



BVN/GBN
Vascular Access Workshop
20/09/2024

Ultrasound for diagnosis of complications

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Introduction

Complications of vascular access:

- Very frequent: +/- 50% of patients
- Dependent on:
 - Type of vascular access device
 - Indication for IV therapy
 - Dwell time of the device
 - Patient weight at time of insertion



van Rens, *Frontiers 2022*

Introduction



**Use ultrasound to
PREVENT complications!!**

Introduction



Use of ultrasound during procedure:

- Higher success rate on first attempt
- Decreased risk of cannulation failure and arterial puncture
- Decreased incidence of complications

2020: International evidence-based guidelines on POCUS for critically ill neonates and children - ESPNIC

Singh, Critical Care 2020; Brusciano, J Ultrasound 2024

Introduction



INFECTION

COMPLICATIONS OF CVAD

MECHANICAL FAILURE



RUPTURE

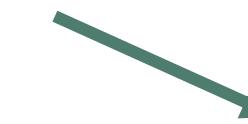


OCCLUSION



TIP MIGRATION

THROMBOSIS
HEMATOMAS



LIFE-THREATENING



PNEUMOTHORAX



PLEURAL EFFUSION
HEMOTHORAX



PERICARDIAL
EFFUSION



Mechanical complications



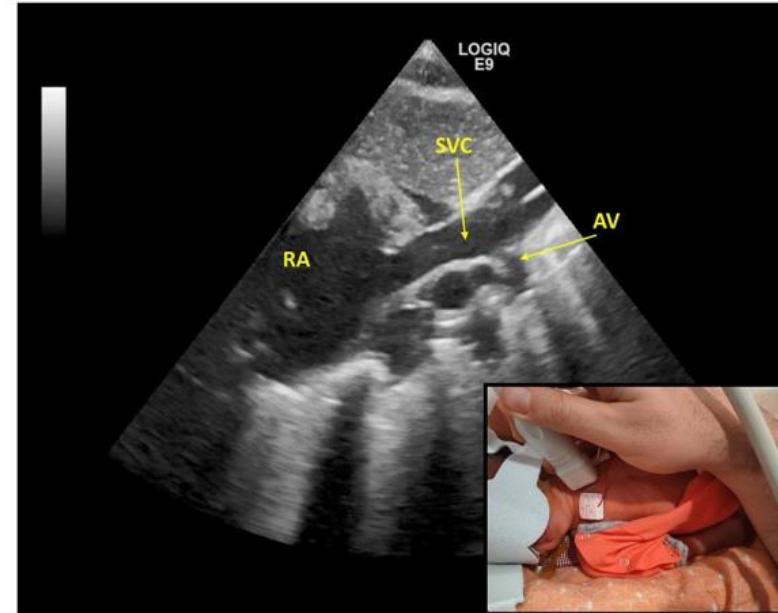
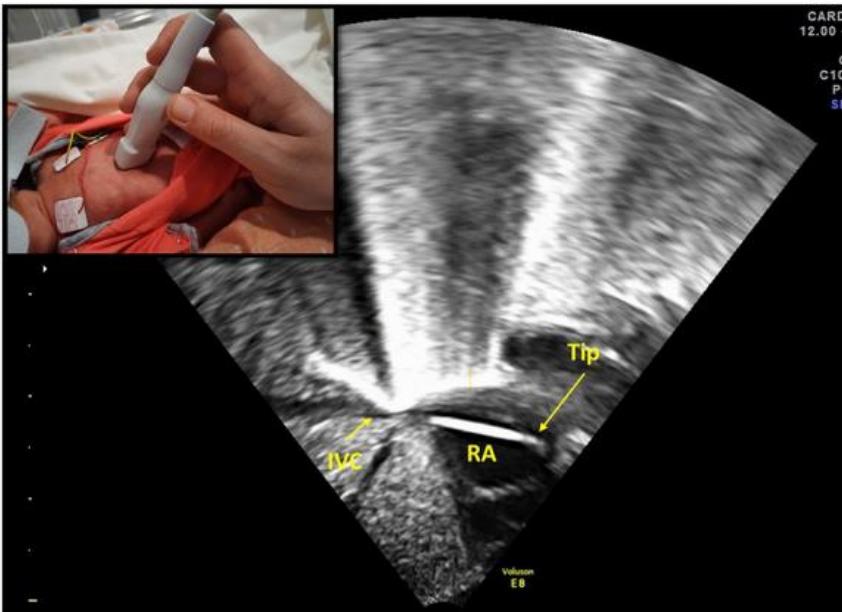
Many complications are caused by malposition or malfunction of the catheter...

- Prevent primary malposition!
- Check for tip migration: UVC, ECC – “bubble test”
- Detection of lesions of the catheter

Neo-ECHOTIP protocol

Barone, JVA 2022; Pittiruti, Eur J Ped 2023; Brusciano, J Ultrasound 2024

Mechanical complications



Barone, JVA 2022

Thrombosis



Catheter-related thrombosis = mural thrombus extending from the catheter into the lumen of a vessel



- Multifactorial
- Symptomatic or asymptomatic
- Requires treatment

Pinelli, JVA 2020; Rubio, Arch Argent Pediatr 2021; Passaro, JVA 2020; Pittiruti, Eur J Ped 2023

Thrombosis



Prevention!

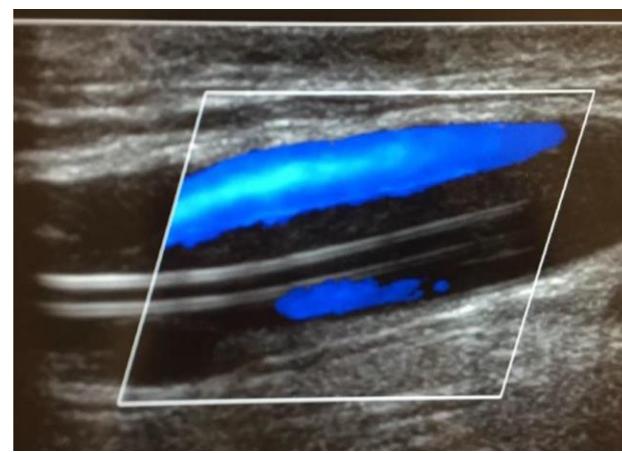
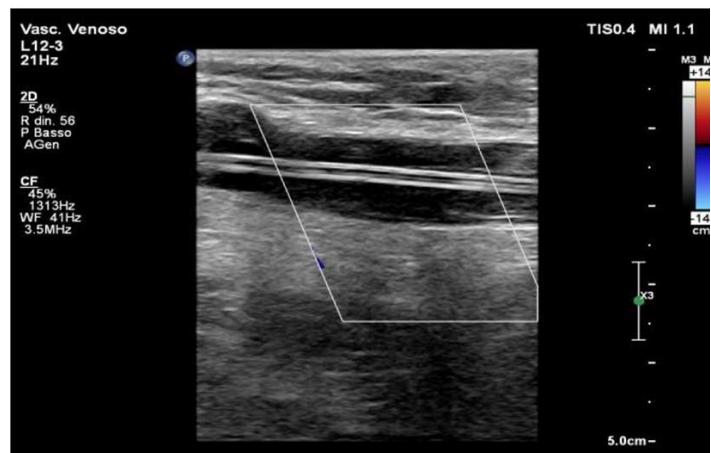
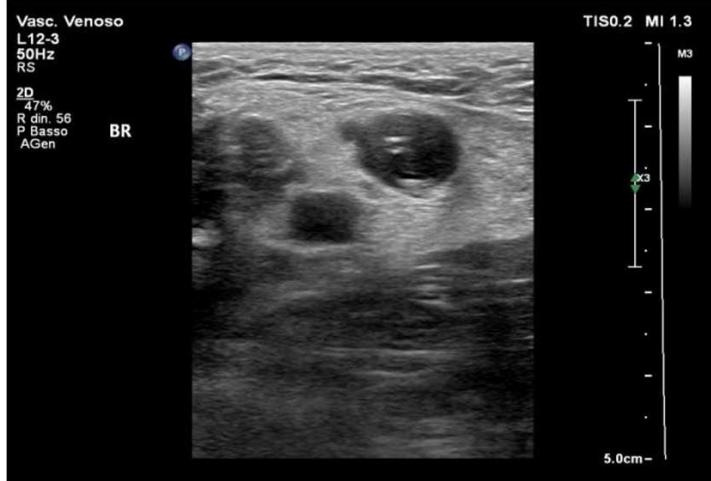
Ultrasound criteria for diagnosis:

- Echogenic material inside the vessel (typical pattern)
- Adhesion to the vein wall
- Lack of color flow
- Other criteria: compressibility, diameter, collaterals

DD: fibroblastic sleeve

Pinelli, JVA 2020; Passaro, JVA 2020; Pittiruti, Eur J Ped 2023

Thrombosis



Passaro, JVA 2020

Life-threatening complications



Immediately upon placement of the catheter:

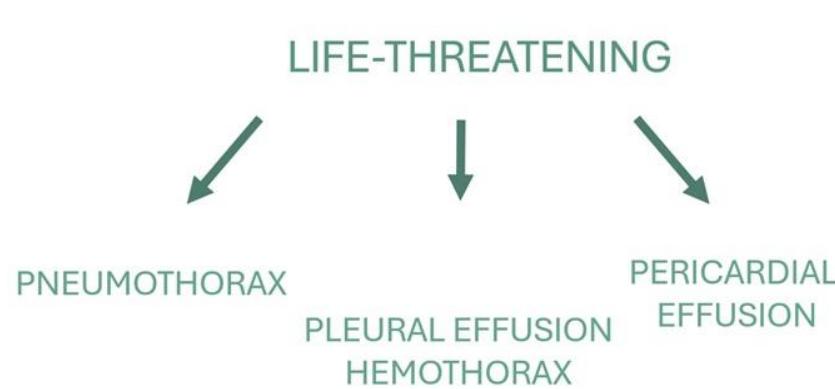
- Mostly related to CICCs
- Internal jugular vein (IJV) and brachiocephalic/subclavian vein (BCV, SCV)
→ *US at the end of the procedure*

Due to tip migration: CICC as well as UVC, ECC

→ *periodic assessment of tip position*

Barone, JVA 2022; Pittiruti, Eur J Ped 2023; Brusciano, J Ultrasound 2024

Life-threatening complications



POCUS = Point Of Care UltraSound



Pittiruti, Eur J Ped 2023; Brusciano, J Ultrasound 2024

Life-threatening complications



1. Recommendations for lung POCUS:

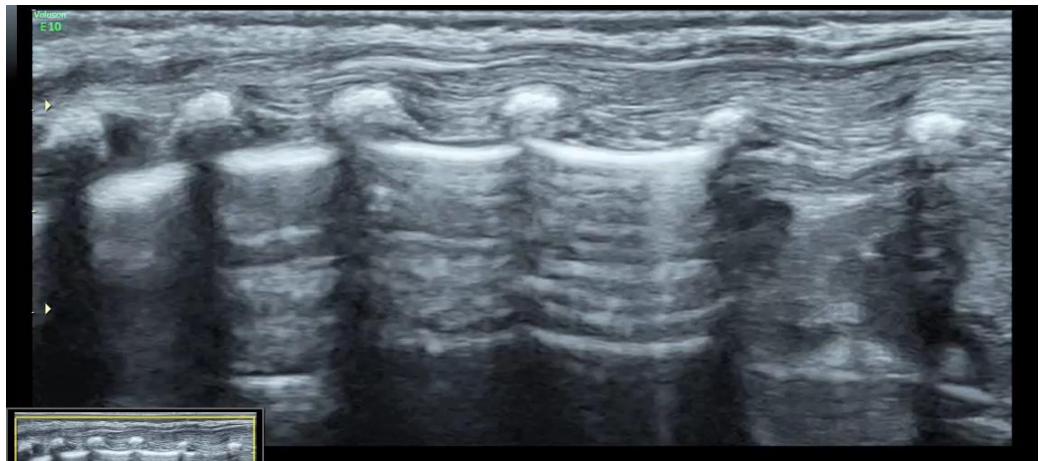
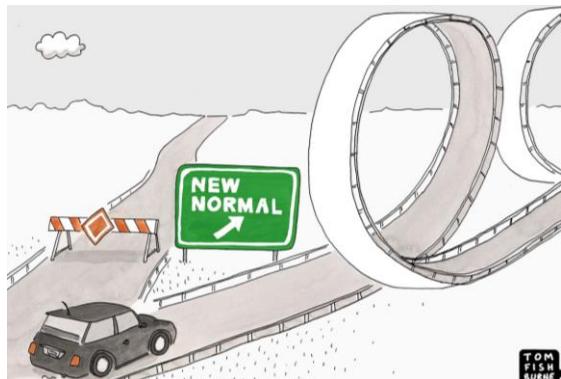
- Detect pneumothorax and pleural effusion
- To help perform thoracocentesis and to insert chest tubes
- Level of training: medium
- Interpretation of ultrasound images is based on artefact generation

Singh, Critical Care 2020; Stewart, Pediatrics 2022

Normal lung ultrasound

Normal pattern lung POCUS:

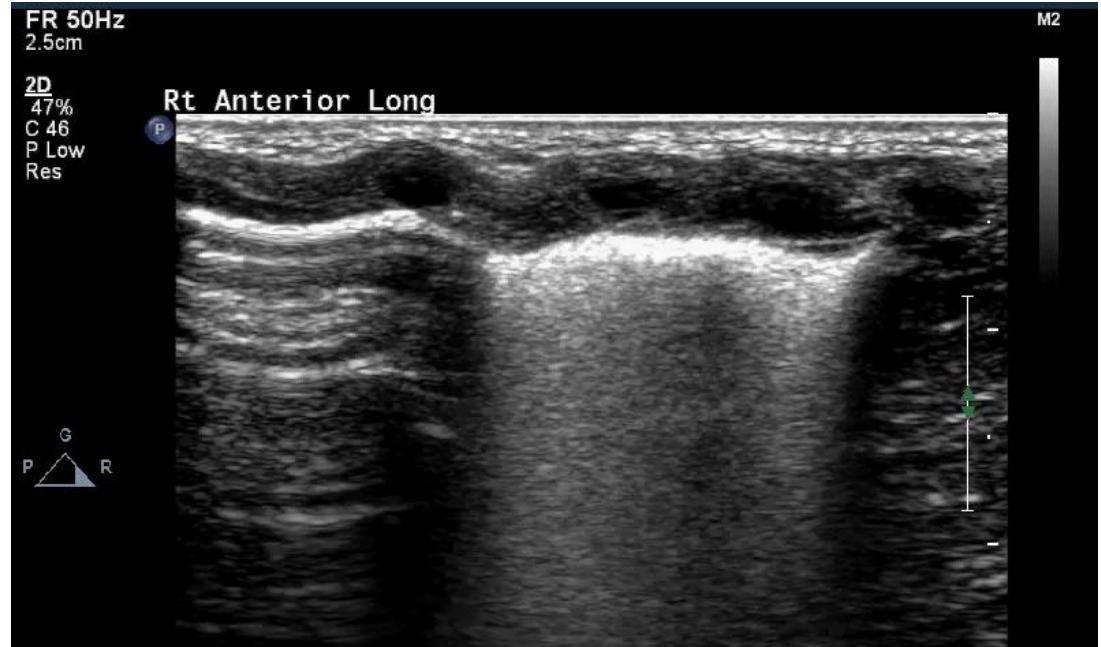
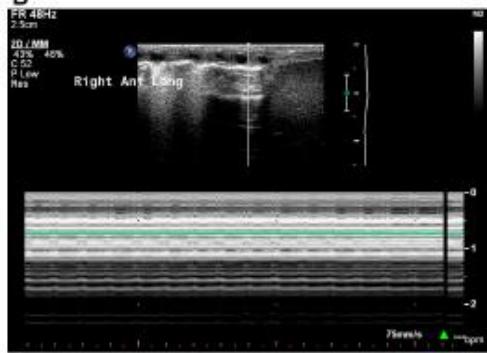
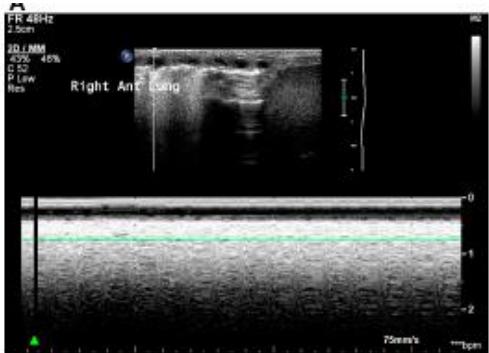
- A-line pattern
- Lung sliding
- M-mode: “seashore sign”



Kurepa, J Perinatol 2017

Pneumothorax

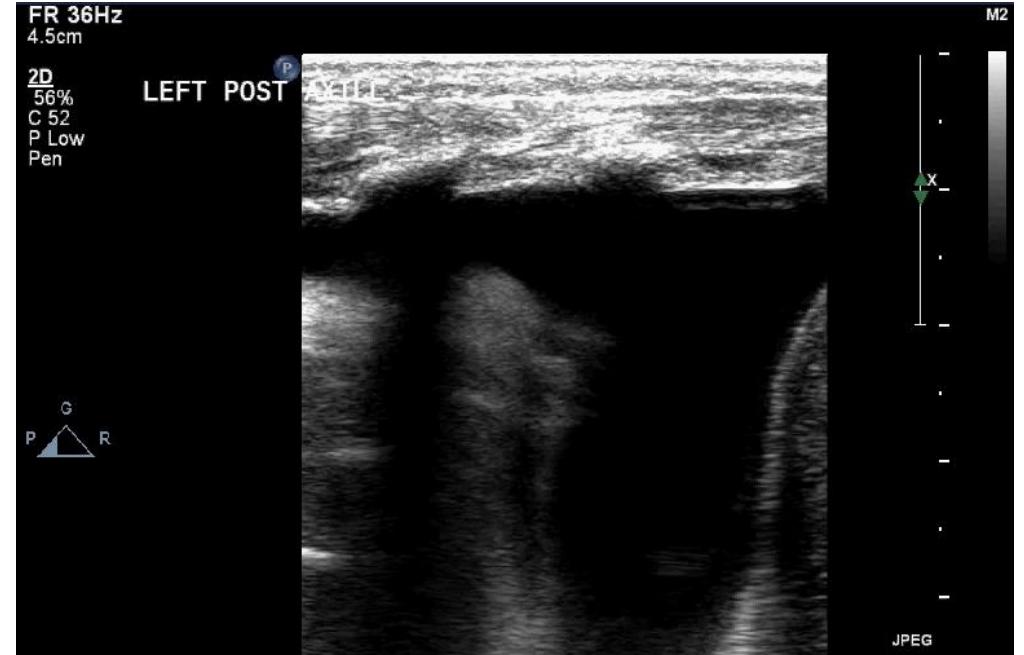
- A-line pattern
- Absence of lung sliding
- Lung point
- M-mode: “barcode sign”



Woods, Arch Dis Child 2018

Pleural effusion

- Anechoic space between pleuras
- Anatomic boundaries
- Lung flapping (“jellyfish sign”)



Kurepa, Perinatol 2018; Woods, Arch Dis Child 2018

Life-threatening complications



2. Recommendations for cardiac POCUS:

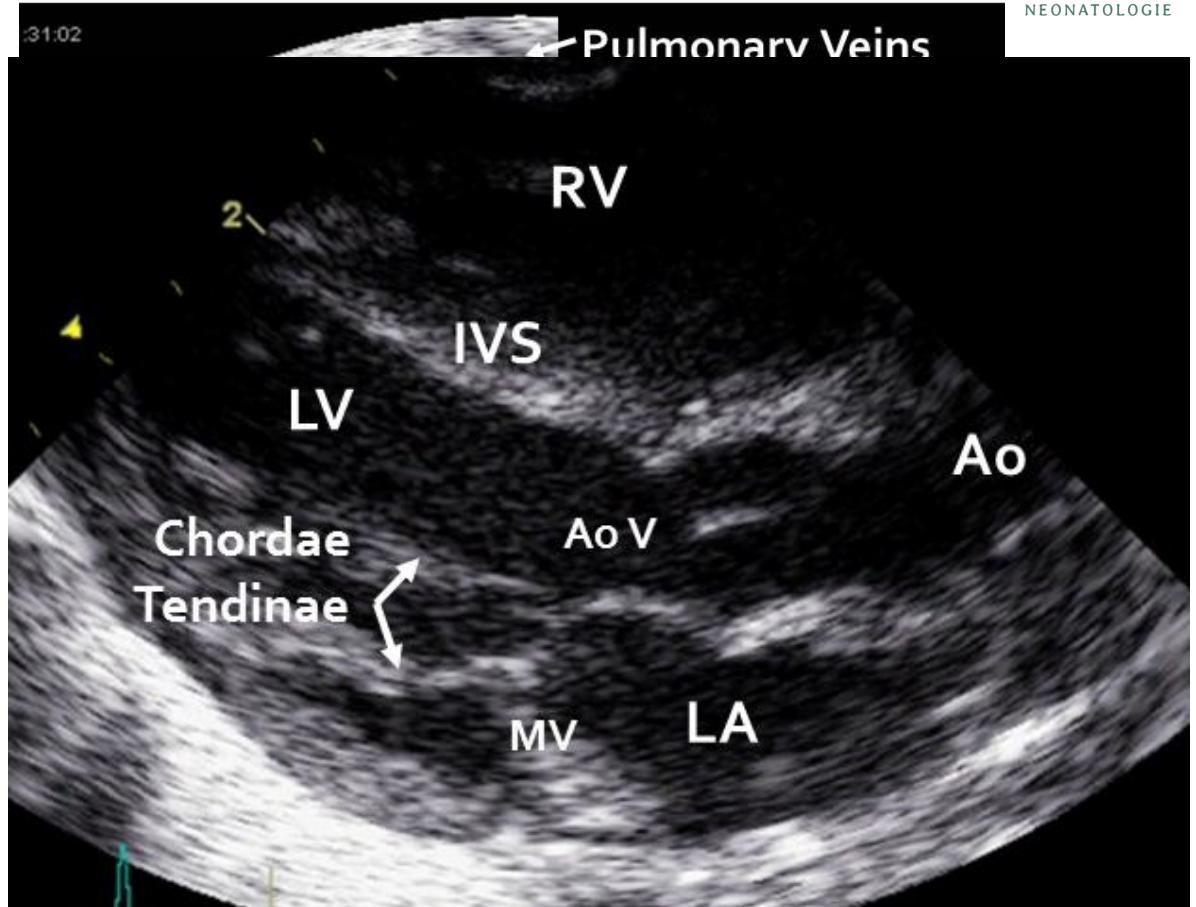
- POCUS is helpful to diagnose pericardial effusion
- Allows for direct visualization to perform and safely guide pericardiocentesis
- Reference to SAFE algorithm
- Level of training: basic

Singh, Critical Care 2020; Stewart, Pediatrics 2022

Pericardial effusion

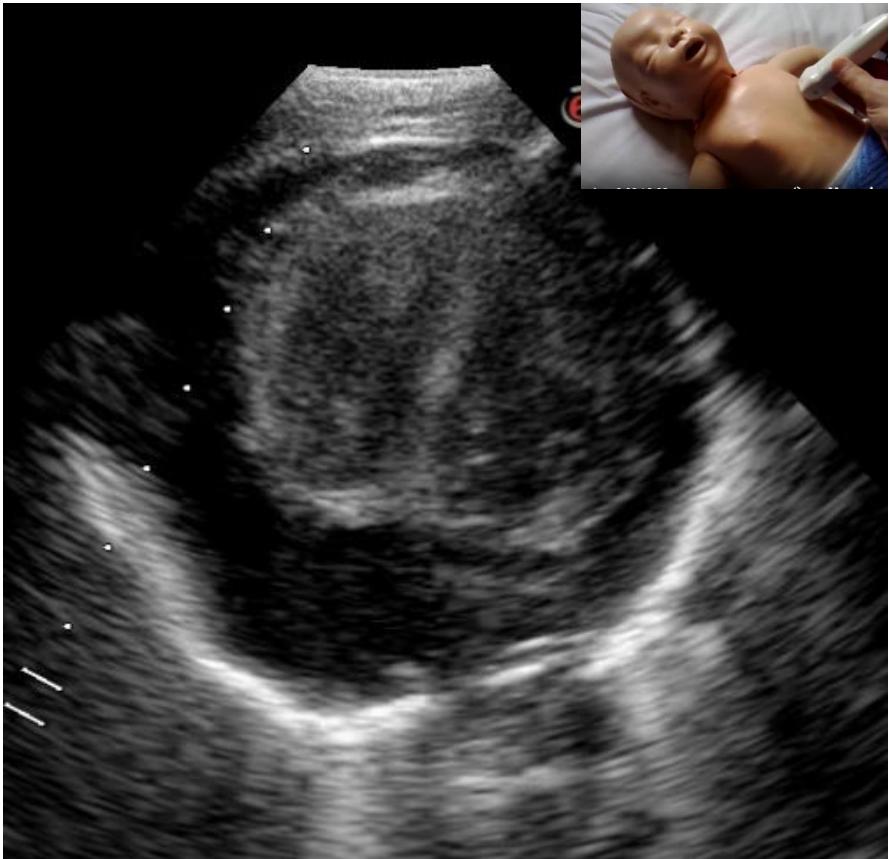
Recommended views:

- Subcostal 4-chamber view
- Apical 4-chamber view
- Parasternal long axis view



Nagdev, *Resuscitation* 2011; Stewart, *Pediatrics* 2022; *TnEcho.com*

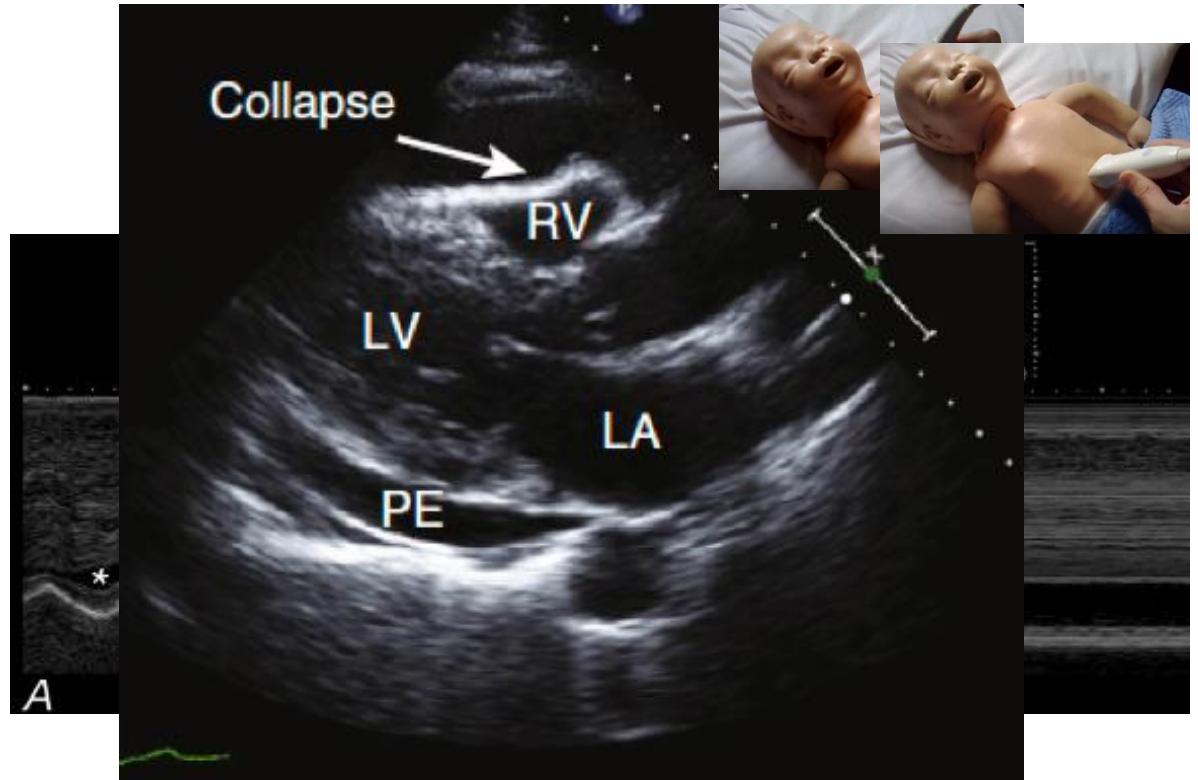
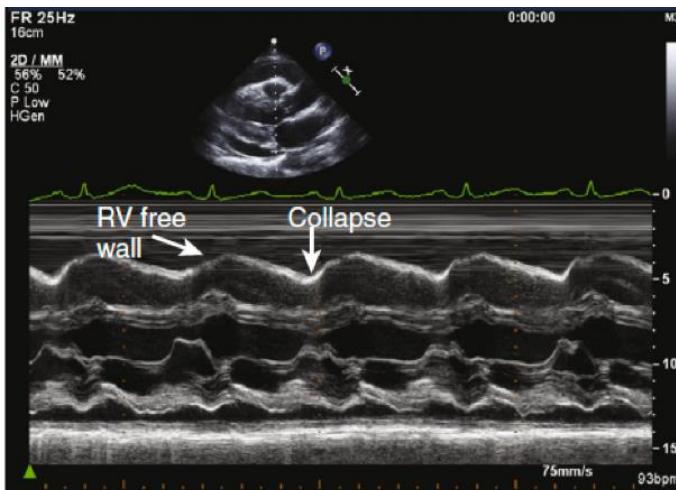
Pericardial effusion



Pericardial effusion - tamponade

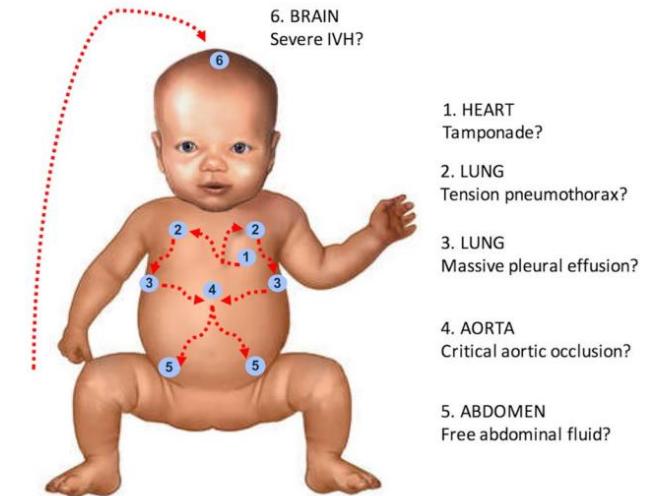
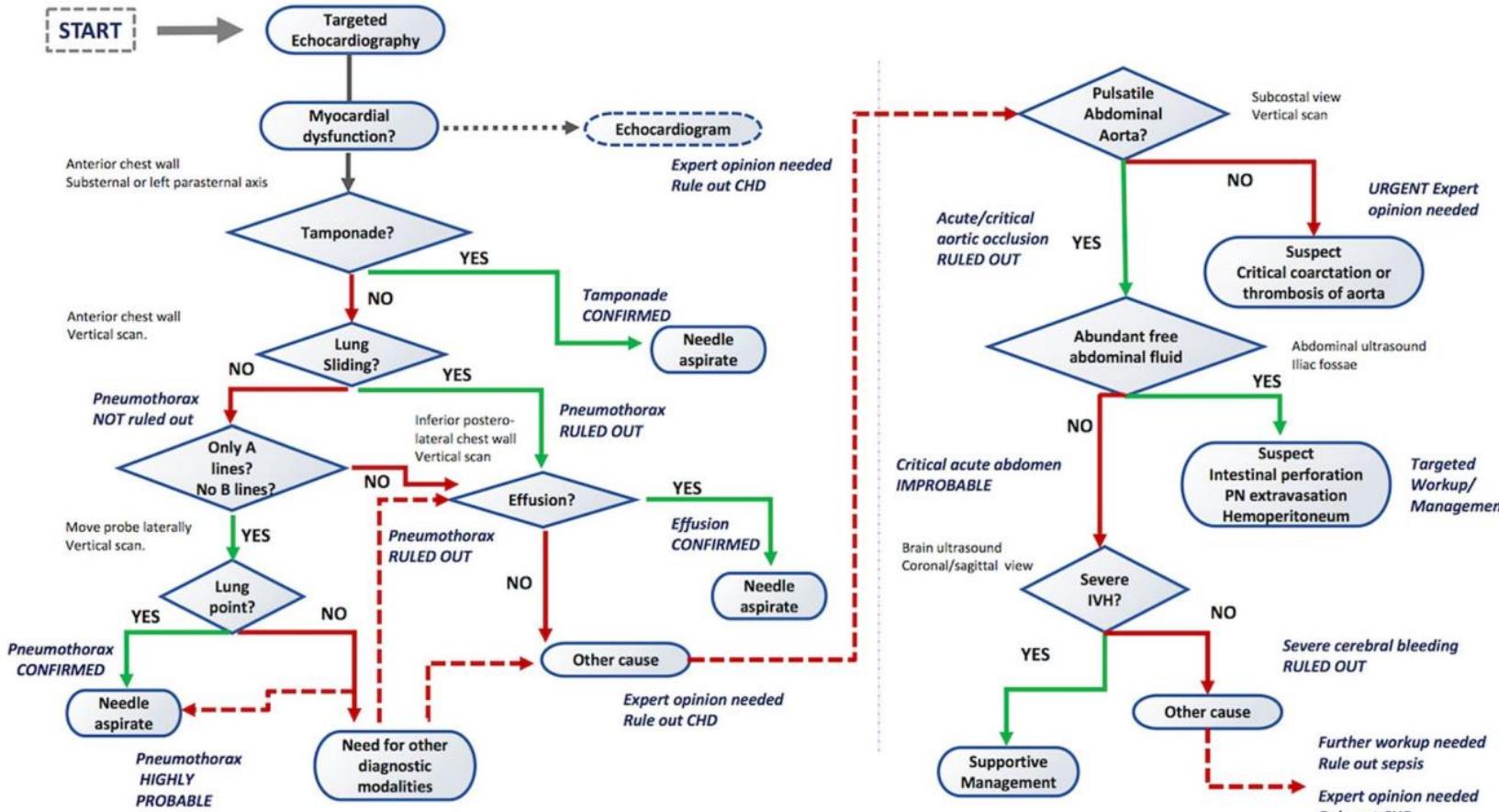
POCUS for tamponade:

- Chamber collapse
- IVC plethora
- (Transvalvular Doppler inflow)



Nagdev, Resuscitation 2011; Stewart, Pediatrics 2022

SAFE-R protocol



Yousef, Eur J Ped 2022

Take home messages

1. Complications related to VAD are very common
2. Use ultrasound to PREVENT of complications
3. Most complications can be easily diagnosed with ultrasound
(and require only basic to medium training levels...)
4. Preferably use standard protocols when performing ultrasound

Questions?



**How I feel when
I find someone
who isn't as excited
by POCUS as I am**