

ECHOTIP NEL NEONATO

Giovanni Barone
TIN Neonatologia.
Ospedale Infermi di Rimini



III Convegno Nazionale GAVePed
Gli Accessi Venosi nel Neonato e nel Bambino
Convegno online, in diretta streaming su www.gavacellconnection.it



ECHOTIP nel neonato

- I have no conflict of interest in relation to this presentation

Tip location

3. Consider the use of ultrasound for CVAD tip location. The clinical applicability of this is currently limited by the small sample sizes used to demonstrate its efficacy as a reliable and safe method to replace chest radiographs in all ages, and its usefulness is limited by the knowledge, skill, and experience of the operator.^{36,43,44,46,63-65} (III)
 - a. The addition of agitated saline to enhance transthoracic echocardiography has been shown to be effective in detecting catheter tip position in the lower third of the SVC, as well as detecting catheter malposition through delayed opacification and reduced echogenicity.⁶⁶⁻⁶⁸ (IV)
4. Consider the use of ultrasound to confirm catheter tip position in neonates due to the relative ease of visualizing the catheter tip in this age group, as well as in the emergency department or other critical care environments where immediate confirmation of tip location is time critical.^{46,69} (IV)

23. CENTRAL VASCULAR ACCESS DEVICE TIP LOCATION

Infusion Therapy Standards of Practice

Why?

Ultrasound

Why not the Chest X Ray?

It is relatively inaccurate. As x-rays do not allow the direct visualization of the veins, the location of the catheter tip is assessed indirectly, i.e., using radiological landmarks such as the vertebral bodies, the cardiac silhouette, the diaphragmatic contour, etc.

It is consistently a post-procedural methodology, since fluoroscopy is not considered appropriate in NICU.

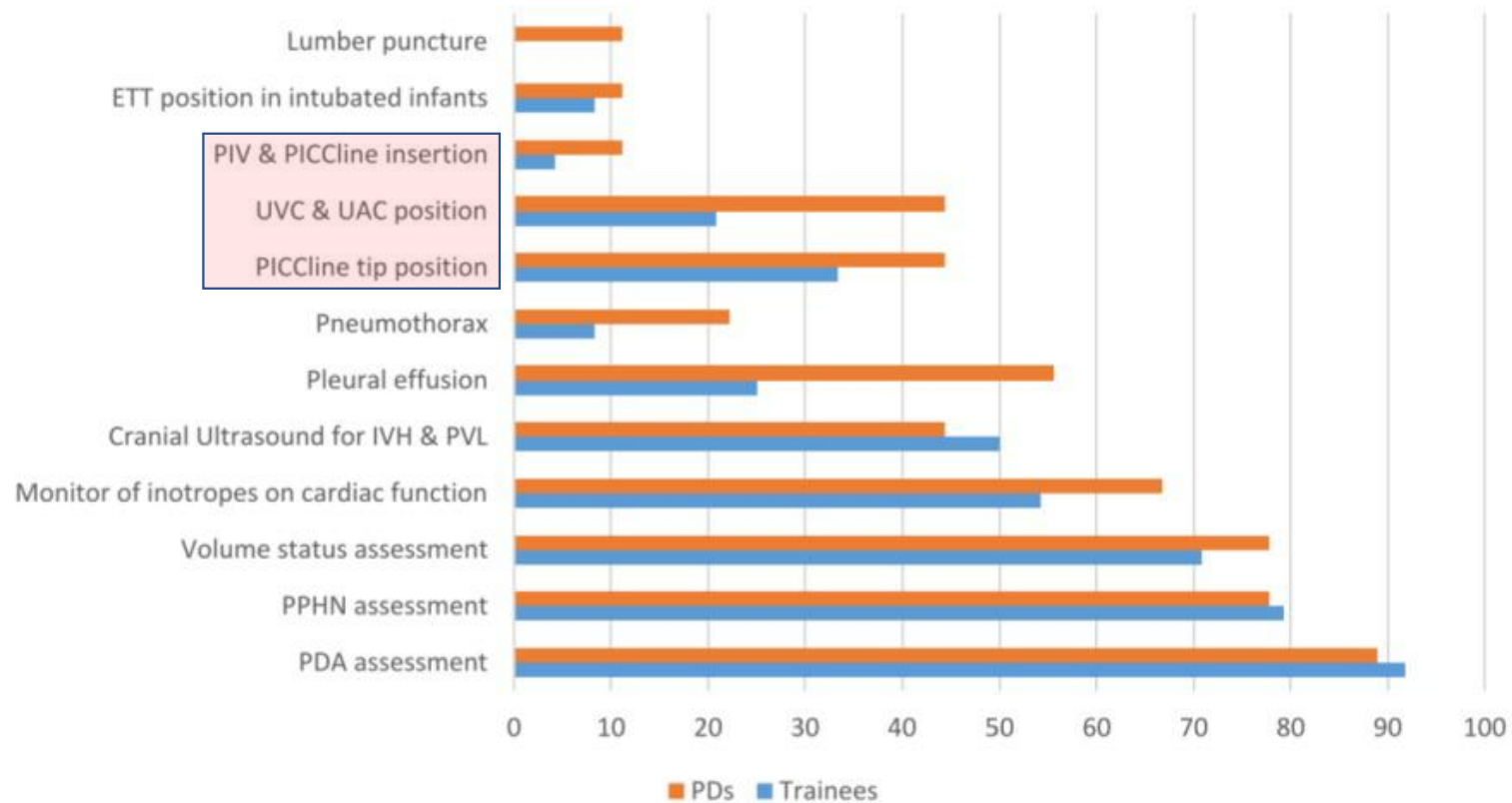
It is not harmless, since it exposes the neonate to ionizing radiation, which may ultimately be associated with long term damage

Tip location

5. Avoid fluoroscopy except where CVAD placement is difficult or has failed at the bedside, as it requires exposure to ionizing radiation.^{4,53,62,70} (IV)
6. Postprocedure radiograph imaging is not necessary if alternative tip location technology confirms proper tip placement.^{46,50,71} (II)

Confirmation of tip location by postprocedure chest radiograph remains acceptable practice and is required in the absence of technology used during the procedure. This method is less accurate because the CAJ cannot be seen on the radiograph, requiring identification of tip location by measurement from the carina, trachea-bronchial angle, or thoracic vertebral bodies. Patient repositioning or movement results in distal or proximal migration of the catheter tip by as much as 2 cm dependent on the movement.^{4,12,69,72-75} (II)

Where are we?



Point of care ultrasound (POCUS) in Canadian neonatal intensive care units (NICUs): where are we?
Journal of Ultrasound.2019

Where are we?

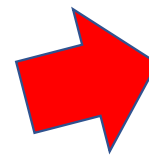
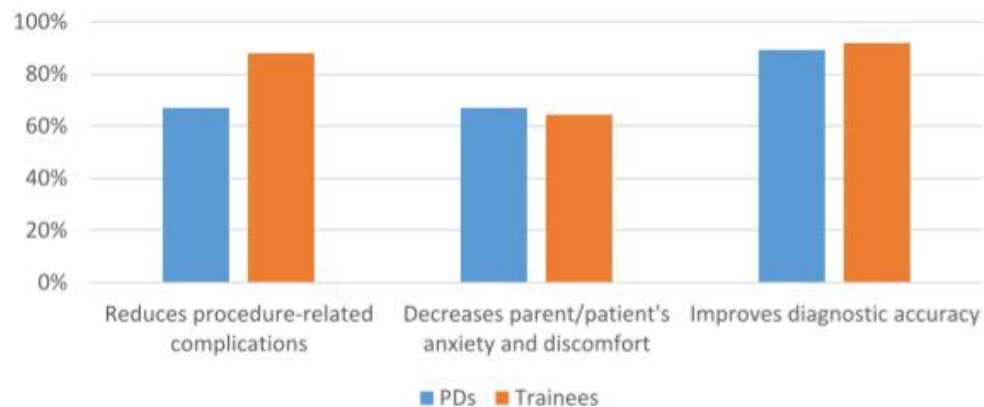
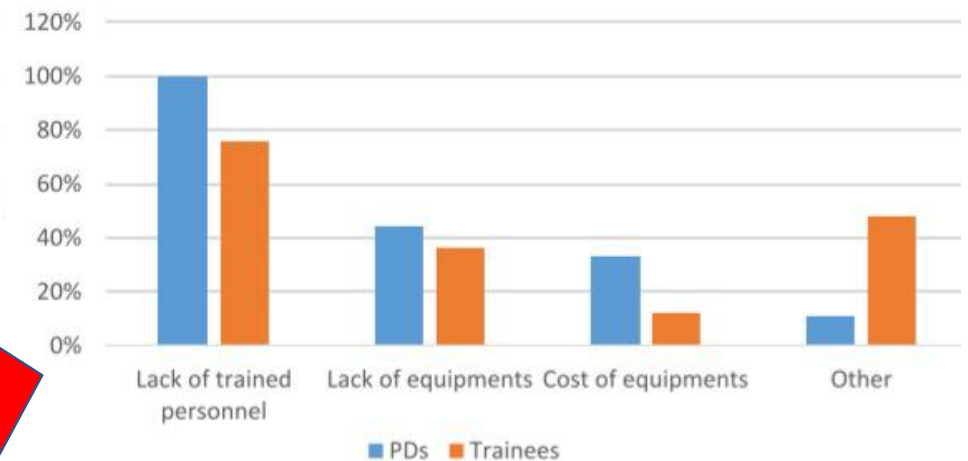


Table 1 Other potential barriers to POCUS training

Lack of dedicated time to get training due to other competing educational priorities
Lack of time and resources to develop POCUS curriculum
Lack of teachers who are expert in POCUS
Acquiring full spectrum of POCUS skills including cardiac ultrasound might take longer than what a 2-year fellowship program can accommodate
Resistance from radiology and cardiology



Point of care ultrasound (POCUS) in Canadian neonatal intensive care units (NICUs): where are we?

Journal of Ultrasound.2019



PLEASE FILL THE GAP



NEO-ECHOTIP protocol

***Infusion Therapy
Standards of Practice***

Pedivan



Neo-ECHOTIP: A structured protocol for ultrasound-based tip navigation and tip location during placement of central venous access devices in neonates

Giovanni Barone¹ , Mauro Pittiruti² , Daniele G Biasucci³,
Daniele Elisei⁴, Emanuele Iacobone⁴ , Antonio La Greca²,
Geremia Zito Marinosci⁵ and Vito D'Andrea⁶ 

The Journal of Vascular Access
1–10

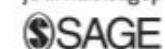
© The Author(s) 2021

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/11297298211007703

journals.sagepub.com/home/jva



Neo Echo Tip protocol

Table 1. Summary of Neo-ECHO tip.

Catheter	Protocol	Probe	Windows
UVC	Tip navigation	Small sectorial probe, 7–8 MHz	Low subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
ECCs inserted via veins of the scalp or of the upper limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA and RaPeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
ECCs inserted via veins of the lower limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Short and long axis view of the femoral vein
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
CICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
FICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz and small sectorial probe	Short and long axis view of the femoral vein and subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view

UVC: umbilical venous catheter; ECC: epicutaneo-caval catheter; RaCeVA: rapid central vein assessment; RaPeVA: rapid peripheral vein assessment; CICC: centrally inserted central catheter; FICC: femoral inserted central catheter.

Neo Echo Tip protocol

Table 1. Summary of Neo-ECHO tip.

Catheter	Protocol	Probe	Windows
UVC	Tip navigation	Small sectorial probe, 7–8 MHz	Low subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
ECCs inserted via veins of the scalp or of the upper limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA and RaPeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
ECCs inserted via veins of the lower limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Short and long axis view of the femoral vein
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
CICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
FICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz and small sectorial probe	Short and long axis view of the femoral vein and subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view

UVC: umbilical venous catheter; ECC: epicutaneo-caval catheter; RaCeVA: rapid central vein assessment; RaPeVA: rapid peripheral vein assessment; CICC: centrally inserted central catheter; FICC: femoral inserted central catheter.

Evidences from the literature

Several studies have evaluated the accuracy of US for UVC tip location. According to most authors, the tip can be successfully located in 95-100% of all patients. Different probes have been used:

- Linear probes, 12-13 MHz
- Micro-convex probes, 7-8.5 MHz
- Small sectorial probes

The subcostal longitudinal view was the most common acoustic window, though some authors adopted also complementary windows such as the apical four-chamber view and the parasternal short-axis view . A saline flush was used in some studies as a complimentary aid to enhance tip visualization. Only one study reported the use of US for tip navigation

Neo-ECHOTIP for UVC

Tip navigation protocol:

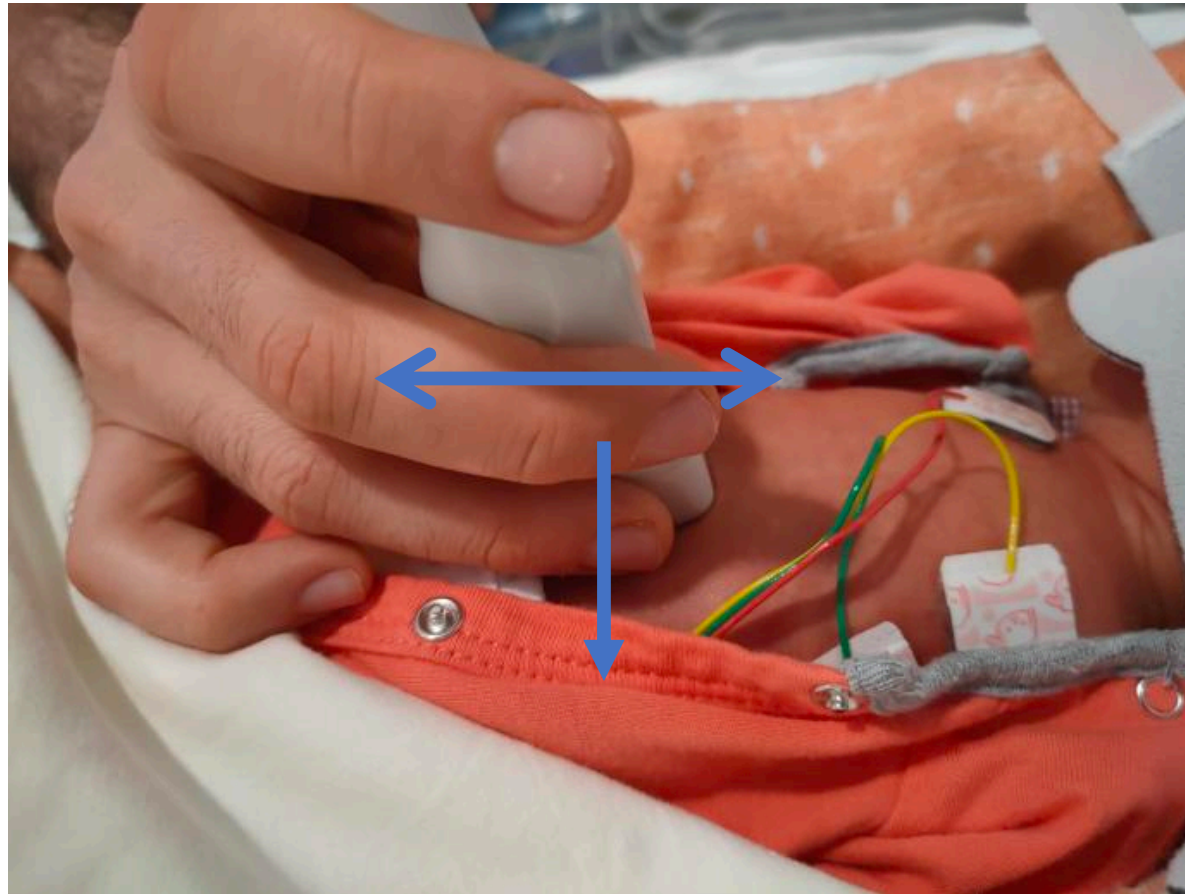
Probe: small sectorial probe, 7-8 MHz.

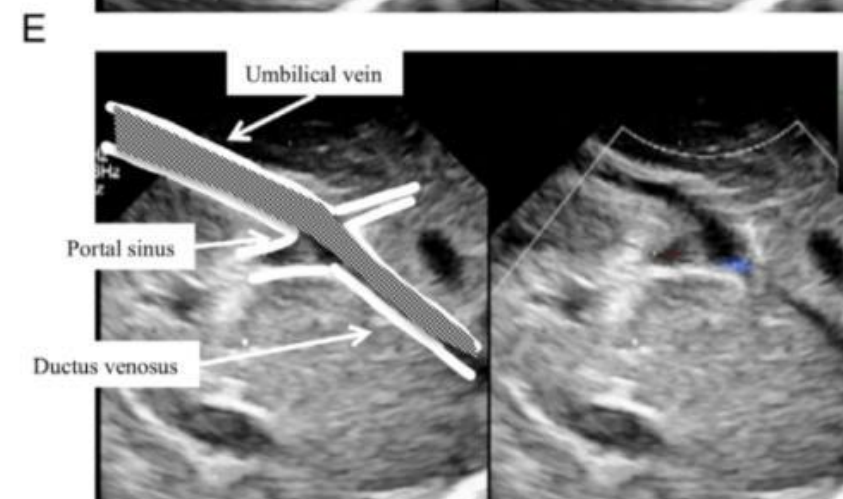
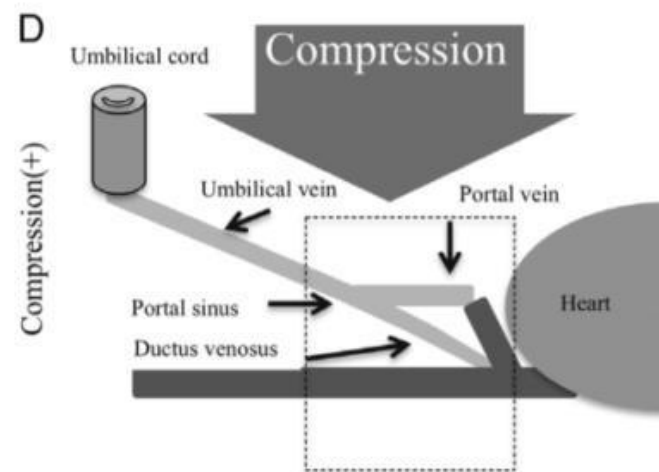
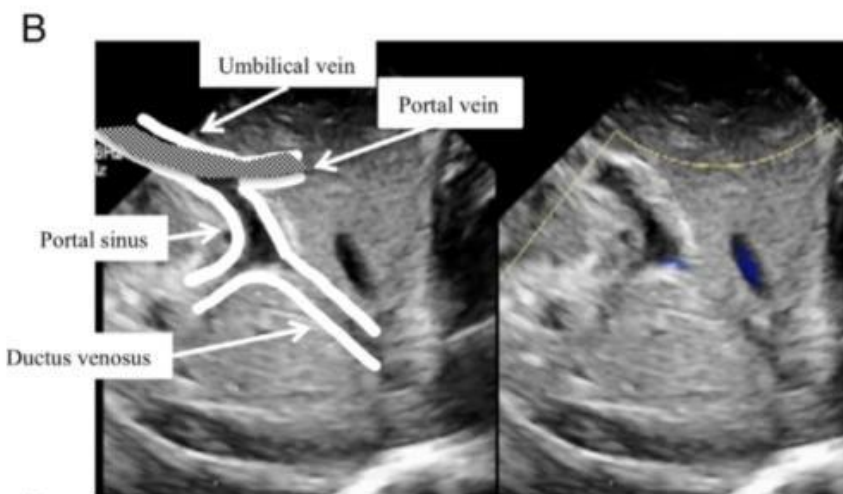
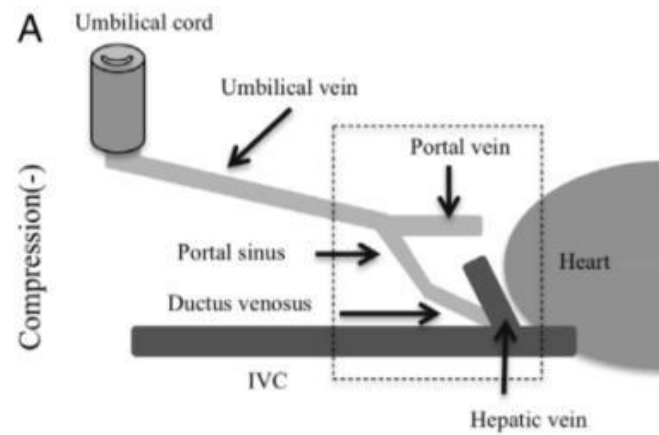
Acoustic window: subcostal longitudinal view. This view allows to visualize the pathway of fetal umbilical venous flow from the umbilical vein to the ductus venosus, and further on to the junction between IVC and RA.

Procedure: During catheter insertion, the tip is visualized as it passes through the umbilical vein, the ductus venosus and the IVC. A small pressure with the probe may facilitate the lineup between the ductus venosus and the IVC, increasing the odds to direct the catheter into the proper position

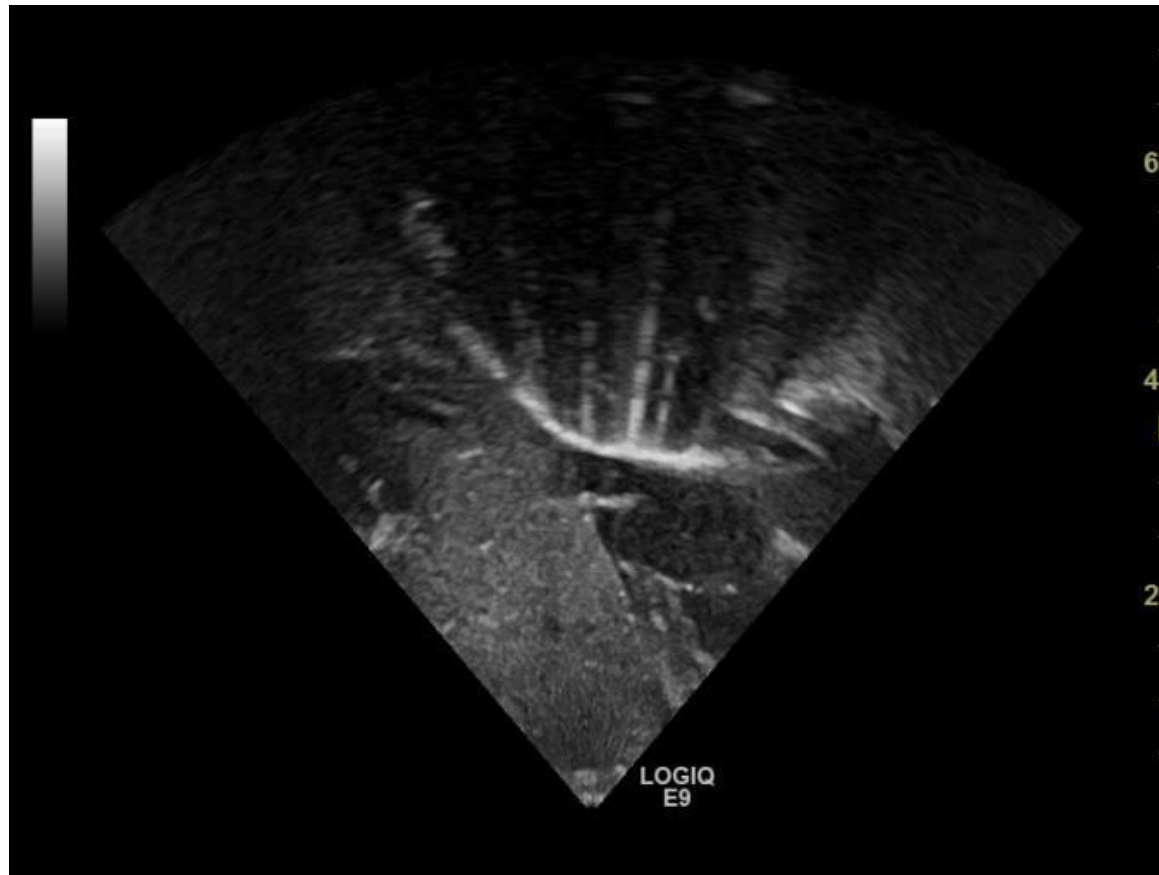
Neo-ECHOTIP for UVC

Probe TIP-Navigation

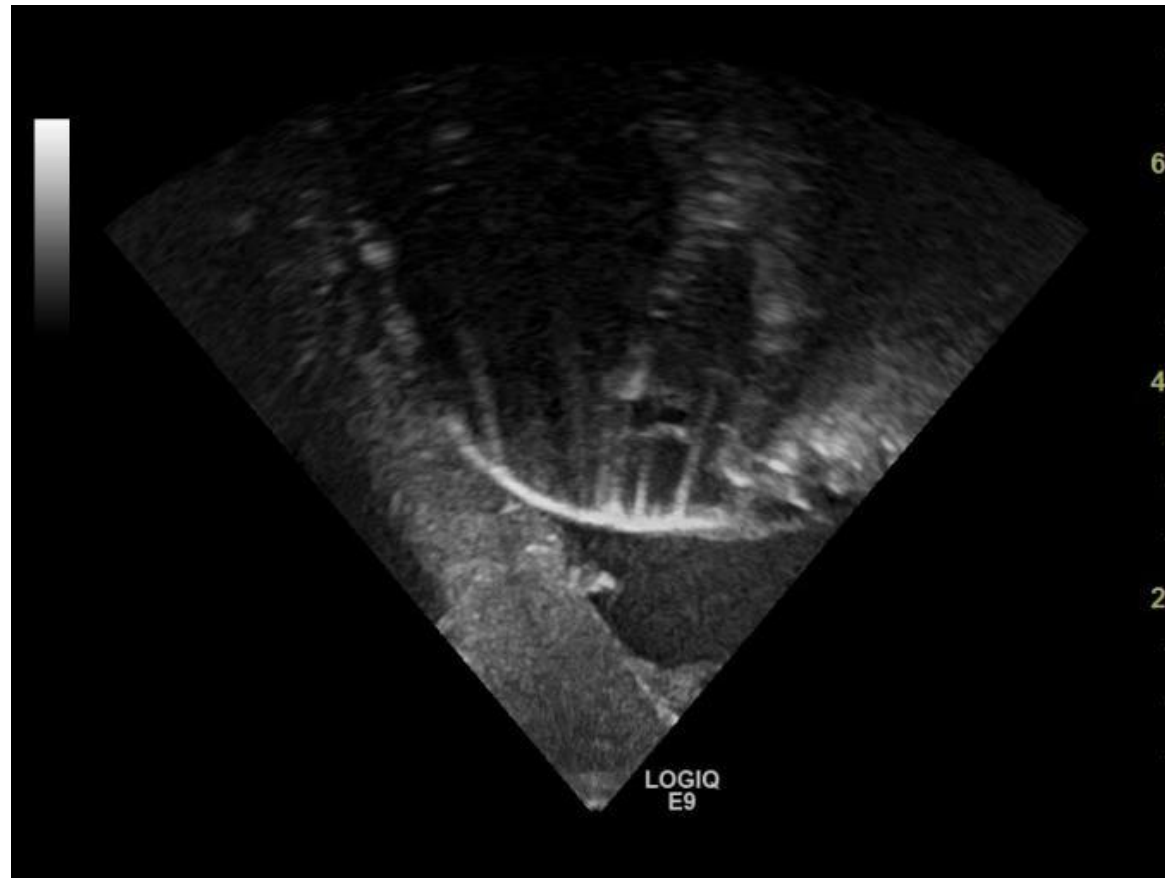




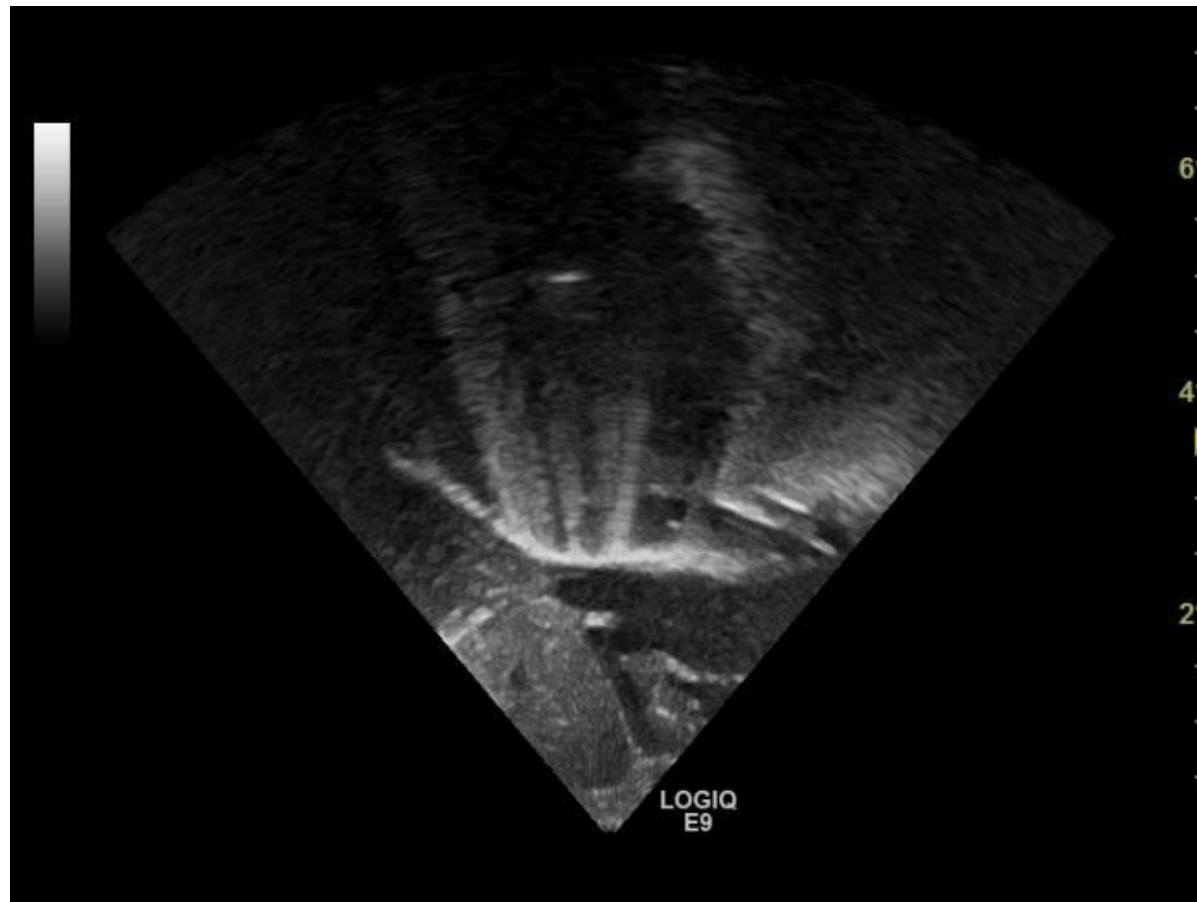
“How we do it better”...



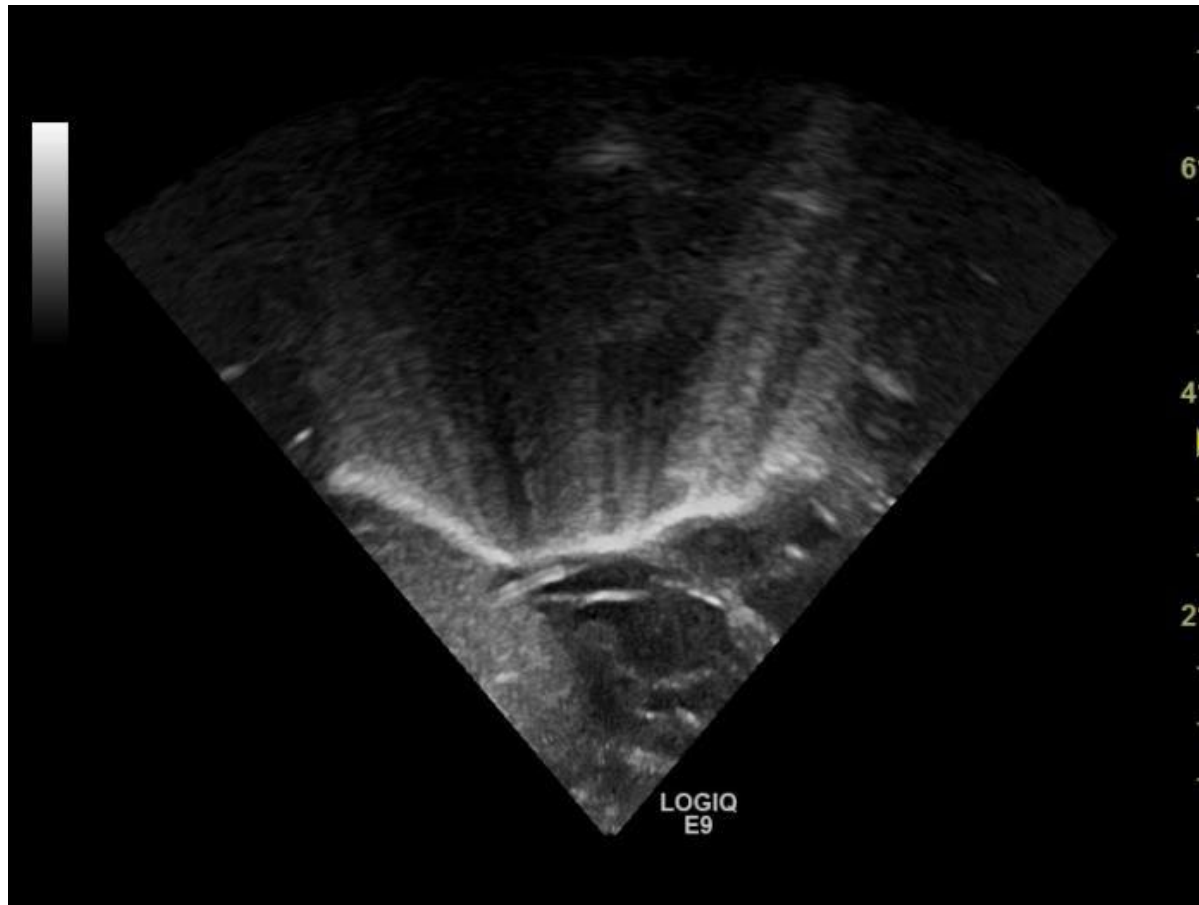
“How we do it better”...



“How we do it better”...



“How we do it better”...



Neo-ECHOTIP for UVC

Tip location protocol:

Probe: small sectorial probe, 7-8 MHz.

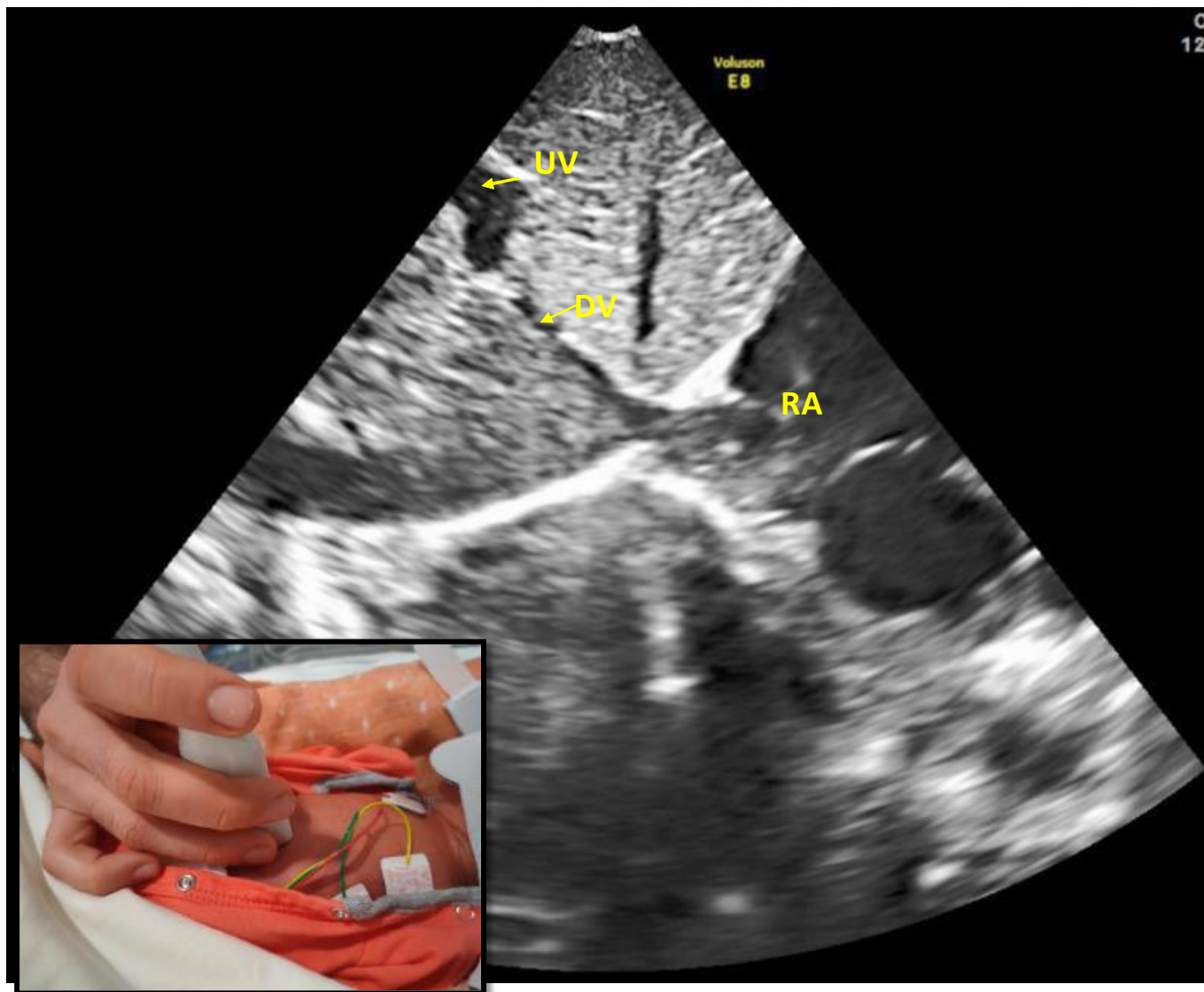
Acoustic window: subcostal longitudinal view. This view allows to visualize the IVC and the RA.

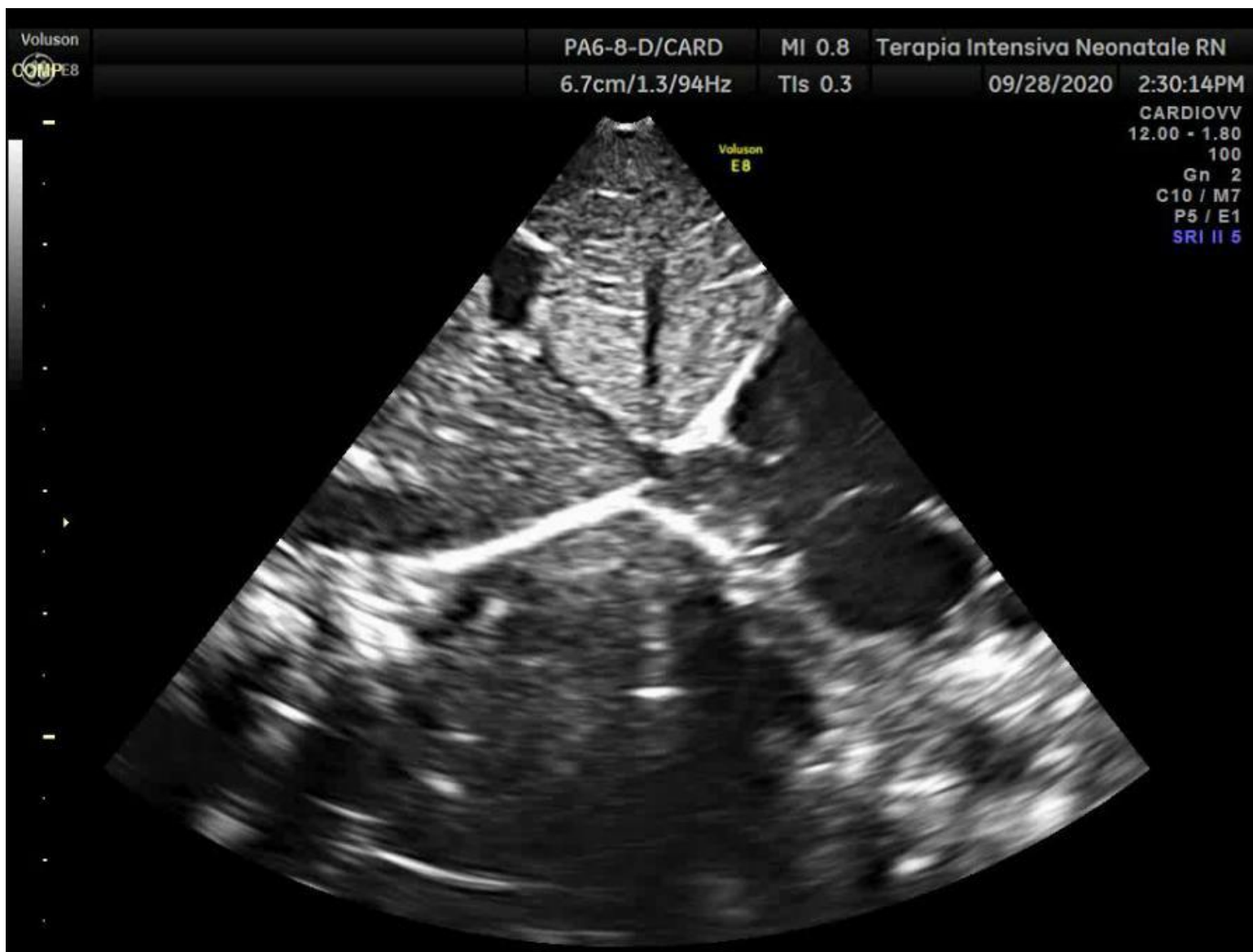
Procedure: the tip is followed until it reaches the target zone, i.e., the junction between the IVC and the RA. A small flush of normal saline (0.5-1 ml) can improve the visualization of the tip

Neo-ECHOTIP for UVC

Probe TIP-Location







Neo-ECHOTIP for UVC: The training

RESEARCH

Open Access

Real-time ultrasound for tip location of umbilical venous catheter in neonates: a pre/post intervention study



Serena Antonia Rubortone^{1*} , Simonetta Costa¹, Alessandro Perri¹, Vito D'Andrea¹, Giovanni Vento¹ and Giovanni Barone²

	Pre-Intervention Phase N = 26	Post-Intervention Phase N = 28	<i>P</i>
Real-time US	4 (15.3)	25 (89.2)	< 0.0001
Chest X-Ray	24 (92.3)	9 (32.1)	< 0.0001
Time to visualize UVC tip (h)	2 [1-3]	0 [0-1]	0.0012
N of manipulations first 24 h	11 (42.3)	5 (17.8)	0.0740
UVC in a good position	8 (30.7)	21 (75.0)	0.0023
Double lumen UVC	21 (80.7)	21 (75.0)	0.7471
Size 3.5- 4 Fr	18 (69.2)	16 (57.1)	0.4082
Size 5 Fr	8 (30.8)	12 (42.9)	0.4082
UVC dwell time (days)	4.7 (2.7)	5.4 (2.5)	0.3306

Neo Echo Tip protocol

Table 1. Summary of Neo-ECHO tip.

Catheter	Protocol	Probe	Windows
UVC	Tip navigation	Small sectorial probe, 7–8 MHz	Low subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
ECCs inserted via veins of the scalp or of the upper limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA and RaPeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
ECCs inserted via veins of the lower limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Short and long axis view of the femoral vein
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
CICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
FICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz and small sectorial probe	Short and long axis view of the femoral vein and subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view

UVC: umbilical venous catheter; ECC: epicutaneo-caval catheter; RaCeVA: rapid central vein assessment; RaPeVA: rapid peripheral vein assessment; CICC: centrally inserted central catheter; FICC: femoral inserted central catheter.

Evidences from the literature

Several clinical studies have evaluated the accuracy of US for tip location during ECC placement. In such studies, the tip was successfully located in a variable percentage of cases, as the percentage of success apparently reaches 100% only when the operator is highly trained.

Different probes have been used:

- Linear probe, 12-13 MHz
- Small sectorial probe

Different acoustic windows have been used: apical 4 chamber-view; parasternal long and short axis view; long axis view of superior vena cava (SVC); subcostal longitudinal view of IVC (for catheter inserted from lower limbs). A saline flush has been used in several studies to achieve a better visualization of the catheter tip. No study in the literature has investigated ultrasound-based tip navigation during ECC placement.

Neo-ECHOTIP for ECC inserted via veins of the upper limbs

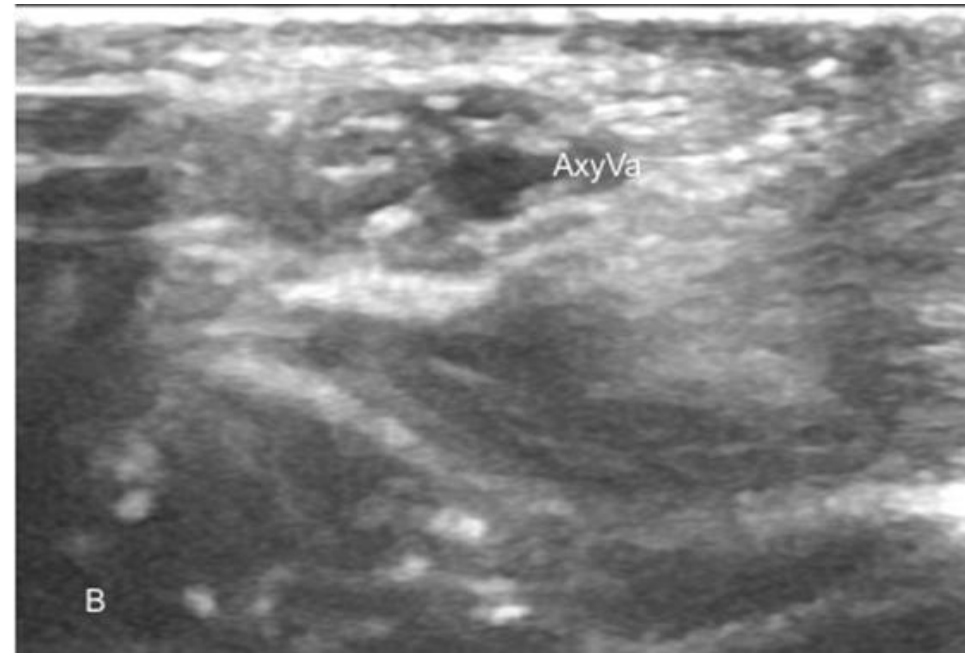
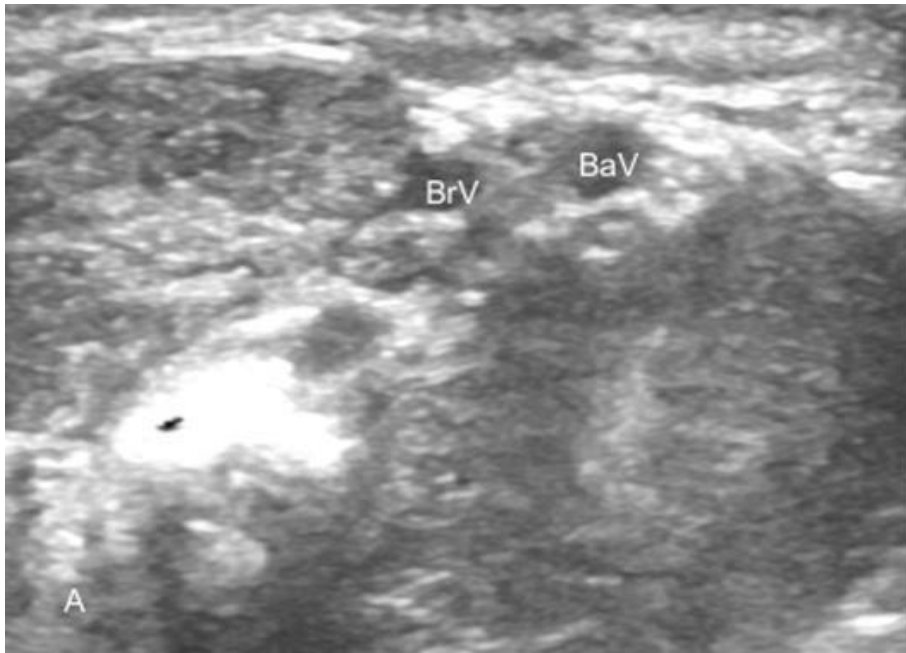
Tip navigation protocol:

Probe: linear 'hockey stick' probe, 10-14 MHz.

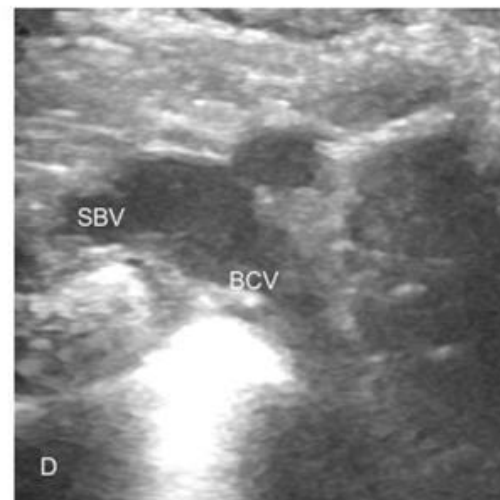
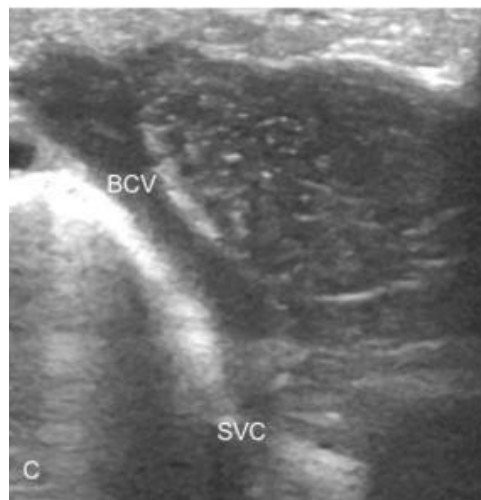
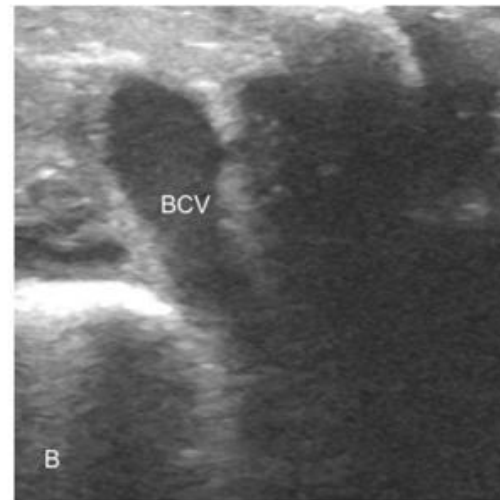
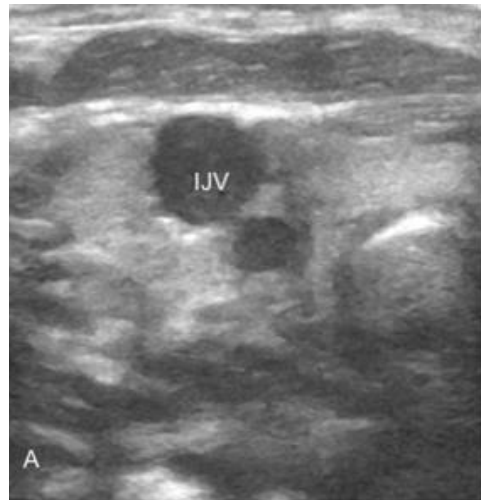
Acoustic windows: the protocol includes the acoustic windows of RaCeVA and RaPeVA .

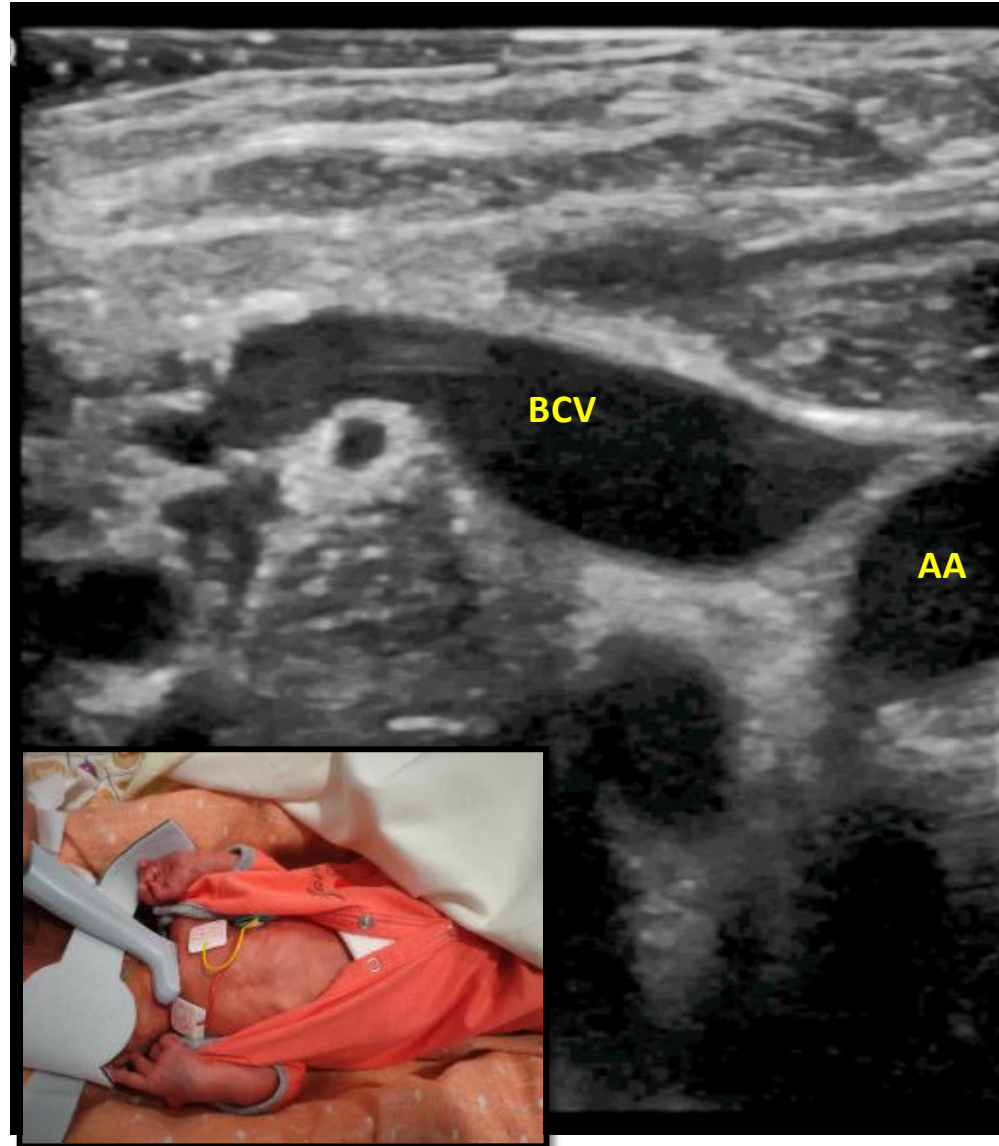
Procedure: the RaPeVA protocol is used in case of difficult progression of the catheter through the deep veins of the arm. The RaCeVA protocol is used for tip navigation of the catheter into the subclavian vein, the brachio-cephalic vein and the SVC, so to prevent primary malposition (such as inside the internal jugular vein) during the maneuver of insertion. The RaCeVA protocol can also easily visualize an ECC inserted into scalp veins as it passes through the internal jugular vein, the brachiocephalic vein and the SVC.

RaPeVa



RaCeVa





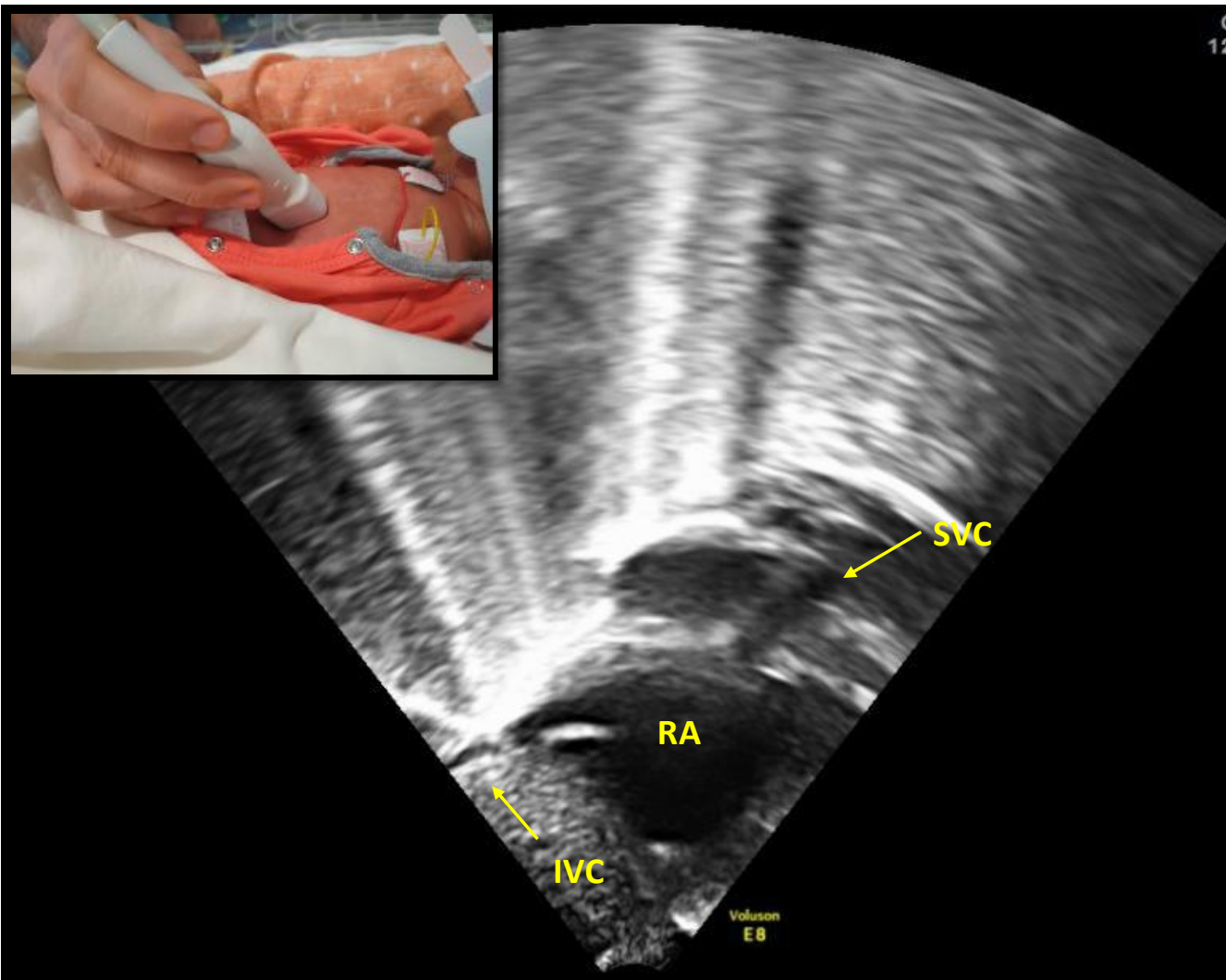
Neo-ECHOTIP for ECC inserted via veins of the upper limbs

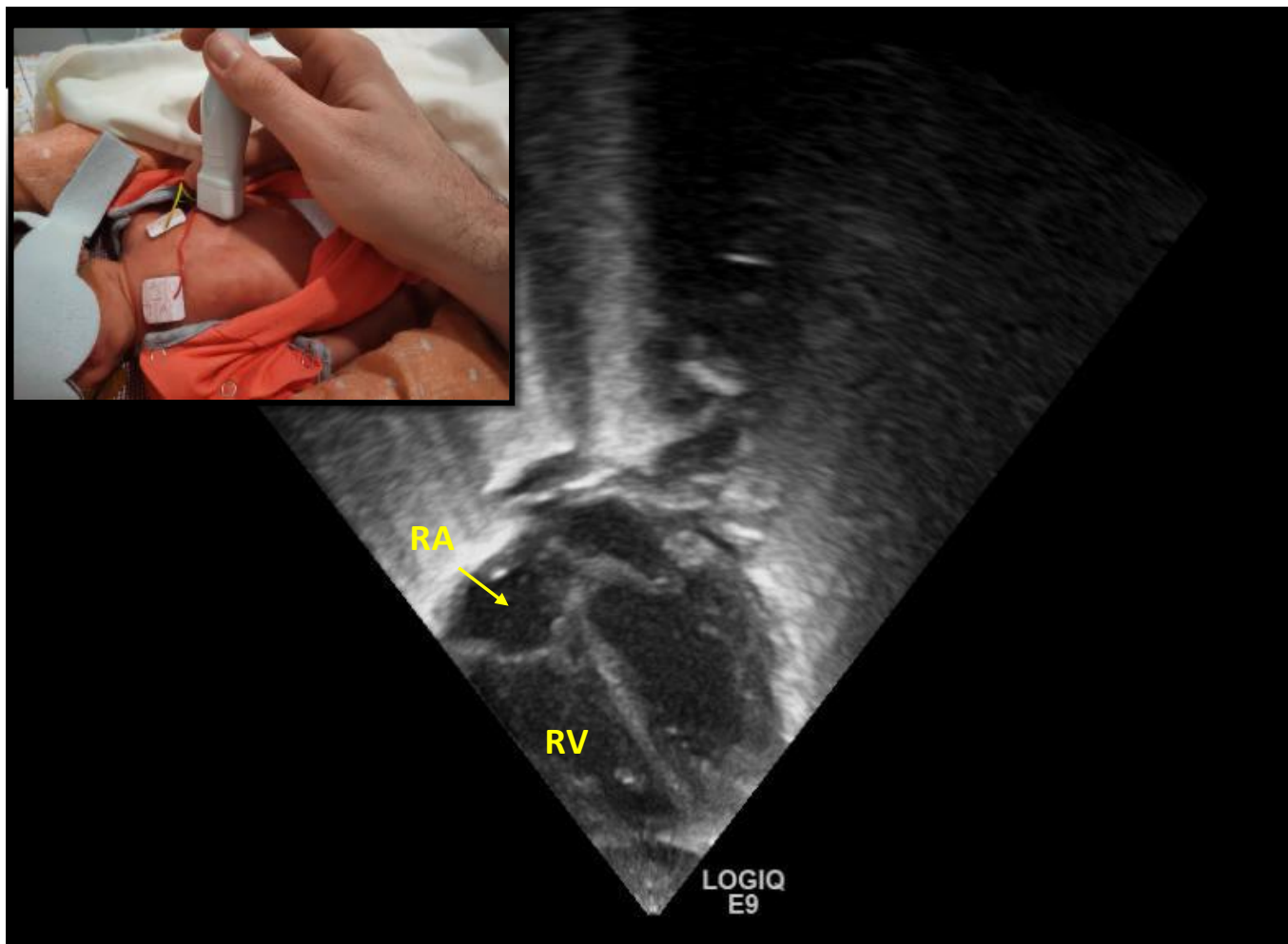
Tip location protocol:

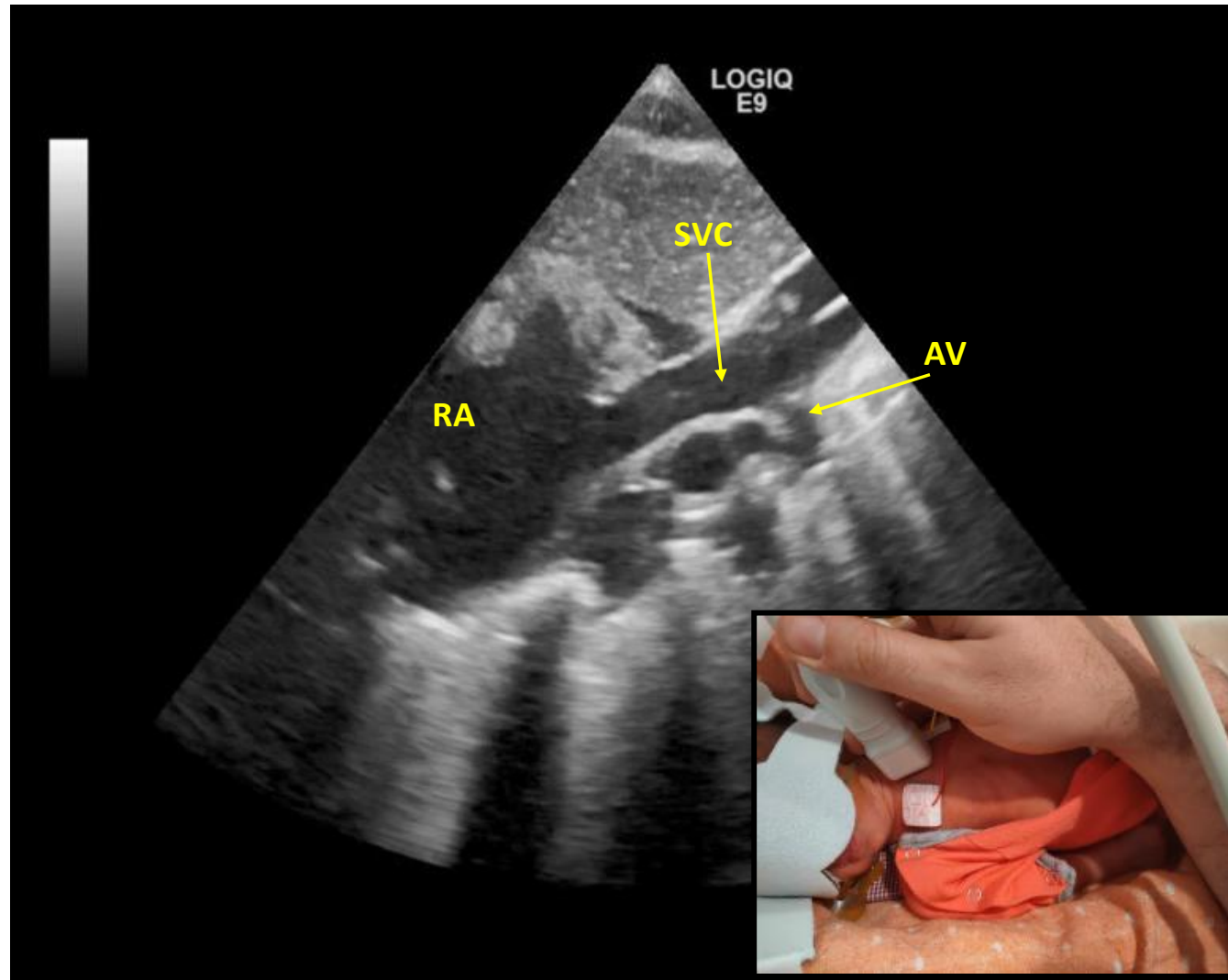
Probe: Small sectorial probe, 7-8 MHz.

Acoustic windows: At least three different windows have been used to locate the catheter tip. The most useful ones are the subcostal longitudinal view ('bi-caval' view); the four-chamber apical view; the parasternal, long axis view of SVC.

Procedure: the catheter tip is followed until it reaches the target zone, i.e., the transition between SVC and RA. A small flush of normal saline (0.5-1 ml) may help visualizing the tip.









Neo-ECHOTIP for ECC inserted via veins of the lower limbs

Tip navigation protocol:

Probe: linear 'hockey stick' probe, 10-14 MHz.

Acoustic window: short and long axis view of the femoral vein.

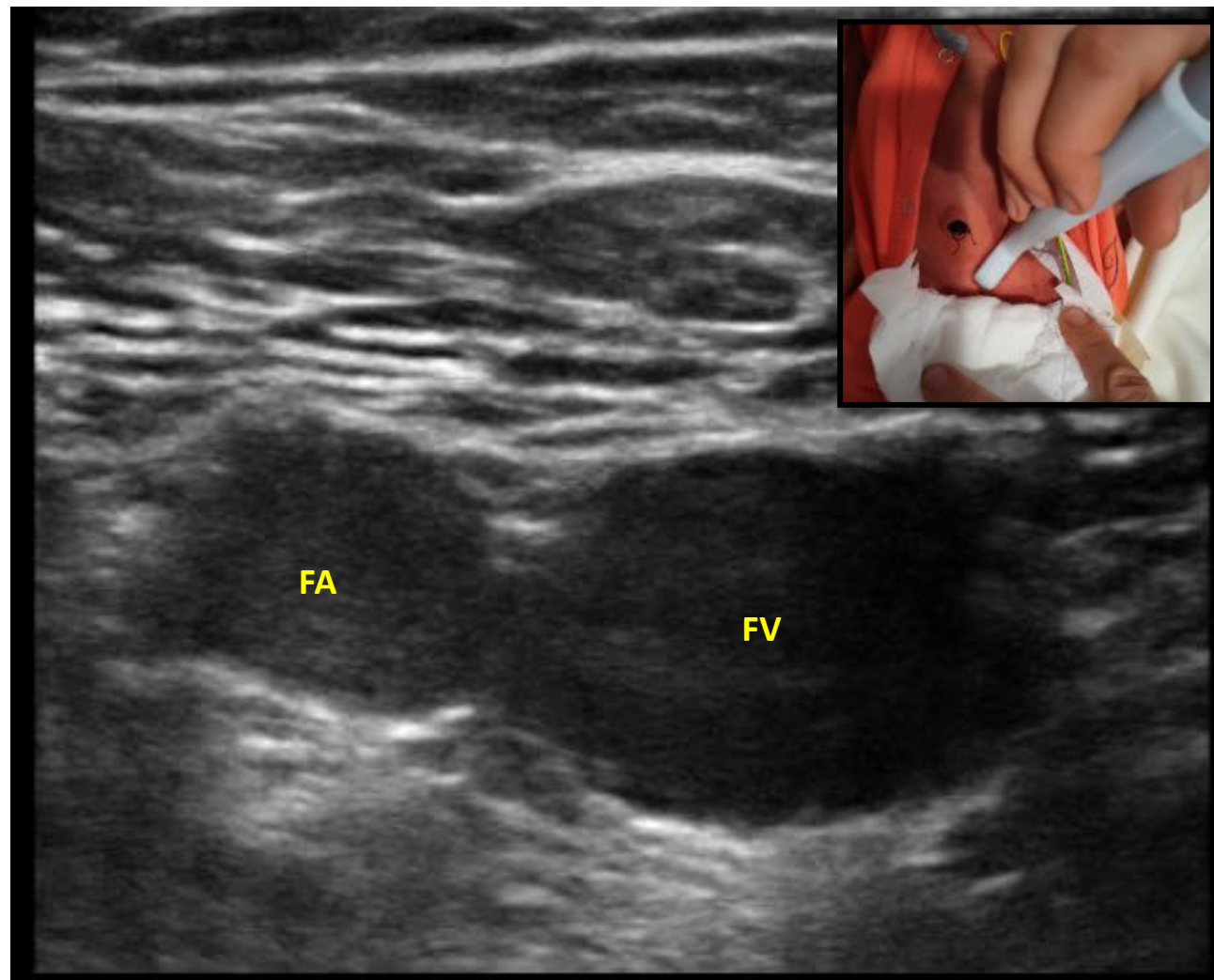
Procedure: During ECC insertion, the catheter tip is visualized into the femoral vein and into the iliac vein.

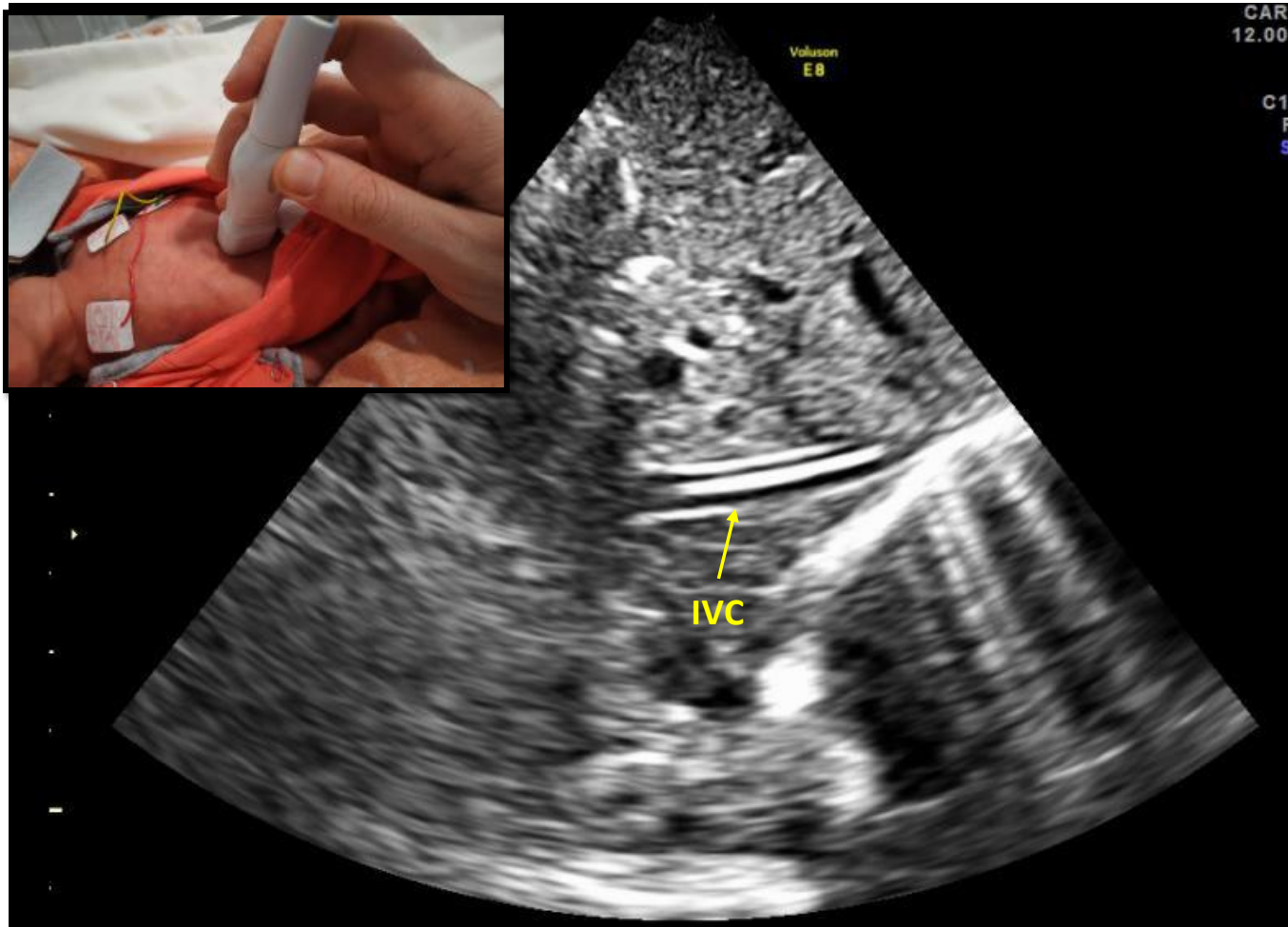
Tip location protocol:

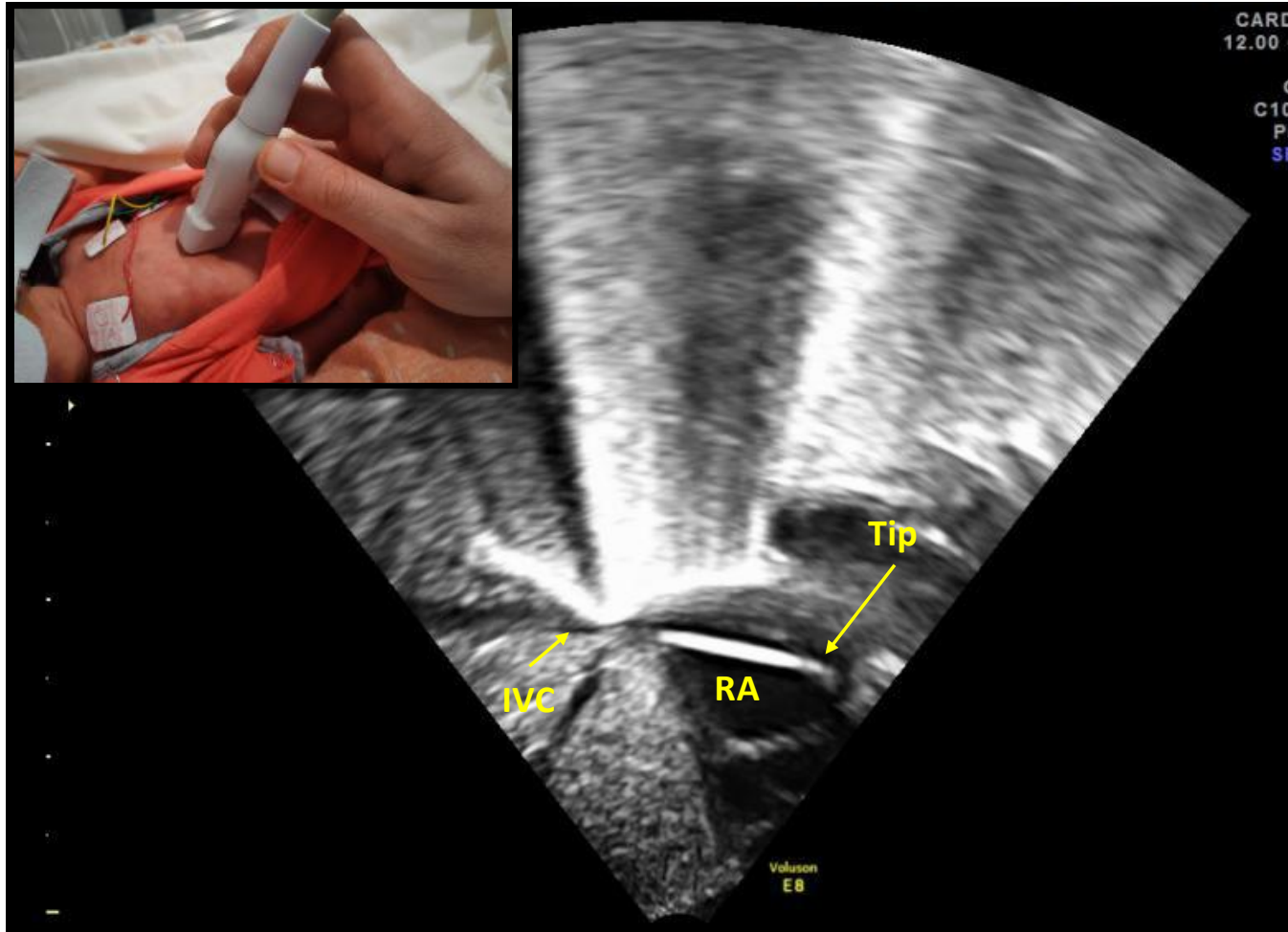
Probe: Small sectorial probe, 7-8 MHz

Acoustic window: subcostal longitudinal view. This view allows visualization of IVC and RA.

Procedure: the tip is followed until it reaches the target zone, i.e. the transition between IVC and RA. A small flush of normal saline (0.5-1 ml) may help visualizing the tip.







Neo-ECHOTIP for ECC: The training

Advanced training is necessary to complete this maneuver with RT-US.

Clinical studies on RT-US for tip location of ECCs show a direct correlation between the level of expertise of the clinician and the percentage of successful tip visualization

GaVePed proposal

1. Basic knowledge of targeted neonatal echocardiography and advanced vascular ultrasound assessment (in particular, the RaCeVA, RaPeVA and RaFeVA protocols).
2. Advanced theoretical training, including the evaluation of several clinical case scenarios (at least 12 hours).
3. Practical training supervised by a neonatologist with expertise in ultrasound-based tip location of ECCs (at least 50 cases).

Neo Echo Tip protocol

Table 1. Summary of Neo-ECHO tip.

Catheter	Protocol	Probe	Windows
UVC	Tip navigation	Small sectorial probe, 7–8 MHz	Low subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
ECCs inserted via veins of the scalp or of the upper limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA and RaPeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
ECCs inserted via veins of the lower limbs	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Short and long axis view of the femoral vein
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
CICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Acoustic windows of RaCeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC
FICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz and small sectorial probe	Short and long axis view of the femoral vein and subcostal longitudinal view
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view

UVC: umbilical venous catheter; ECC: epicutaneo-caval catheter; RaCeVA: rapid central vein assessment; RaPeVA: rapid peripheral vein assessment; CICC: centrally inserted central catheter; FICC: femoral inserted central catheter.

IC ECG or US???

Reasons for using RT-US during CICC and FICC placement in newborns:

1. RT-US allows both tip navigation and tip location.
2. RT-US can easily rule-out primary malposition, such as the accidental direction of the catheter into the opposite brachio-cephalic vein.
3. RT-US is an effective rescue strategy when the intracavitary ECG is not applicable (for instance in newborns with atrial flutter).
4. RT US is the only way to evaluate the tip location of a FICC when the tip is scheduled to be inside the IVC.

Neo-ECHOTIP for CICC

Tip navigation protocol:

Probe: linear 'hockey stick' probe, 10-14 MHz.

Acoustic windows: same acoustic windows of the RaCeVA protocol, including proper visualization of the brachio-cephalic veins in long axis on both sides.

Procedure: During CICC placement, the brachio-cephalic vein and the SVC should be clearly visualized.

- the needle is visualized during the venipuncture.
- the guidewire is visualized as it passes into the brachio-cephalic vein and into the SVC. It is recommended at this stage also to rule out pneumothorax.
- the micro-introducer is visualized inside the brachio-cephalic vein.
- the catheter is visualized inside the brachio-cephalic vein and then inside the SVC.

Review

JVA | The Journal of
Vascular Access

Rapid Central Vein Assessment (RaCeVA): A systematic, standardized approach for ultrasound assessment before central venous catheterization

Timothy R Spencer¹ and Mauro Pittiruti²

The Journal of Vascular Access

1-11

© The Author(s) 2018

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/1129729818804718

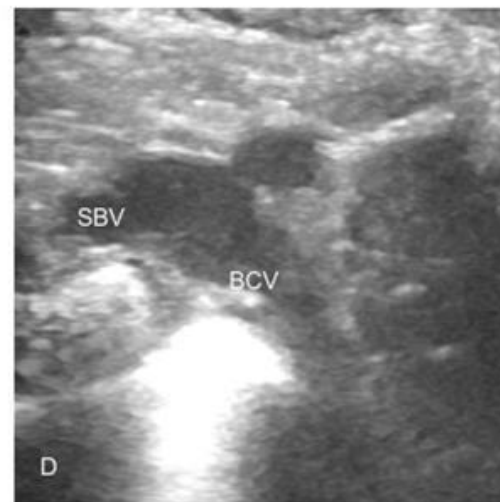
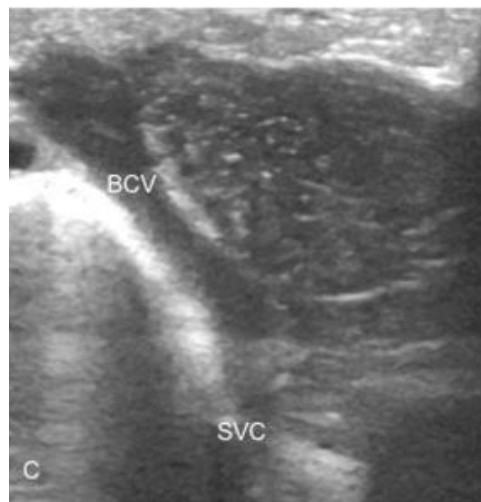
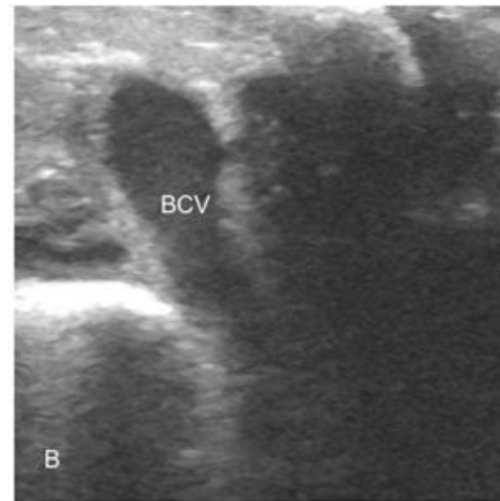
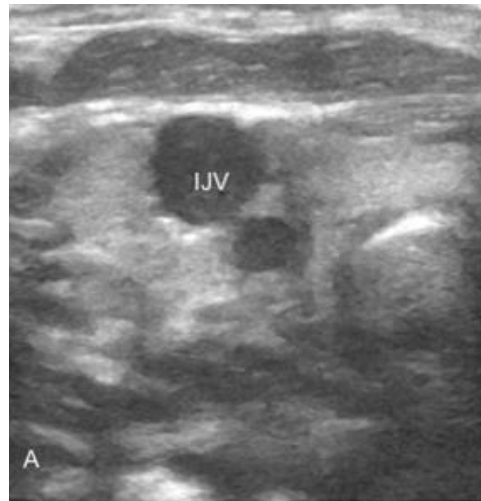
journals.sagepub.com/home/jva

 SAGE

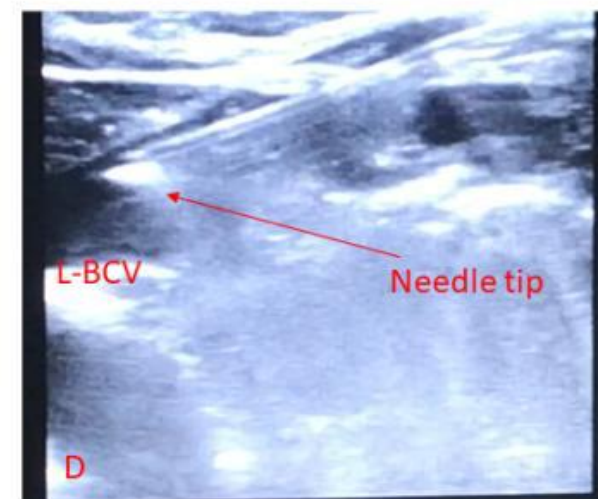
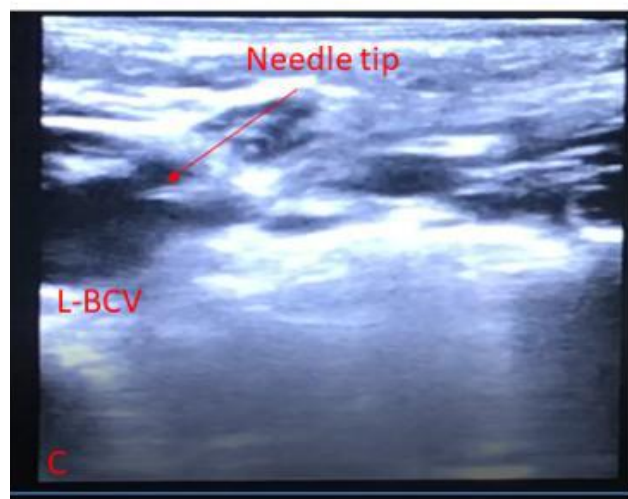
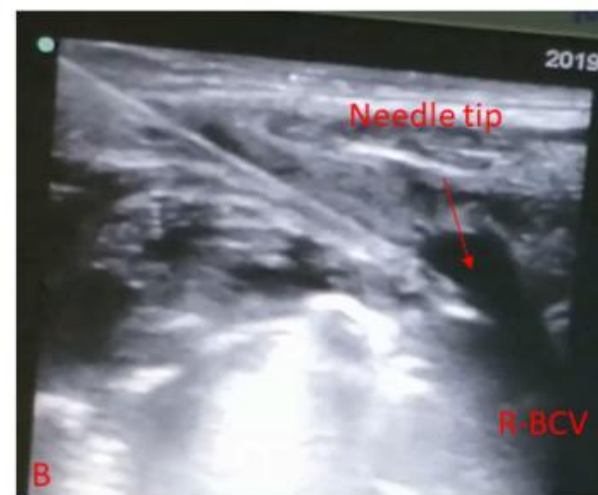
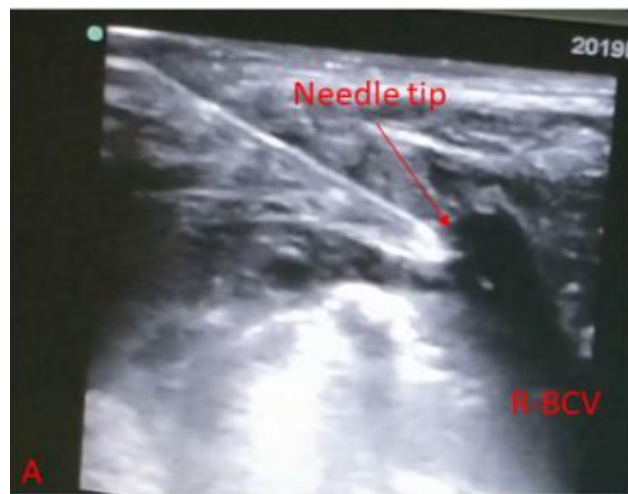
Table 1. The seven steps of the Rapid Central Vein Assessment (RaCeVA).

	Transducer position	Structures to be assessed	Surrounding structures
Step 1	Mid-neck (transverse)	Internal jugular vein Carotid artery	Thyroid gland Trachea
Step 2	Base of neck (transverse)	Internal jugular vein Carotid artery Subclavian artery	Trachea Phrenic and vagus nerve
Step 3	Sternoclavicular (transverse)	Internal jugular vein Brachiocephalic vein	Pleura (mediastinum) Phrenic nerve
Step 4	Supraclavicular (longitudinal)	Subclavian vein Subclavian artery External jugular vein	Pleura (lung apex)
Step 5	Infraclavicular (transverse)	Axillary vein Axillary artery Cephalic vein	Pleura Ribs
Step 6	Infraclavicular (longitudinal)	Axillary vein Axillary artery	Pleura Ribs
Step 7	Sliding lung (longitudinal)	Pleura (anterior chest wall)	Ribs

RaCeVa



Tip navigation 1



Ris
S MB

M-Turbo

2019Mar12 09:22

- Ven
SLA



99%

IM

0,8

ITT

0,1

-A

Ris



0

MB On



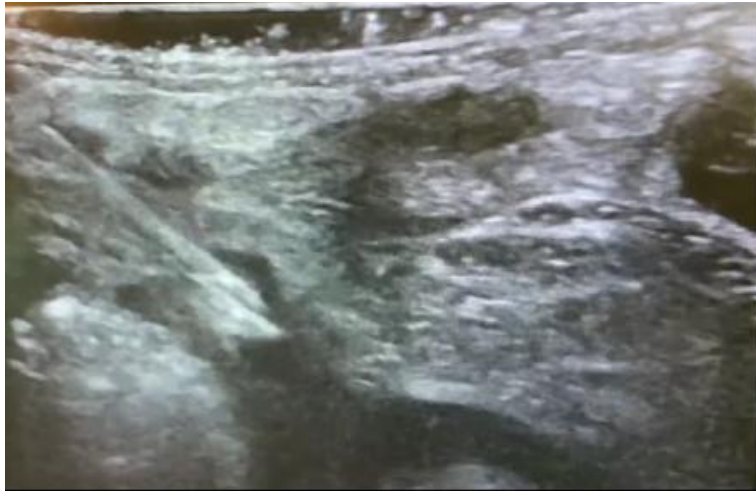
A close-up photograph of a surgical procedure. A gloved hand is visible on the left, holding a blue surgical drape. Another gloved hand is at the bottom, holding a thin, dark, flexible metal guide. The guide is being inserted into a surgical incision. The incision reveals a reddish, fleshy internal structure, possibly a tendon or muscle. A white, spongy material is visible at the base of the incision. The background is a blue surgical drape.

Inserzione della guida metallica

An intraoperative photograph showing a surgical procedure. A surgeon's gloved hands are visible, manipulating a thin, blue microintroducer. The introducer is being inserted into a small, rectangular incision in the skin, which reveals underlying red, fleshy tissue. The surgical field is draped in blue sterile cloth. A blue surgical instrument is also visible near the incision. The text "inserzione del microintroduttore" is overlaid in yellow at the bottom of the image.

inserzione del microintroduttore

Tip navigation



Neo-ECHOTIP for CICC

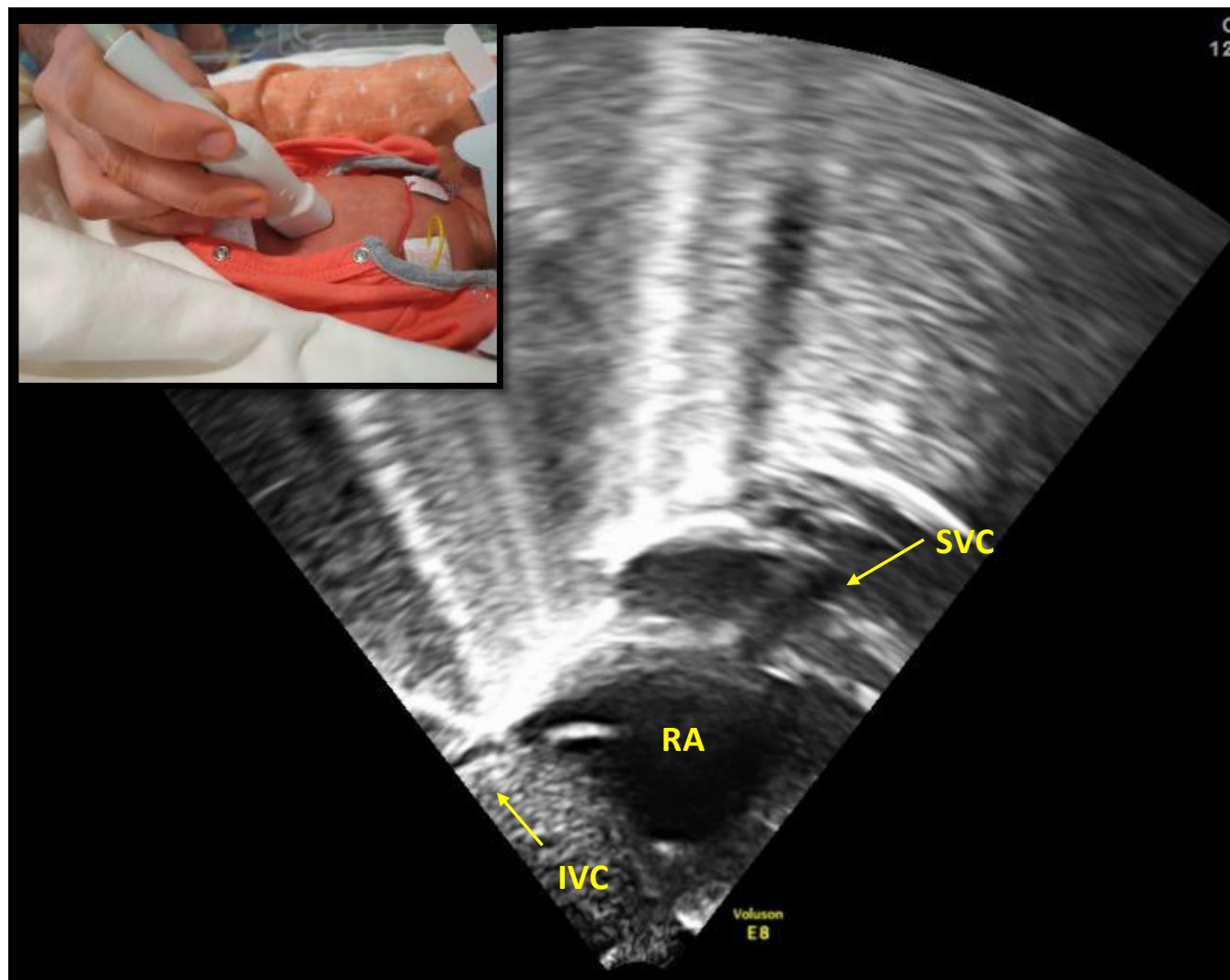
Tip location protocol:

Probe: Small sectorial probe, 7-8 MHz

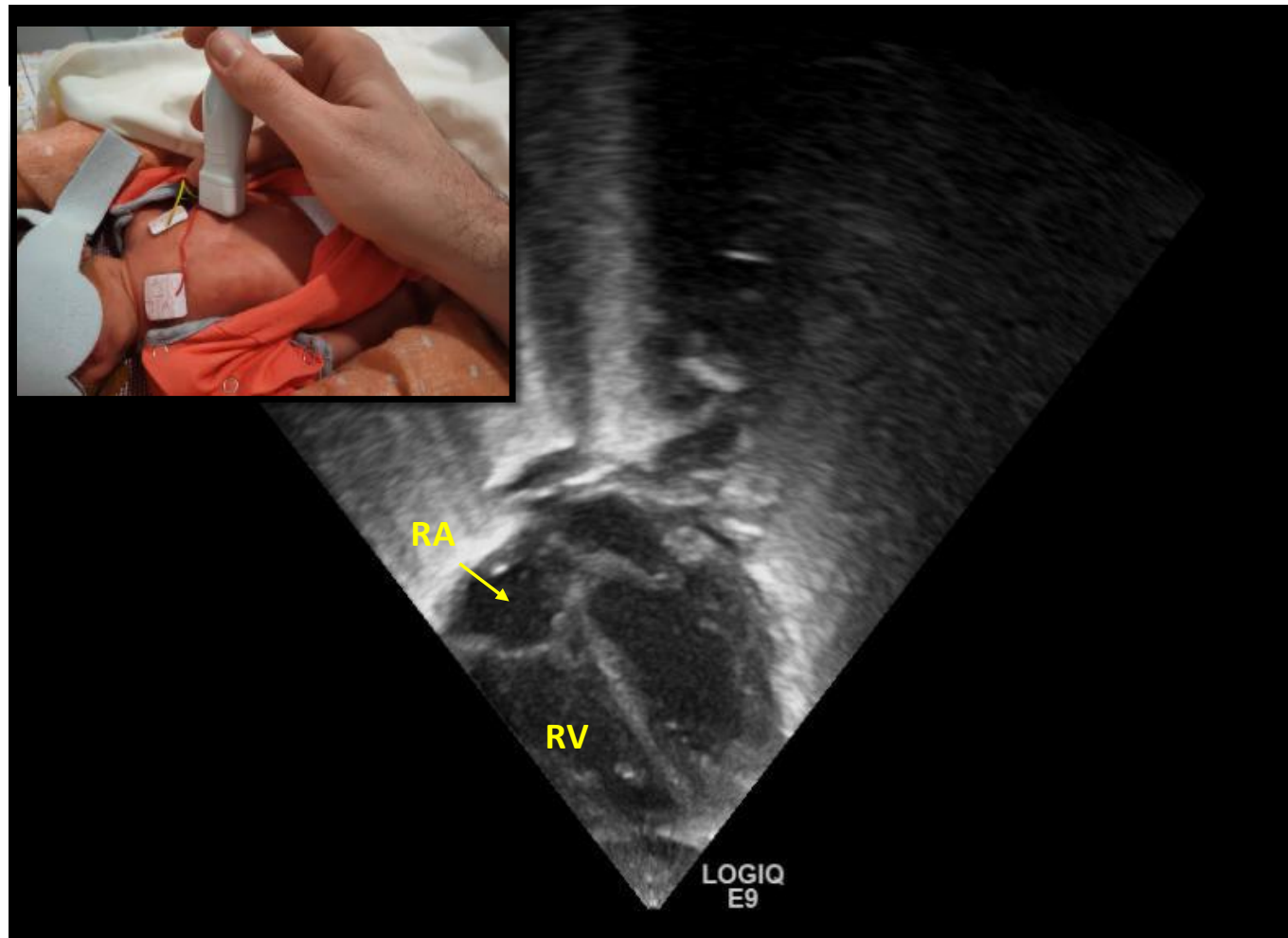
Acoustic windows: three different windows are recommended to locate accurately the tip of the catheter. The most useful ones are the subcostal longitudinal view ('bi-caval' view), the four-chamber apical view, and the long axis view of SVC.

Procedure: follow the catheter tip until it reaches the target zone, i.e., the transition between SVC and RA. A small flush of normal saline (0.5-1 ml) may help confirming the tip position.

4



5



6.0cm

2D

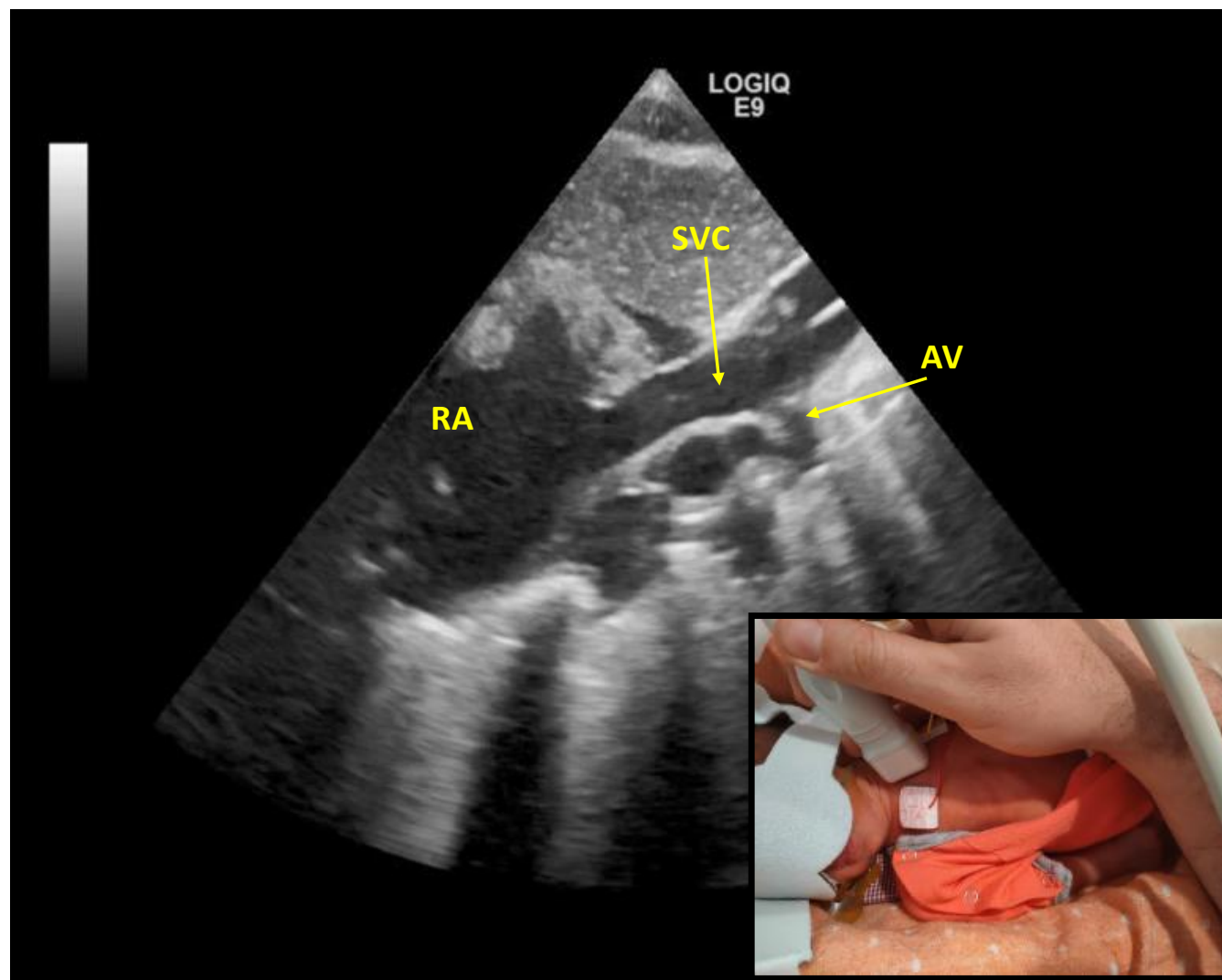
67%
C 50
P Off
AGen

PLAX



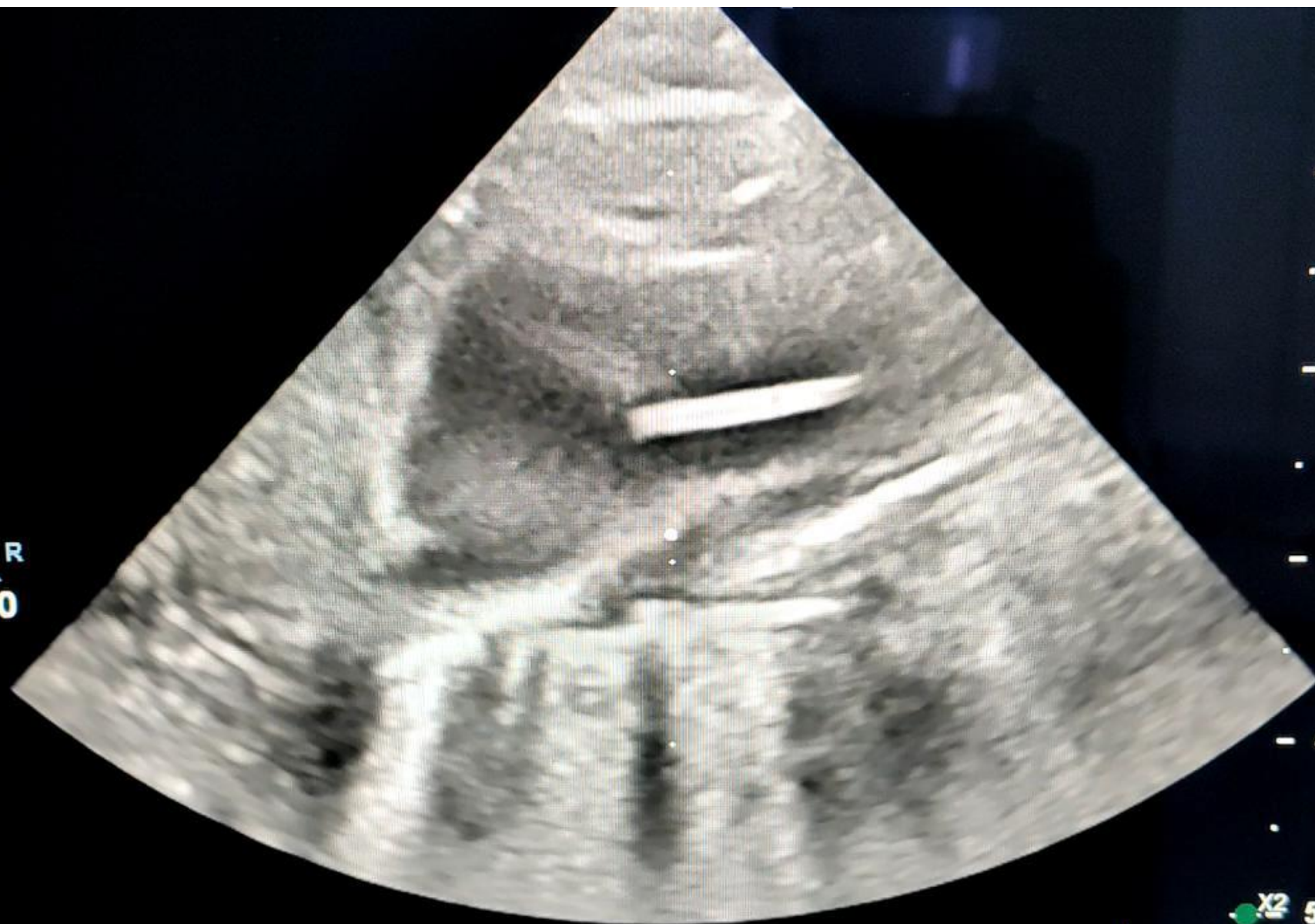
P

6



2D
80%
C 50
P Off
AGen

Ⓒ
P R
3.0 6.0



- 1

- 2

- 3

- 4

6

X2 5

2D
80%
C 50
P Off
AGen



X2 5

5



Neo-ECHOTIP for FICC

1. Tip navigation protocol:

Probe: linear 'hockey stick' probe, 10-14 MHz

Acoustic window: **RaFeVa**

Procedure: During FICC placement, the femoral vein should be clearly visualized.

- the needle is visualized during the venipuncture
- the guidewire is visualized as it passes through the femoral vein (long axis).
- the micro-introducer is visualized inside the femoral vein
- the catheter is visualized inside the femoral vein and then inside the iliac vein.

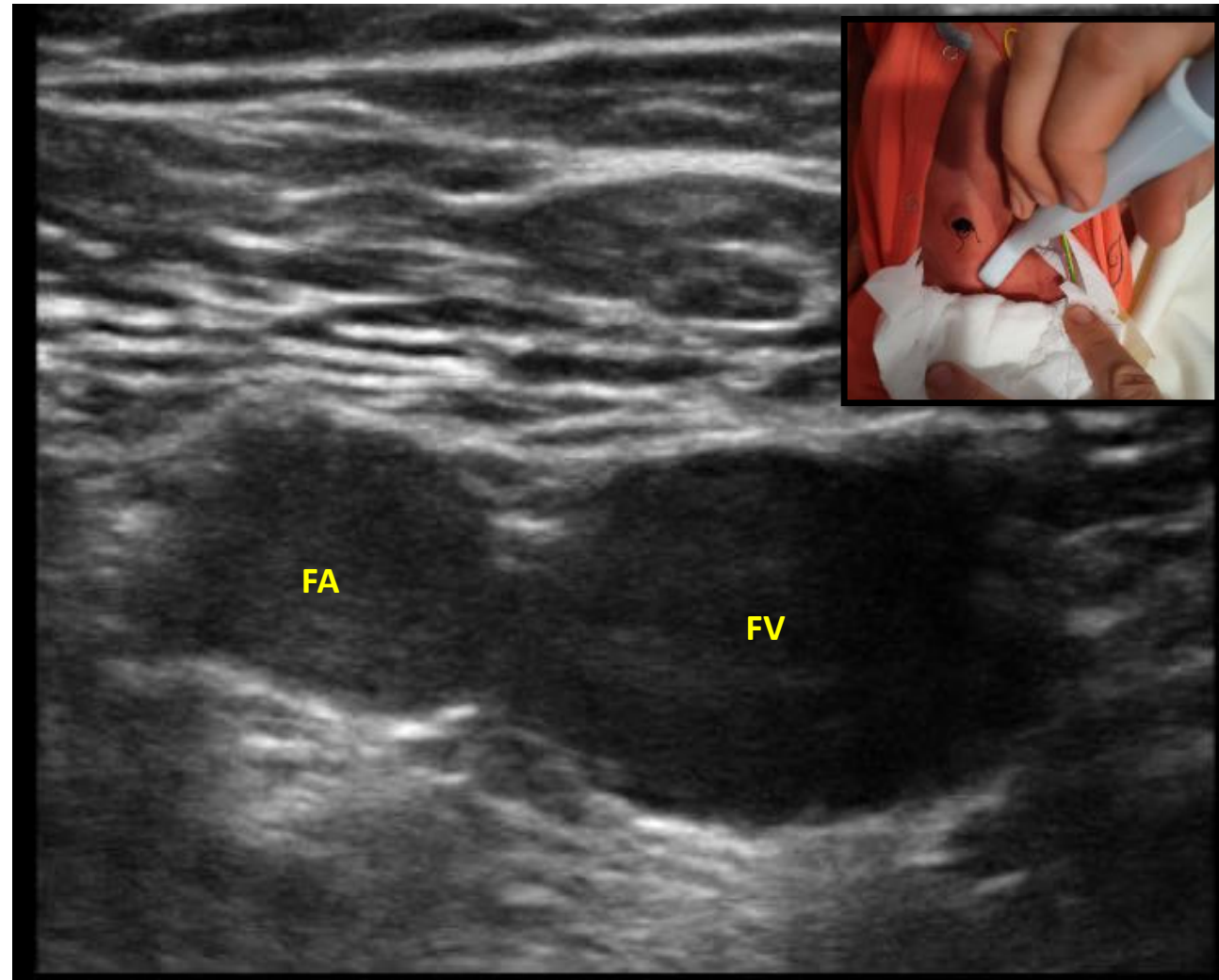
**Rapid Femoral Vein Assessment
(RaFeVA): A systematic protocol for
ultrasound evaluation of the veins of the
lower limb, so to optimize the insertion
of femorally inserted central catheters**

**Fabrizio Brescia¹ , Mauro Pittiruti² , Matthew Ostroff³ 
and Daniele G Biasucci⁴**

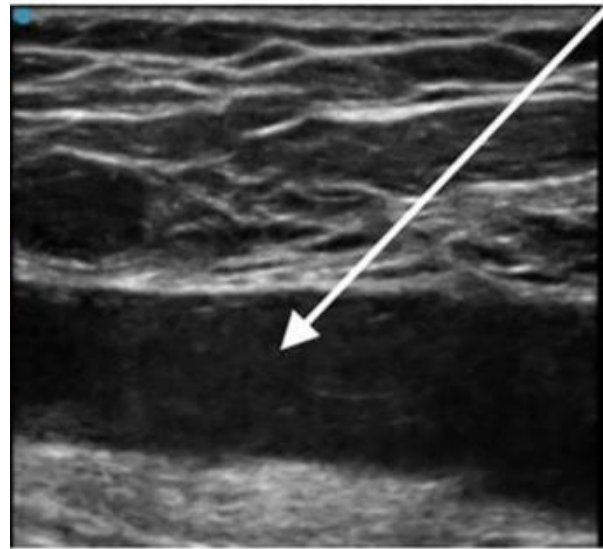
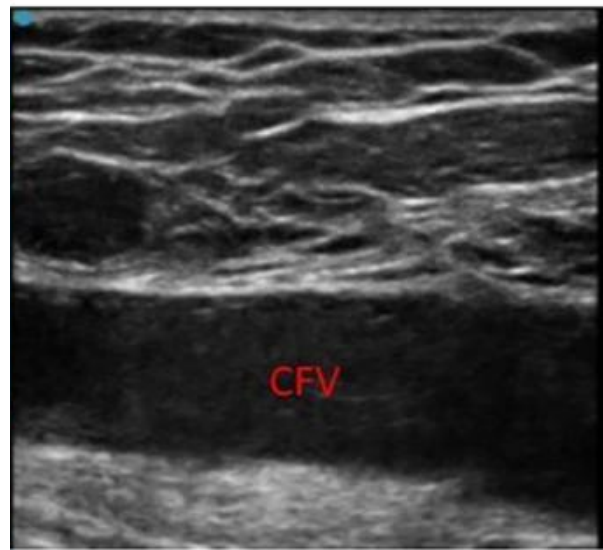
Table 1. The seven steps of the Rapid Femoral Vein Assessment (RaFeVA).

	Vascular structures to be assessed	Visualization of the vein
Step 1	Common femoral artery Common femoral vein	Short axis
Step 2	Common femoral vein	Long axis
Step 3	External iliac vein Common femoral artery	Short axis Common femoral vein Saphenous vein
Step 4	Superficial femoral artery Deep femoral artery Common femoral vein	Short axis
Step 5	Superficial femoral artery Deep femoral artery Superficial femoral vein Deep femoral vein	Short axis
Step 6	Superficial femoral artery Superficial femoral vein	Short axis
Step 7	Superficial femoral artery Superficial femoral vein	Oblique axis

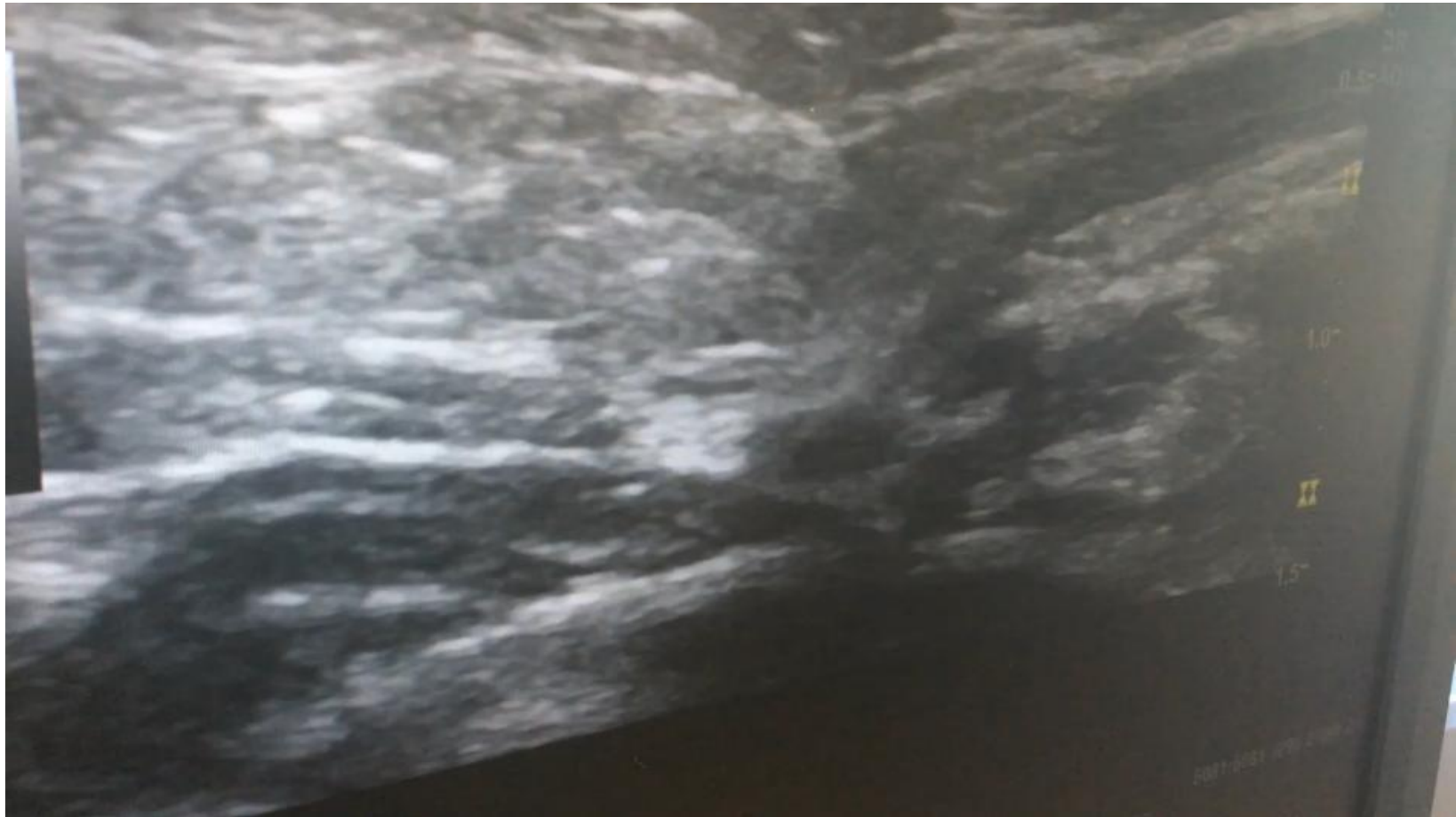
Step 1



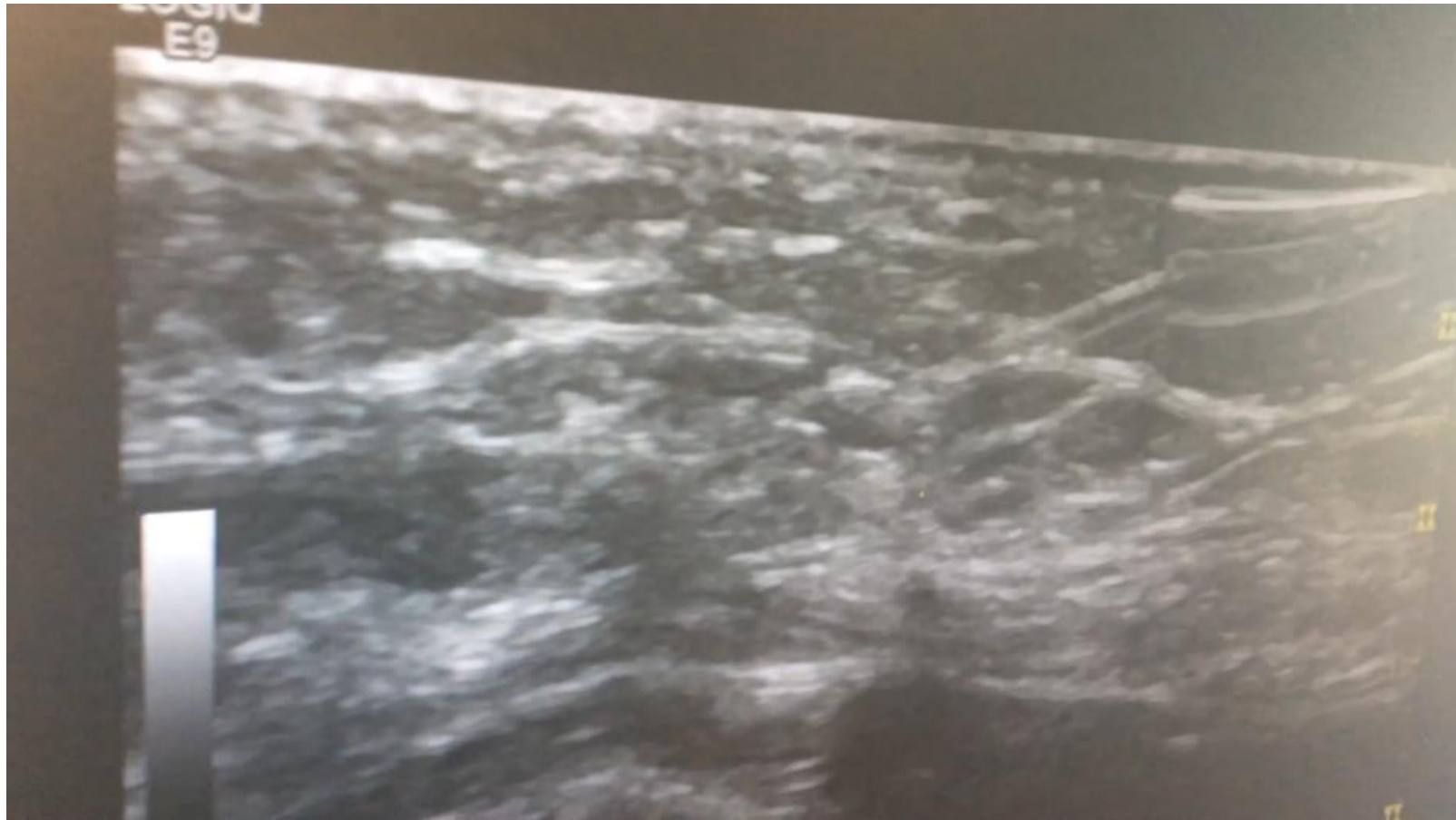
Step 2



Tip Navigation



Tip Navigation



Neo-ECHOTIP for FICC

Tip location protocol - A:

Probe: Small sectorial probe, 7-8 MHz

Acoustic window: subcostal longitudinal view. It's mandatory to visualize properly the IVC.

Procedure: the catheter tip is visualized as it passes through the IVC.

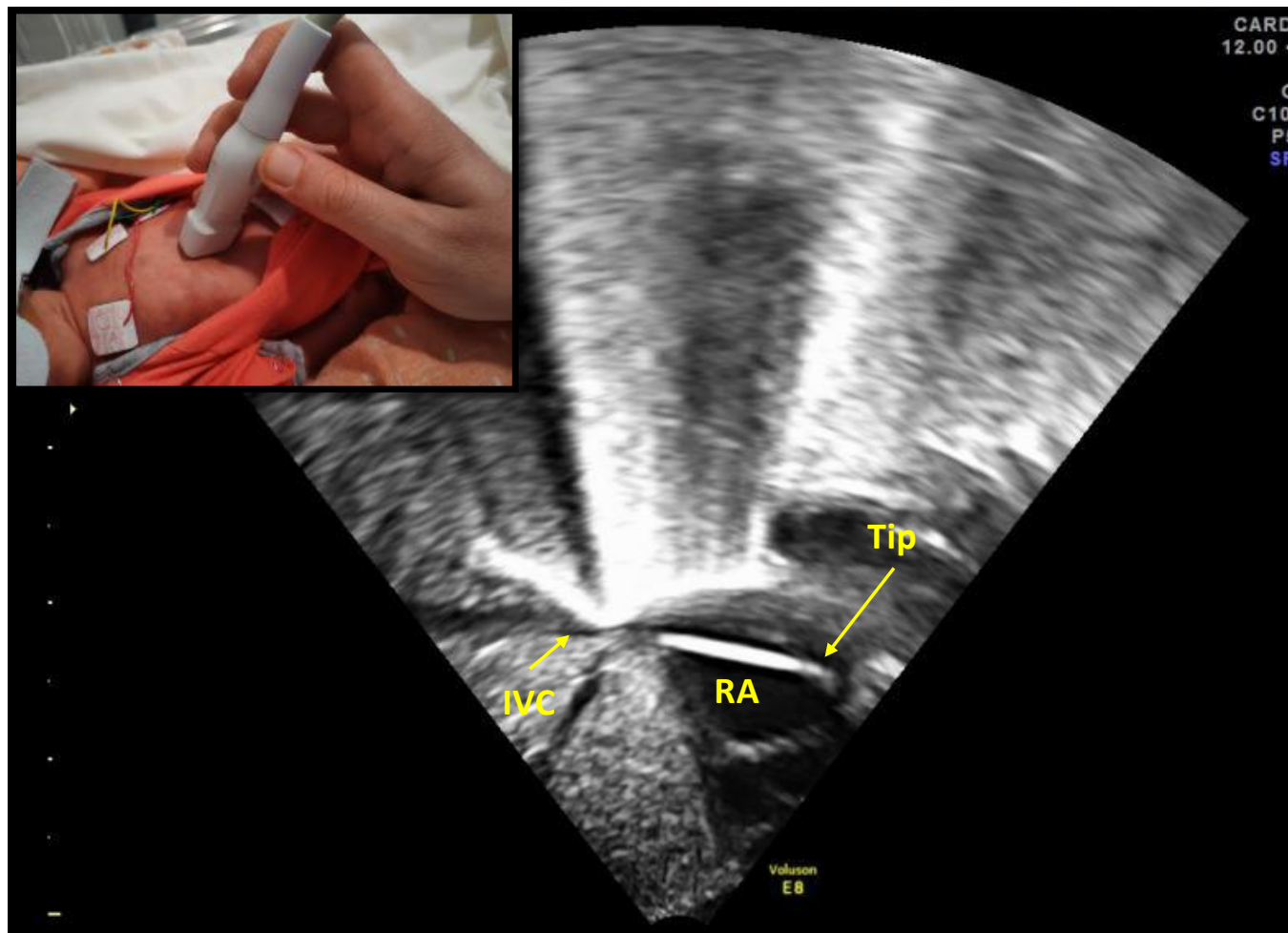
If hemodynamic monitoring is not required, the catheter tip of the FICC is placed below the renal veins

Tip location protocol B:

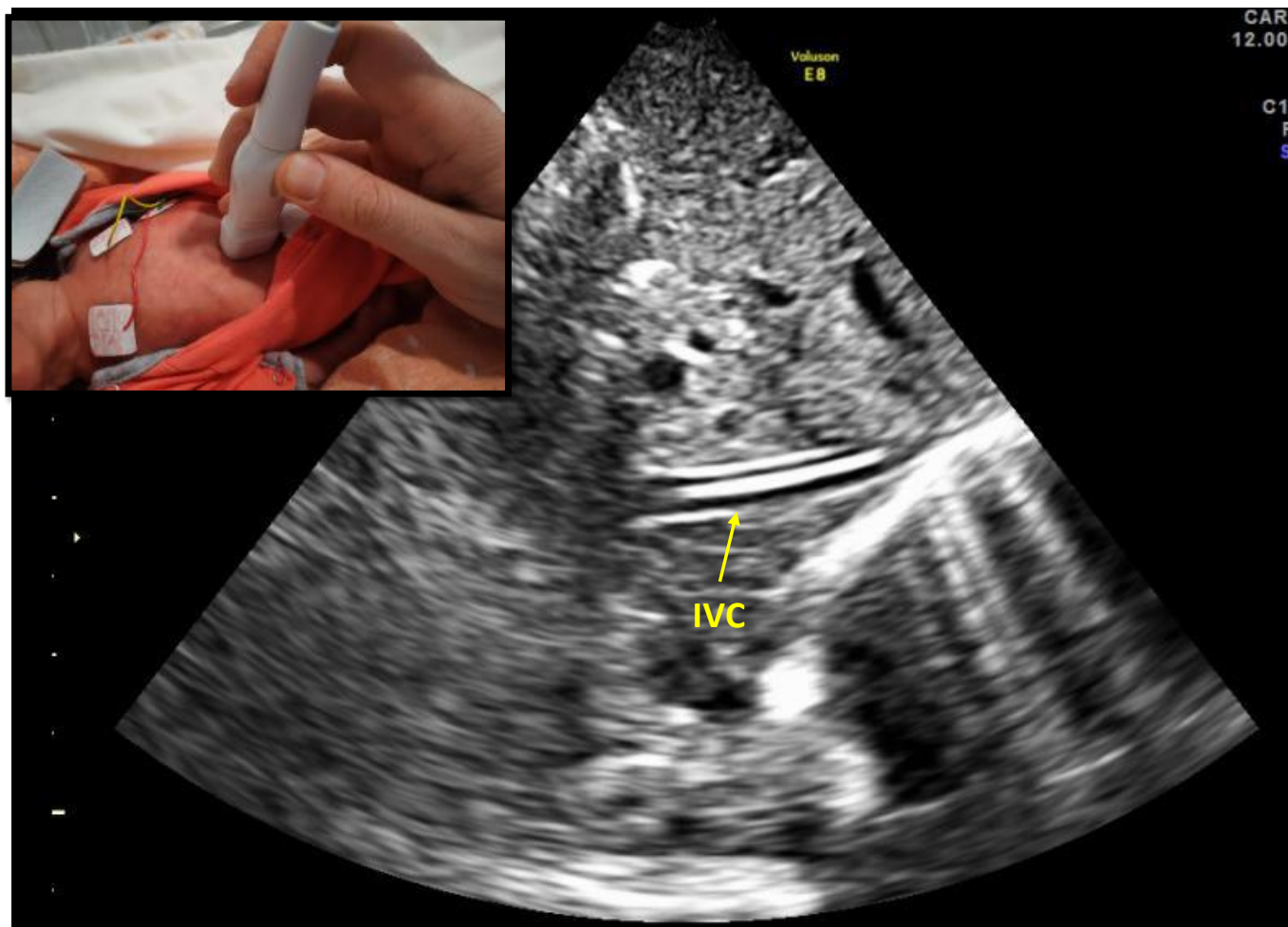
Probe: Small sectorial probe, 7-8 MHz

Acoustic window: subcostal longitudinal view, so to visualize IVC and RA.

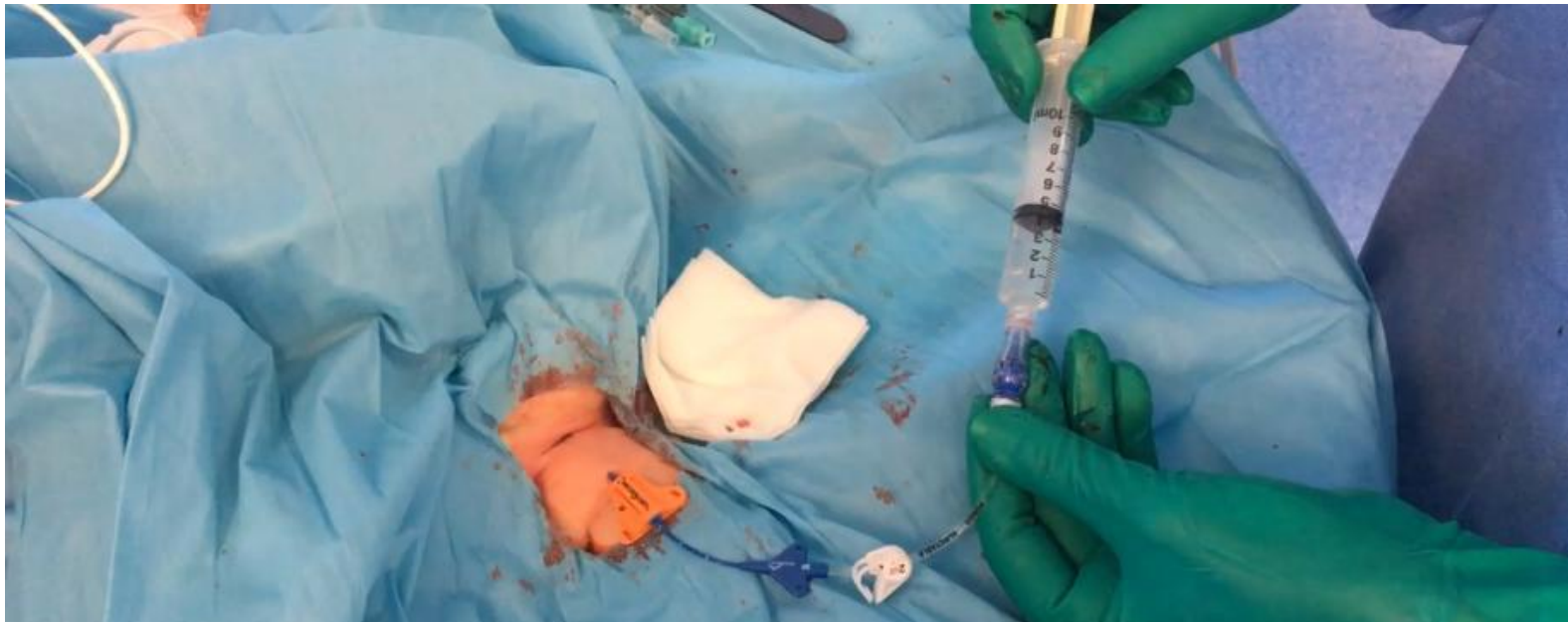
Procedure: the catheter tip is visualized as it reaches the target zone, i.e., the transition between IVC and RA. A small flush of normal saline (0.5-1 ml) may help visualizing the tip



9



Bi-Caval view



Take Home Message

Neo-Echo Tip is stepwise and standardized procedure, potentially useful to perform both ultrasound-based tip navigation and tip location, in all central venous access devices currently used in NICU.

Some of these maneuvers are easy and require only a minimal training, while some others imply a well-trained operator with more than basic knowledge in the field of vascular ultrasound and echocardiography.

Training is the main open question.

Ultrasound-based tip location will have an increasingly important role for CVAD in NICU, considering its many advantages in terms of accuracy, cost-effectiveness and safety.

THANK YOU

GRACIAS
ARIGATO
SHUKURIA
GOZAIMASHITA
EFCHARISTO
JUSPAXAR
DANKSCHEEN
TASHAKKUR ATU
YAQHANYELAY
SUKSAMA
EKHMET
MEHRBANI
MAAKE
GRAZIE
PALDIES
BOLZİN
MERCI
BIYAN
SHUKRIA
TINGKI
SPASSIBO
SNACHALHYA
MURUH
CHALTU
WADEEJA
MAITEKA
HUI
YUSPAGABATAM
SHAHYABAD
ANIMA
ATTO
SPASIBO
DENKAUJA
NEHACHALHYA
SHALCHEER
SHUKRI
GU
HATUR
ENOU
SIKOMO
MAHETU
MINMOHCHAB
FAKAAR
AGUYJE
KOMAPSUMNIDA
GAJTHO
MEBASTAHY
TAVYAPUCH
MEDAHAGSE
BAWA
SAKCO
LAH

