

Ecocardioscopia e bubble test per la verifica della posizione della punta di PICC, CICC e FICC nel bambino



Maria Giuseppina ANNETTA

Verifica della posizione della punta (*'tip location'*)

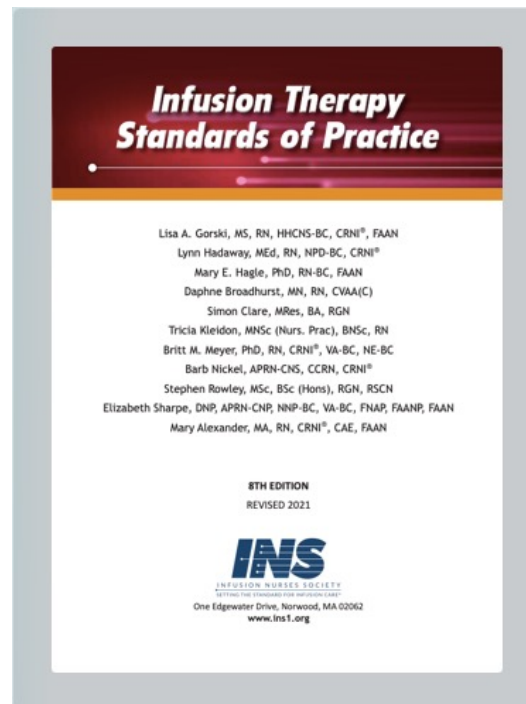
Accessi
venosi
centrali

- cateteri venosi ombelicali
- cateteri epicutaneo-cava
- CICC
- PICC
- FICC
- port
- cateteri per dialisi

E' necessaria la tip location?

Le attuali linee guida e consensus internazionali raccomandano che qualunque posizionamento di accesso venoso centrale preveda una appropriata verifica della posizione della punta

E' necessaria la tip
location?



EJA

Eur J Anaesthesiol 2020; **37**:344–376

GUIDELINES

European Society of Anaesthesiology guidelines on peri-operative use of ultrasound-guided for vascular access (PERSEUS vascular access)

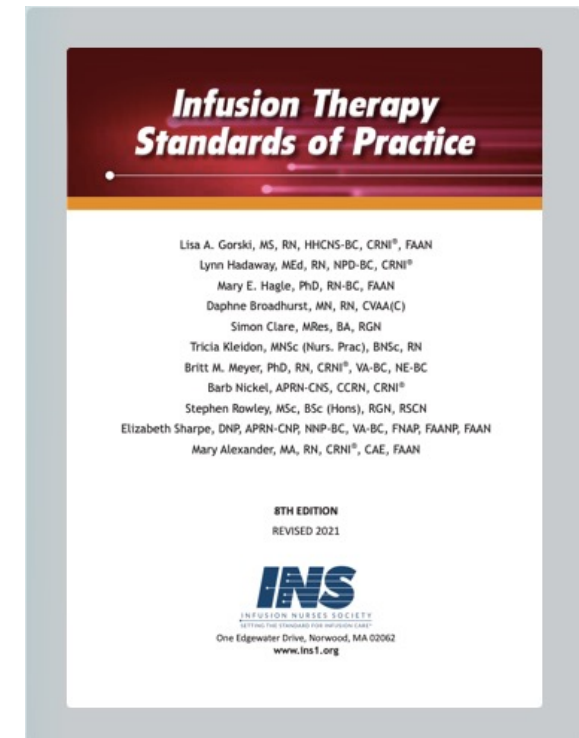
Massimo Lamperti, Daniele Guerino Biasucci, Nicola Disma, Mauro Pittiruti, Christian Breschan, Davide Vailati, Matteo Subert, Vilma Traškaitė, Andrius Macas, Jean-Pierre Estebe, Regis Fuzier, Emmanuel Boselli and Philip Hopkins

Intraprocedurale o postprocedurale?

Le attuali linee guida e consensus internazionali raccomandano che la tip location sia **intraprocedurale**

Use methods for identifying CVAD tip location during the insertion procedure (ie, “real-time”) due to greater accuracy, more rapid initiation of infusion therapy, and reduced costs.³⁸⁻⁴⁷ (III)

2021



Quale metodo intraprocedurale è raccomandato come prima opzione?

Le attuali linee guida e consensus internazionali raccomandano che **nell'adulto e nel bambino** la tip location intraprocedurale venga effettuata ogni qualvolta sia possibile mediante il metodo dell'**ECG intracavitario**

Use electrocardiogram (ECG) methods with either a metal guidewire or a column of normal saline inside the catheter lumen and observe the ECG tracing to place the CVAD tip at the CAJ.

2021

Infusion Therapy Standards of Practice

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SETTING THE STANDARD FOR INFUSION CARE
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Quale altro metodo intraprocedurale è raccomandato?

Le attuali linee guida e consensus internazionali raccomandano che la tip location intraprocedurale venga preferibilmente effettuata – se il metodo dell'ECG intracavitario non è applicabile o non è fattibile - mediante **ecocardiografia transtoracica**.

Qualora il metodo ECG (convenzionale o modificato) non offra risultati chiari e univoci, si raccomanda di utilizzare anche il metodo di localizzazione della punta in ecocardiografia trans-toracica, mediante *'bubble test'*, con sonda convex o settoriale, secondo quanto raccomandato dal protocollo ECHOTIP. Tale metodo può essere utilizzato anche da solo, qualora il metodo ECG non sia applicabile per motivi clinici (assenza di onda P visibile in paziente non fibrillante; difficile valutazione delle onde f) o logistici (posizionamento di CICC in urgenza, senza disponibilità di monitor ECG). La radiografia del torace post-procedurale sarà indicata soltanto nei rari casi in cui i risultati dell'ECG



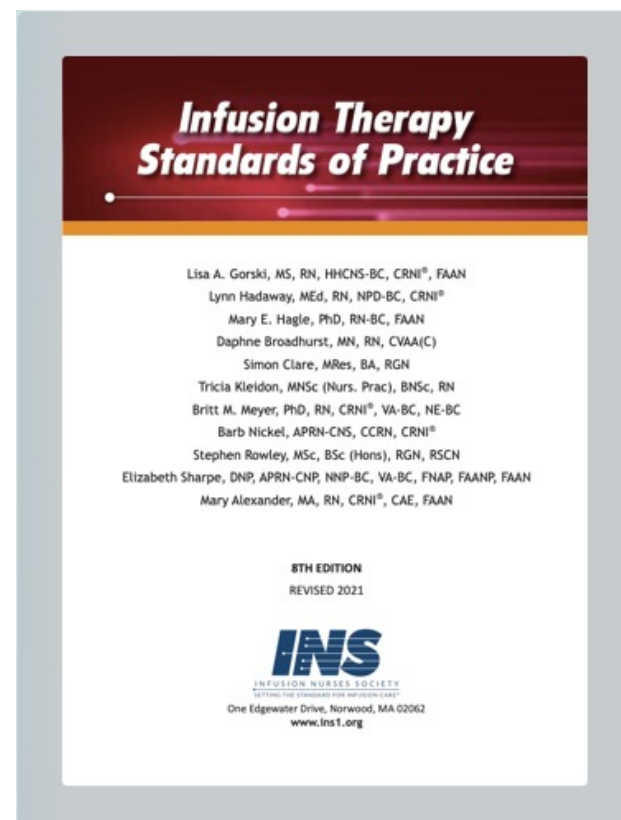
RACCOMANDAZIONI GAVeCeLT 2021
PER LA INDICAZIONE, L'IMPIANTO E LA GESTIONE
DEI DISPOSITIVI PER ACCESSO VENOSO

a cura di Mauro Pittiruti e Giancarlo Scoppettuolo

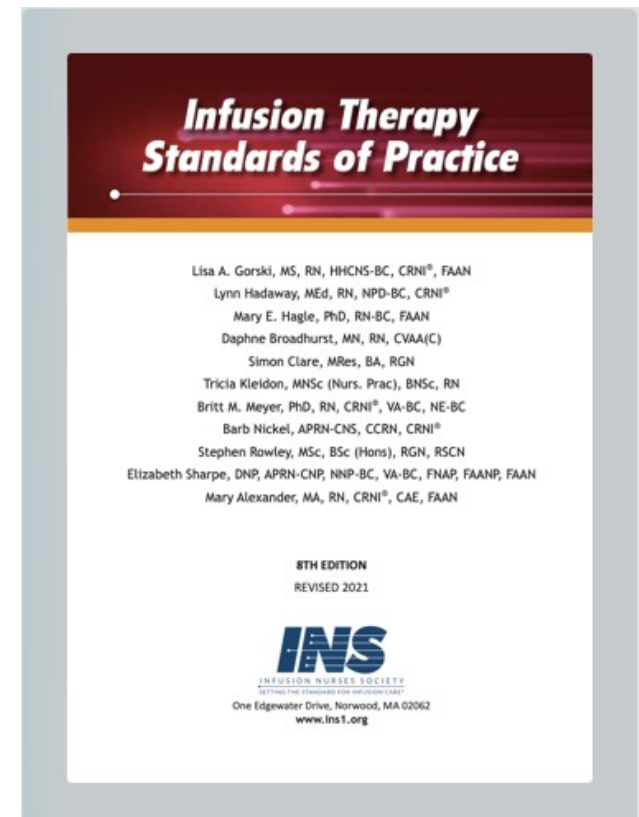
v. 2.0

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 trans-thoracic 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)



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)



GUIDELINES

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Massimo Lamperti, Daniele Guerino Biasucci, Nicola Disma, Mauro Pittiruti, Christian Breschan, Davide Vailati, Matteo Subert, Vilma Traškaitė, Andrius Macas, Jean-Pierre Estebe, Regis Fuzier, Emmanuel Boselli and Philip Hopkins

When an intracavity electrocardiogram is not applicable, we recommend using real-time ultrasound to detect and prevent central venous catheter malposition, as it has been shown to be well tolerated, feasible, quickly performed and interpreted at the bedside, and it is more accurate and faster than chest radiograph (1C).

We recommend combining and integrating vascular ultrasound (to assist in navigating the tips of guidewires and central venous lines) with transthoracic echocardiography (for tip location) (1C).

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2020

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Tip location by echocardiography
(Trans-thoracic echo – TTE)

Echo: tip location

- convex probe (adults) or microconvex (children)
- adopting 'bubble test'
- Sub-xyphoid view
 - Four chambers
 - Bi-caval



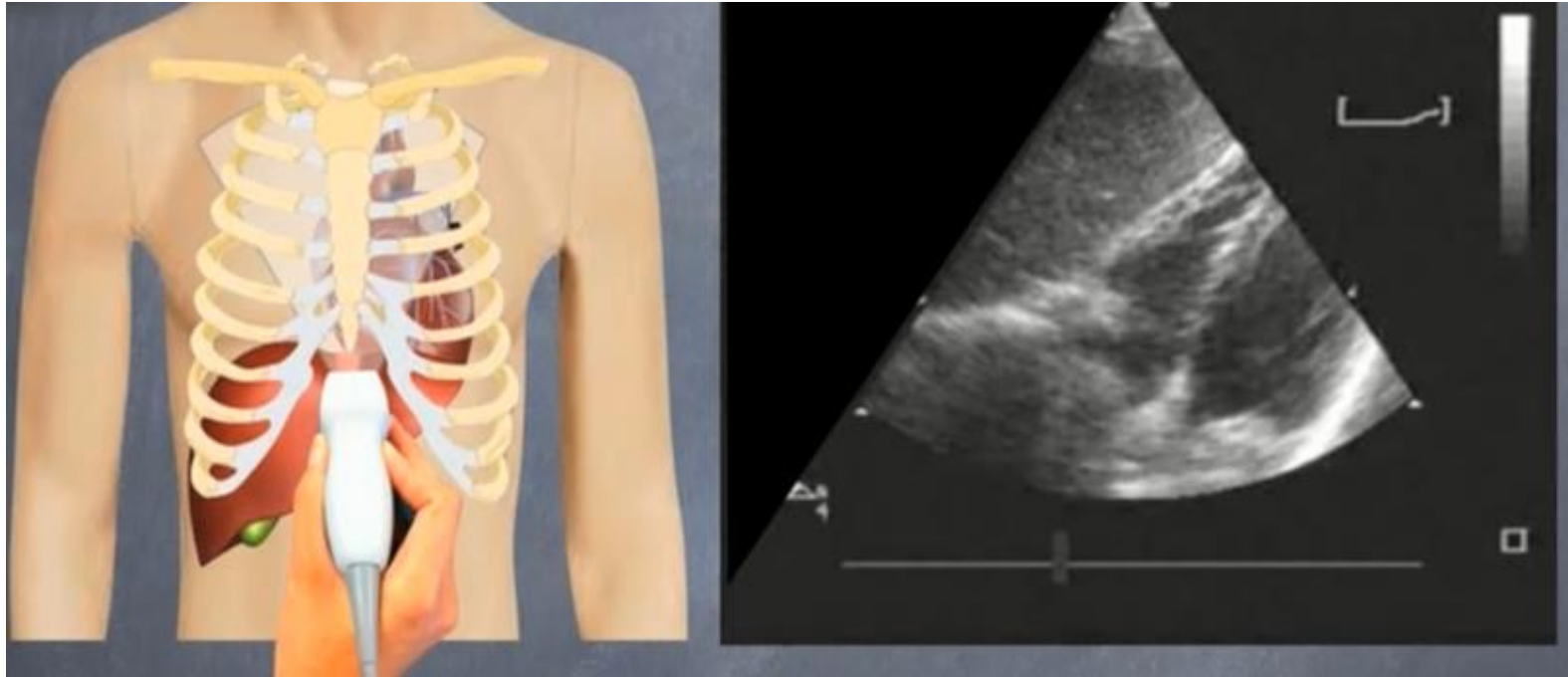
THREE MAIN METHODS OF US-BASED VISUALIZATION:

1. Tip navigation: ultrasound-based visualization of the guidewire and/or of the catheter to verify the correct direction into the superior vena cava (SVC) or inferior vena cava (IVC).
2. Tip location by direct visualization of the final position of the tip of the catheter, usually at the junction between right atrium and SVC or between right atrium (RA) and IVC.
3. Tip location by indirect visualization of the final position of the tip of the catheter, using the so-called “bubble test” (visualization of micro-bubbles inside the vasculature after injection of saline or saline/air mixture into the catheter).

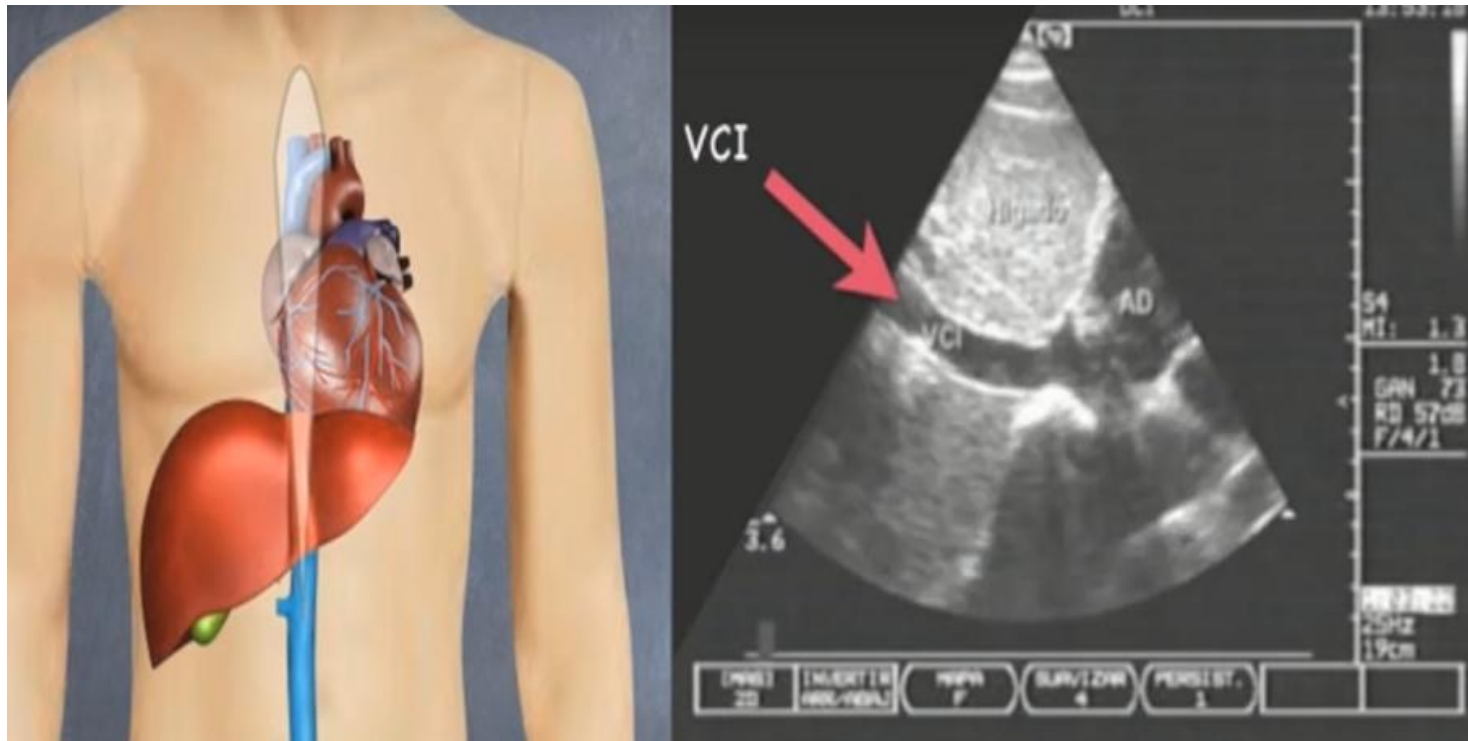
ECHOTIP: A structured protocol for ultrasound-based tip navigation and tip location during placement of central venous access devices in adult patients

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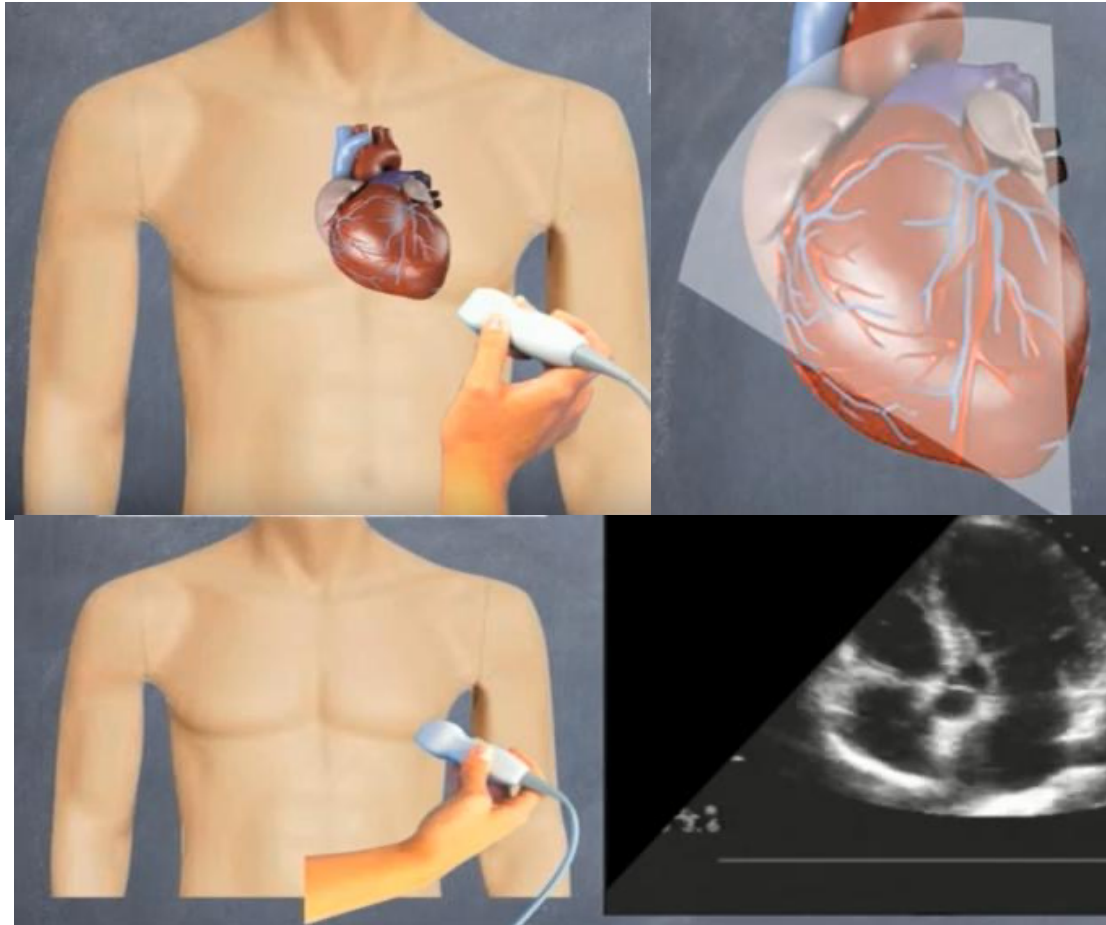
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Subcostal 4-chamber view



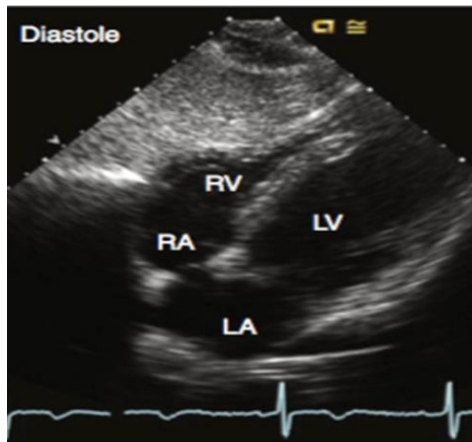
Subcostal bicaval view



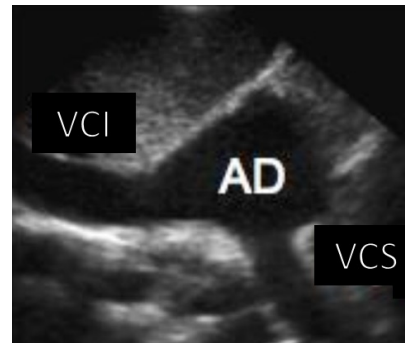
Apical 4-chamber view

Echocardiography

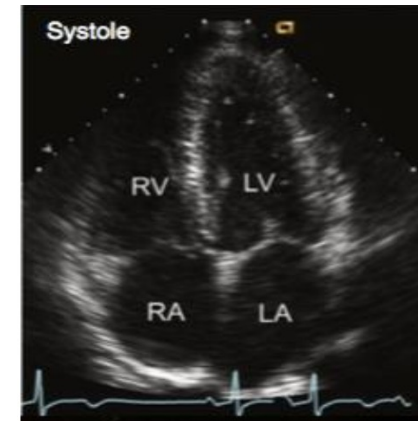
TTE: direct visualization of the tip of catheter, only if it is in atrium



1st choice
Subcostal four chamber view

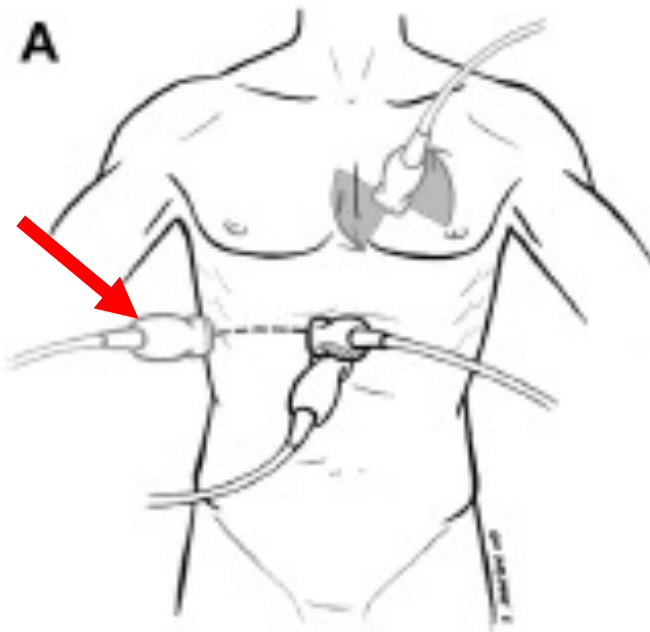


Subcostal bi-caval view



2nd choice
Apical four chamber view

Utile per i FICC:
finestra transepatica per la visualizzazione
della vena cava inferiore sottodiaframmatica



Ecografia e accessi venosi centrali

Protocolli ECHOTIP

(tip navigation + tip location)

Neo-ECHOTIP (neonati)

ECHOTIP-Ped (bambini)

ECHOTIP (adulti)



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 

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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.

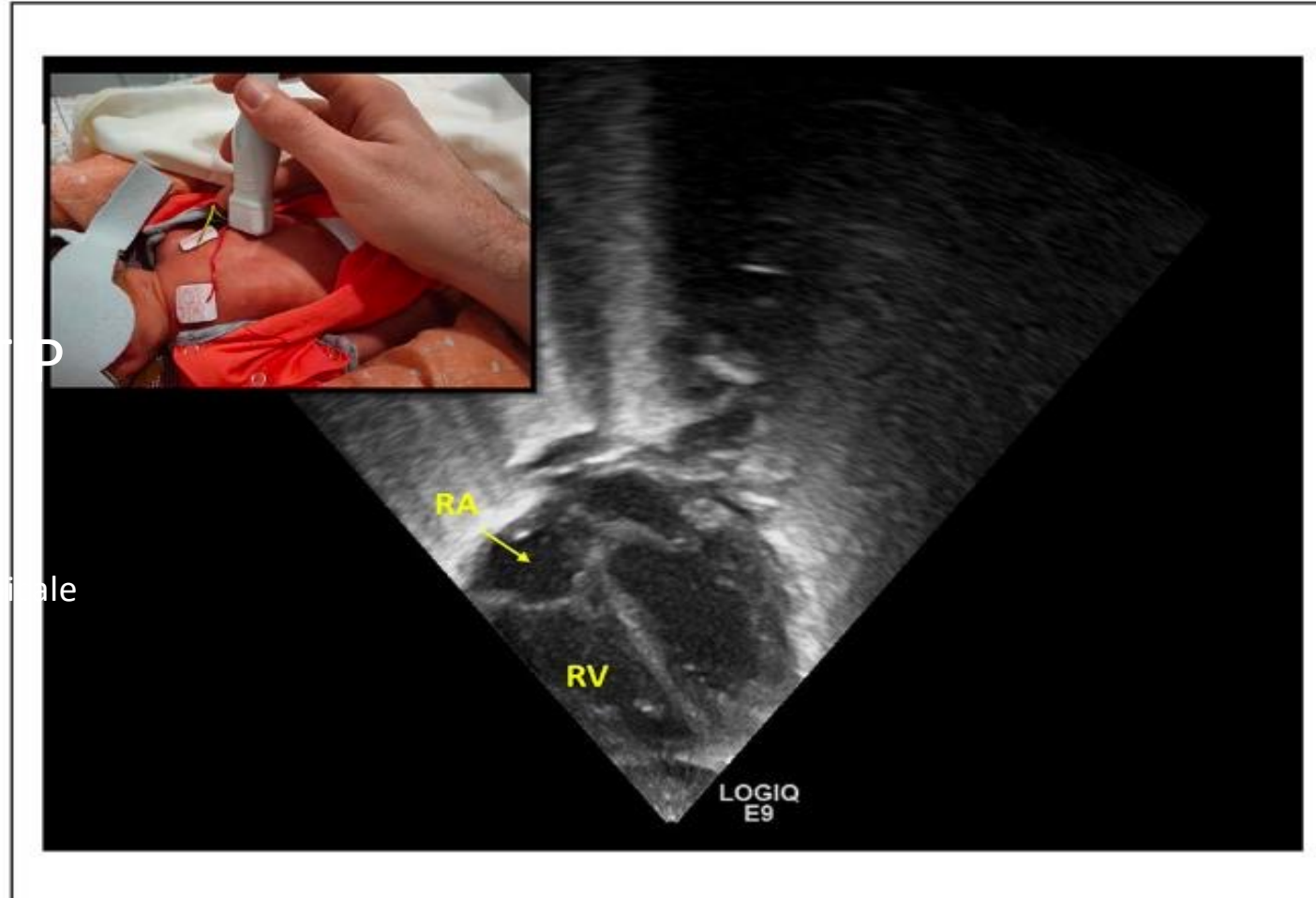


Figure 5. Four-chamber apical view. The four chambers of the heart are clearly visible. The right atrium (RA) and the right ventricle (RV) are visualized on the right side.

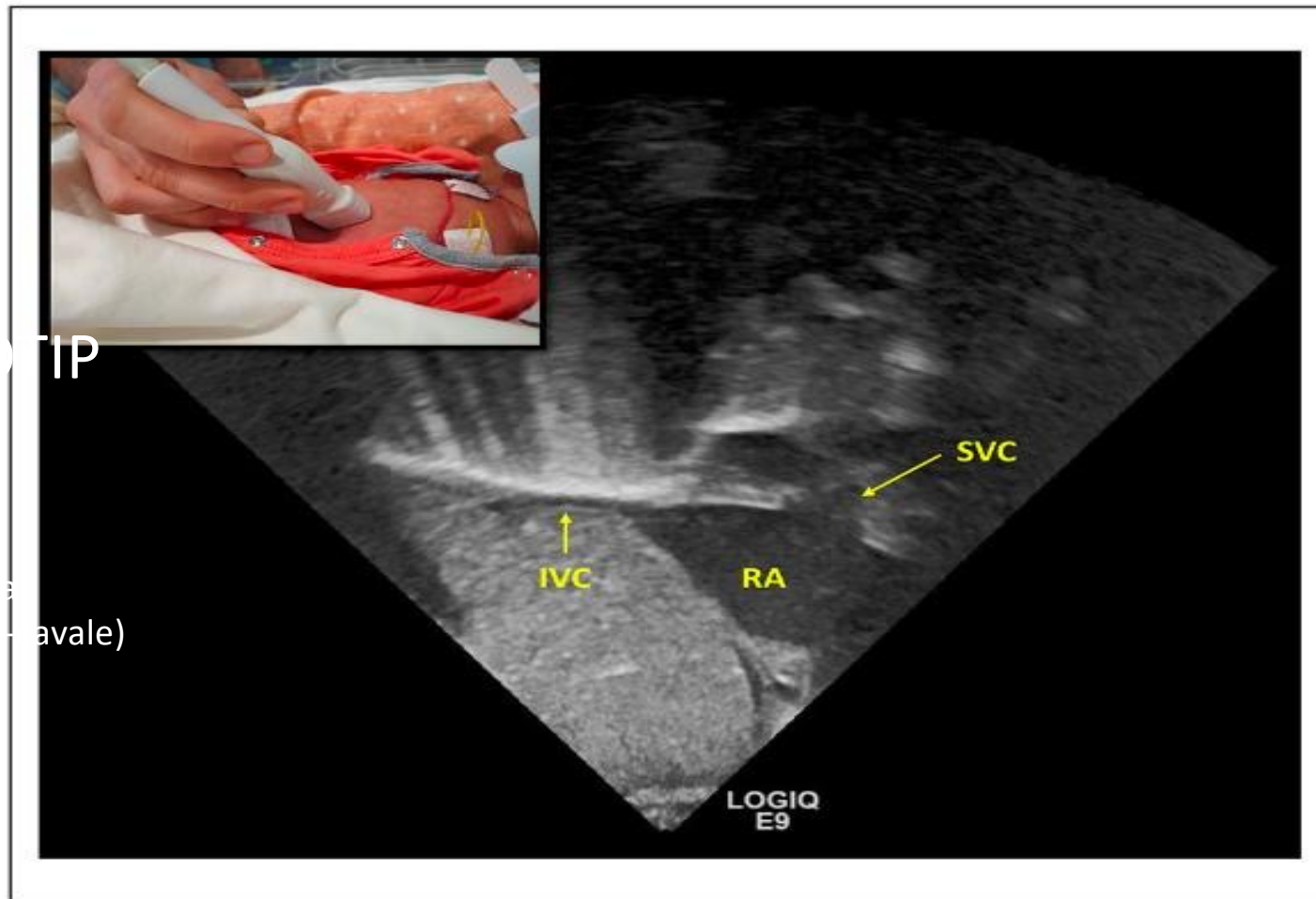


Figure 2. Subcostal longitudinal view. The inferior vein cave (IVC), the right atrium (RA) and the superior vein cave (SVC) are clearly visible.

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

Geremia Zito Marinosci^{1*}, Daniele Guerino Biasucci^{2*} , Giovanni Barone³, Vito D'Andrea⁴ , Daniele Elisei⁵, Emanuele Iacobone⁵ , Antonio La Greca⁶ and Mauro Pittiruti⁶ 

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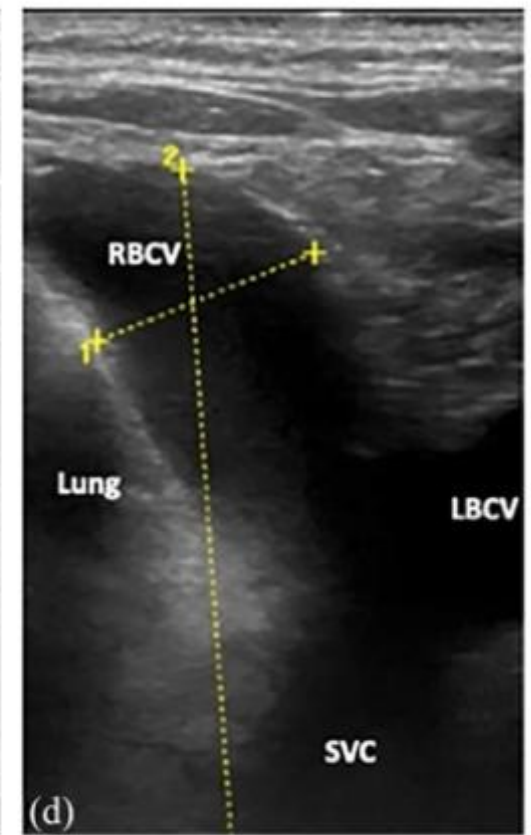
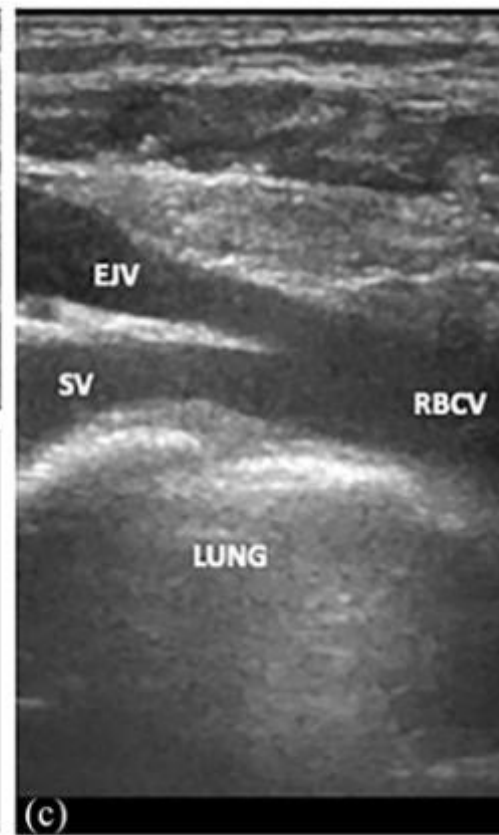
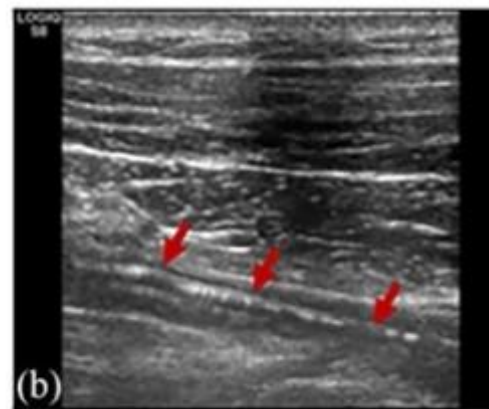
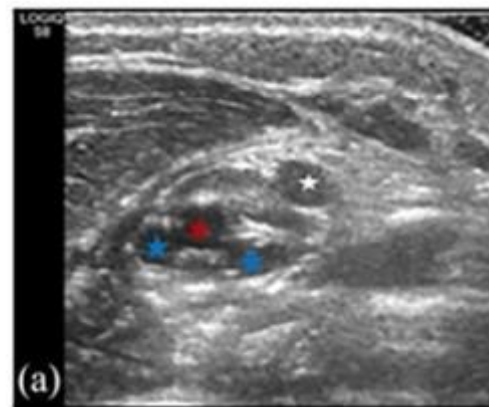


Table 2. Summary of ECHOTIP-Ped.

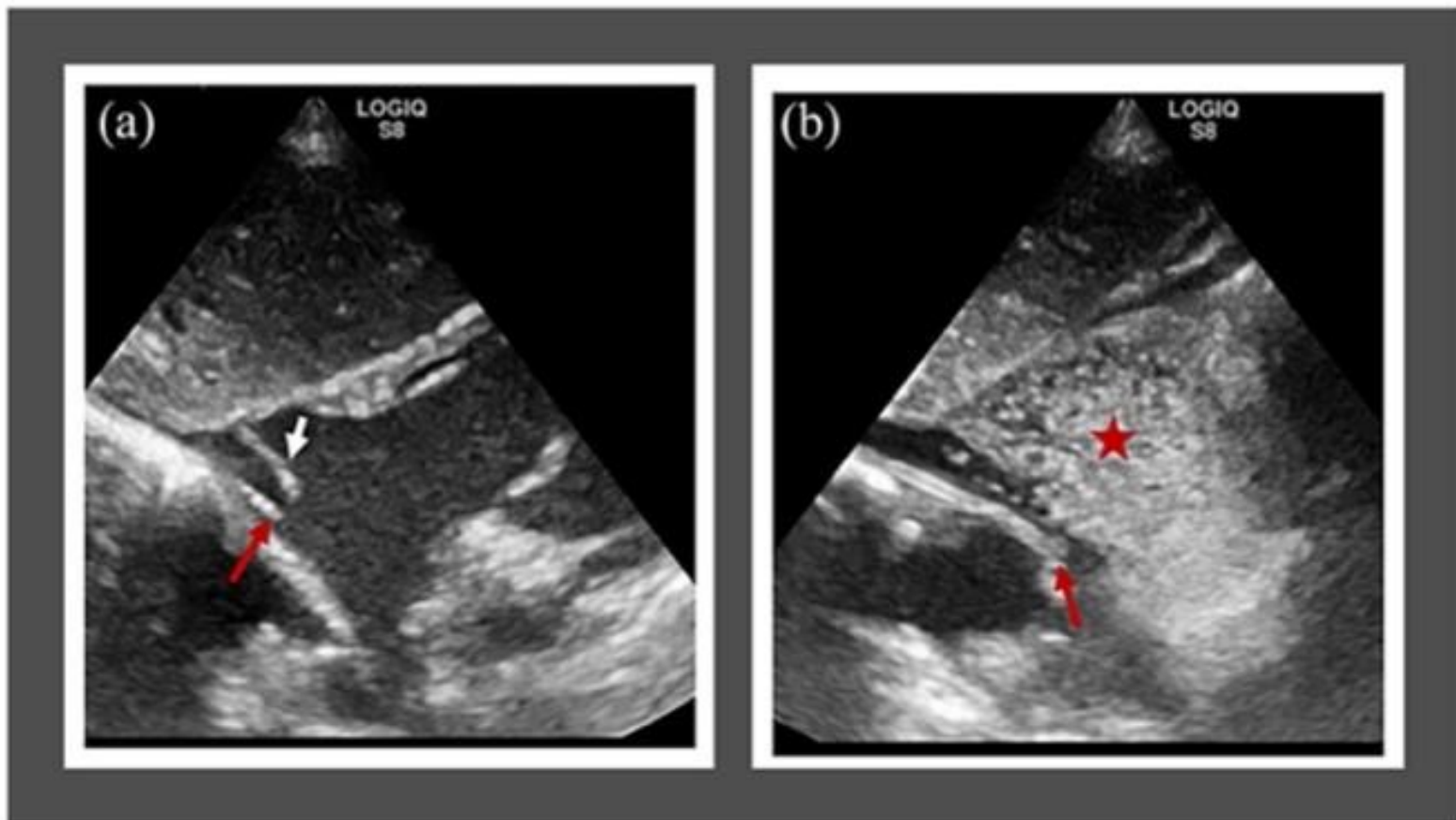
CVC	Protocol	Probe	Windows
CICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Same acoustic windows as RaCeVA
	Tip location	Micro-convex probe, 4–8 MHz, or small sectorial probe, 3–7 MHz	Subcostal bi-caval view (recommended) or four-chambers apical view (as alternative option)
PICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz	Same acoustic windows as RaPeVA and RaCeVA
	Tip location	Micro-convex probe, 4–8 MHz, or small sectorial probe, 3–7 MHz	Subcostal bi-caval view (recommended) or four-chambers apical view (as alternative option)
FICC	Tip navigation	Linear “hockey stick” probe, 10–14 MHz, or micro-convex probe, 4–8 MHz	Short + long axis views of the femoral vein and external iliac vein; and short + long axis views of IVC
	Tip location	Micro-convex probe, 4–8 MHz	Subcostal longitudinal view of the IVC

PICC: peripherally inserted central catheter; RaCeVA: rapid central vein assessment; RaPeVA: rapid peripheral vein assessment; CICC: centrally inserted central catheter; FICC: femoral inserted central catheter; IVC: inferior vena cava.

Tip navigation



Tip location



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Original research article

Ultrasound versus intracavitary electrocardiography for intraprocedural tip location during central venous catheterization in infants and children: A prospective clinical study

Mauro Pittiruti¹ , Gilda Salerno², Aldo Mancino²,
Debora Carlini², Davide Celentano³, Maria Giuseppina Annetta⁴ 
and Giorgio Conti⁴

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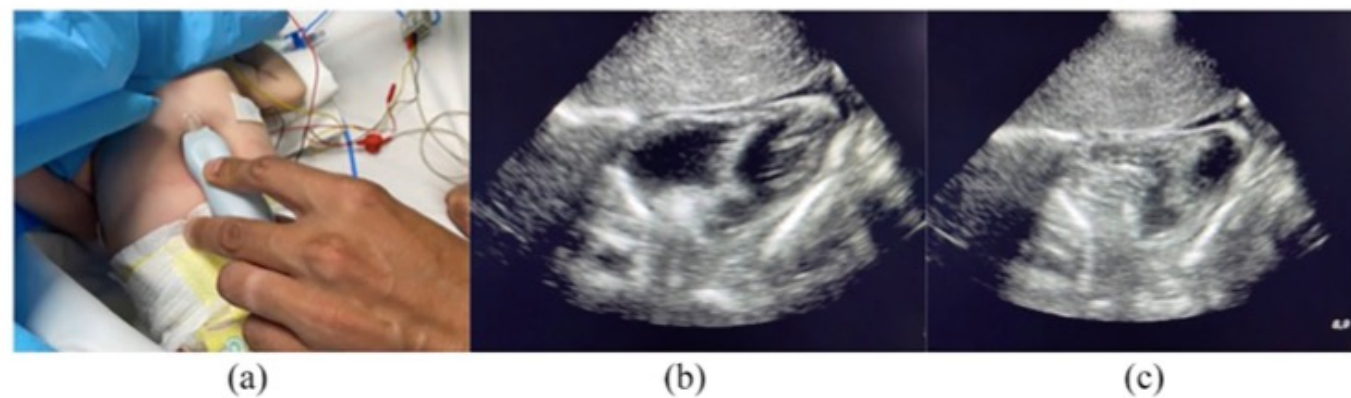
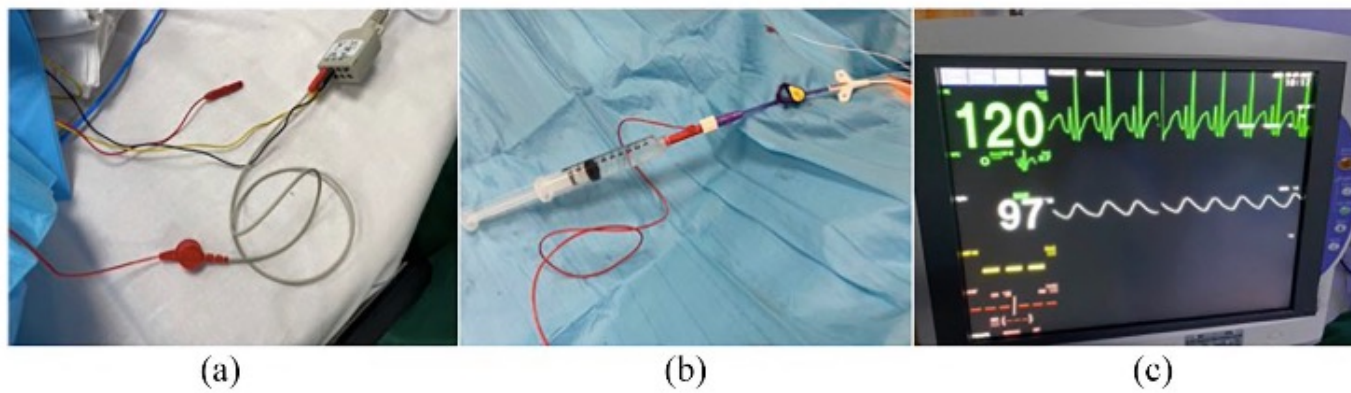
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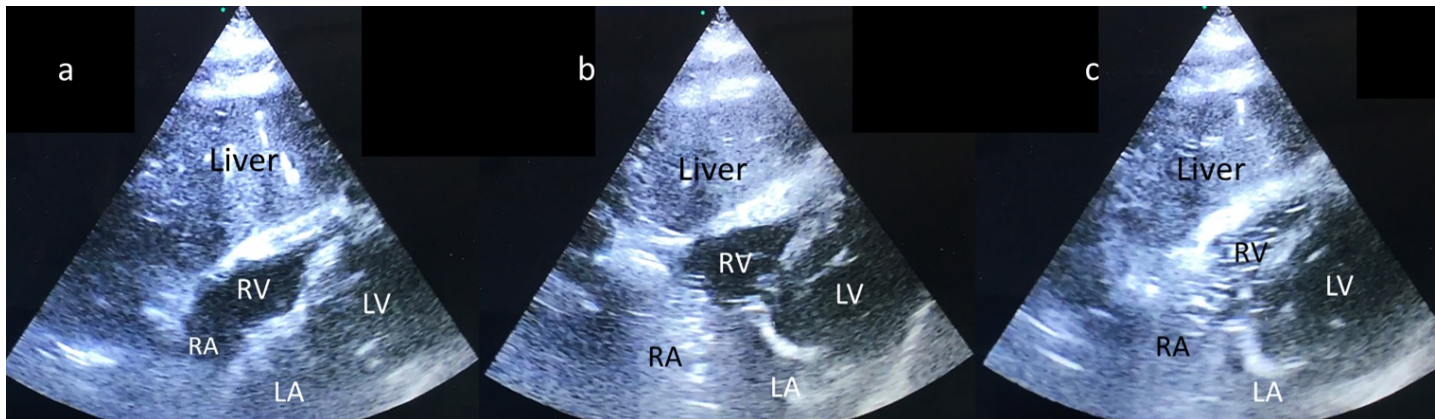


La localizzazione della punta si ottiene visualizzando l'atrio destro (attraverso diverse finestre acustiche).

Iniettando rapidamente la soluzione fisiologica nel catetere, se compaiono bolle nell'atrio destro immediatamente (entro 500 millisecondi), la punta del catetere è ben posizionata.

('bubble test')

Subcostal 4-chamber view: bubble test



- Studio prospettico della durata di un anno
 - Inclusi 100 bambini che richiedevano il posizionamento di CVC in elezione
 - Tutti i CVC sono stati inseriti secondo il bundle di inserzione
 - Tip location con IC-ECG e trans-thoracic echocardiography (TTE)
-
- IC-ECG applicabilità definita come visualizzazione dell'onda P sul tracciato ECG
 - IC-ECG fattibilità definita dalla comparsa di variazioni nell'altezza dell'onda P
-
- TTE applicabilità definita come possibilità di ottenere una buona finestra US (sottocostale o apicale) con visualizzazione dell'atrio di destra
 - TTE fattibilità definita come visualizzazione della comparsa delle microbolle nell'atrio di destra

- Risultati

- Applicabilità dell'IC-ECG 98%

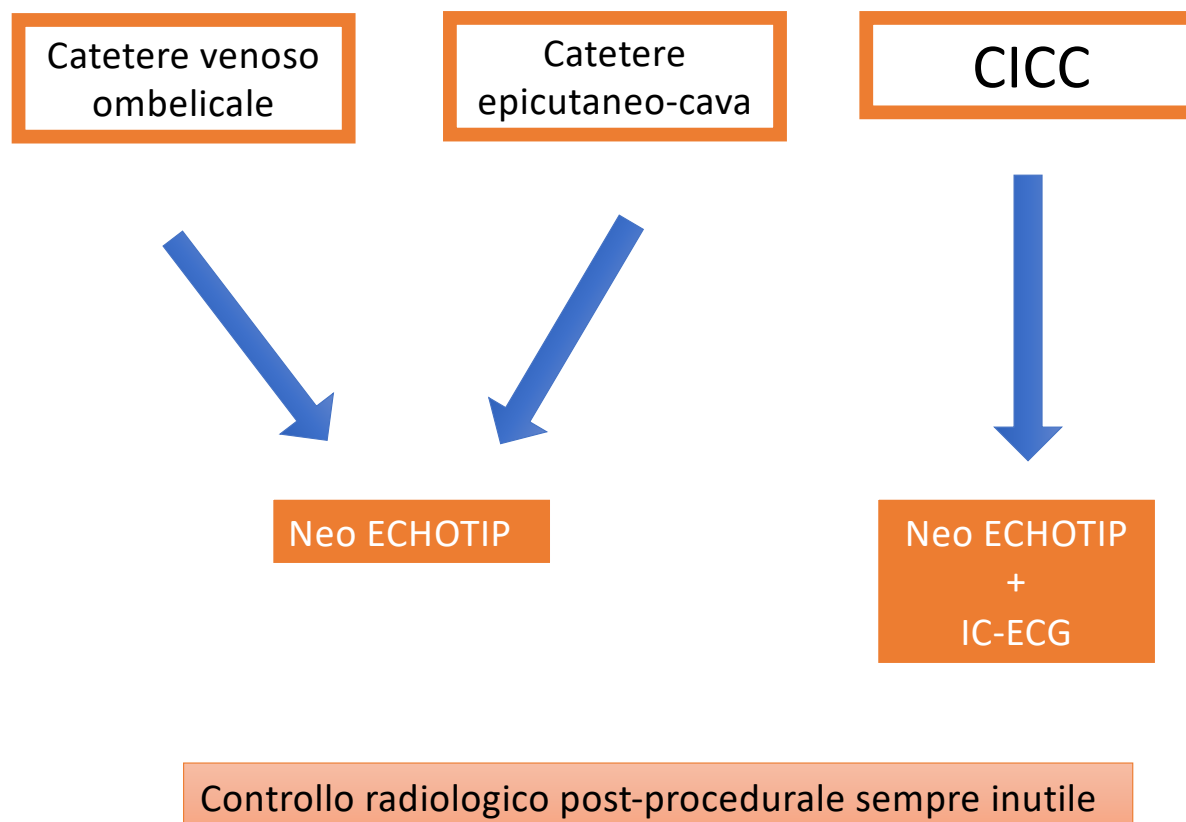
- Fattibilità dell'IC-ECG 100%

- Applicabilità del TTE 96%

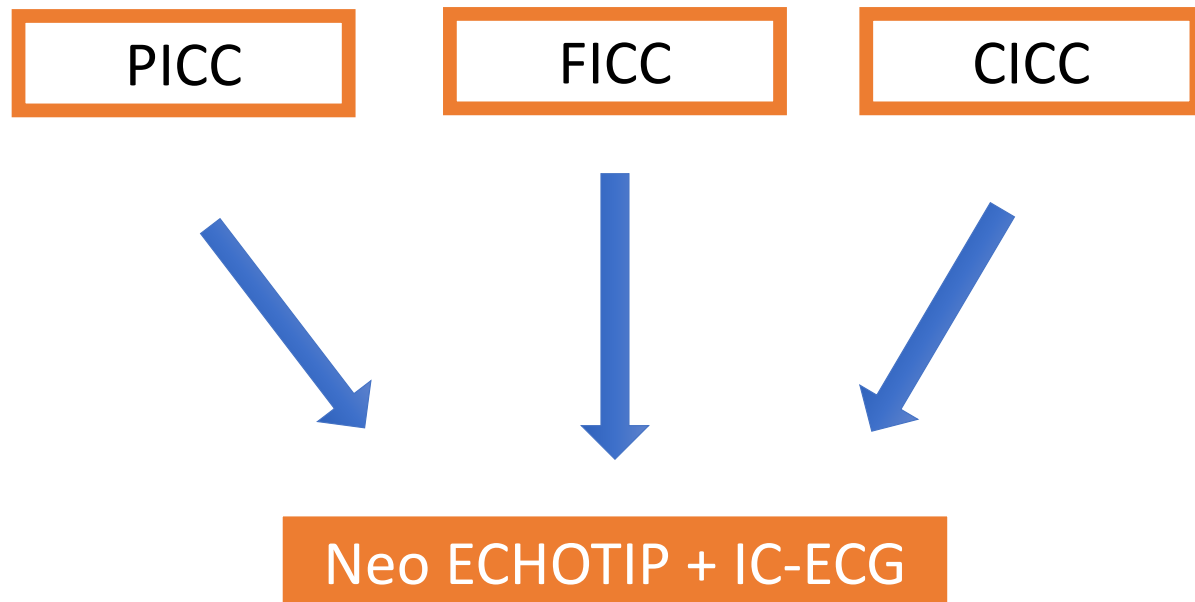
- Fattibilità del TTE 100%

Come combinare insieme i metodi di tip location elettrocardiografici ed ecografici ?

Algoritmo di scelta del metodo di tip location nel neonato



Algoritmo di scelta del metodo di tip location nel bambino



Controllo radiologico post-procedurale quasi sempre inutile

Algoritmo di scelta
del metodo di tip
location per FICC
nel paziente
pediatrico e adulto

Necessità di punta in atrio
destro o alla giunzione VCI/AD



IC- ECG
+
ECHOTiP
(finestra sottocostale/apicale)



Necessità di punta in VCI
sottodiaframmatica



ECHOTiP
(finestra laterale transepatica)



Controllo radiologico post-procedurale in casi selezionati

- Conclusioni
- L'utilizzo dell'ecografia è necessaria ed indispensabile per la scelta della vena, la puntura ecoguidata, la tip navigation, la tip location e la valutazione delle complicanze precoci e tardive



Grazie dell'attenzione

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