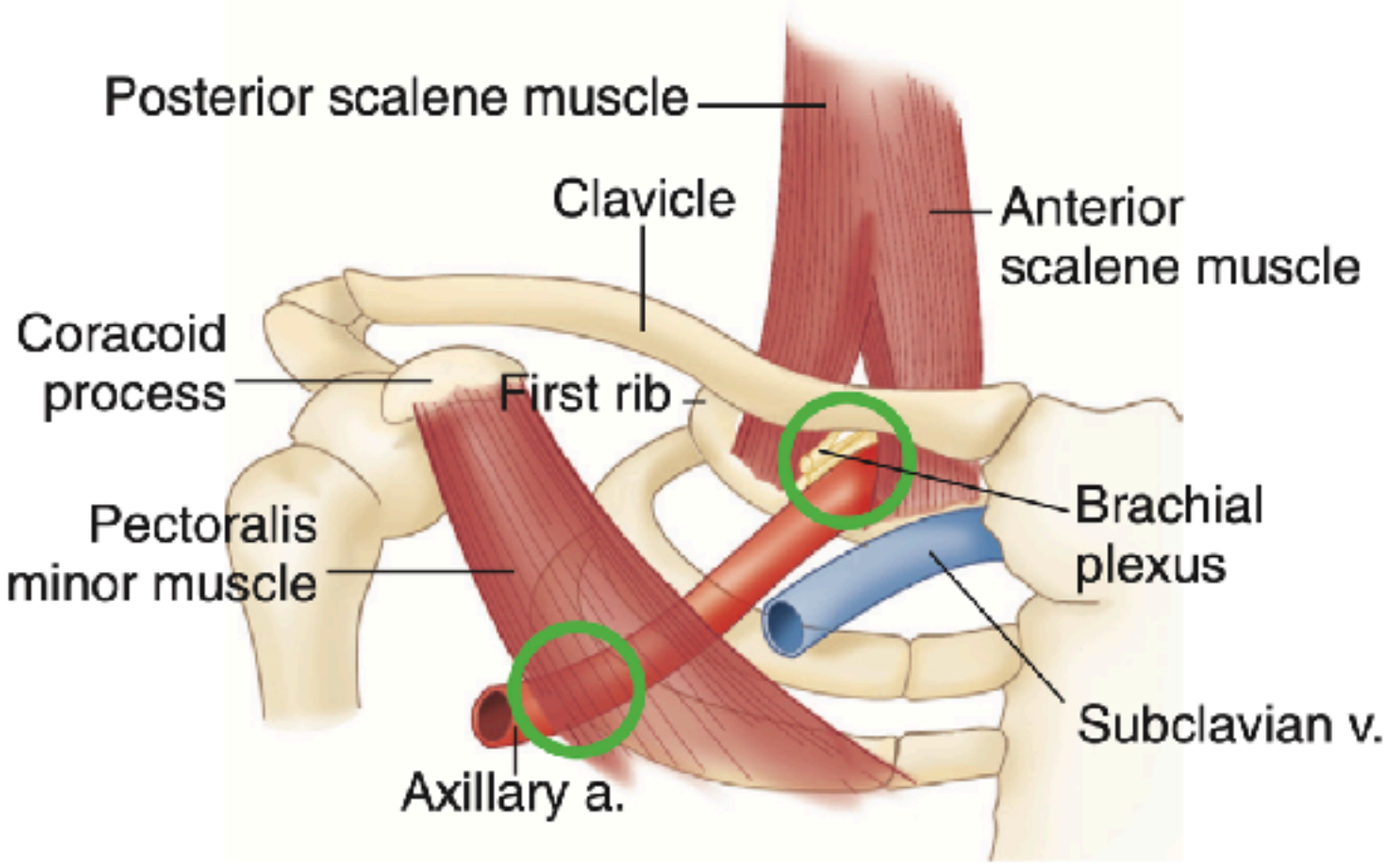
Femoral/Popliteal CW Doppler

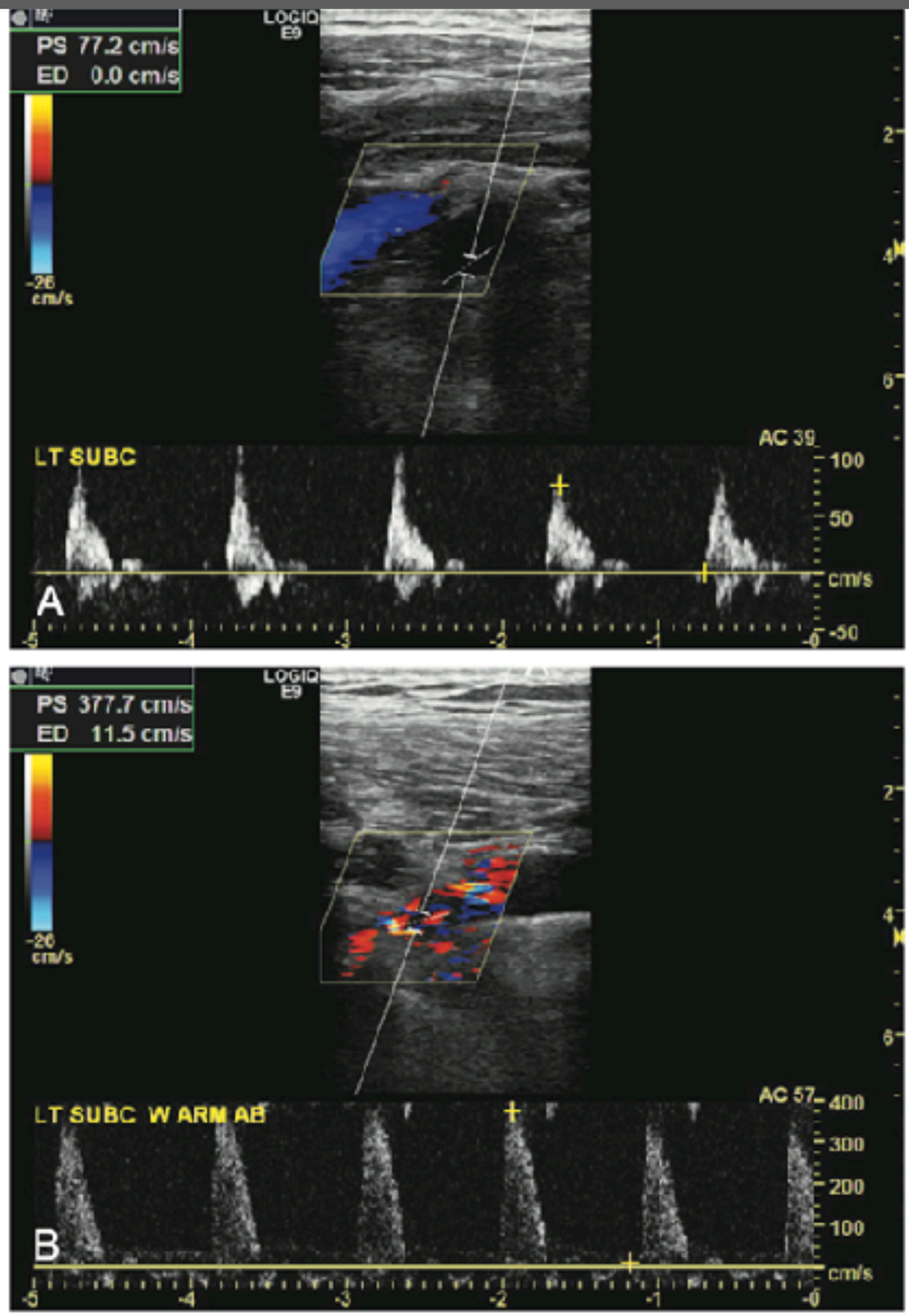
AT / PI

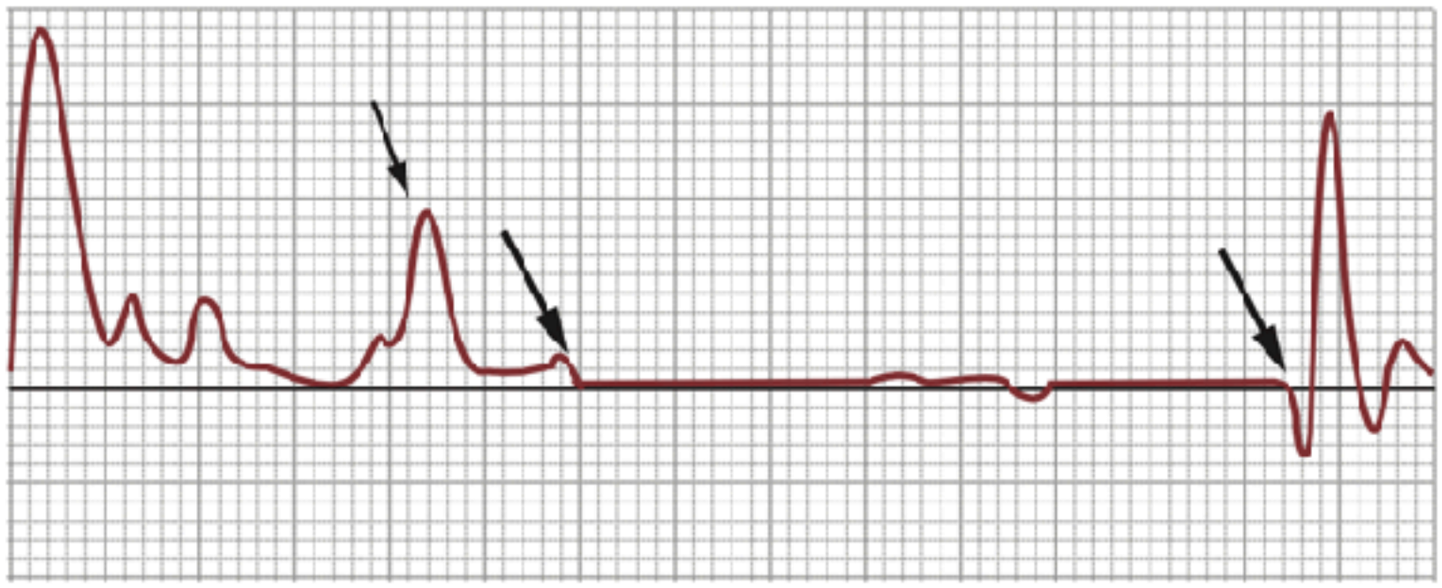
Treadmill Exercise

Duplex Sonography, if indicated

Thoracic outlet syndrome







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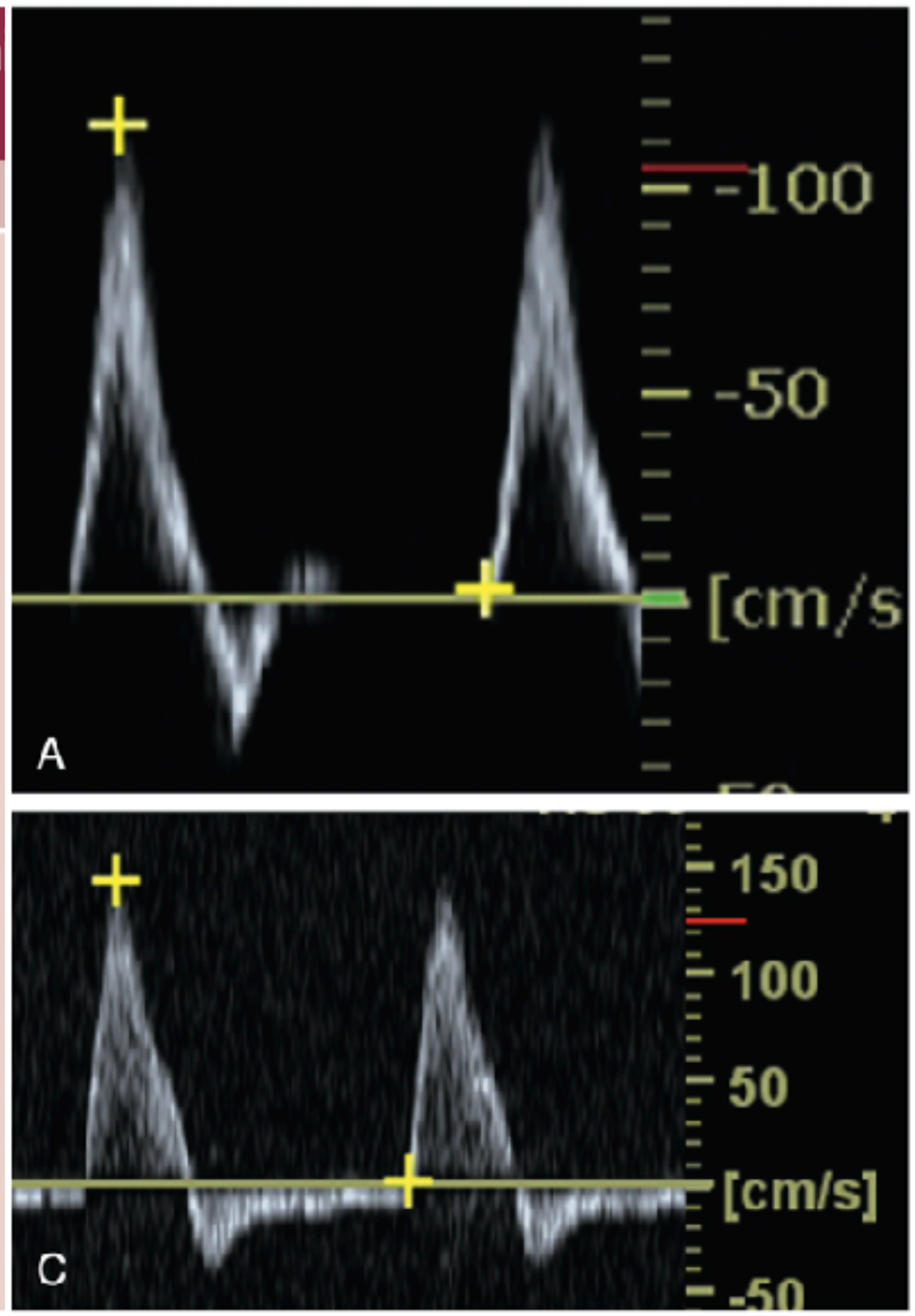
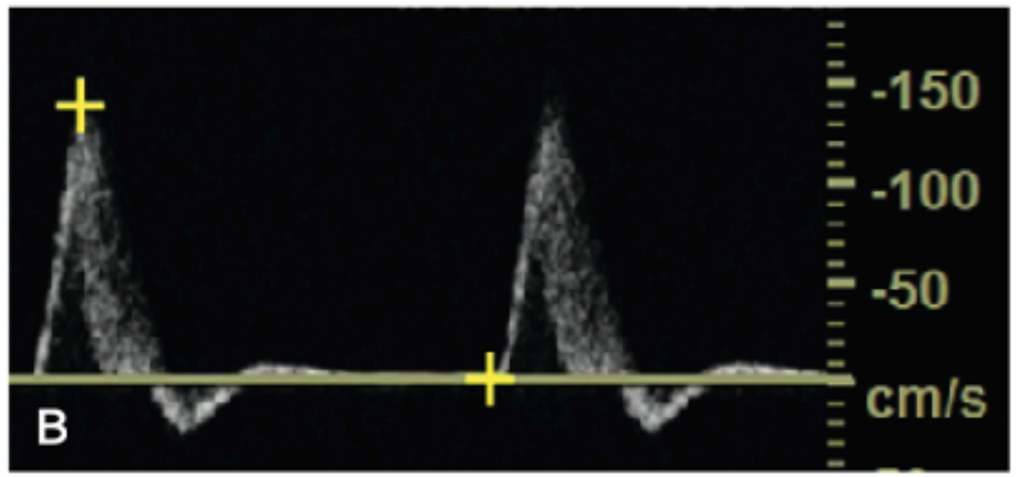
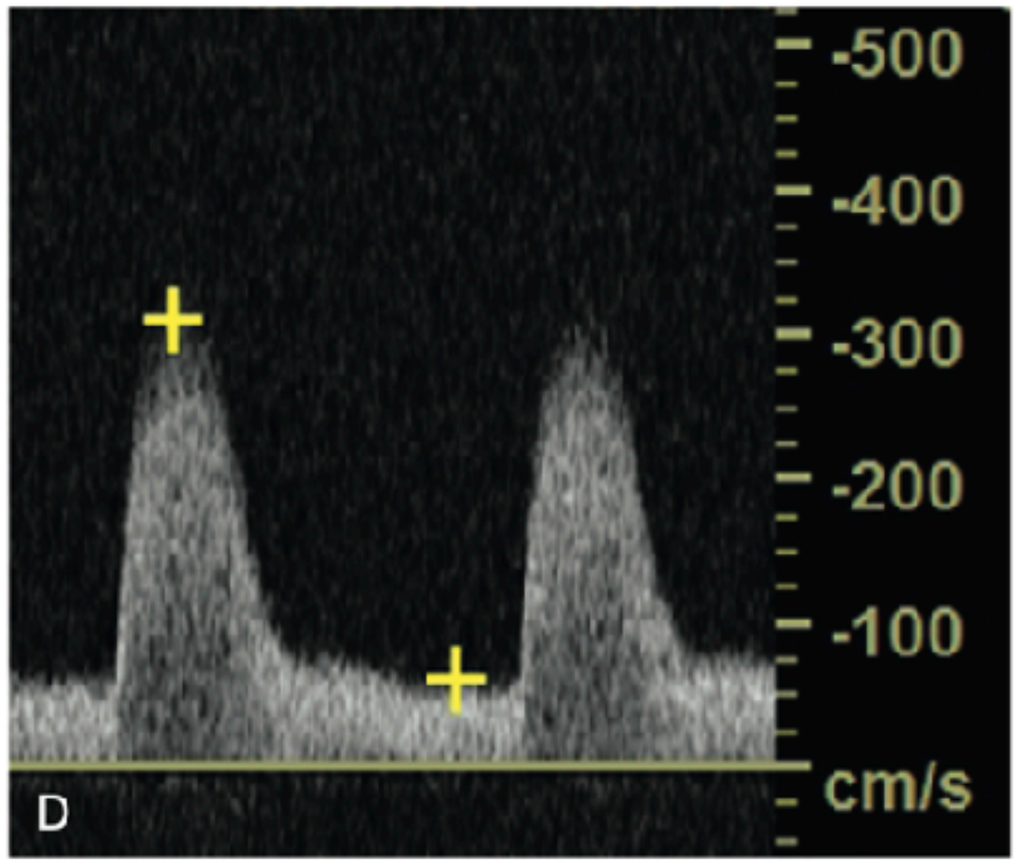
Waveform for stenosis category

TABLE 15.2 Un
Extremity Arterial

Disease Severity
Normal
1%–19% diameter reduction
20%–49% diameter reduction
50%–99% diameter reduction
Occlusion







91F, R thigh painful swelling for 3 d

請問造成附圖大腿病灶最可能的原因為何？

Abscess

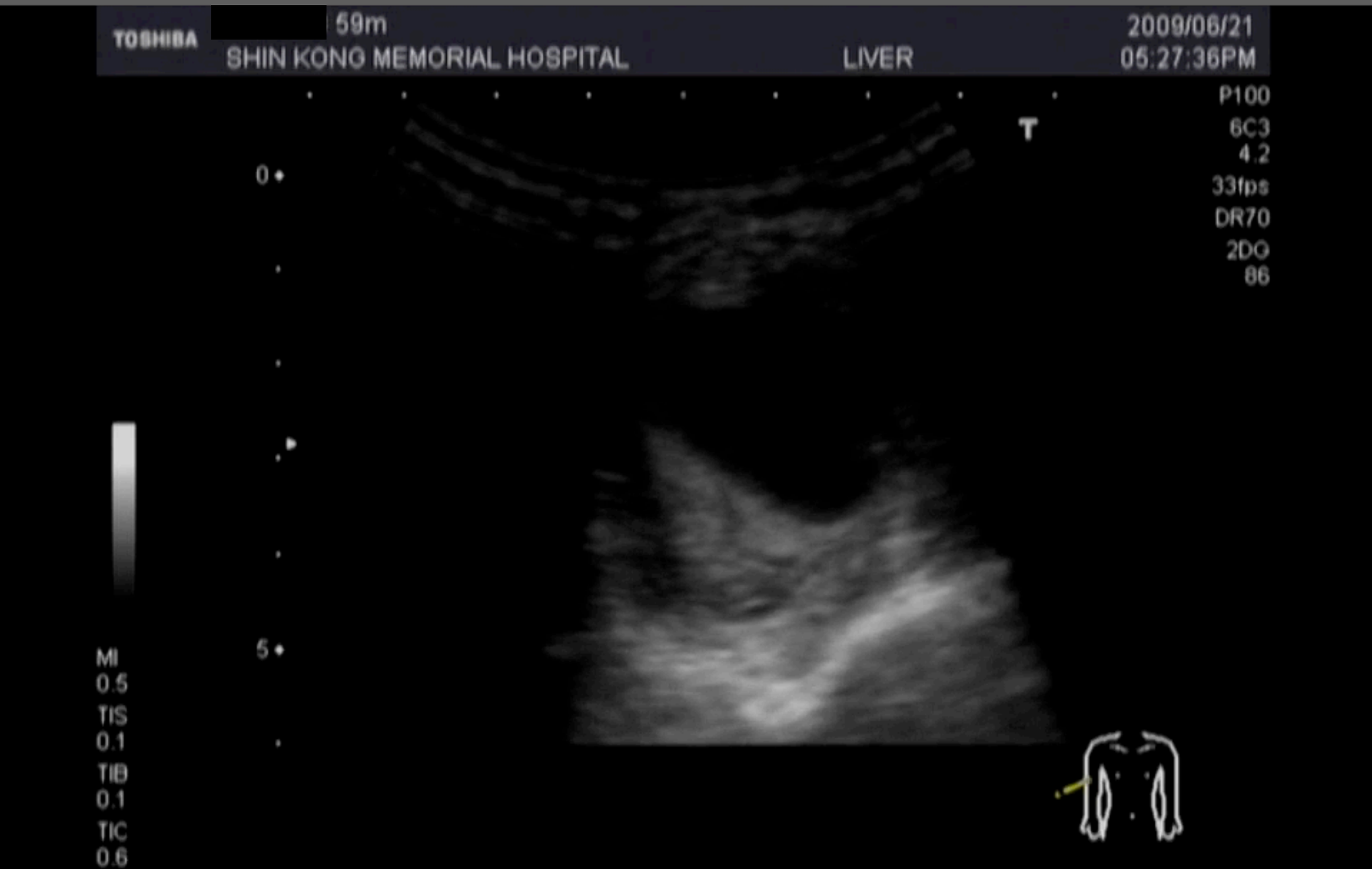
Pseudo-aneurysm

DVT

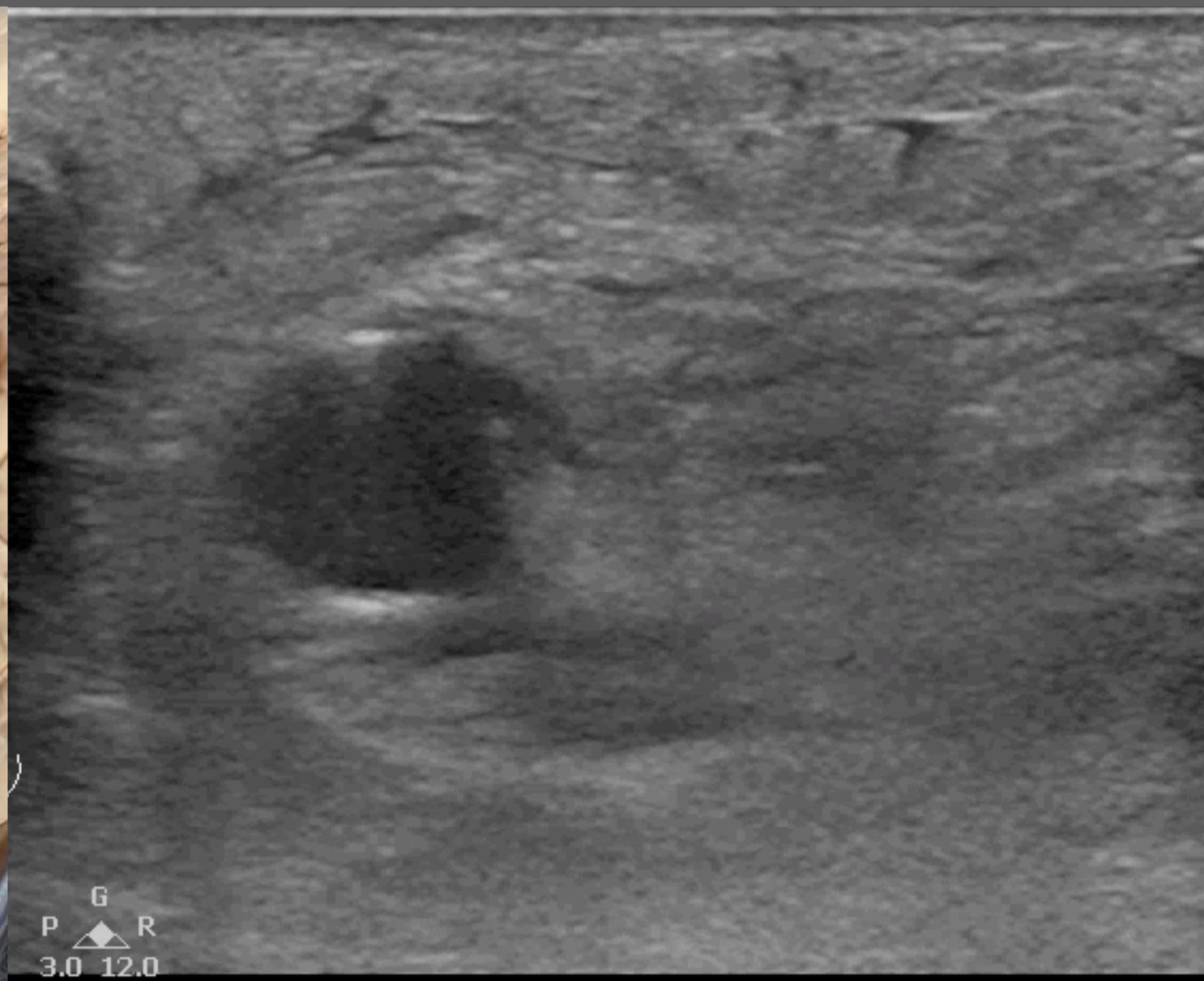
Tumor

Pseudo-aneurysm rupture

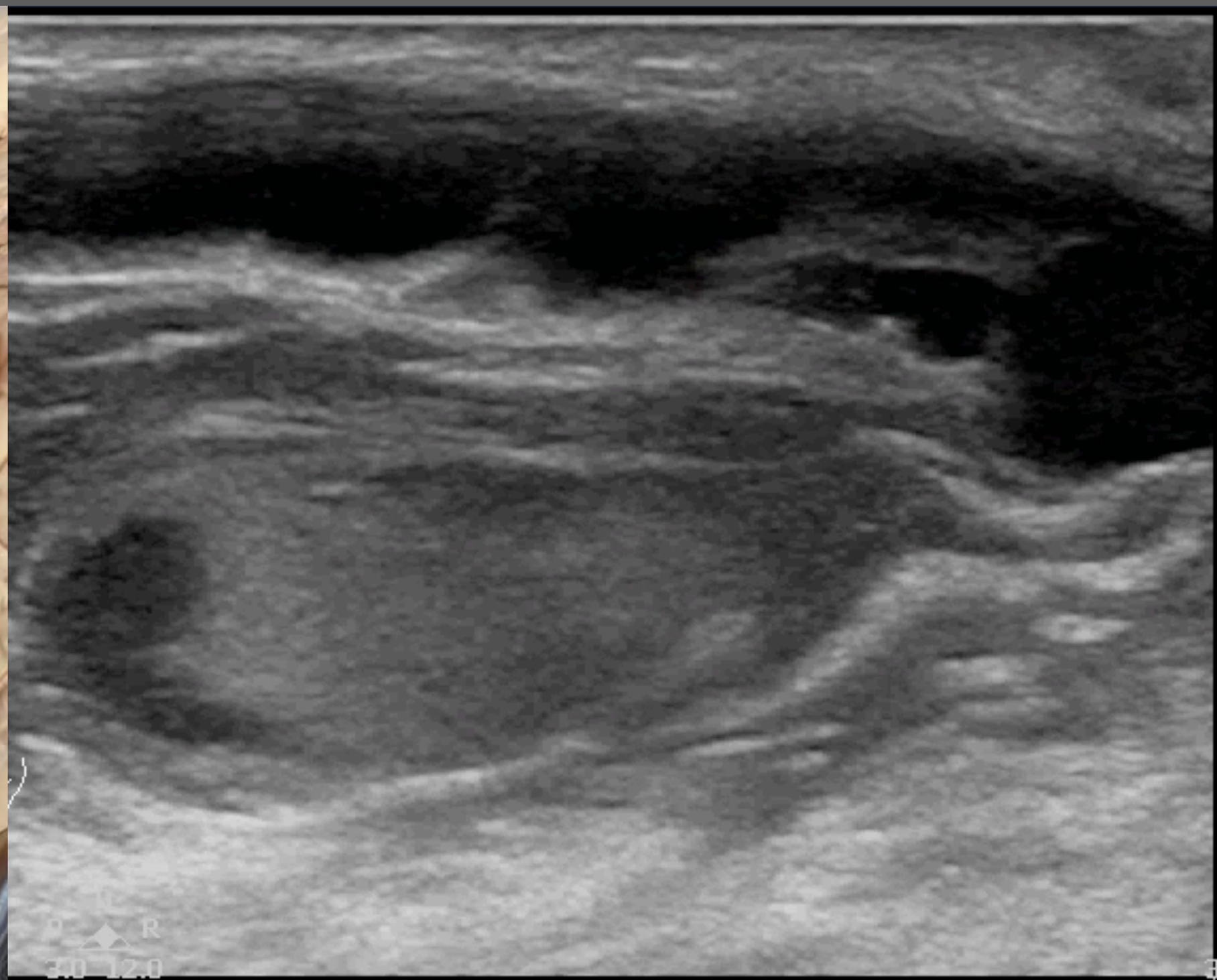
59M with right arm painful swelling



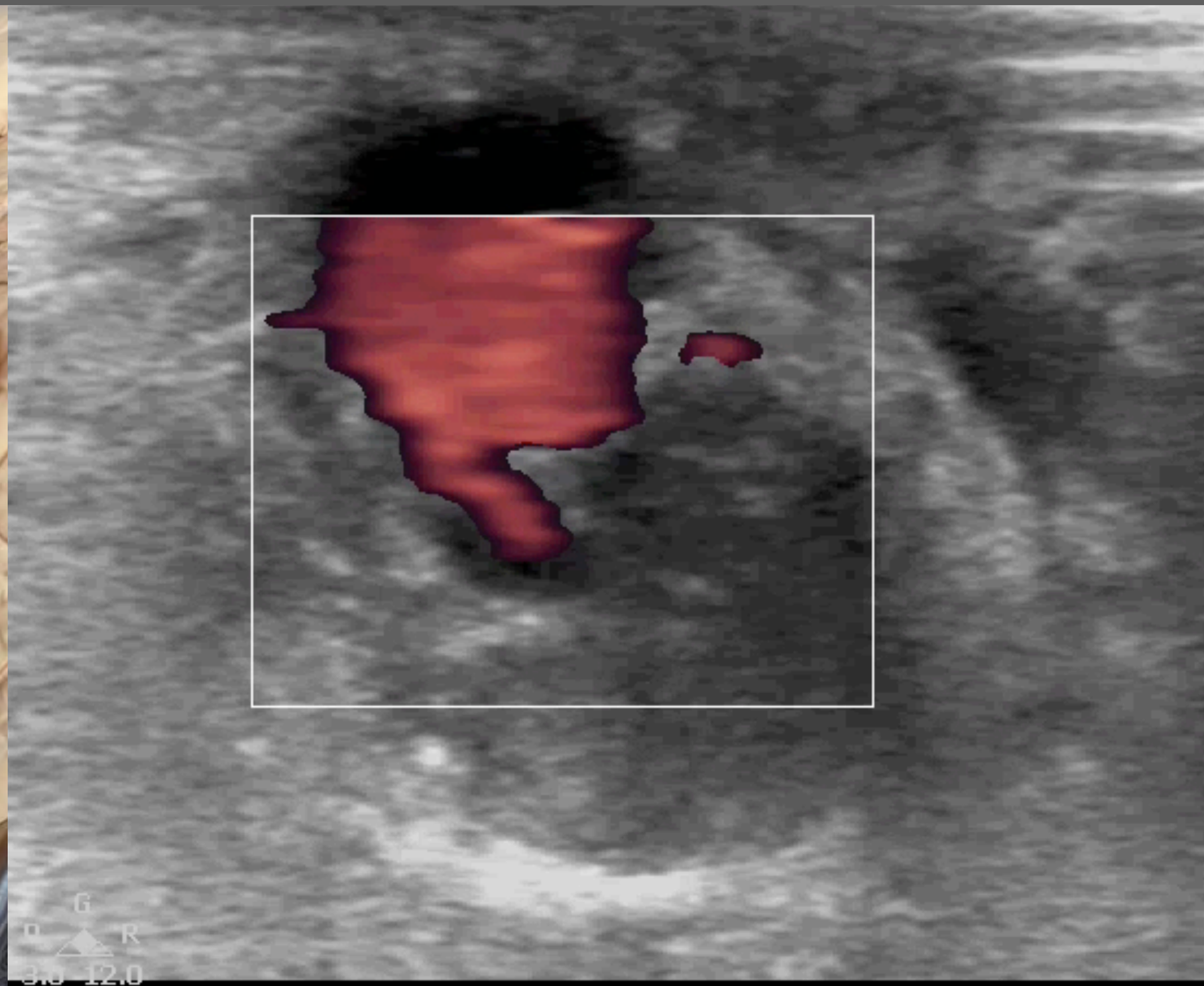
57F, ESRD on HD, arm swelling



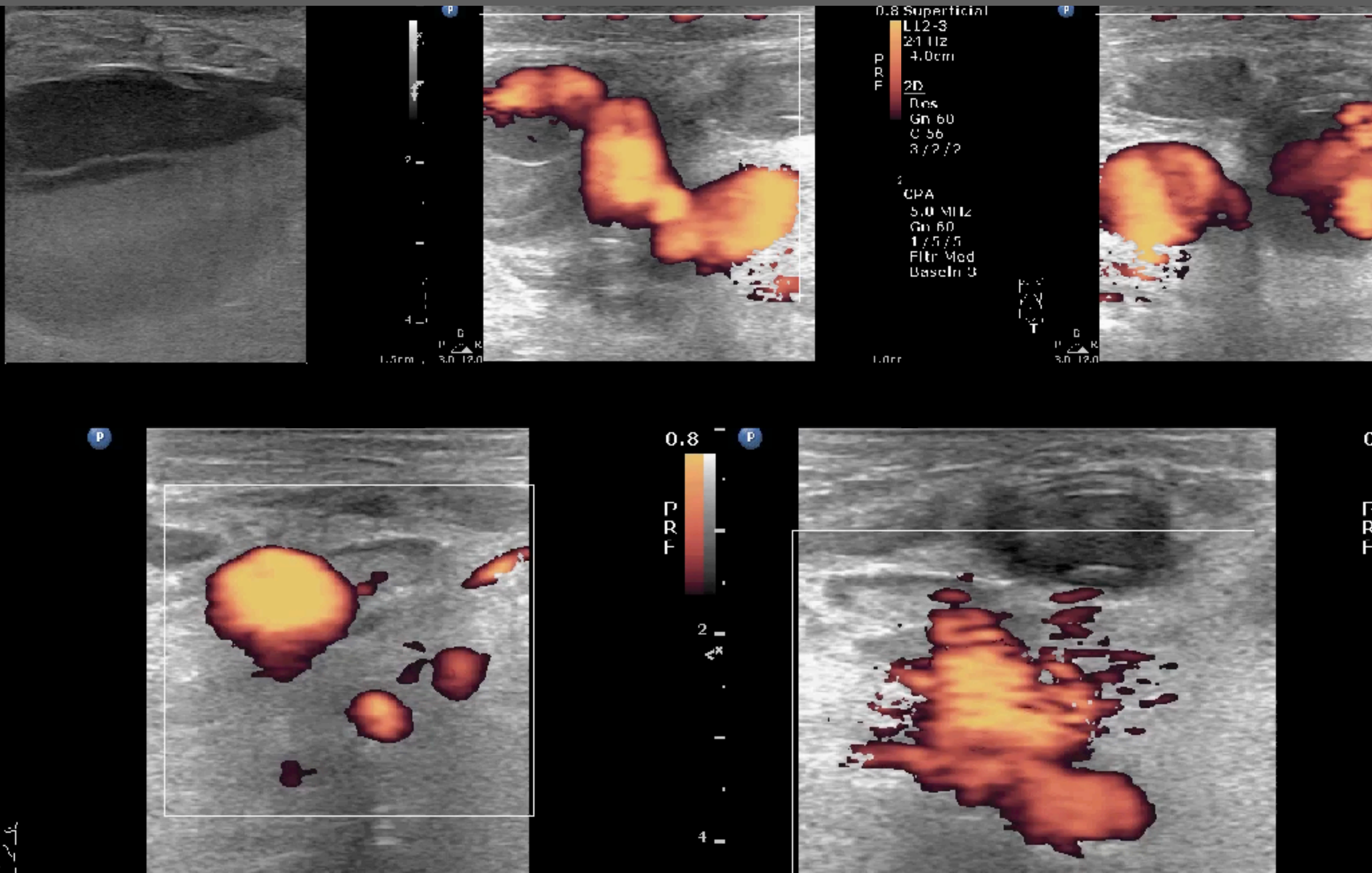
57F, ESRD on HD, arm swelling



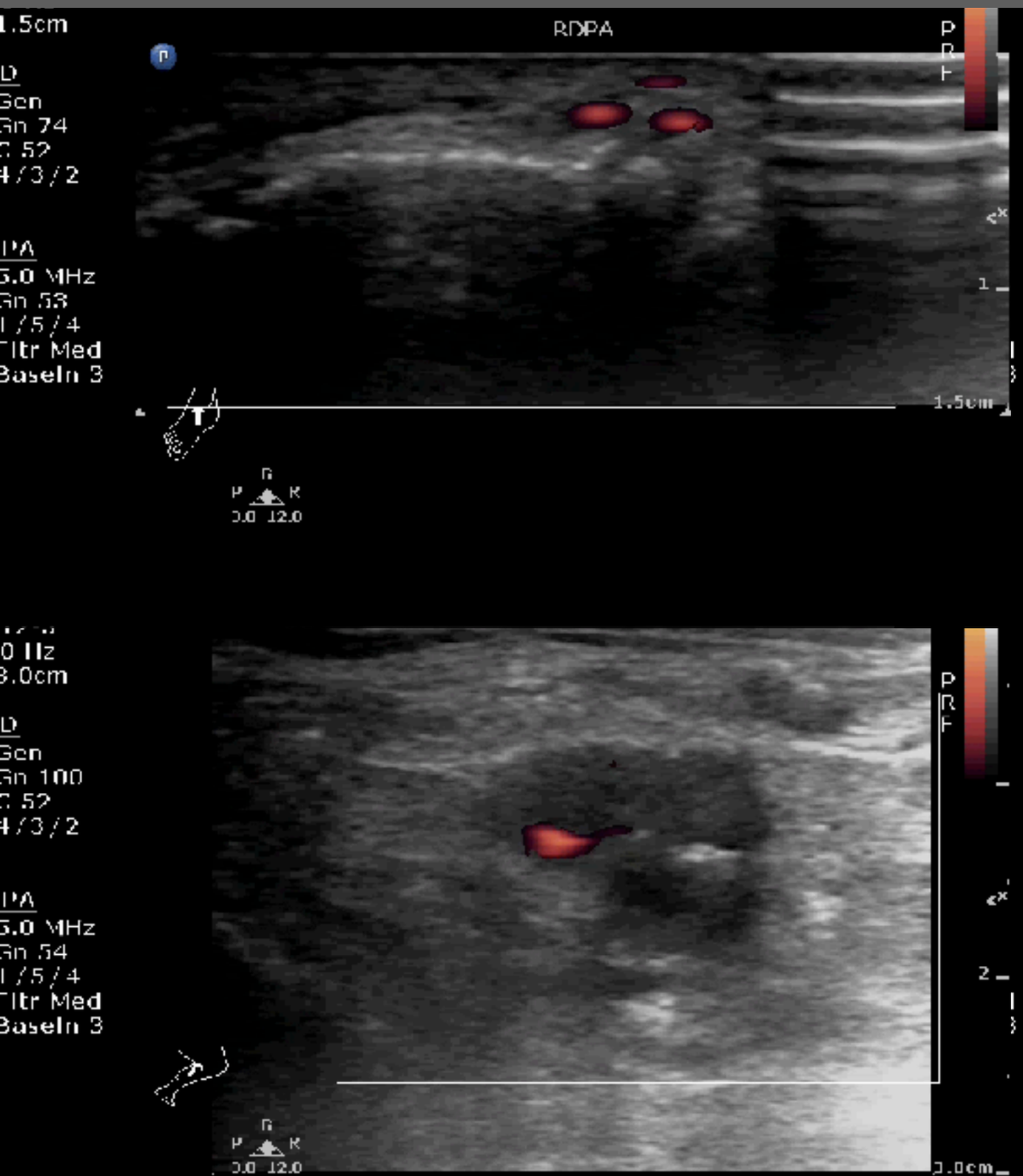
57F, ESRD on HD, arm swelling

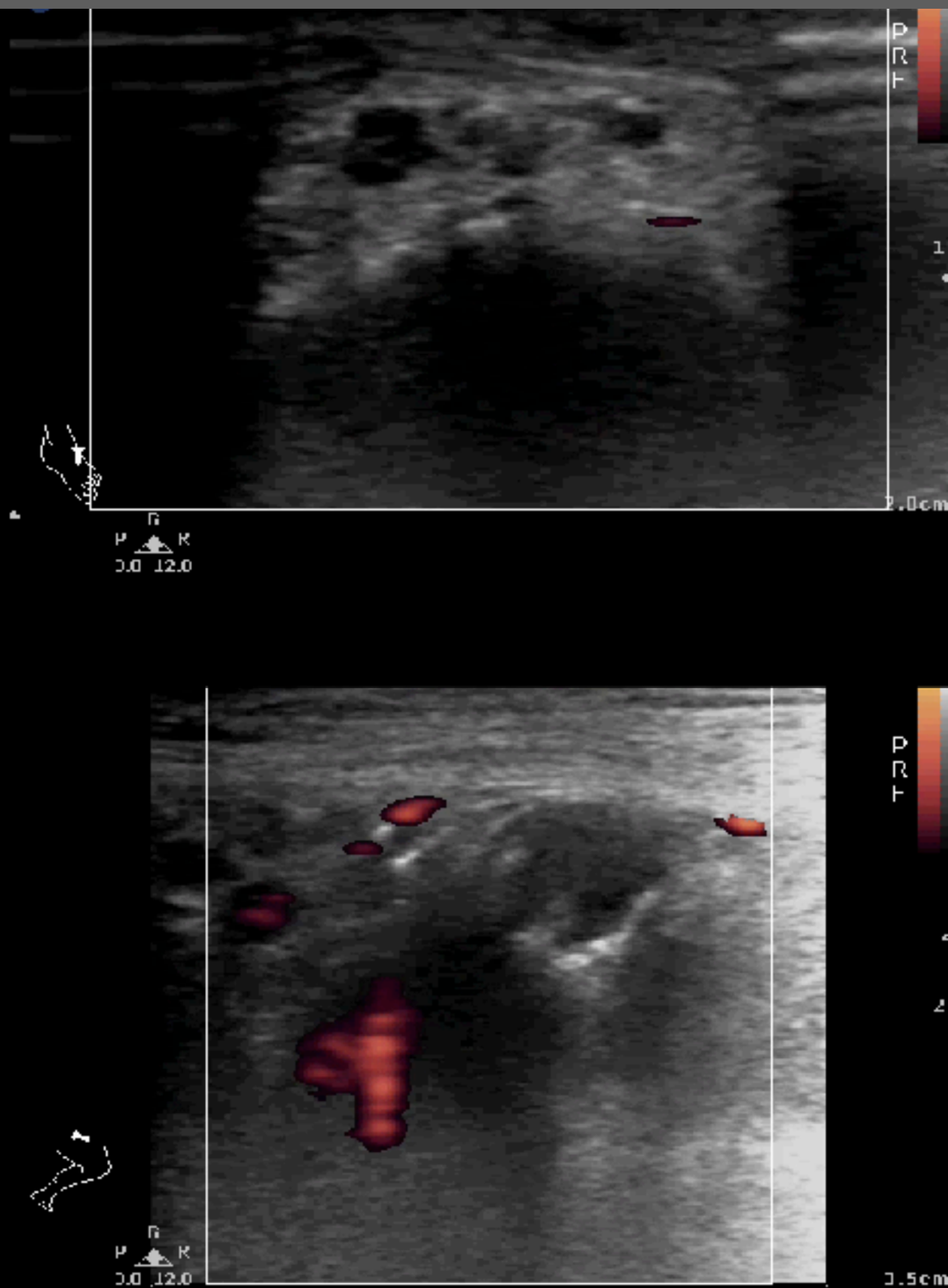


Left femoral painful swelling

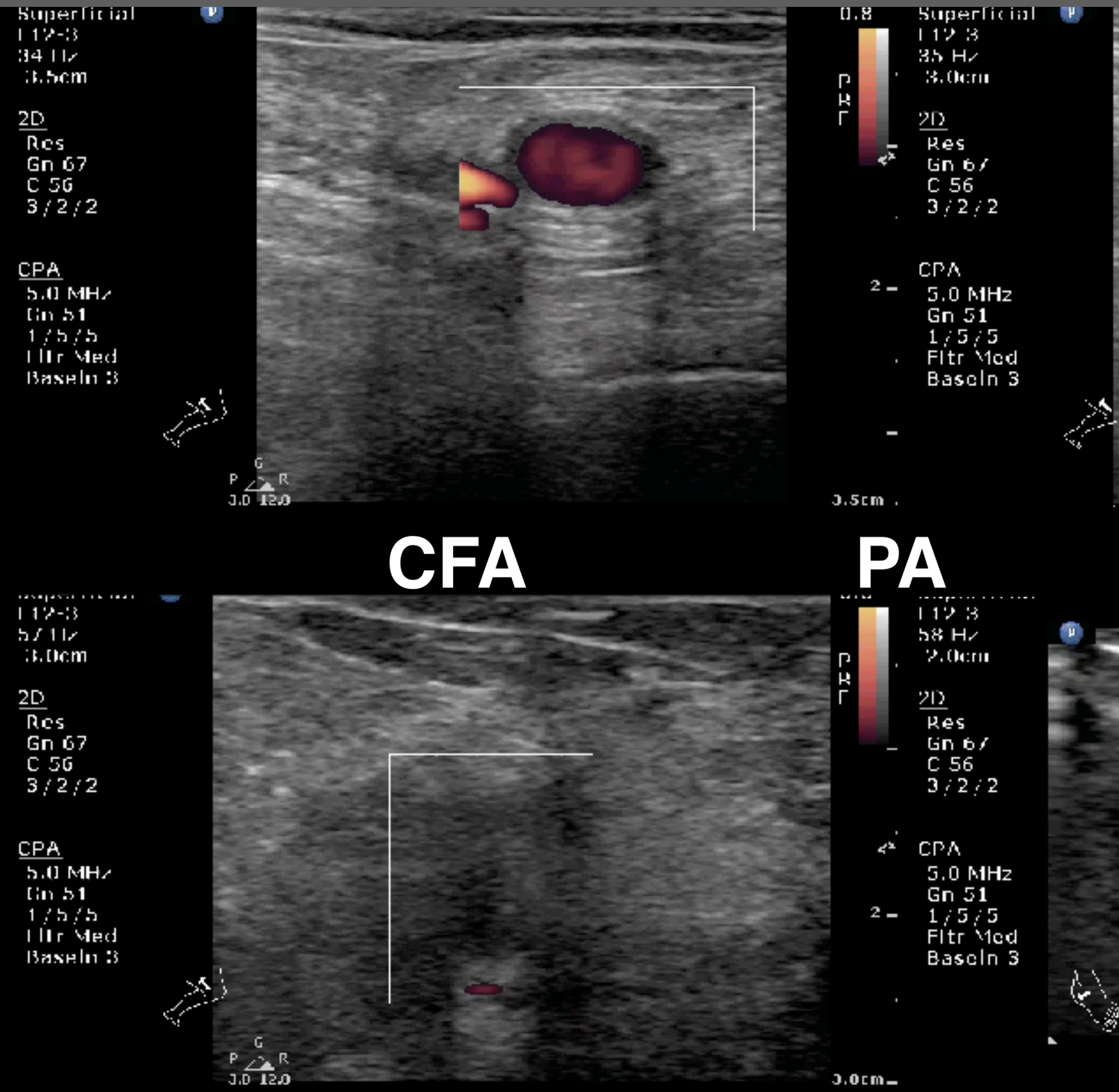


71F, Leg pain & cold





86F, Leg pain

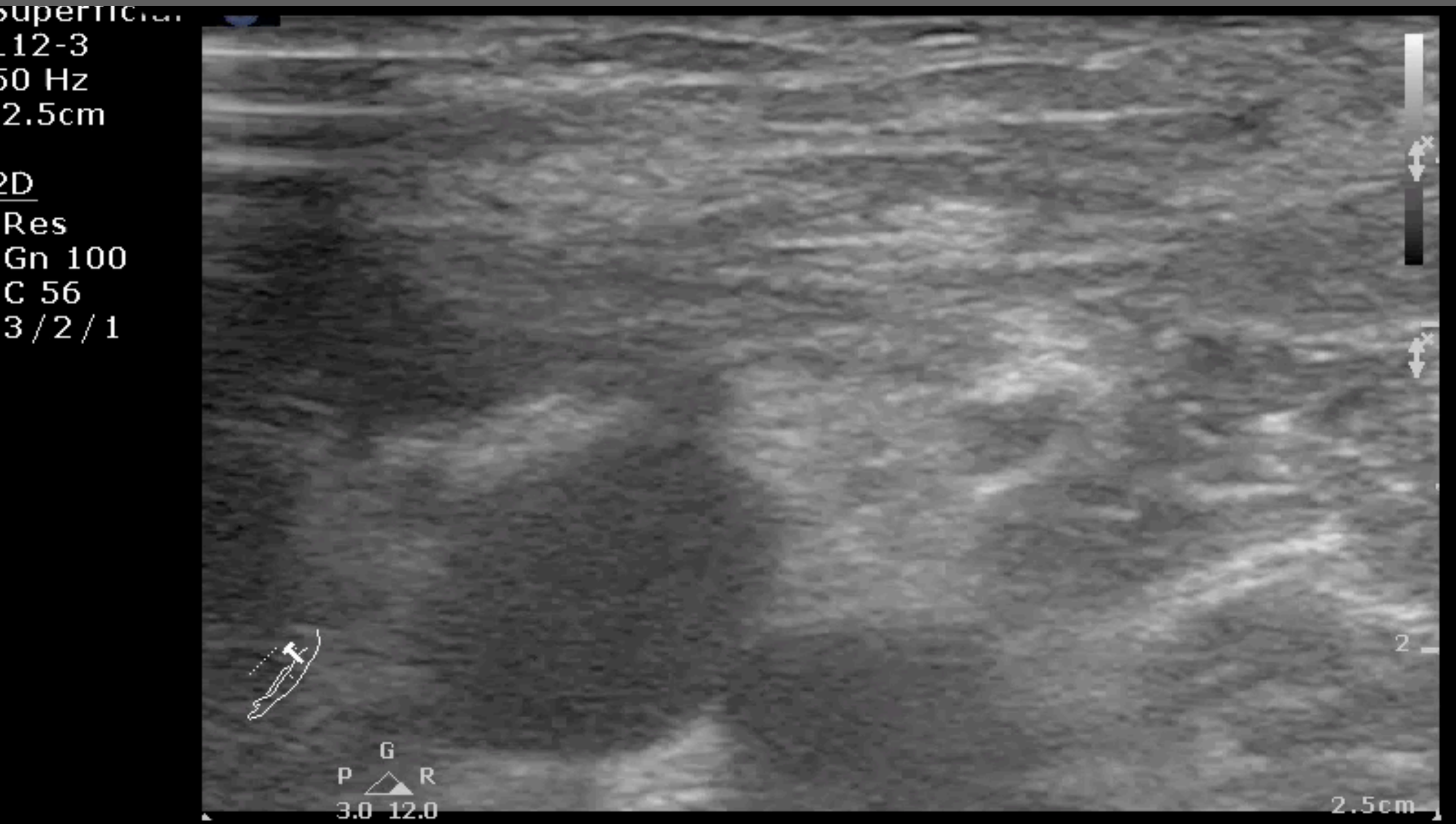


CFA

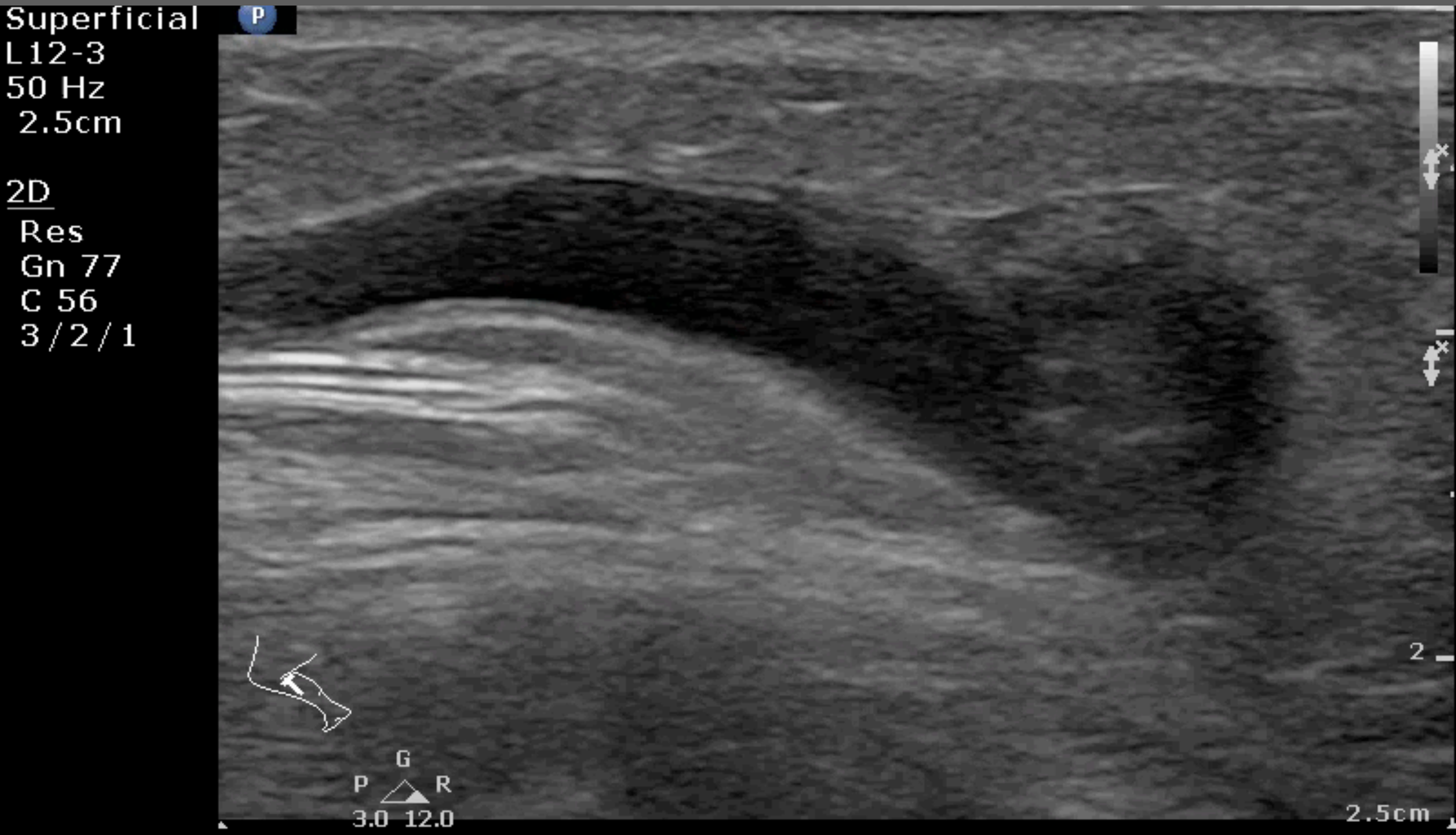
PA

DP/PTA

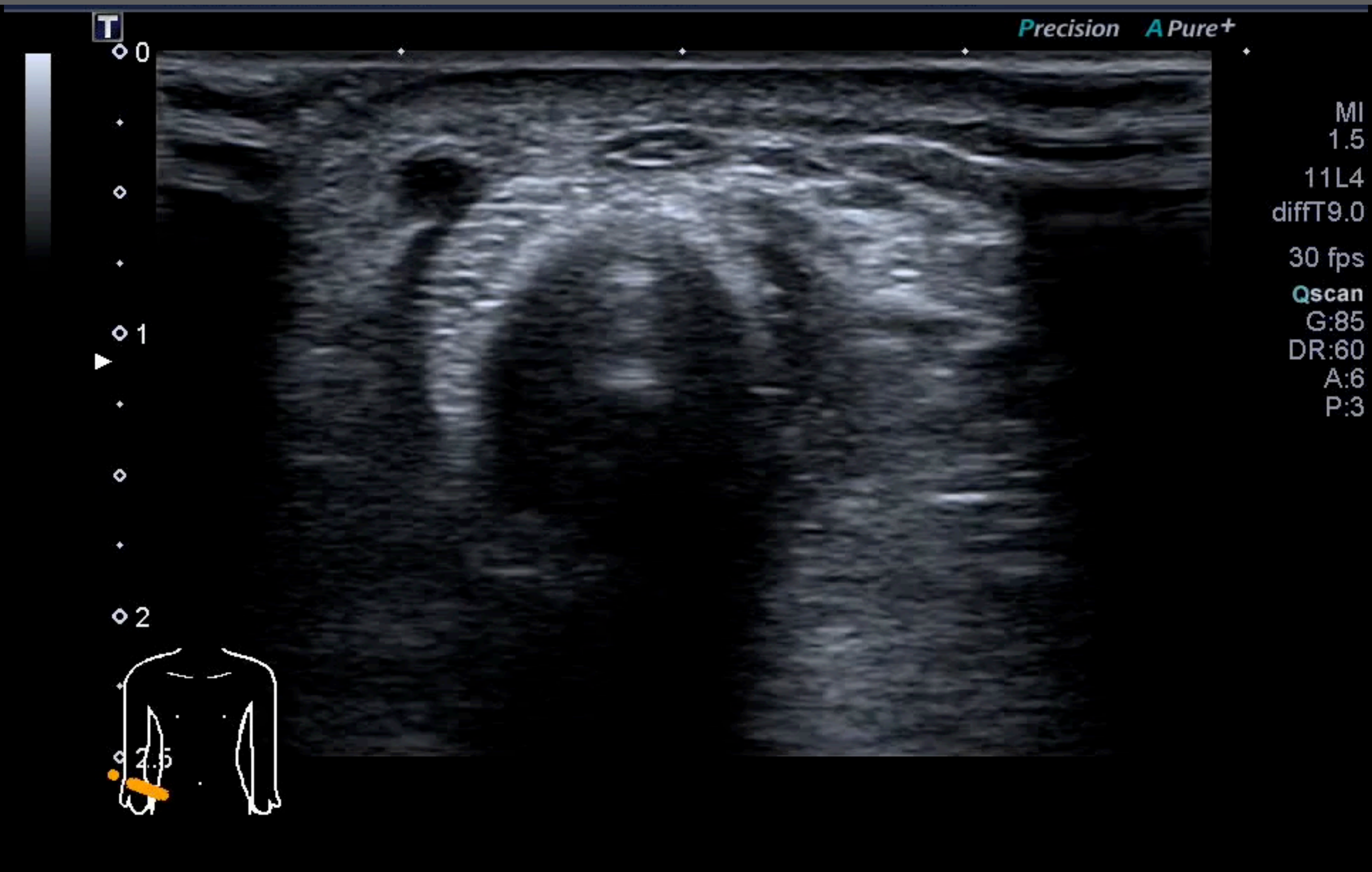
72M, ESRD on HD



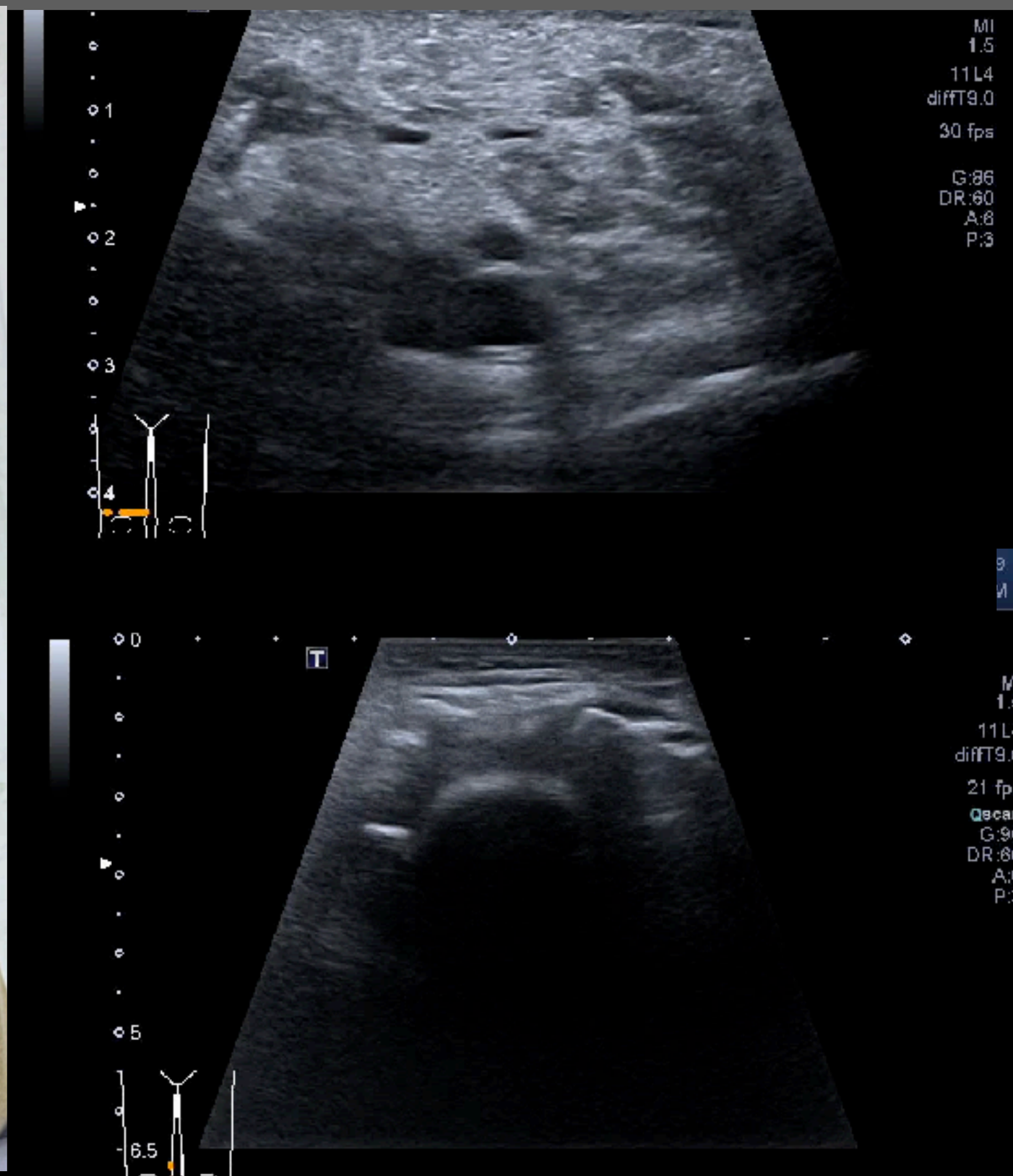
76F, Leg pain


Superficial
P
L12-3
50 Hz
2.5cm
2D
Res
Gn 77
C 56
3/2/1
G
P
R
3.0 12.0
2
2.5cm

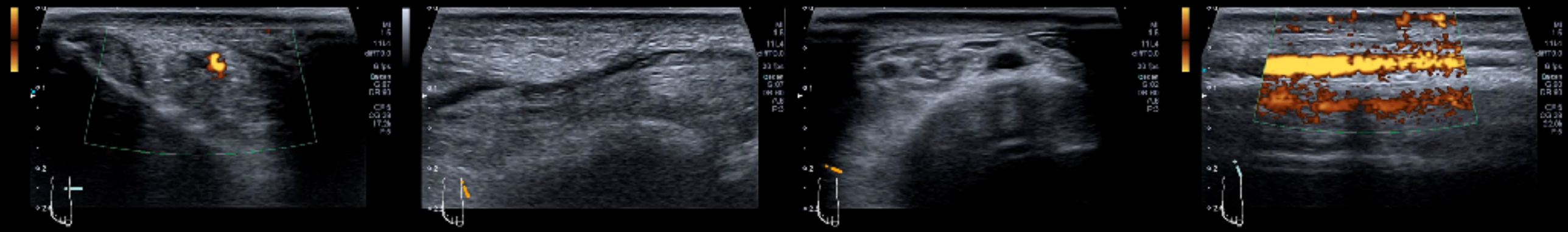
54M，右手有蜂窩性組織炎病史.覺這幾天右手前臂又開始發紅疼痛故

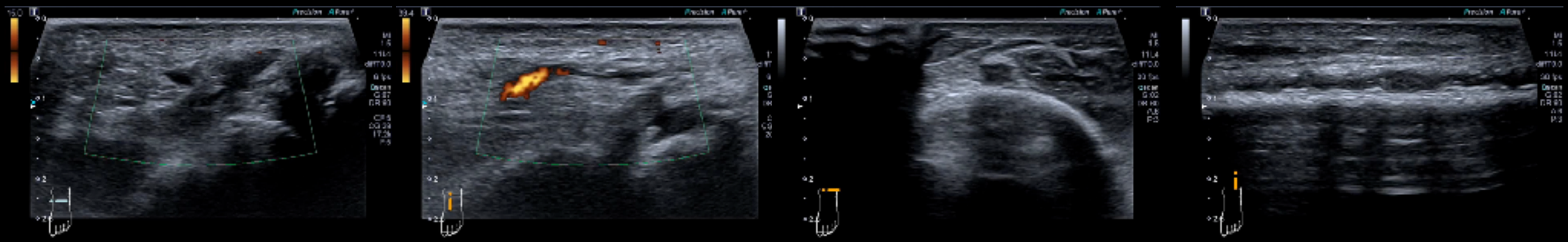


80F, 兩週前跌倒後雙腳沒力,左大腿疼痛,瘀青,曾至本院急診求治,現雙下肢體多處AW疼痛不適有發炎情形

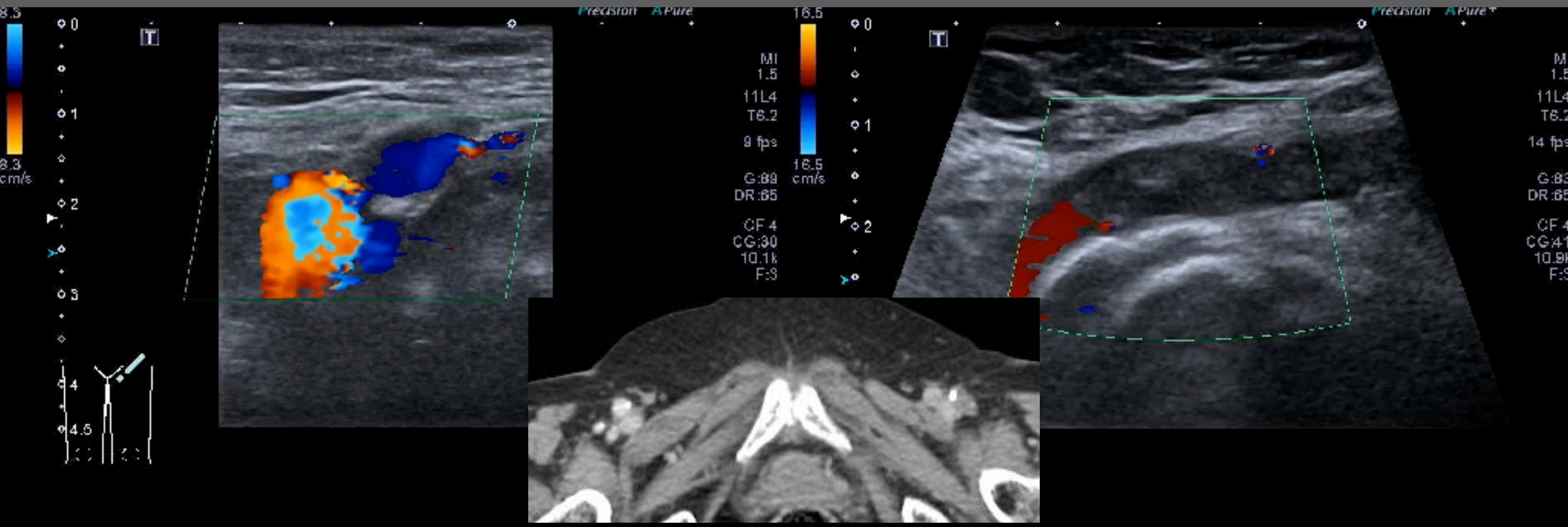


80F, 兩週前跌倒後雙腳沒力,左大腿疼痛,瘀青,曾至本院急診求治,現雙下肢體多處AW疼痛不適有發炎情形

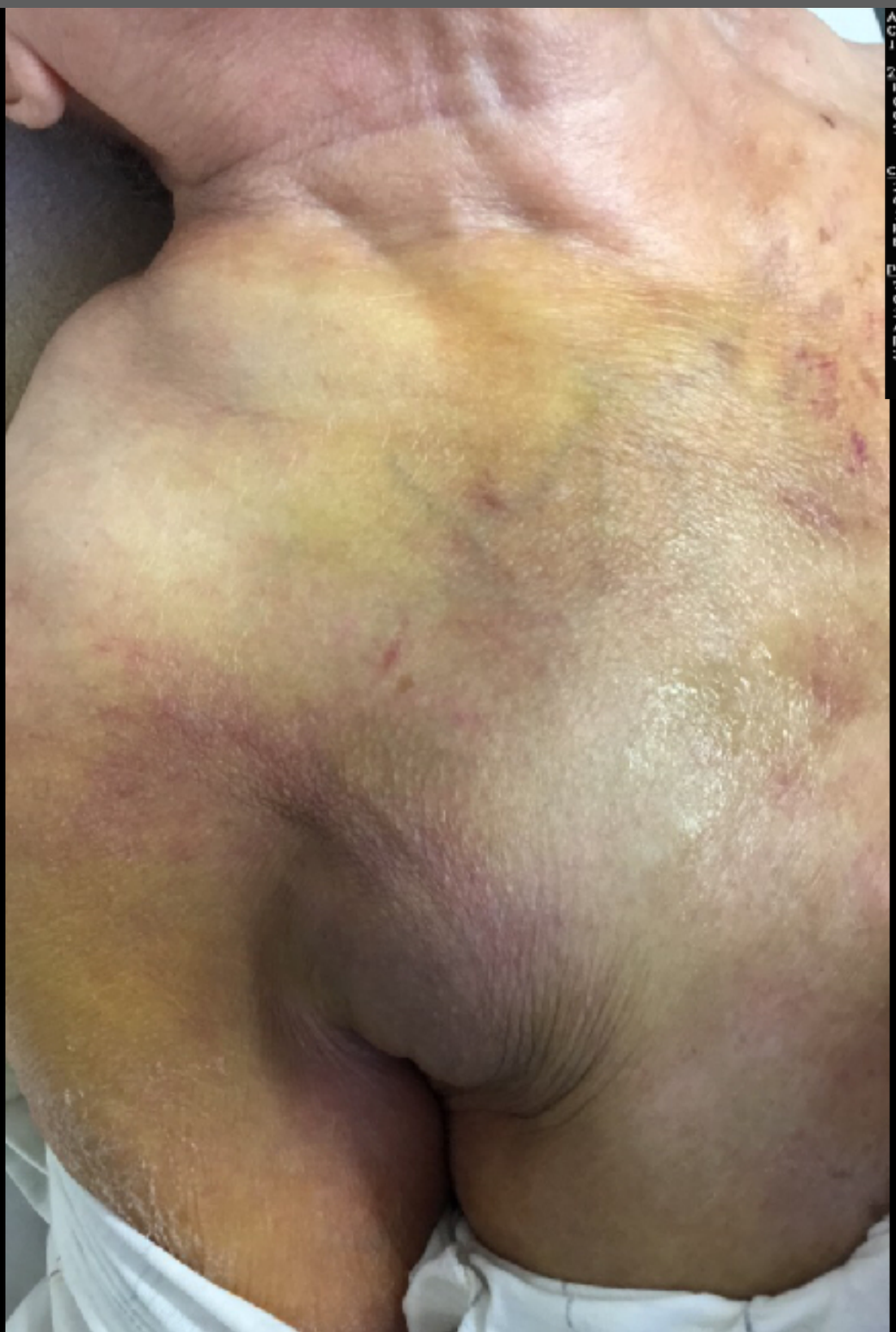


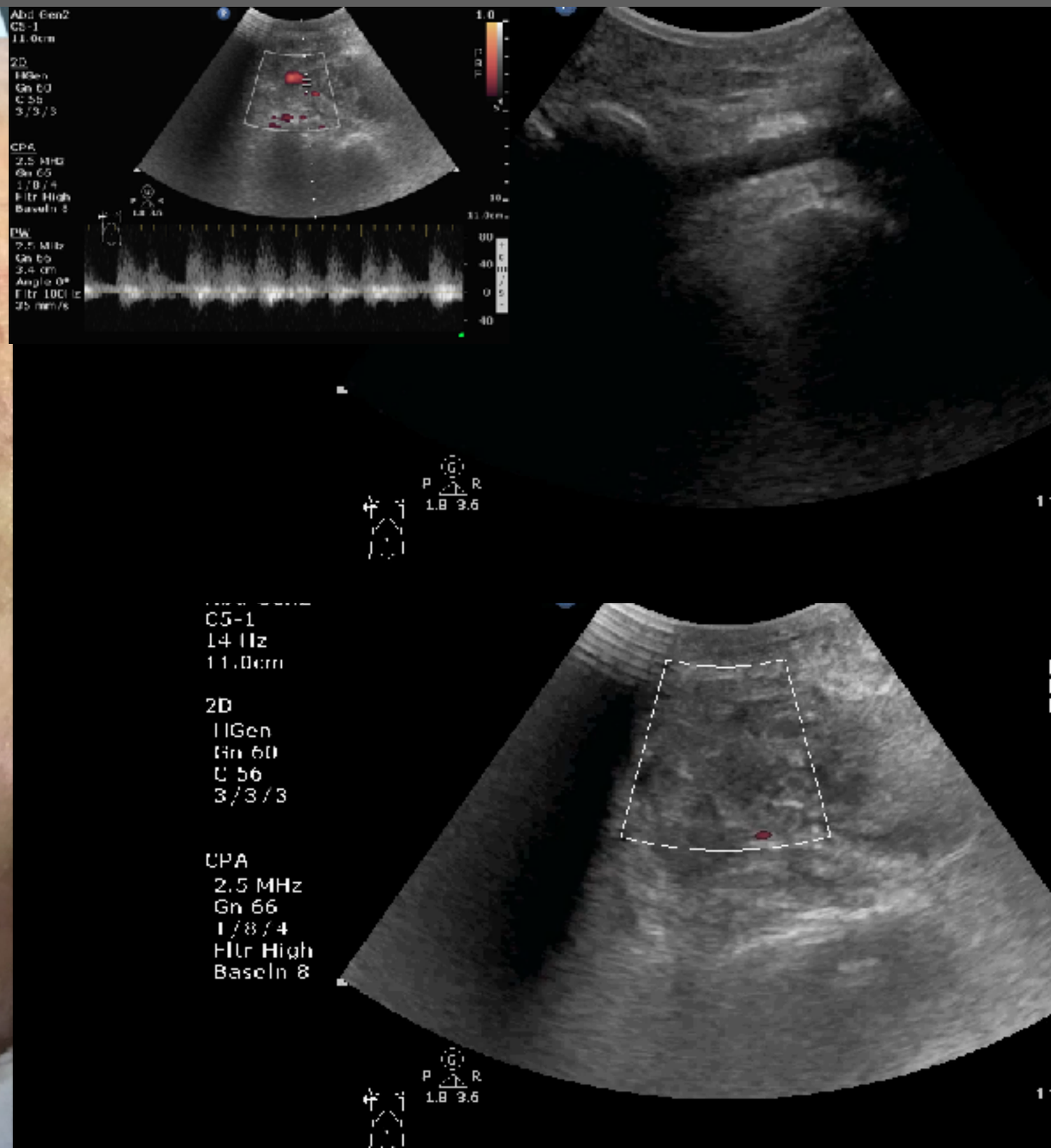


86F，腹痛3-4天了，今天腹痛改善，今天早上9點左右開始左腳無力且疼痛不適 (ER 0814; AZ0615)

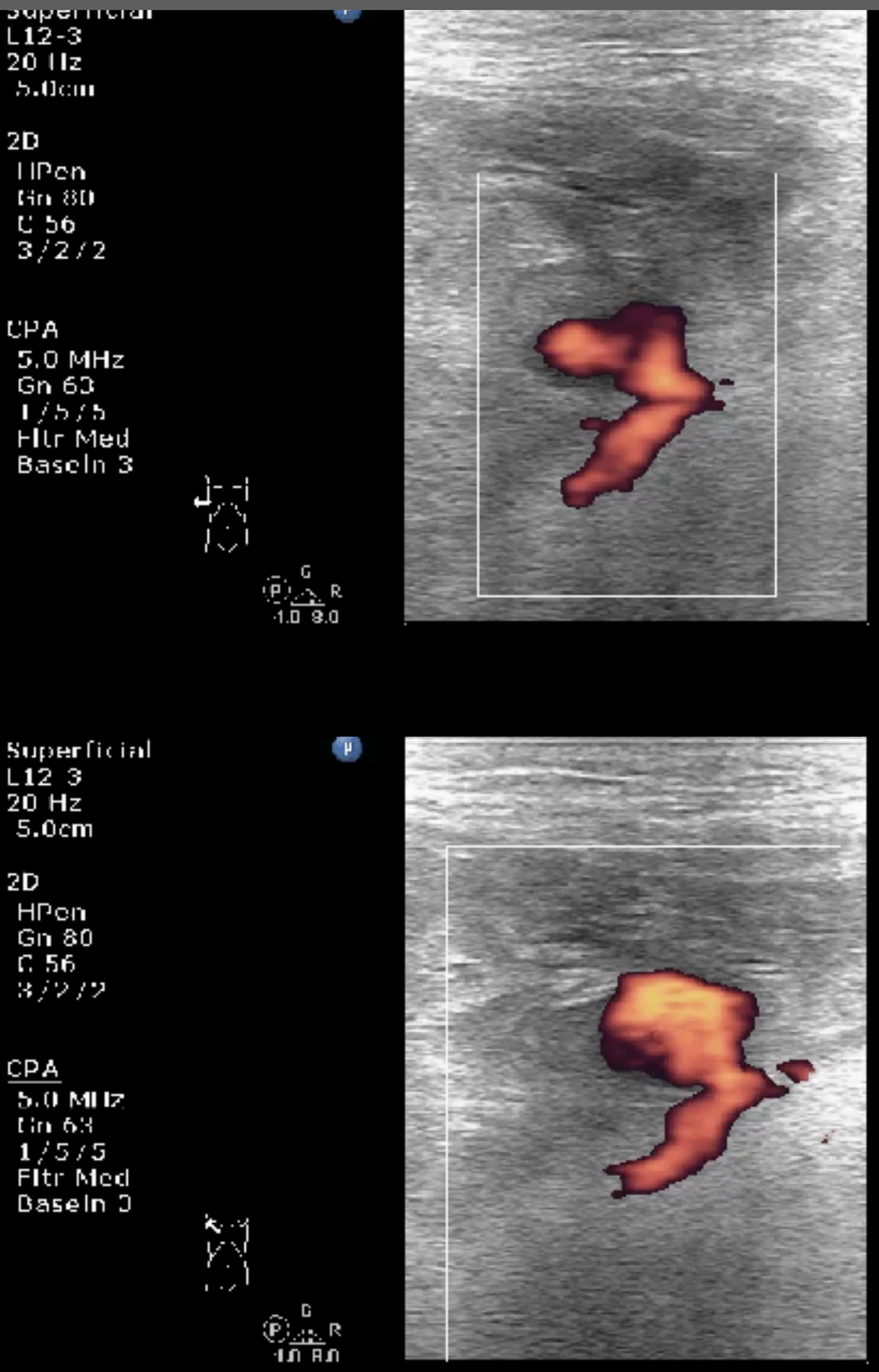


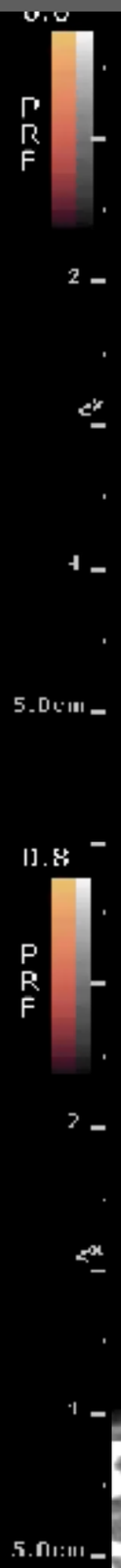
93F, Right chest wall painful swelling

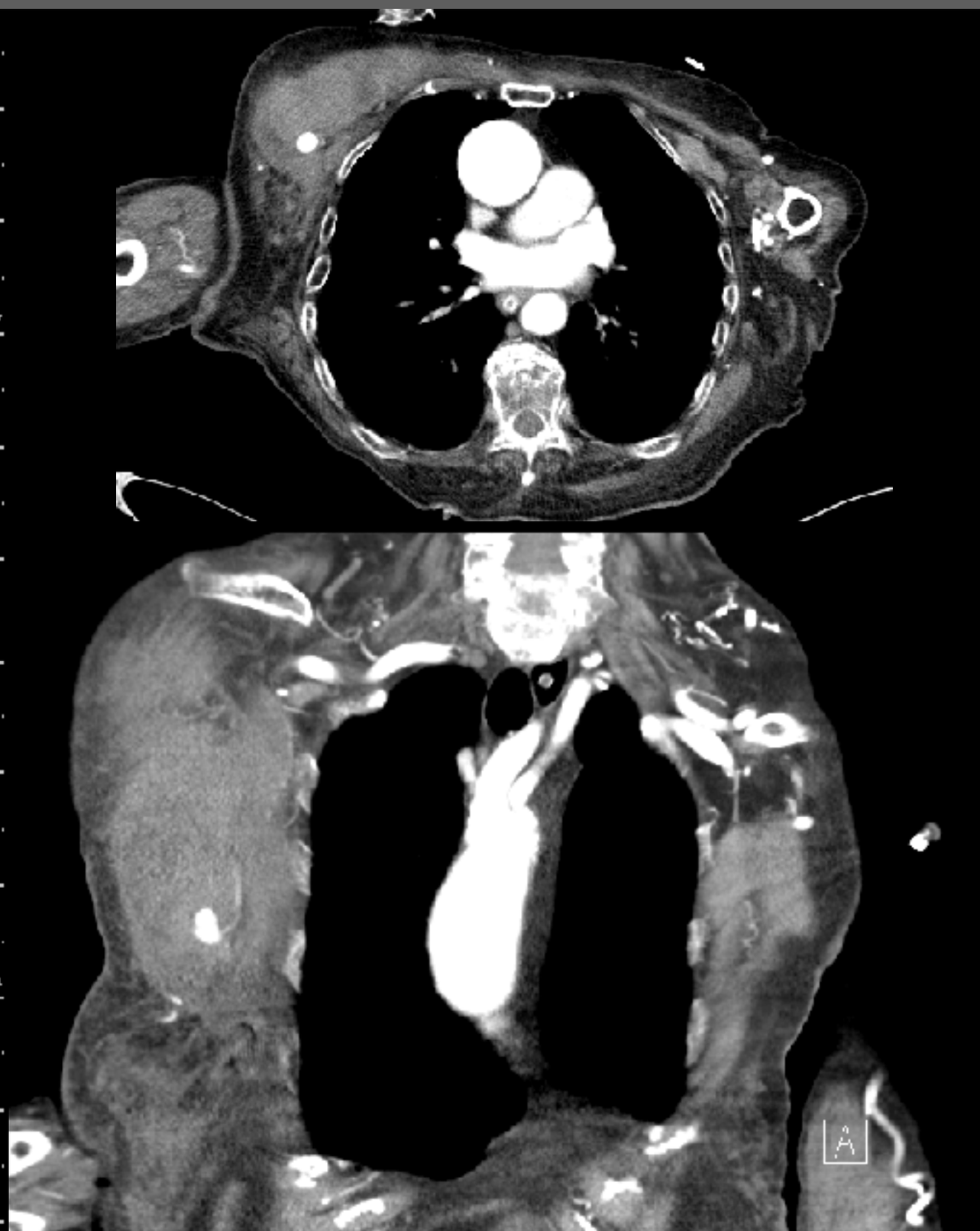


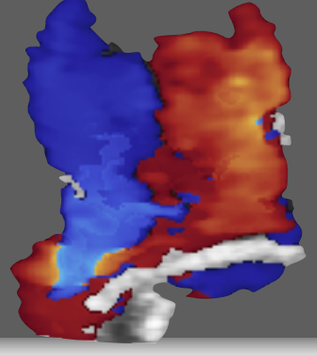


93F, Right chest wall painful swelling





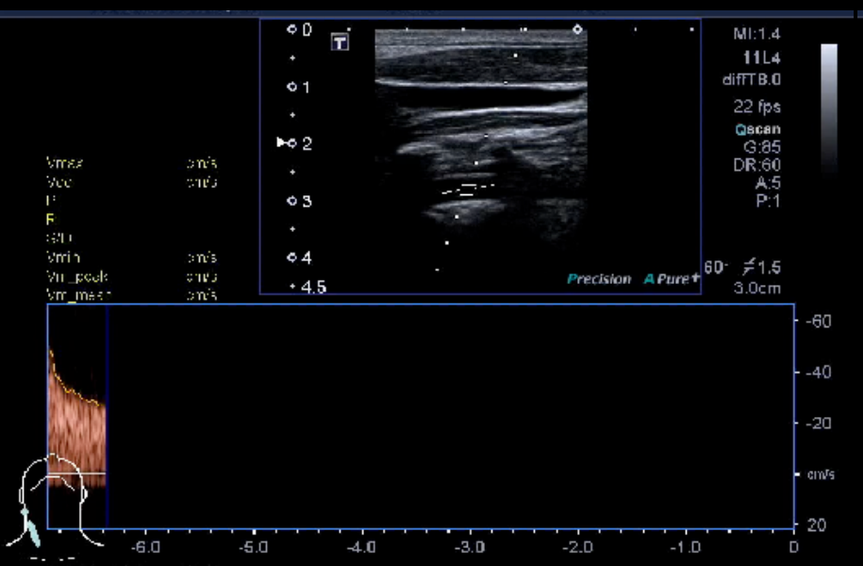


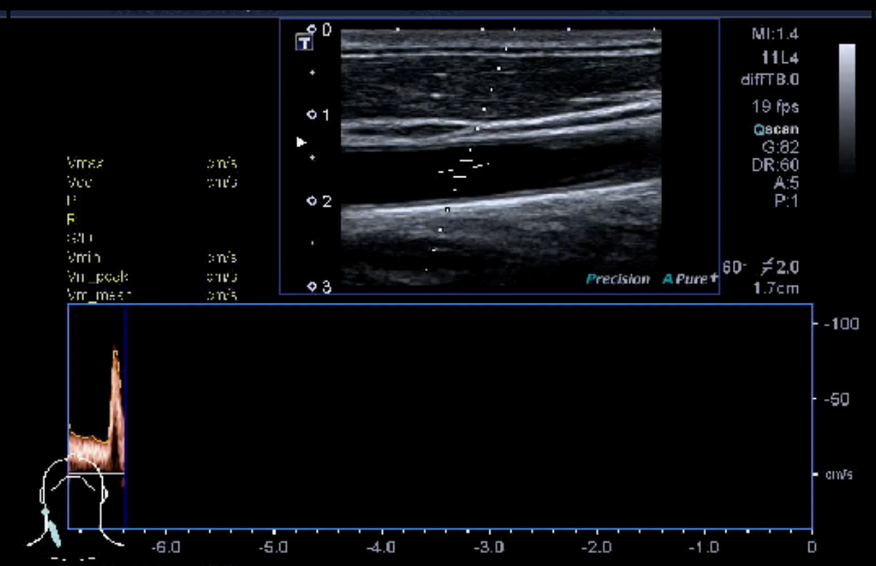


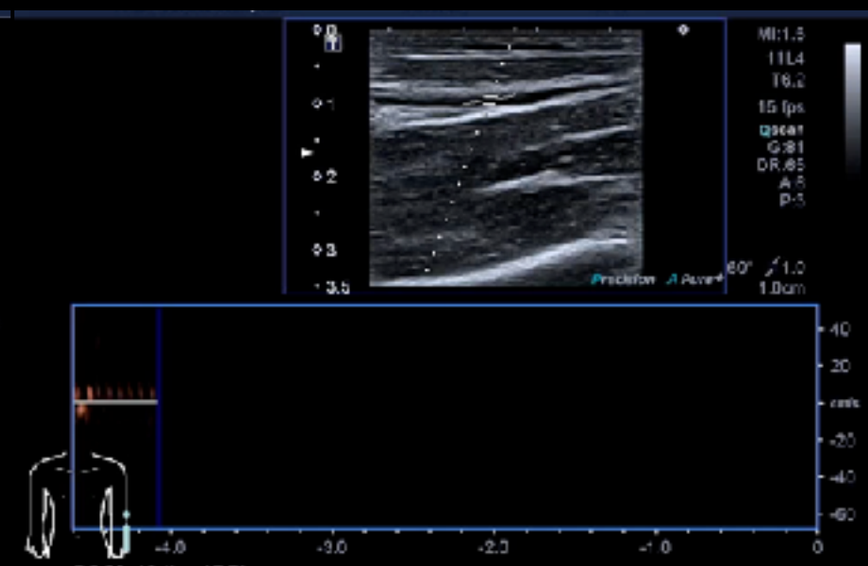
Vascular POCUS

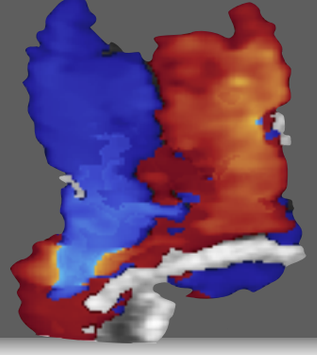
AAA AD DVT Line

會判讀 辨異常 認波形







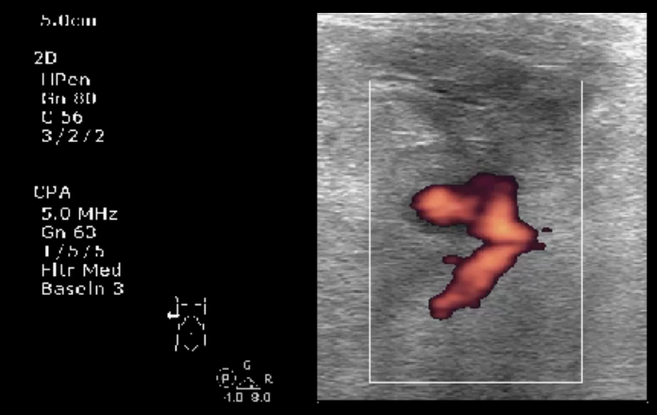


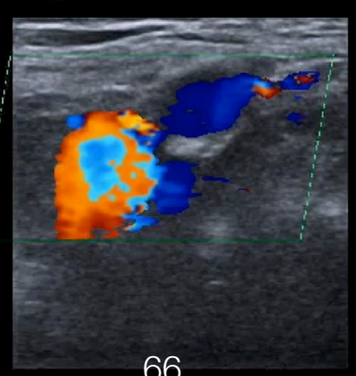
Vascular POCUS

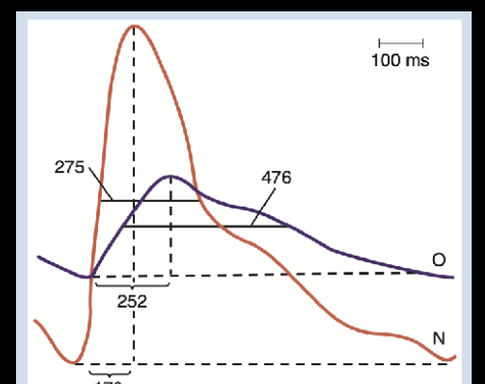
juice119@gmail.com

會判讀 辨異常 認波形

破裂 阻塞 狹窄







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