



V Convegno
Nazionale
GAVePed



Accessi venosi
nel neonato e
nel bambino

Palacongressi, Rimini
15-16 maggio 2023



Ecoscopia e bubble test per la verifica della posizione della punta di CICC e FICC nel neonato

Dott.ssa A.Capasso

U.O.C. Neonatologia e Terapia Intensiva Neonatale - Napoli

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UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

Tip location

CICC: Giunzione cavo-atriale, tratto inferiore cava
FICC: posizione centrale giunzione cavo atriale inferiore
**Posizione periferica sopra le renali sotto lo sbocco
dell'epatica in cava**

Infusion Therapy Standards of Practice

Lisa A. Gorski, MS, RN, HHCNS-BC, CRNI®, FAAN
Lynn Hadaway, MEd, RN, NPD-BC, CRNI®
Mary E. Hagle, PhD, RN-BC, FAAN
Daphne Broadhurst, MN, RN, CVAA(C)
Simon Clare, MRes, BA, RGN
Tricia Kleidon, MNSc (Nurs. Prac), BNSc, RN
Britt M. Meyer, PhD, RN, CRNI®, VA-BC, NE-BC
Barb Nickel, APRN-CNS, CCRN, CRNI®
Stephen Rowley, MSc, BSc (Hons), RGN, RSCN
Elizabeth Sharpe, DNP, APRN-CNP, NNP-BC, VA-BC, FNAP, FAANP, FAAN
Mary Alexander, MA, RN, CRNI®, CAE, FAAN

8TH EDITION
REVISED 2021





**RACCOMANDAZIONI GAVeCeLT 2021
PER LA INDICAZIONE, L'IMPIANTO E LA GESTIONE
DEI DISPOSITIVI PER ACCESSO VENOSO**

Verifica intra-procedurale della posizione centrale
della punta (tip location) mediante ECG
intracavitario e/o mediante ecocardioscopia con
bubble test (secondo il protocollo
ECHOTIP)

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Mary Alexander, MA, RN, CR

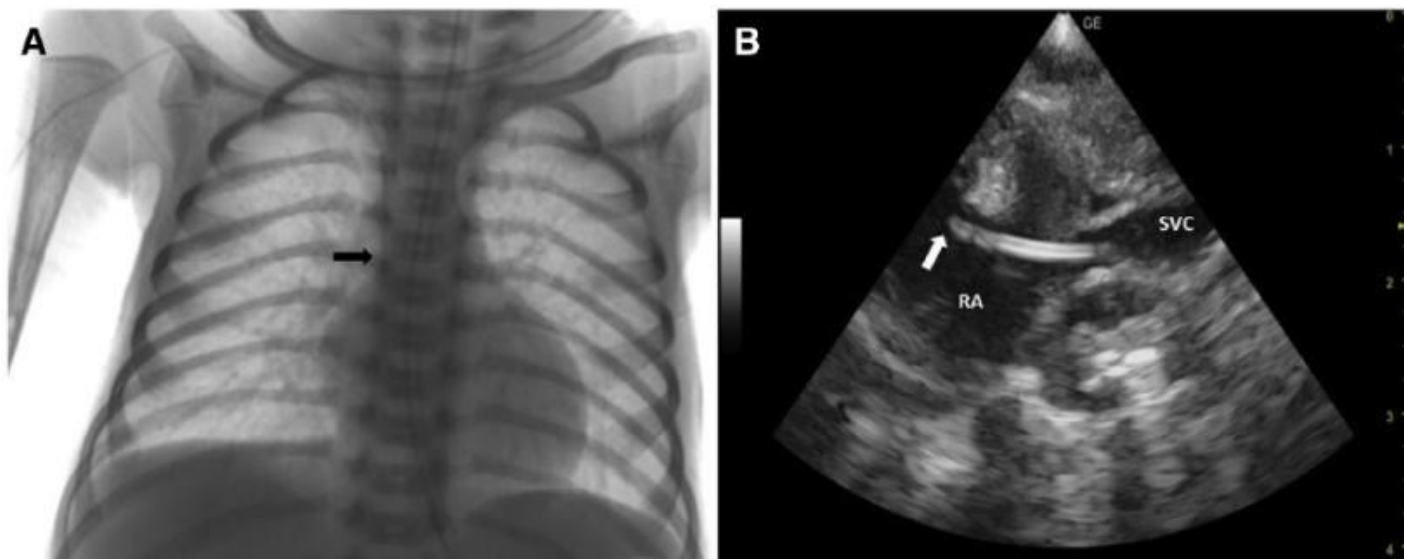
8TH EDITION

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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)
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 CAI



RA, right atrium; SVC, superior vena cava

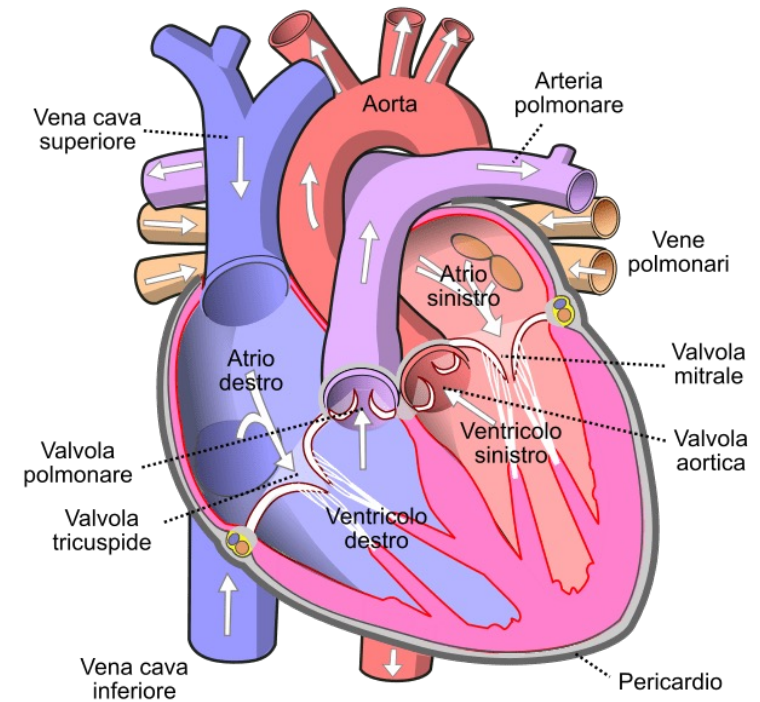
Figure 3. Radiographic and POCUS guided tip location performed on the same patient. **A**, A chest radiograph shows PICC tip in correspondence of landmark of CAJ whereas **B**, the US examination reveals the tip located in the RA. Arrows indicates PICC tip.

Quando richiediamo un Rx torace



Sempre in 2 proiezioni!!!!

Inserzione della cava posteriore



Quando il collega boomer ti dimostra come non perdere tempo...



Internista che fa notare al radiologo che nel quesito clinico dell' RX torace veniva chiesto di scrivere la posizione del CVC



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
CICC	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
	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: rapidly placed epicutaneo-portal vein catheter; CICC: centrally inserted central catheter; FICC: femoral inserted central catheter.

Editorial

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 Iacopone⁵, Antonio La Greca², Geremia Zito Marinosci² and Vito D'Andrea⁶

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The Journal of Vascular Access
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Bubble test

Mix di soluzione fisiologica ed aria
Infusione rapida di circa 0,5-1mL
Comparsa di bolle con evidenza di bolle

Corradi et al. *Critical Care* (2022) 26:113
<https://doi.org/10.1186/s13054-022-03985-3>

Critical Care

RESEARCH

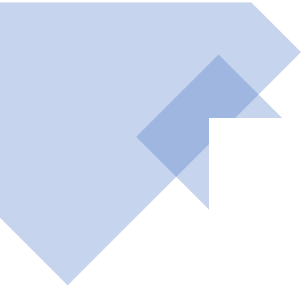
Open Access



Ultrasound localization of central vein catheter tip by contrast-enhanced transthoracic ultrasonography: a comparison study with trans-esophageal echocardiography

Francesco Corradi^{1,10*}, Fabio Guarracino², Gregorio Santori³, Claudia Brusasco⁴, Guido Tavazzi^{5,6}, Gabriele Via⁷, Silvia Mongodi⁶, Francesco Mojoli^{5,6}, Raffaello Umberto Dario Biagini¹, Alessandro Isirdi¹, Federico Dazzi¹, Chiara Robba^{3,8}, Luigi Vetrugno⁹ and Francesco Forfori¹ on behalf of UCARE research group

**Nel neonato sufficiente flush
di fisiologica**



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.
- 

TIP NAVIGATION

1. Tip navigation protocol:

Probe: Linear “hockey stick” probe, 10–14 MHz.

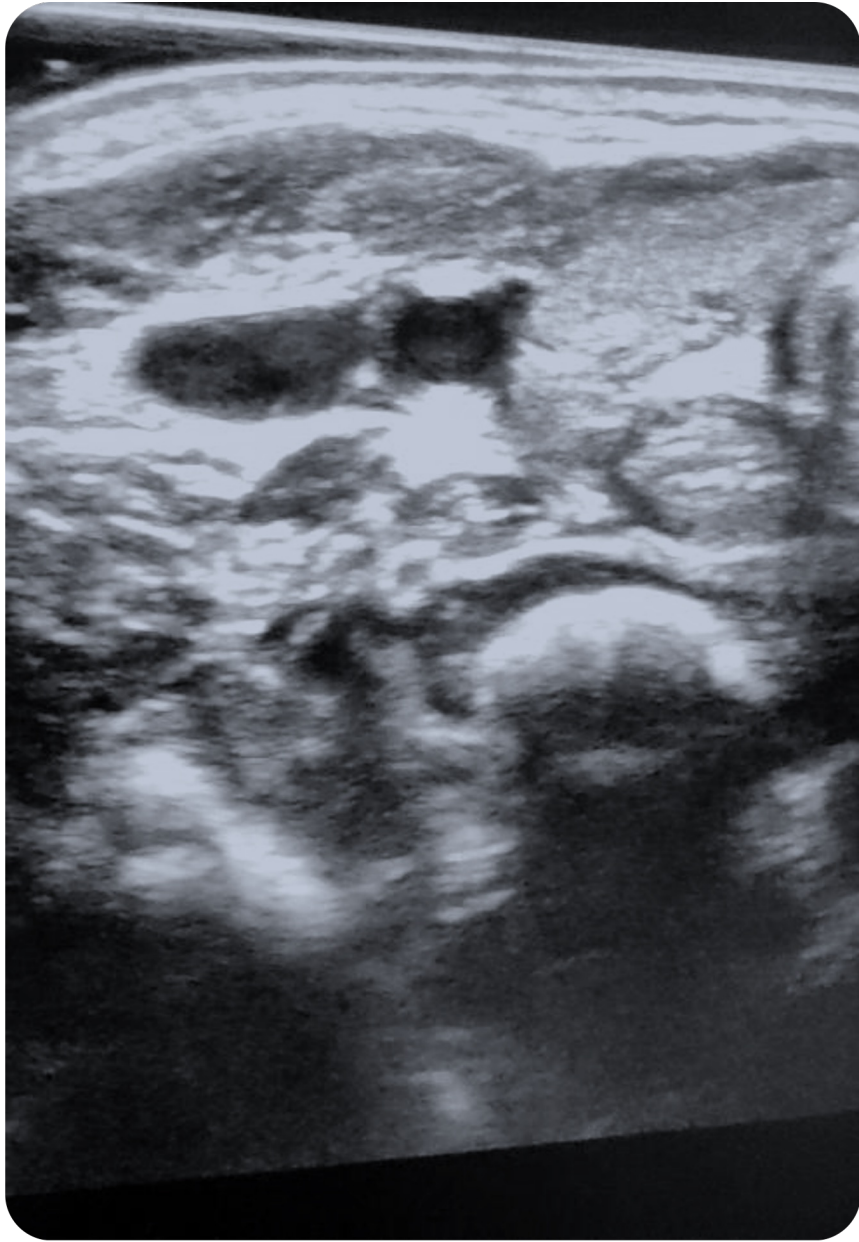
Acoustic windows: Same acoustic windows of the RaCeVA protocol,^{9,10,43} including proper visualization of the brachio-cephalic veins in long axis on both sides.

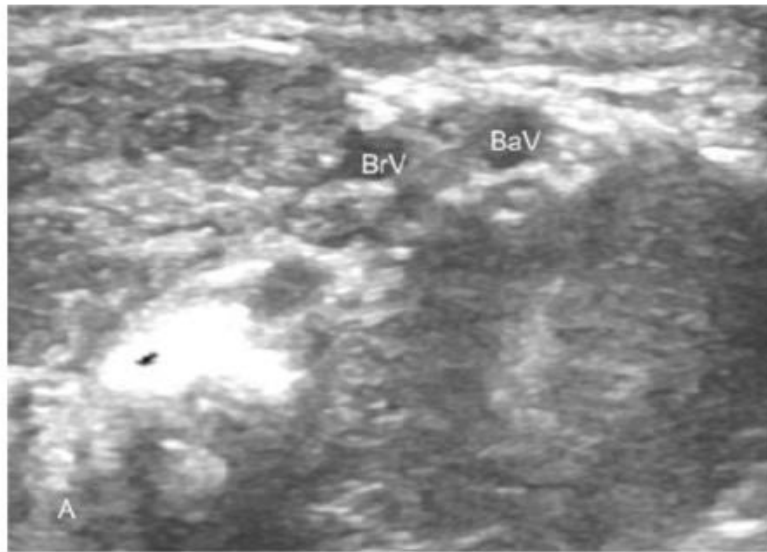
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- The micro-introducer is visualized inside the brachio-cephalic vein.
- The catheter is visualized inside the brachio-cephalic vein and then inside the SVC.

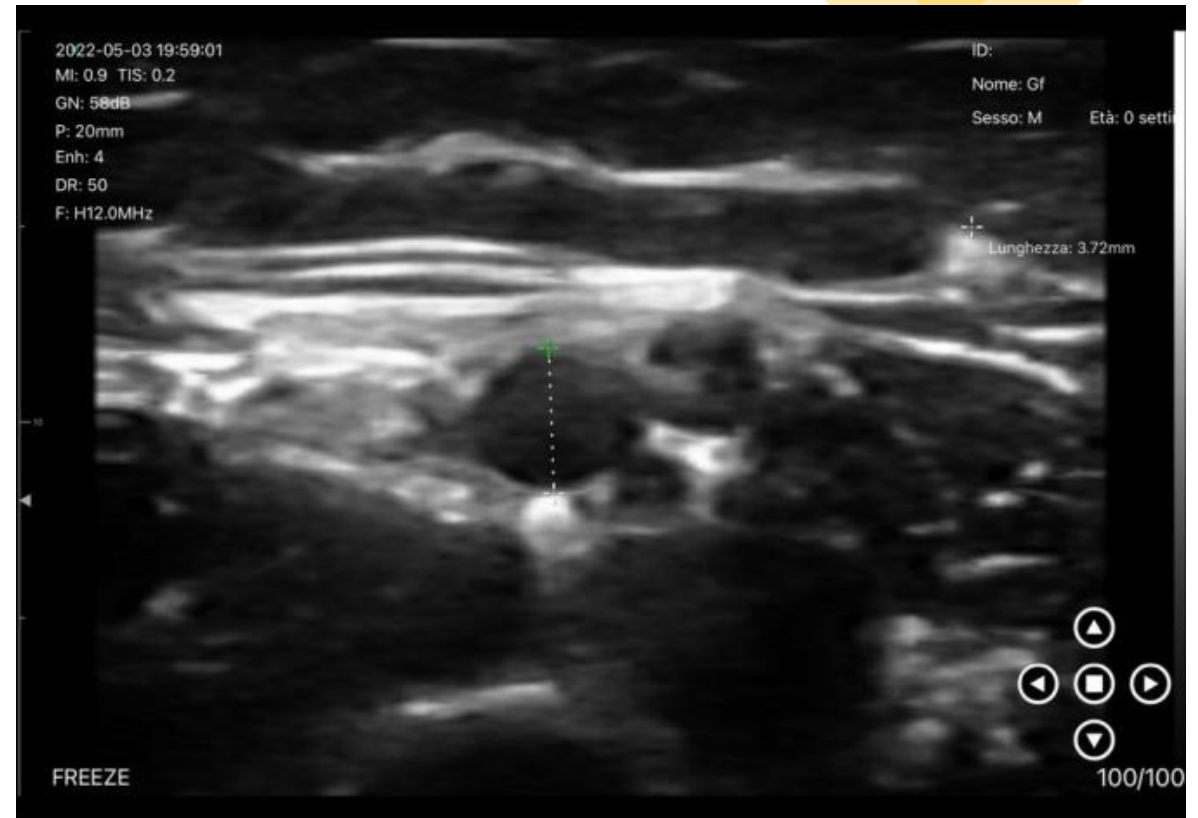








**Curtesy of G.
Barone**



V.Ascellare

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.

Asse lungo della cava sup.





Precision+ A Pure+

0



MI

0 1

0 2

0 3

0 3



Precision+

0

MI

0.9

i10S4

d9.0

104 fps

Qscan

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DR:55

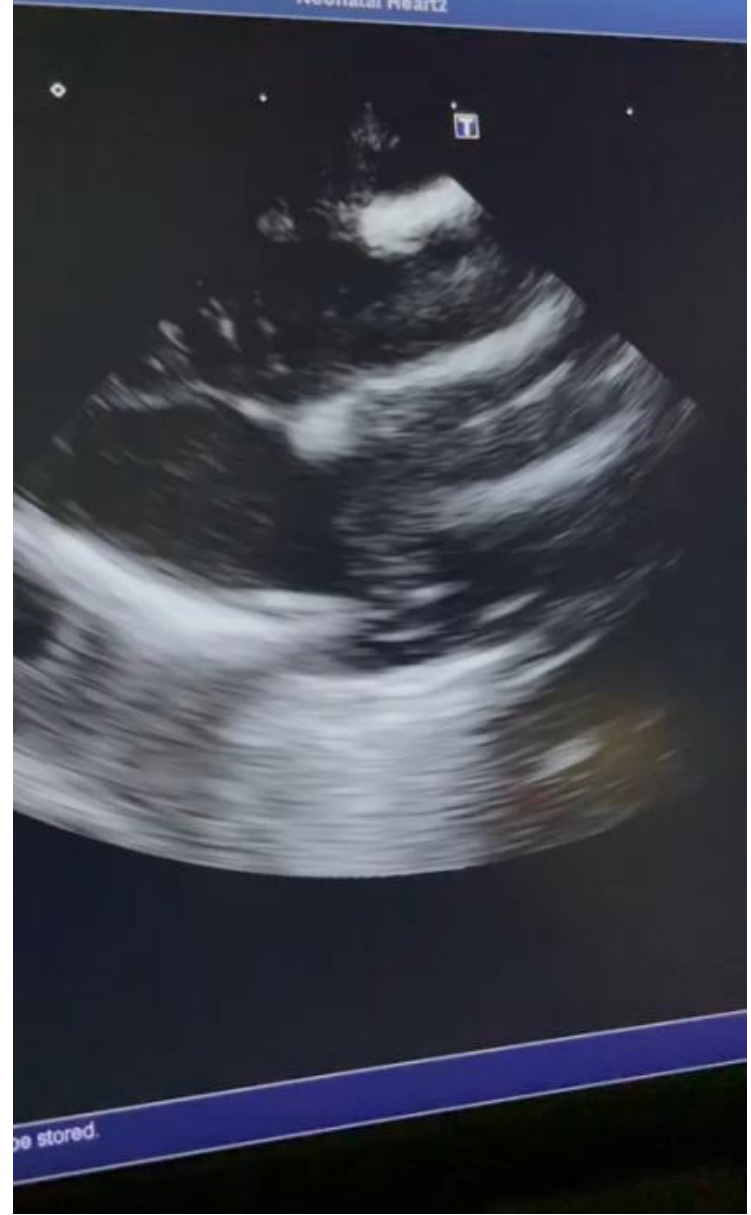
P:4

0 2

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A close-up photograph of a medical procedure being performed on a pig model. A person's hand, wearing a white nitrile glove, is positioned over the pig's side. A green stethoscope is visible, with its chest piece resting on the pig's skin. Several white circular sensors or electrodes are attached to the pig's body with black wires. The pig's skin is reddish-brown. The word "Bicavale" is overlaid in white text in the center of the image.

Bicavale



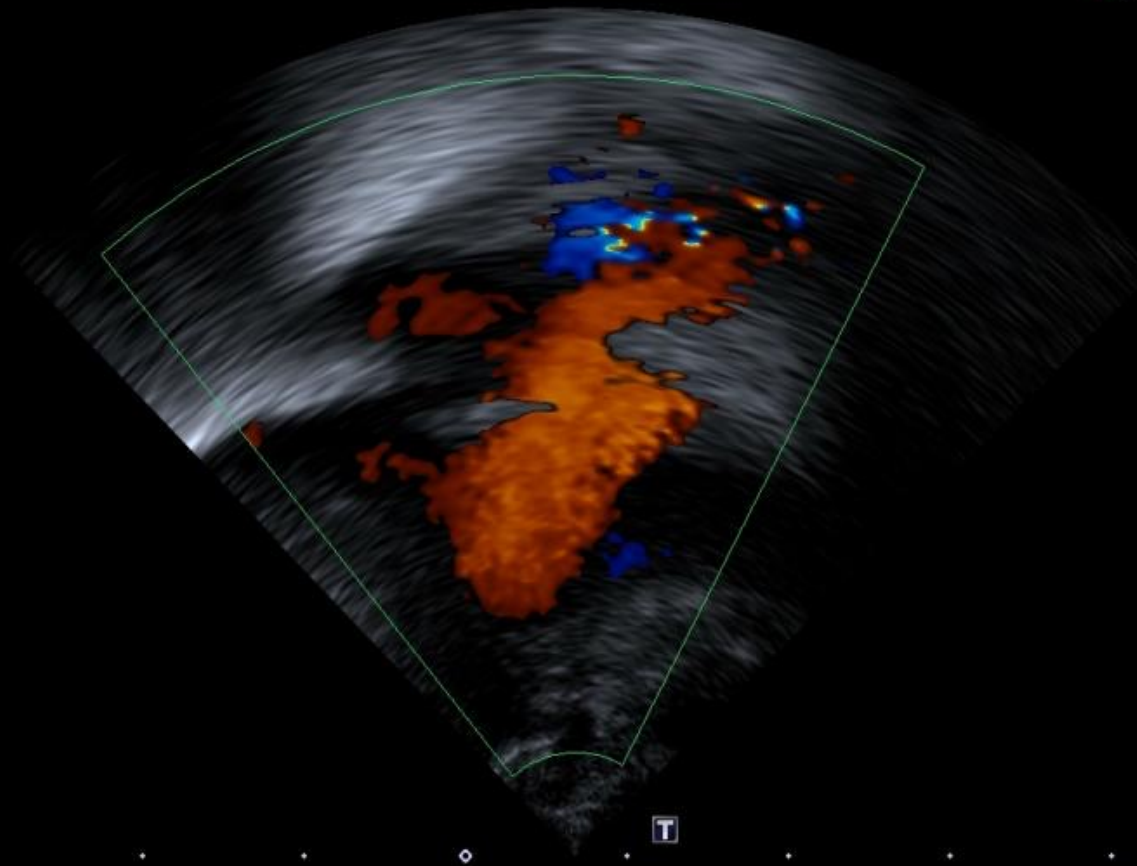
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P10xp/8-4 Cardiaco
IM: 0,6 ITT: 0,8

27 Feb 2023 / 12:50

11,0 cm



2D: G: 50
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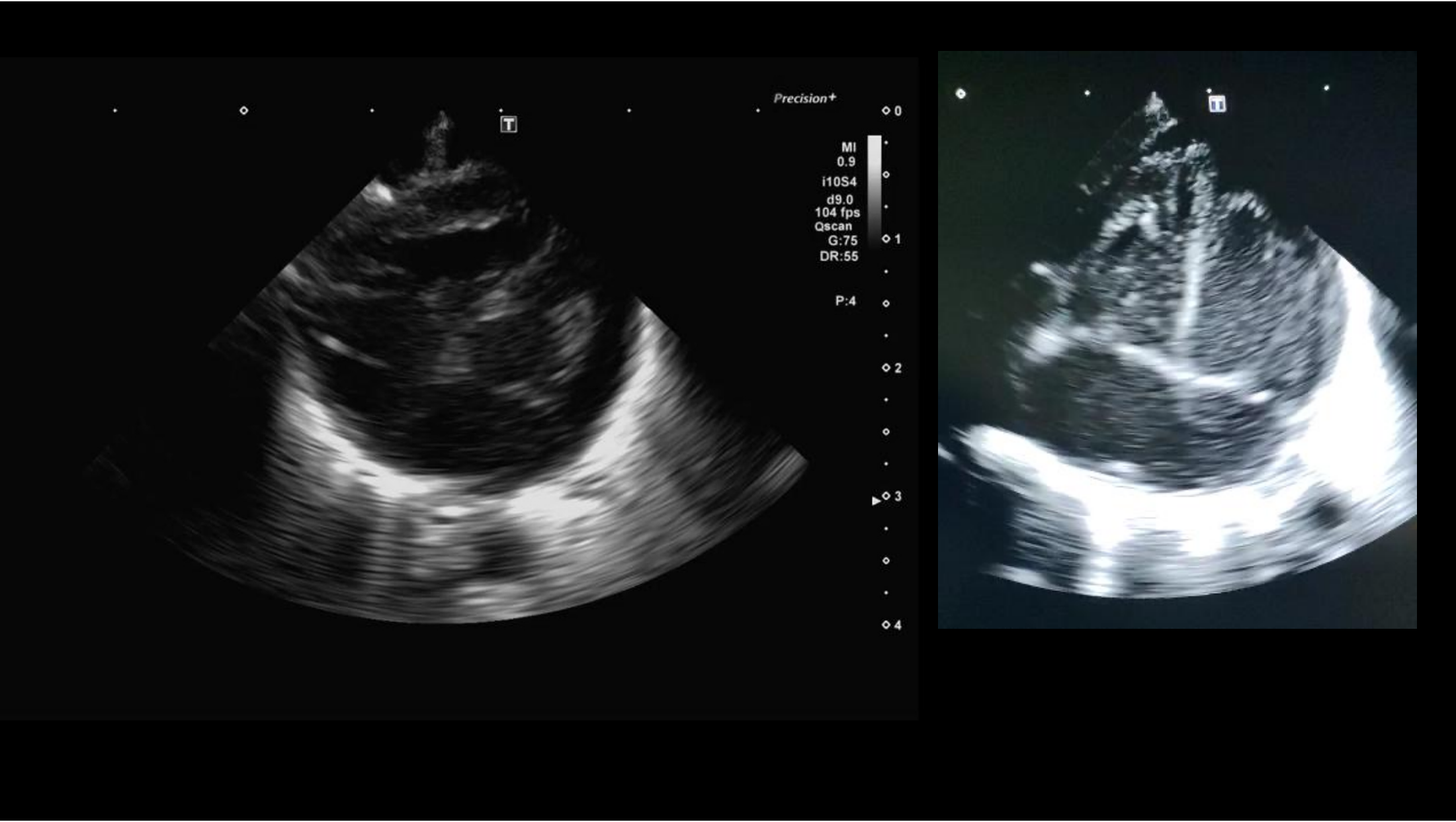


Precision+





Apicale 4 camere



Neo Echo Tip protocol

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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-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.

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.

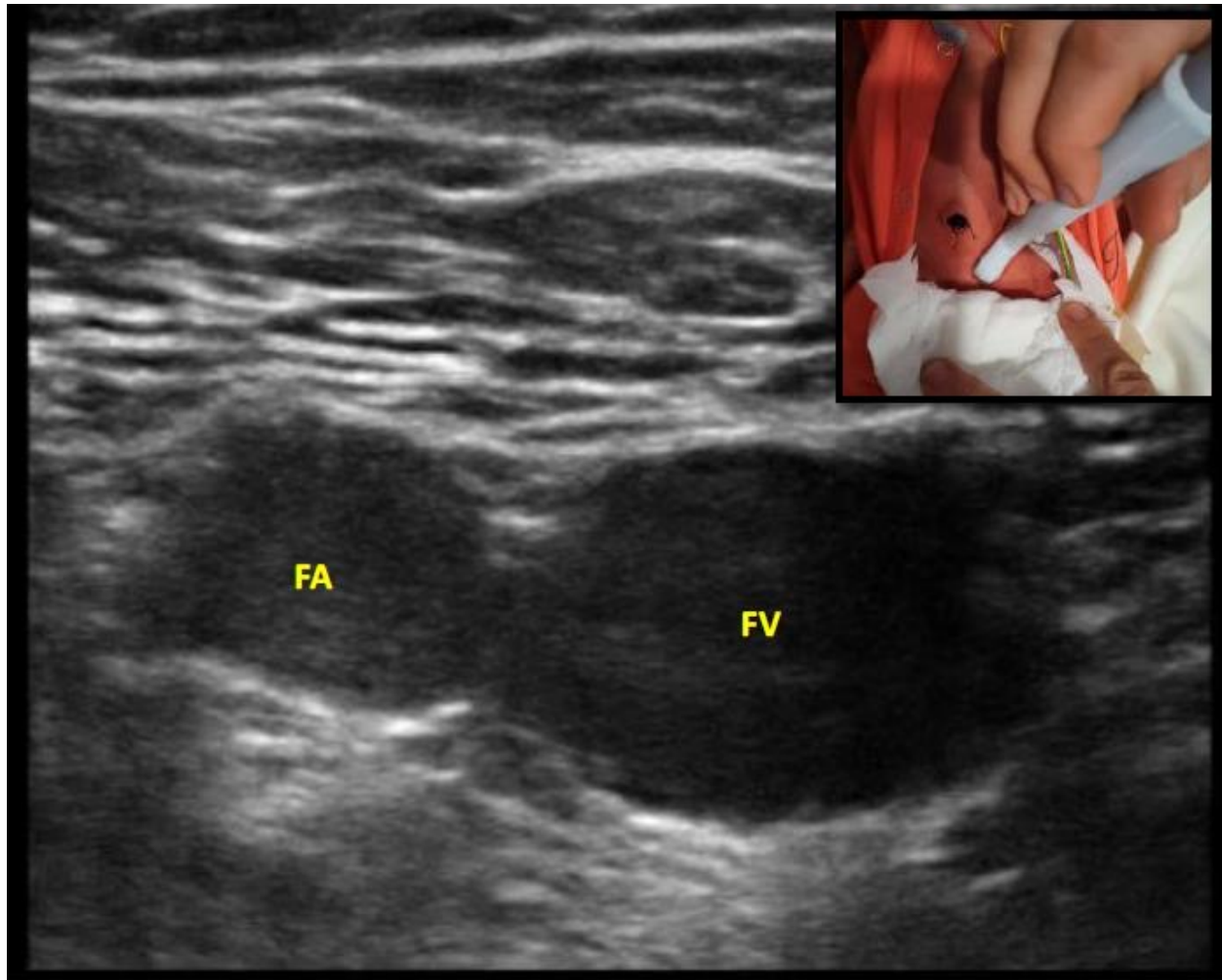
If hemodynamic monitoring is not required, the catheter tip of the FICC is placed below the renal veins

Tip location protocol B:

Probe: Small sectorial probe, 7-8 MHz

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

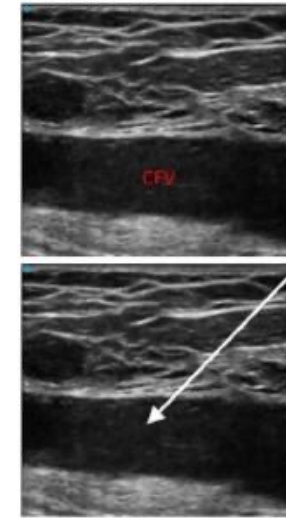
Procedure: the catheter tip is visualized as it reaches the target zone, i.e., the transition between IVC and RA. A small flush of normal saline (0.5-1 ml) may help visualizing the tip



Curtesy of G. Barone

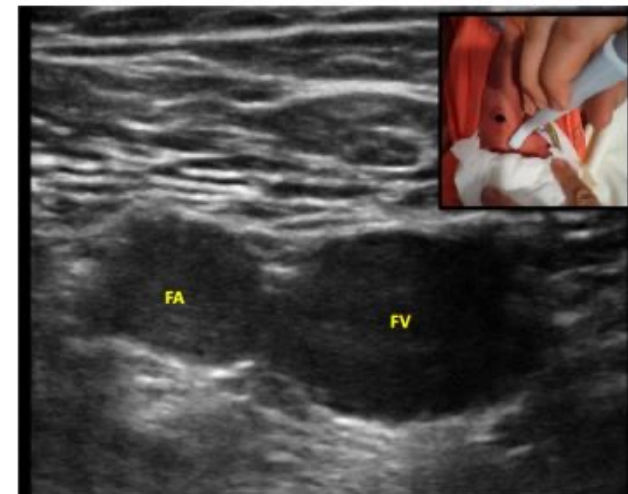
Table 1. The seven steps of the Rapid Femoral Vein Assessment (RaFeVA).

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



Curtesy of G. Barone

**Tip location of FICCs still remains a matter of debate.
If the tip of the catheter is planned to be in the RA or at
junction between IVC/RA, both IC-ECG and TTE can be used.**

**The subxiphoid views allow to easily visualize the
last portion of the IVC, the IVC/RA junction, and the RA.
if the catheter tip is planned to be in the
subdiaphragmatic IVC, other ultrasound views must be
considered.**

**In this regard, the right lateral transhepatic
view is specifically interesting, since it allows to visualize
the subdiaphragmatic tract of the IVC in most patients**

Applicability and feasibility of intraprocedural tip location of femorally inserted central catheters by transhepatic ultrasound visualization of the inferior vena cava in adult patients

Maria Giuseppina Annetta¹ , Bruno Marche¹, Igor Giarretta² and Mauro Pittiruti¹ 

IVC can be visualized by
three methods: subxiphoid long axis

Right transhepatic coronal long axis
short axis (SXSA) and right transhepatic
coronal long axis

(THCLA). The latter has been defined as
"rescue view"⁸

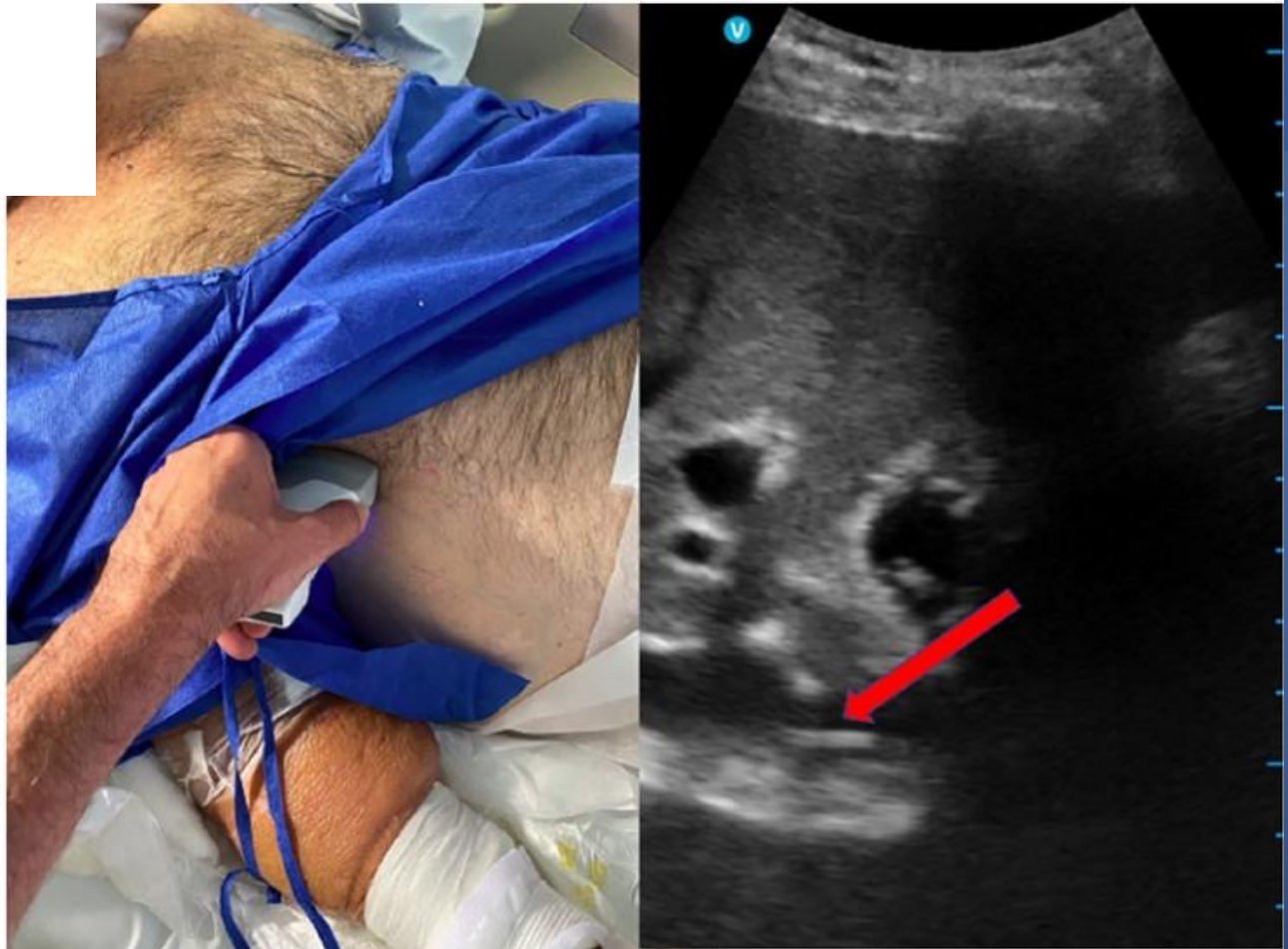
"Rescue view"
Specific advantages: not affected by
factors (pericardial drainage, abdominal surgical
wounds,
gas distension of stomach or colon, non-invasive
ventilation, pregnancy, percutaneous endoscopic gastrostomy,
pregnancy, obesity) which may be an obstacle for the
subxiphoid view.

Applicability and feasibility of intraprocedural tip location of femorally inserted central catheters by transhepatic ultrasound visualization of the inferior vena cava in adult patients

Maria Giuseppina Annetta¹, Bruno Marche¹, Igor Giarretta²
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Ultrasound identification
of the tip of FICCs in the
abdominal tract of the IVC,
using the right transhepatic
coronal long axis view
(THCLA)





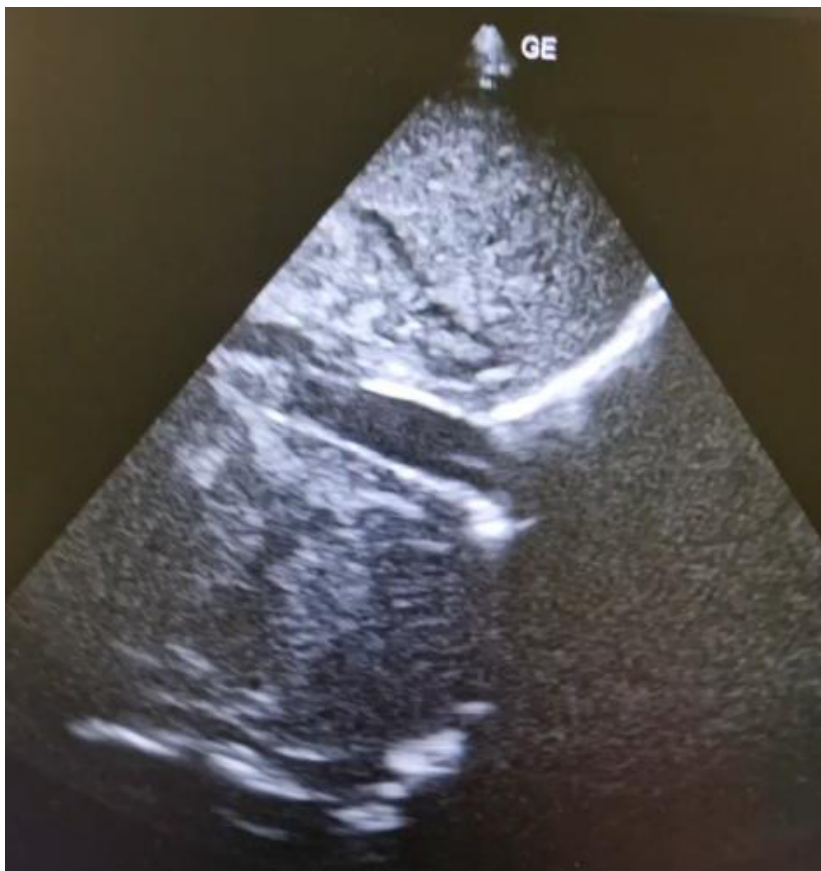
50 neonati con FICC:
-sonda lineare
-proiezione transepatica
-proiezione sottocostale
con bubble test
-Rx torace



Fig 5 Transhepatic Ultrasound View



Fig 2 Abdominal Radiograph
Confirmation of ST-FICC





Sottocostale



Training

In our experience, the minimum training requirements for ultrasound-based tip navigation and tip location of ECCs should include:

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 h).
3. Practical training supervised by a neonatologist with expertise in ultrasound-based tip location of ECCs (at least 50 cases).



Training





AND NOW?

L Echo nell UVC è nettamente superiore all Rx, rapida curva di apprendimento e possibilità di tip navigation. Studi necessari per IC- ECG

L ECHO per l ECC curva di apprendimento meno rapida, operatore dipendente, maggiore specificità dell RX. Consente tip navigation. Studi ancora scarsi sull IC ECG

L ECHO per CICC in associazione all IC ECG consente ottima tip location e tip navigation

L ECHO per FICC superiore all RX, consente tip navigation . Studi sull IC ECG ancora in corso, transepatica



GRAZIE