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Venous access in neonates and children

-

New methods and new technologies

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Central lines in neonates, infants and children

- Umbelical – **DIRECT INSERTION**
- Epicutaneo-caval caths – **NIR TECHNOLOGY**
- CICC, PICCs, etc. **ULTRASOUND GUIDANCE**

NIR TECHNOLOGY

Ideal for detection – puncture –
cannulation of **superficial**
veins (< 7mm of depth)

British Journal of Anaesthesia **110** (6): 888–91 (2013)
doi:10.1093/bja/aet078



EDITORIAL II

Difficult peripheral veins: turn on the lights

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ULTRASOUND

Ideal (mandatory!) for detection – puncture – cannulation of **deep veins (> 7mm of depth)**

Intensive Care Med
DOI 10.1007/s00134-012-2597-x

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**International evidence-based
recommendations on ultrasound-guided
vascular access**

US-guided central venous access

SUPRACLAVICULAR CVC

Brachio-cephalic, internal jugular, external jugular, subclavian

INFRACLAVICULAR CVC

Axillary vein at the chest

PICC

Axillary vein at the arm, basilica, brachial

INFERIOR VENA CAVA CATH

Saphenous, femoral

Axillary vein at the arm, basilica, brachial = PICC

Conventional use of US guided PICC lines in children:

- central lines via arm veins (brachial, basilic, axillary, cephalic)
- small caliber veins (3 mm or >)
- small caliber PICCs (3 Fr or >)
- no age limit: only limit is vein diameter

US guided PICCs



Ideal for:

- pediatric intensive care unit
- pediatric surgery (perioperative access)
- pediatric parenteral nutrition
- pediatric oncology/haematology

Ideally:

- power injectable polyurethane

Conventional use of PICC in infant



Conventional use of PICCs

In pediatric intensive care, PICCs (specially if power injectable and non-valved) can be used as **multi-purpose central lines** for any i.v. infusion and for hemodynamic monitoring

Crucial factors are:

- US guidance
- appropriate protocol of insertion
- appropriate policies for maintenance

Conventional use of PICCs

Conventional use of PICCs (US-guided venipuncture at midarm) **is applicable to children and some infants, but not to neonates.**

Limitation (regardless of age/weight):

availability of a deep vein at arm (brachial, basilica or axillary) with diameter > 3 mm

CICC = centrally inserted central catheters

SUPRACLAVICULAR CVC

Brachio-cephalic, internal jugular, external jugular, subclavian

INFRACLAVICULAR CVC

Axillary vein at the chest

Non-conventional use of PICCs as CICC

PICCs = ideal as CICC in neonates and small infants

- optimal micro-introducer
- echogenic 21G needle
- nitinol guidewire
- adjustable length (tunneling, etc.)
- power injectable polyurethane



‘key points’ for an uneventful insertion in neonates/infants

- Ultrasound study of deep veins (RaCeVA)
- US-guided venipuncture and cannulation
- Tunneling

‘key points’ for an uneventful insertion in neonates/infants

- **Ultrasound study of deep veins (RaCeVA)**
- US-guided venipuncture and cannulation

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International evidence-based recommendations on ultrasound-guided vascular access

Table 3 Recommendations on ultrasound vascular access in neonates and children

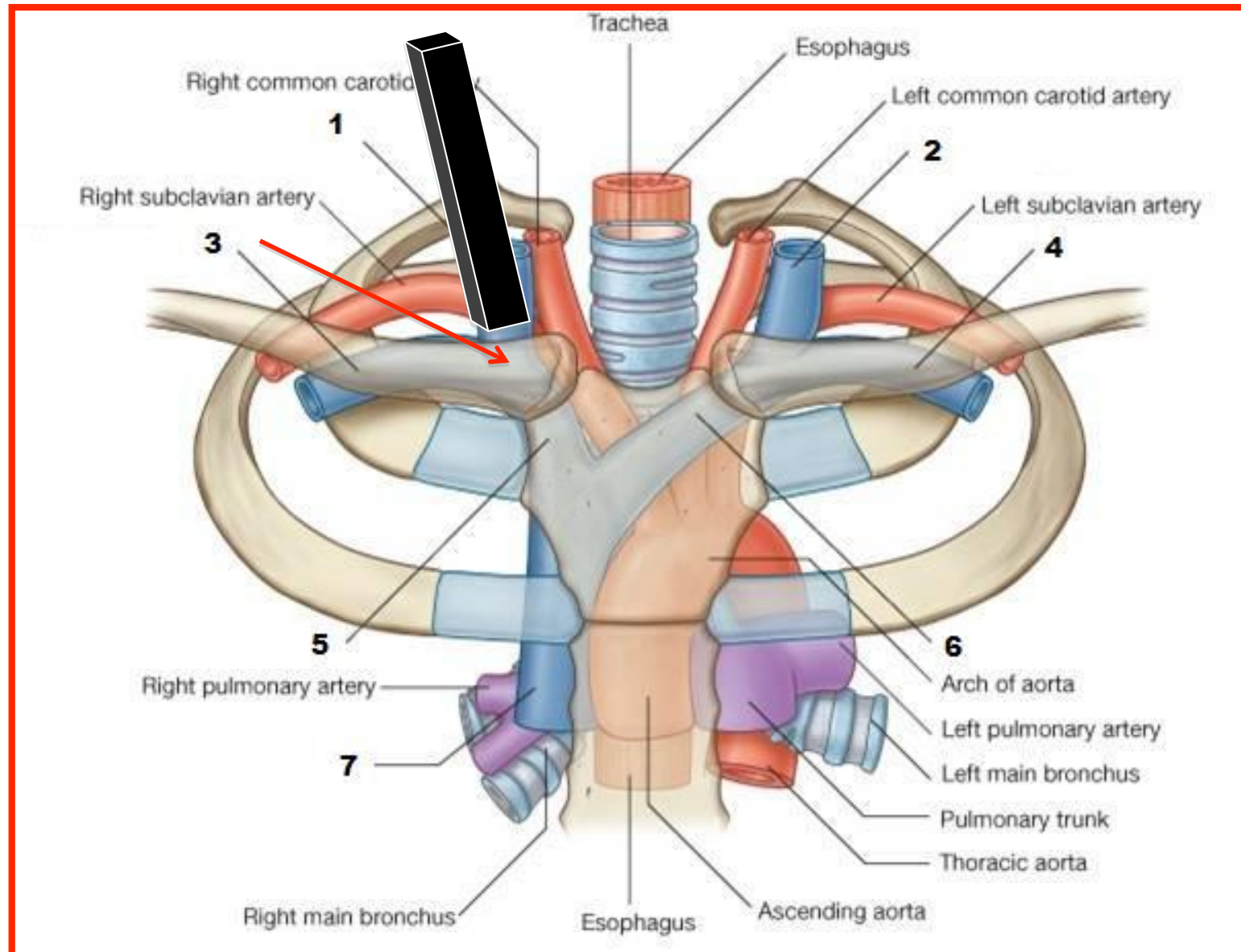
Ultrasound vascular access in neonates and children

Domain code	Suggested definition	Level of evidence
D4.SD1.S1–2	Ultrasound guidance should be routinely used for short- and long-term central venous access in children and neonates	A
D4.SD1.S3	Ultrasound vessel imaging with ultrasound assistance as “a minimum” should be routinely performed before internal jugular vein puncture in neonates	A
D4.SD1.S4	In neonates, ultrasound screening should be used before subclavian vein puncture. Ultrasound-guided puncture should be considered for catheterization using the supra-clavicular route, but this technique requires experienced operators	C
D4.SD1.S5	Ultrasound vessel screening should be routinely used before femoral vein puncture. Ultrasound-guided femoral puncture is recommended to decrease inadvertent arterial puncture	B
D4.SD1.S6	Ultrasound guidance can be considered when difficult peripheral venous access is required in areas such as the antecubital fossa and ankle. Blind deep antecubital fossa puncture should disappear	C
D4.SD1.S7	Ultrasound-guided arterial catheterization improves first-pass success and should be used routinely in children and neonates	A
D4.SD1.S8	After central venous catheter placement in paediatric patients including neonates, the ultrasound equipment should remain easily accessible at the patient’s bedside to detect early life-threatening catheter-related complications such as pneumothorax, cardiac tamponade and hemothorax	B
D4.SD1.S9	There is no ideal site for cannulation in children; the best site should be determined after ultrasound examination	A

D4.SD1.S9

There is no ideal site for cannulation in children; the best site should be determined after ultrasound examination

A



RaCeVa = Rapid Central Vein Assessment

The vein to puncture is chosen after careful ultrasound evaluation of central veins.



Linear probe
10-14 Mhz
'hockey stick'



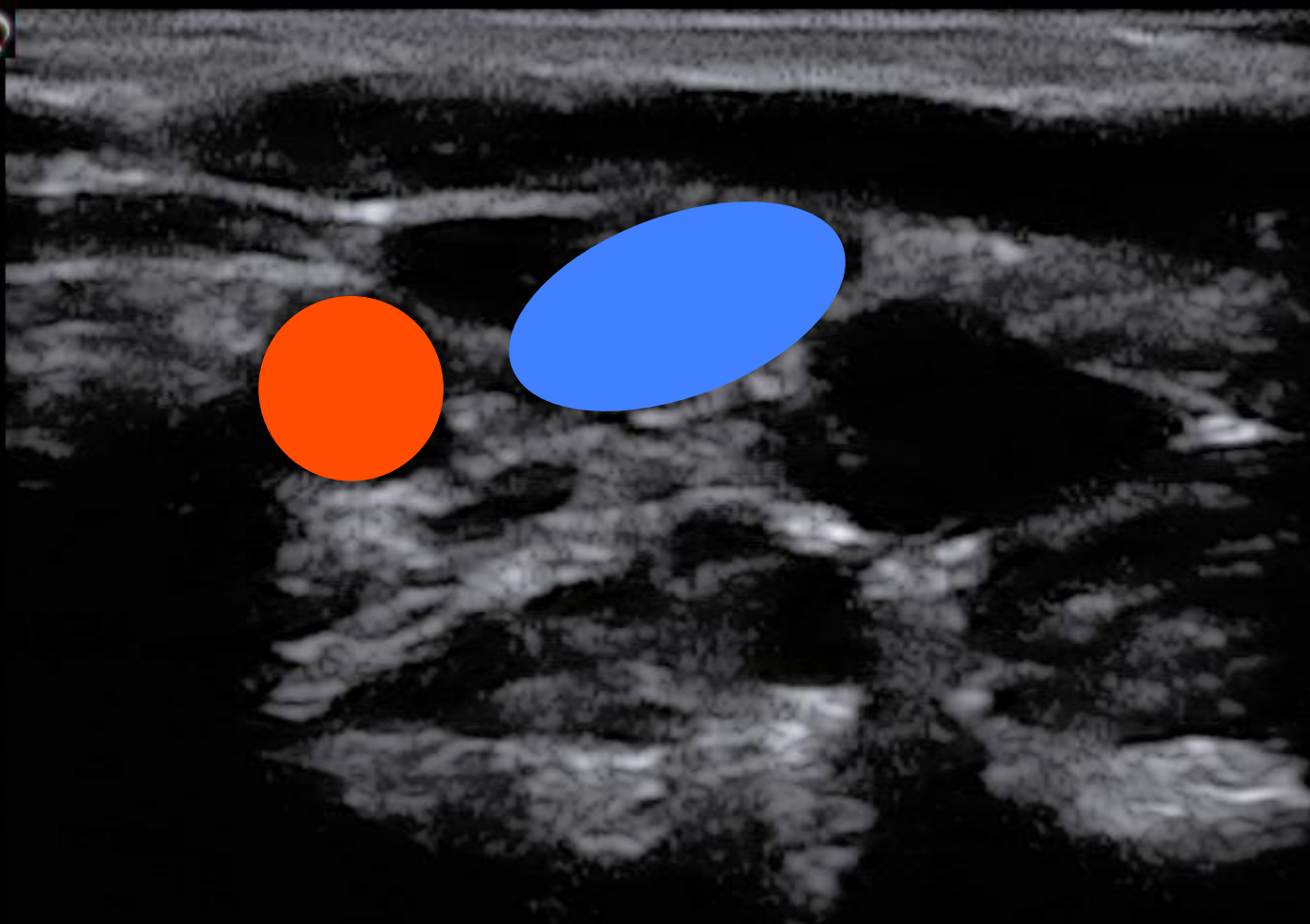


O.

ACCESSO
VASCOLARE

F	RIS	G	50%
D	25 mm	XV	1
PRC	4/3/H	PRS	4
PST	1/10	MV	-

SL3323





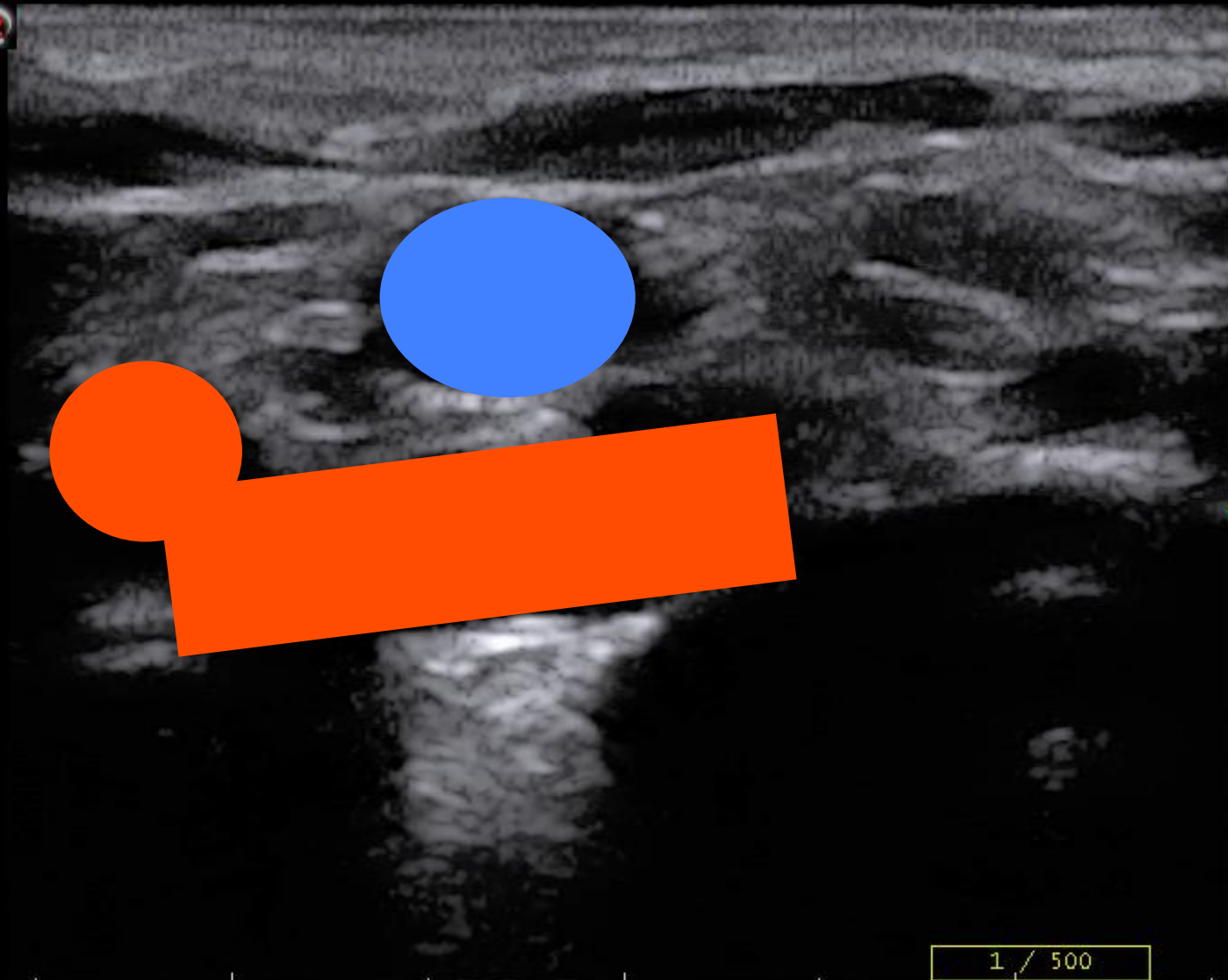


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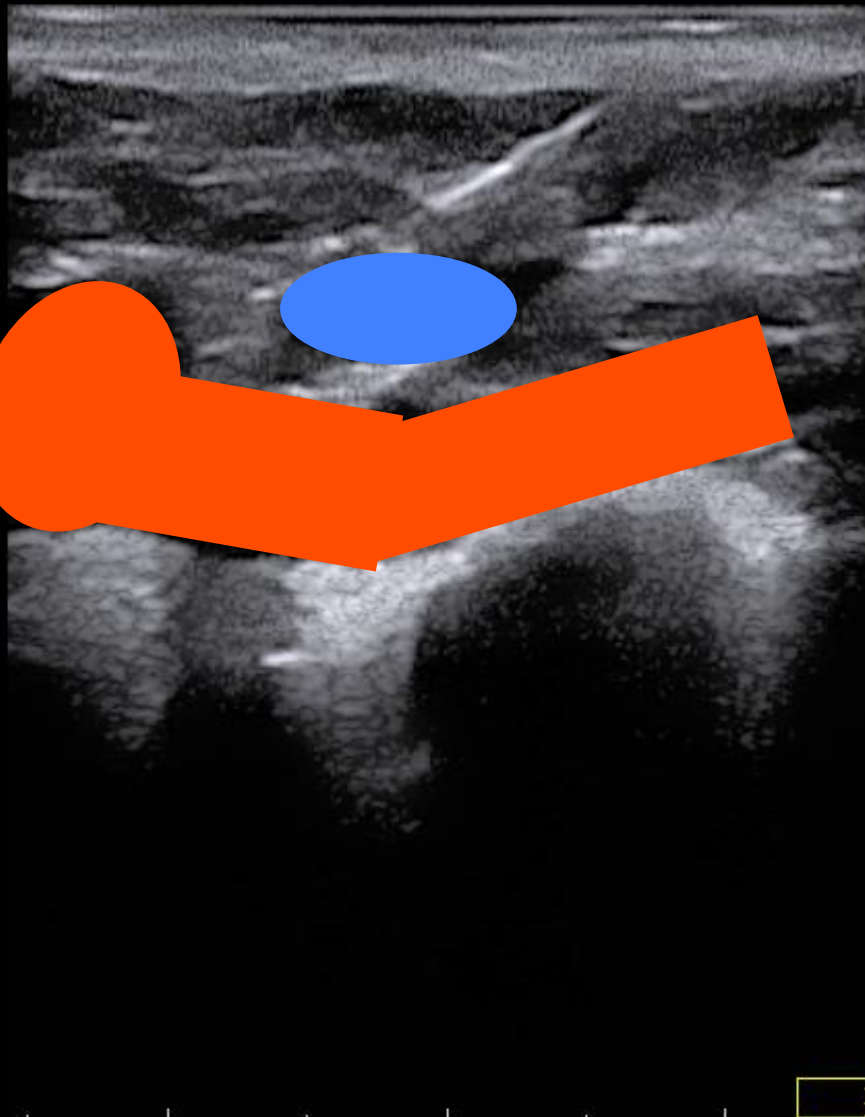


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VASCOLARE

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D	40 mm	XV	1
PRC	4/3/H	PRS	4
PST	1/10	MV	-

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3



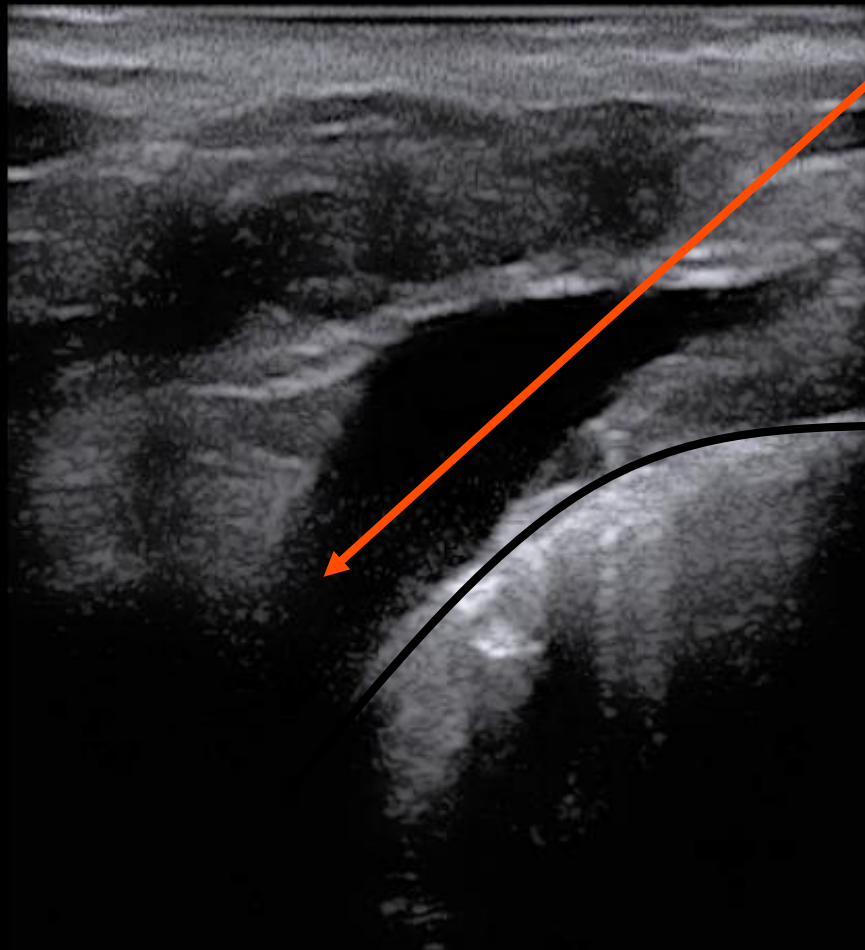


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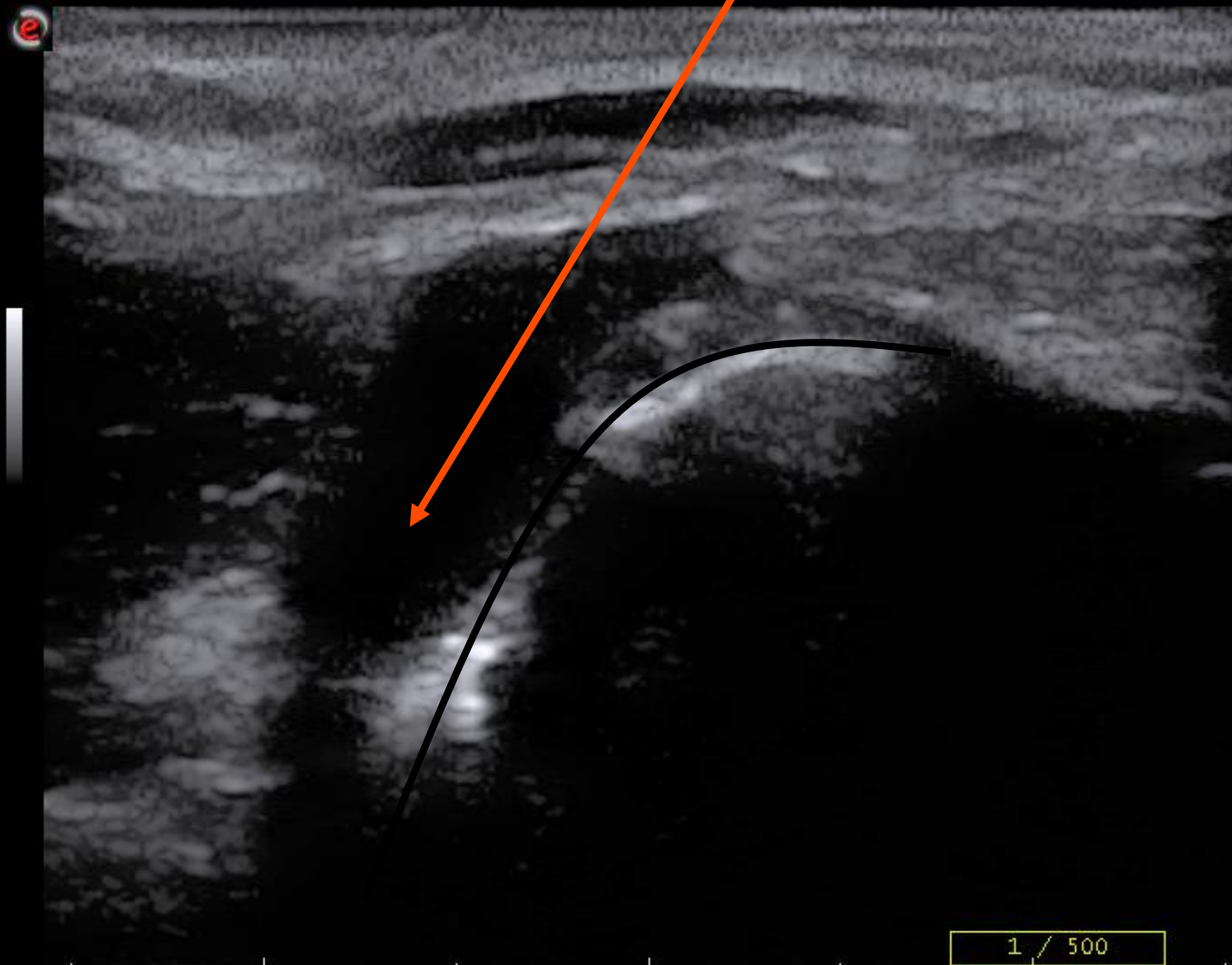
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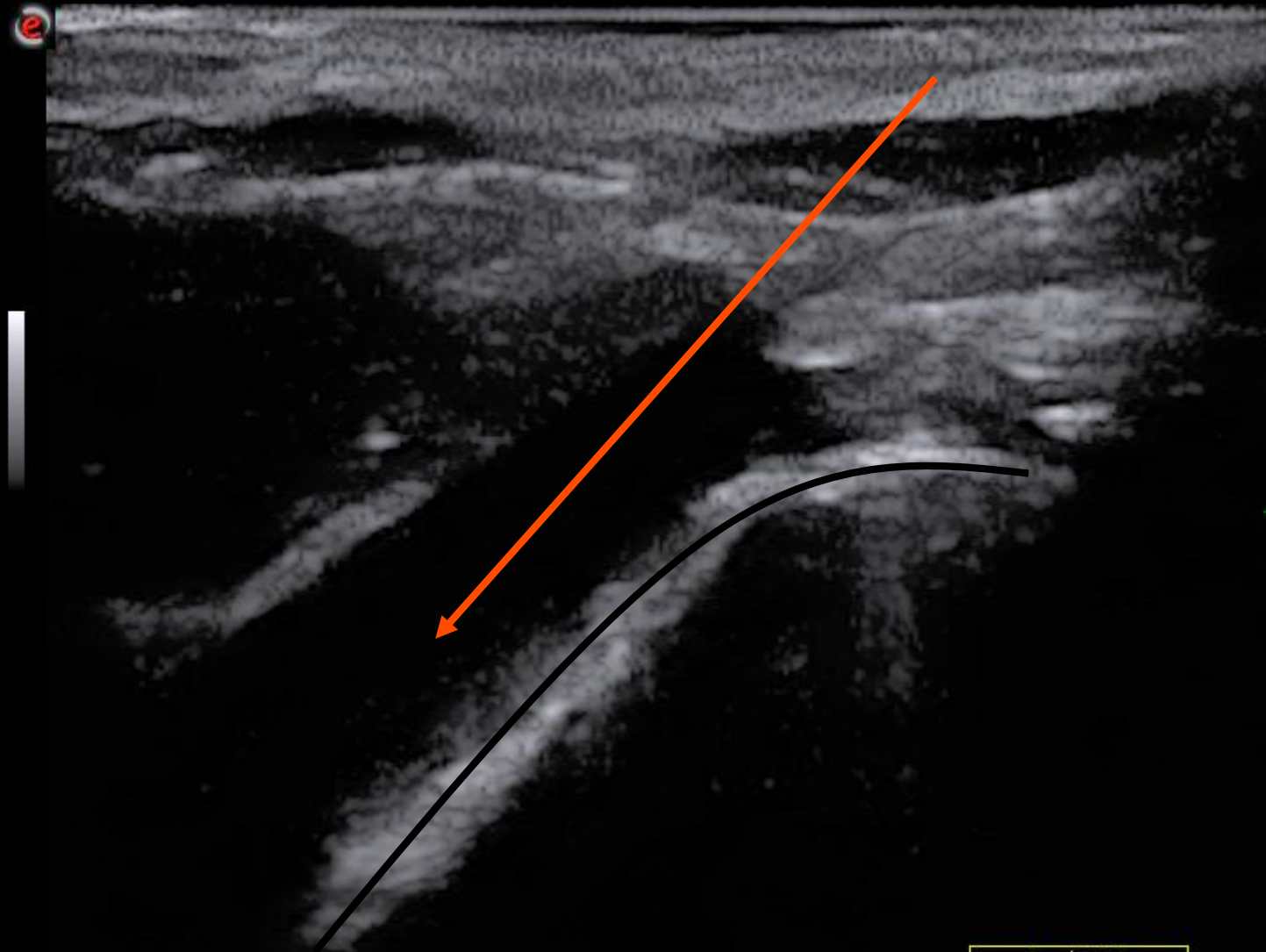


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Axillary vein at the chest

- Atypical (CICC or PICC?)
- Rare (ma possible) in neonates
- Most likely to be feasible in infants and children



‘key points’ for an uneventful insertion in neonates/infants

- Ultrasound study of deep veins (RaCeVA)
- **US-guided venipuncture and cannulation**

- Different PICCs can be used (silicon, polyurethane, power injectable polyurethane), single and double lumen
- The calibre - 3Fr or 4Fr or 5Fr - is chosen considering the diameter of the vein (vein mm = or > cath Fr)



Key point: Check the diameter of the vein



Key point: all catheters are inserted by real time ultrasound guidance, by the 'in-plane' approach.





IST. G. GASLINI

07/06/15 18:24:07

ADM 040615-104616

MI 0.6

TIs 0.3 12L-RS

Adulto

GE

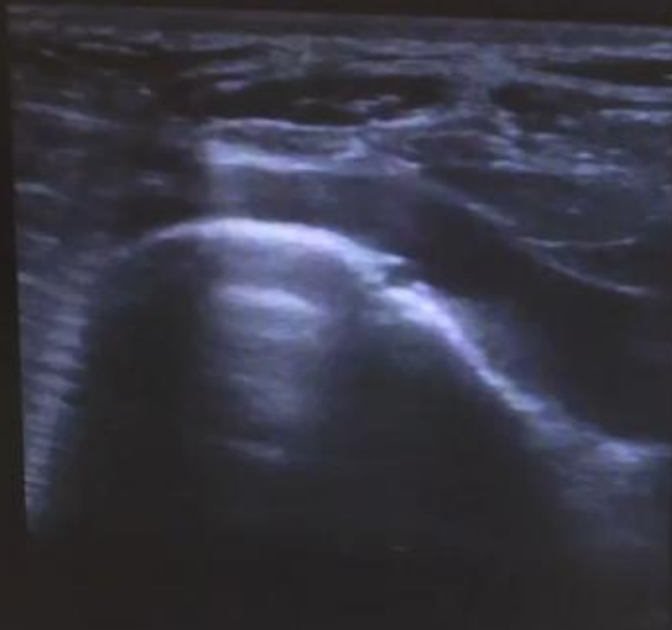
- B
- Frq 10.0 MHz
- Gn 58
- E/A 1/3
- Mapp A/O/O
- D 4.0 cm
- DR 90
1- FR 29 Hz
- AO 100 %
- XBeam On

190:190 (19.4:19.4 s)

• Cardiac

- (Z) Dimensione
- (X) Area
- (C) Volume
- (V) Massa
- (B) Shunt
- (W) PISA
- (J) LA/Ao
- (I) Valvola mitrale
- (J) RV/LV
- AVA

Worksheet



2-

3-

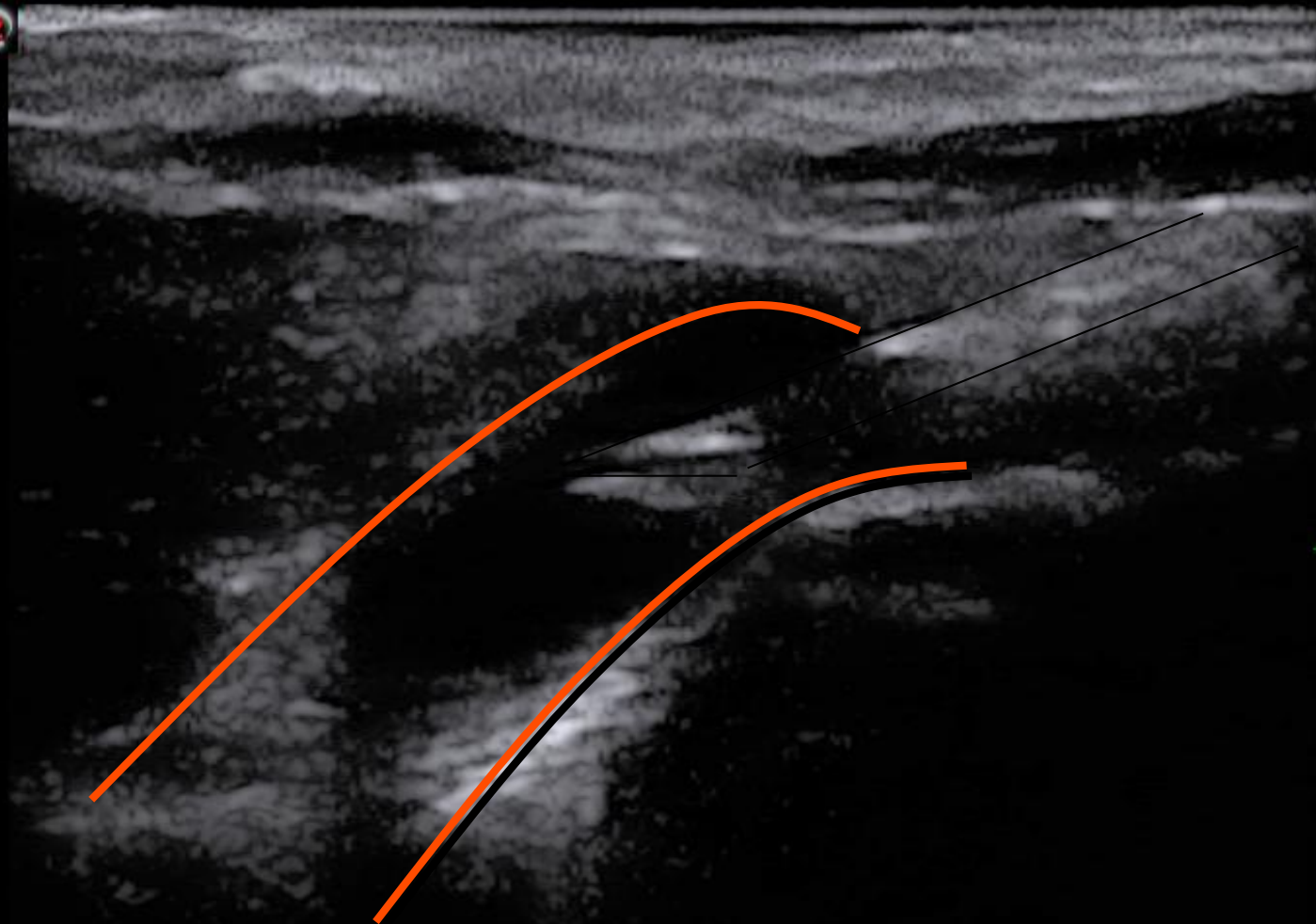
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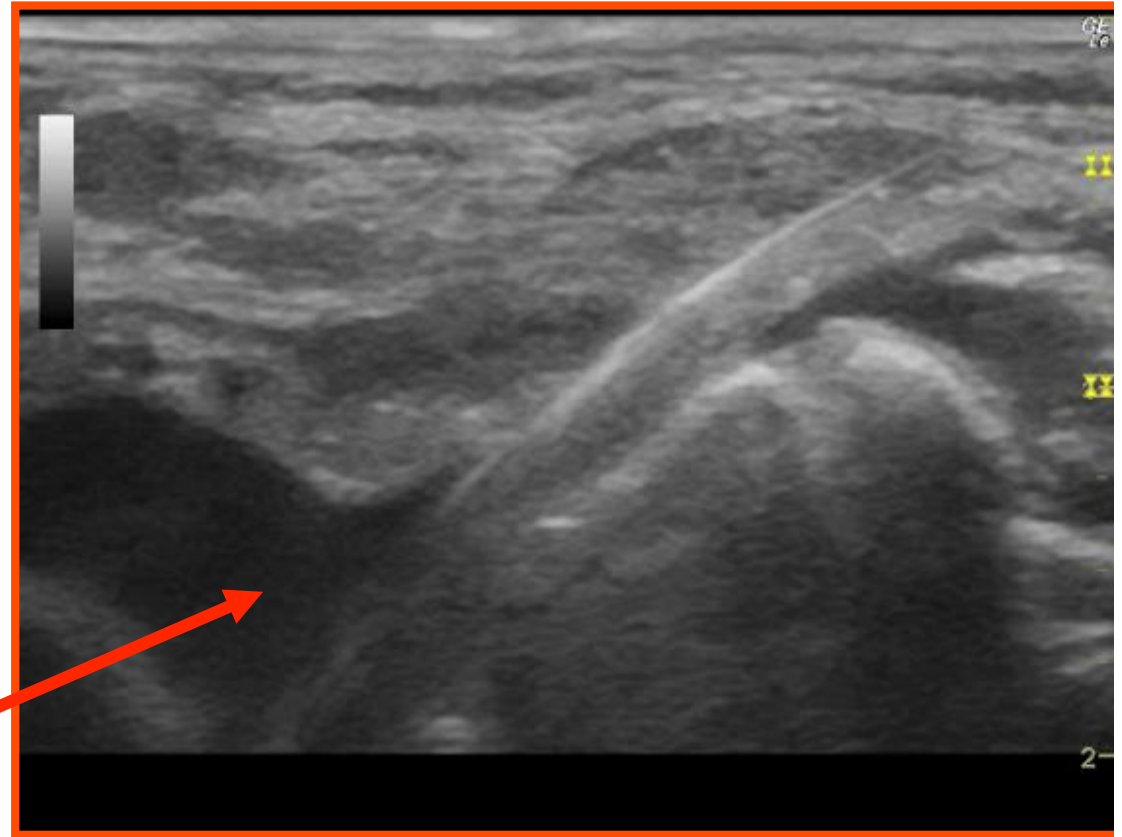
Easy
puncture...





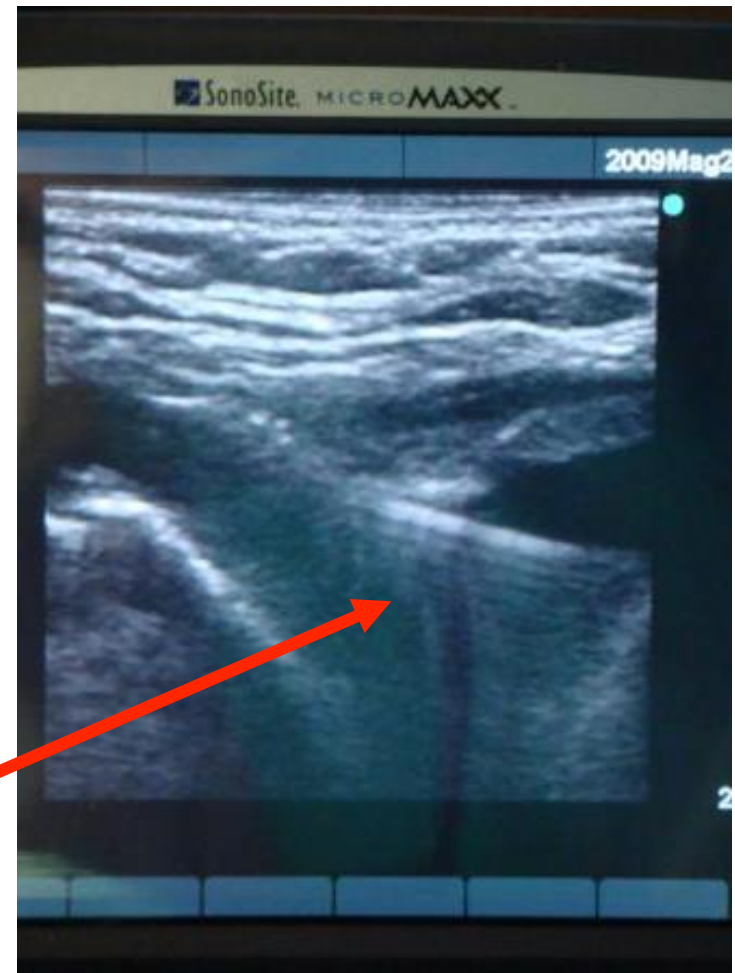
Not so easy!
(800 gr)

Ultrasound is constantly used to assess the direction of the guidewire, soon after its insertion in the needle



Correct direction

Ultrasound is constantly used to assess the direction of the guidewire, soon after its insertion in the needle



Wrong direction

Micro
introducer



Catheter





Conclusions

- Rapid vein assessment:
RaCeVA
- Correct probe for neonates and infants
- Measure vein before VAD positioning
- Our experience > 1500 gr





Istituto Giannina Gaslini



Grazie per l'attenzione

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