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Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

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Ospedale Infermi di Rimini

GdS Accessi Vascolari Neonatali

GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine

Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

I have no actual or potential conflict of interest in relation to this presentation

Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

Editorial

An Italian expert consensus on the choice of the method of tip location for central venous access devices

Vincenzo Faraone[1], Mauro Pittiruti[2], Maria Giuseppina Annetta[3], Giovanni Barone[4], Fabrizio Brescia[5], Maria Calabrese[6], Antonella Capasso[7], Giuseppe Capozzoli[8], Vito D'Andrea[9], Sonia D'Arrigo[3], Daniele Elisei[10], Stefano Elli[11], Igor Giarretta[1], Antonio Gidaro[13], Davide Giustivi[14], Emanuele Iacobone[10], Rossella Mastroianni[15], Fulvio Pinelli[16], Giancarlo Scoppettuolo[17], Ferdinando Spagnuolo[18], Geremia Zito Marinosci[19], Gilda Pepe[2] and Daniele G Biasucci[20]

Review

A narrative review on tip navigation and tip location of central venous access devices in the neonate: Intracavitary ECG or real time ultrasound?

Miria Natile[1], Gina Ancora[1], Vito D'Andrea[2], Mauro Pittiruti[3] and Giovanni Barone[1]

Tip location

E. Use tip locating methods to identify CVAD tip location during the insertion procedure (ie, "real-time") for neonate, pediatric, and adult patients. Studies have demonstrated greater accuracy, more efficient initiation of infusion therapy, and reduced costs.[1,12] (IV)
   1. 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. Follow manufacturers' directions for use with other ECG-based technology using a changing light pattern to detect tip location.[1,12-30] (I)

22. CENTRAL VASCULAR ACCESS DEVICE TIP LOCATION

Tip location

2. 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.[6,33-38] (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.[6,39] (IV)
3. Consider using ultrasound to confirm catheter tip position in neonates and in the emergency department or other critical care environments where immediate confirmation of tip location is time critical.[6,33,40] (IV)

22. CENTRAL VASCULAR ACCESS DEVICE TIP LOCATION

Infusion Therapy Standards of Practice

Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

- La tip location deve essere sempre intraprocedurale
- Esistono in letteratura 4 tecniche di tip location intraprocedurali:

1. ECG endocavitario
2. Ecocardioscopia transtoracica
3. Ecocardioscopia transesofagea
4. Fluoroscopia

Metodologie di tip location nel neonato: ECG intracavitario vs.

1. **Ecocardioscopia transesofagea**
- Invasiva e costosa. Molto accurata

2. **Fluoroscopia**
- Inaccurata, costosa, esposizione a radiazioni ionizzanti

Panel recommendations

Statement 5.1: Intraprocedural tip location by TEE, while being the "gold standard" in terms of accuracy (if the tip location is planned at the superior cavo-atrial junction, in the right atrium, or at the inferior cavo-atrial junction), has limited clinical indications because it is invasive, expensive, potentially associated with complications, and because it requires specific training.

(100% agreement: 90.9% strongly agree, 9.1% agree)

Statement 5.2: In the newborn, intraprocedural tip location by TEE may have indication only in exceptional cases.

Statement 4.2: In the newborn, the use of fluoroscopy for the purpose of tip location of central venous accesses is never justified.

(100% agreement: 90.9% strongly agree, 9.1% agree)

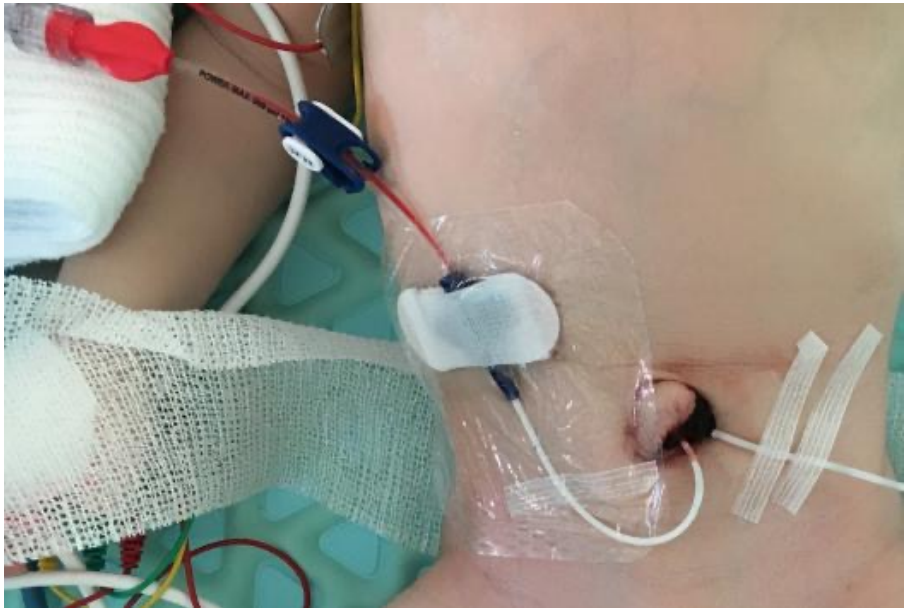
Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

- Quale metodologia utilizzare?

1. ECG endocavitario
2. Ecocardioscopia transtoracica

Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

CVO



Tip location del CVO

Table 1. Tip location by intracavitary ECG.

Vascular Access Device	Applicability	Feasibility	Accuracy
UVC	Applicable, but not recommended	Yes	Low
ECC – upper limbs	Applicable, but not recommended	Not always feasible	High
ECC – lower limbs	Not always applicable	Not always feasible	Low
CICC	Applicable and highly recommended	Yes	High
FICC	Not always applicable	Not always feasible	Low

IC-ECG = never applicable for tip navigation.

Table 2. Tip location by real time ultrasound.

Vascular Access Device	Applicability	Feasibility	Accuracy
UVC	Applicable, highly recommended	Yes	High
ECC – upper limbs	Applicable, recommended	Yes	High
ECC – lower limbs	Applicable, recommended	Yes	High
CICC	Applicable	Yes	High
FICC	Applicable, recommended	Yes	High

Real time ultrasound = always applicable for tip navigation.

Editorial

JVA The Journal of Vascular Access

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

Giovanni Barone[1], Mauro Pittiruti[2], Daniele G Biasucci[3], Daniele Elisei[4], Emanuele Iacobone[4], Antonio La Greca[2], Geremia Zito Marinosci[5] and Vito D'Andrea[6]

The Journal of Vascular Access
2022, Vol. 23(5) 679–688

DOI: 10.1177/11297298211007703
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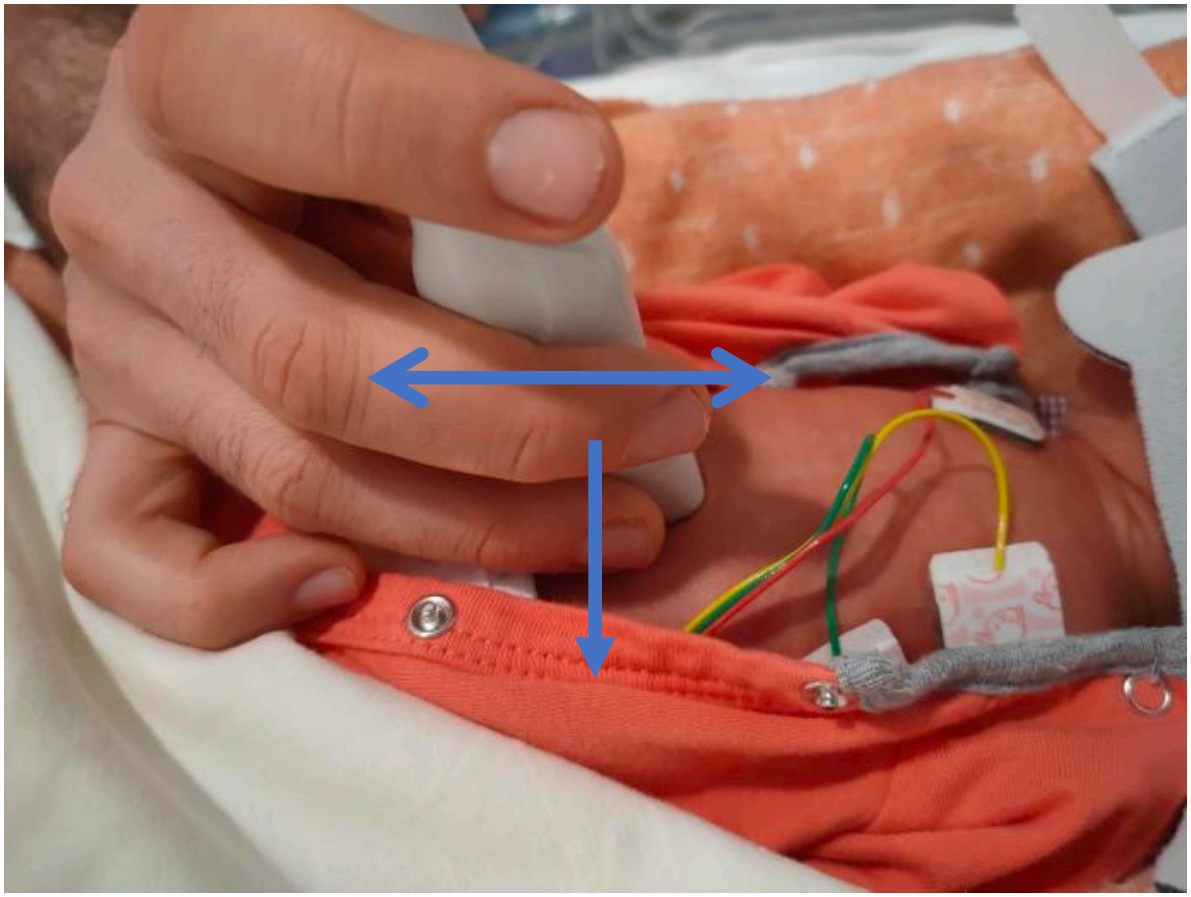
Table 1. Summary of Neo-ECHO tip.

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.

Neo-ECHOTIP per il CVO

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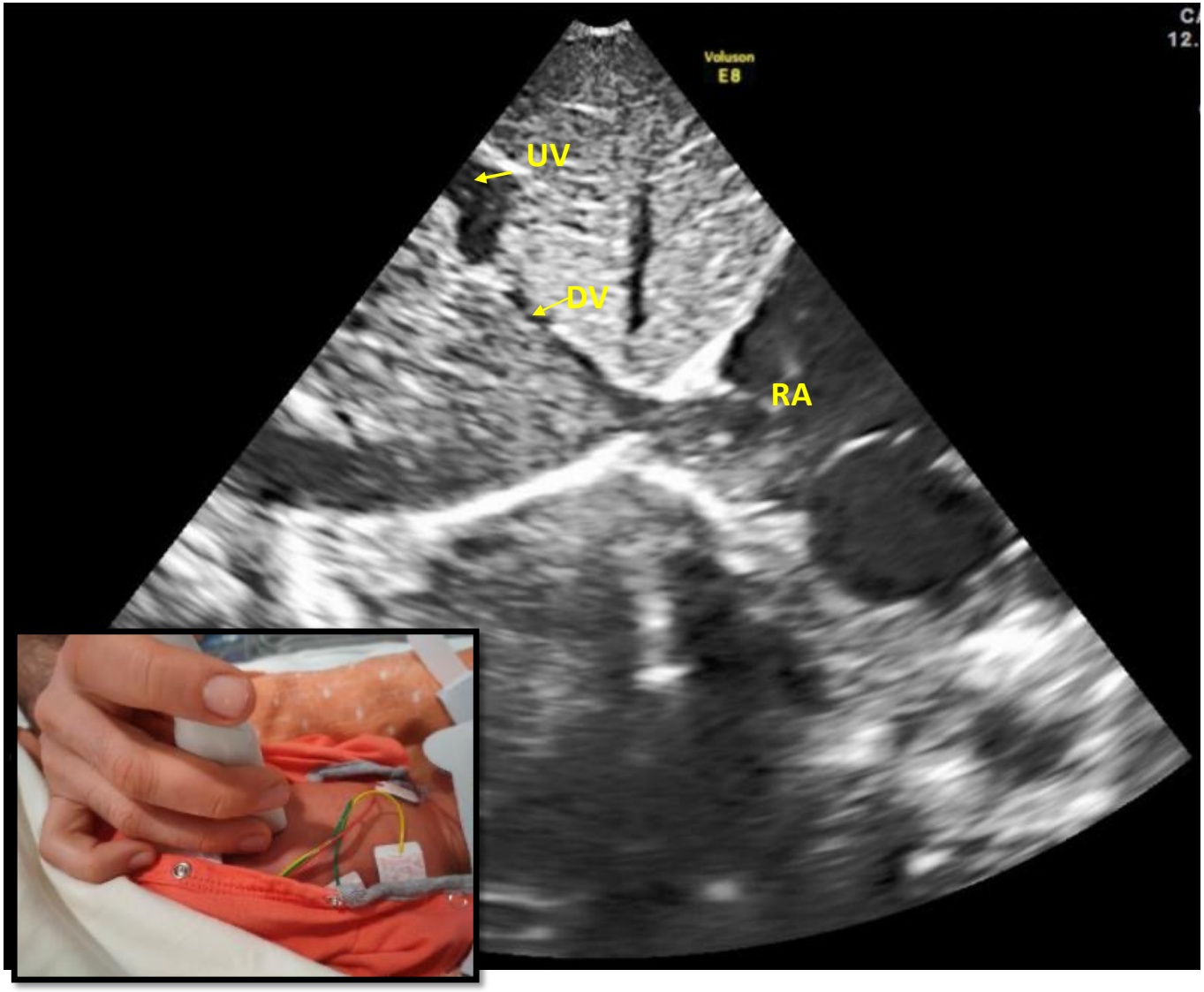
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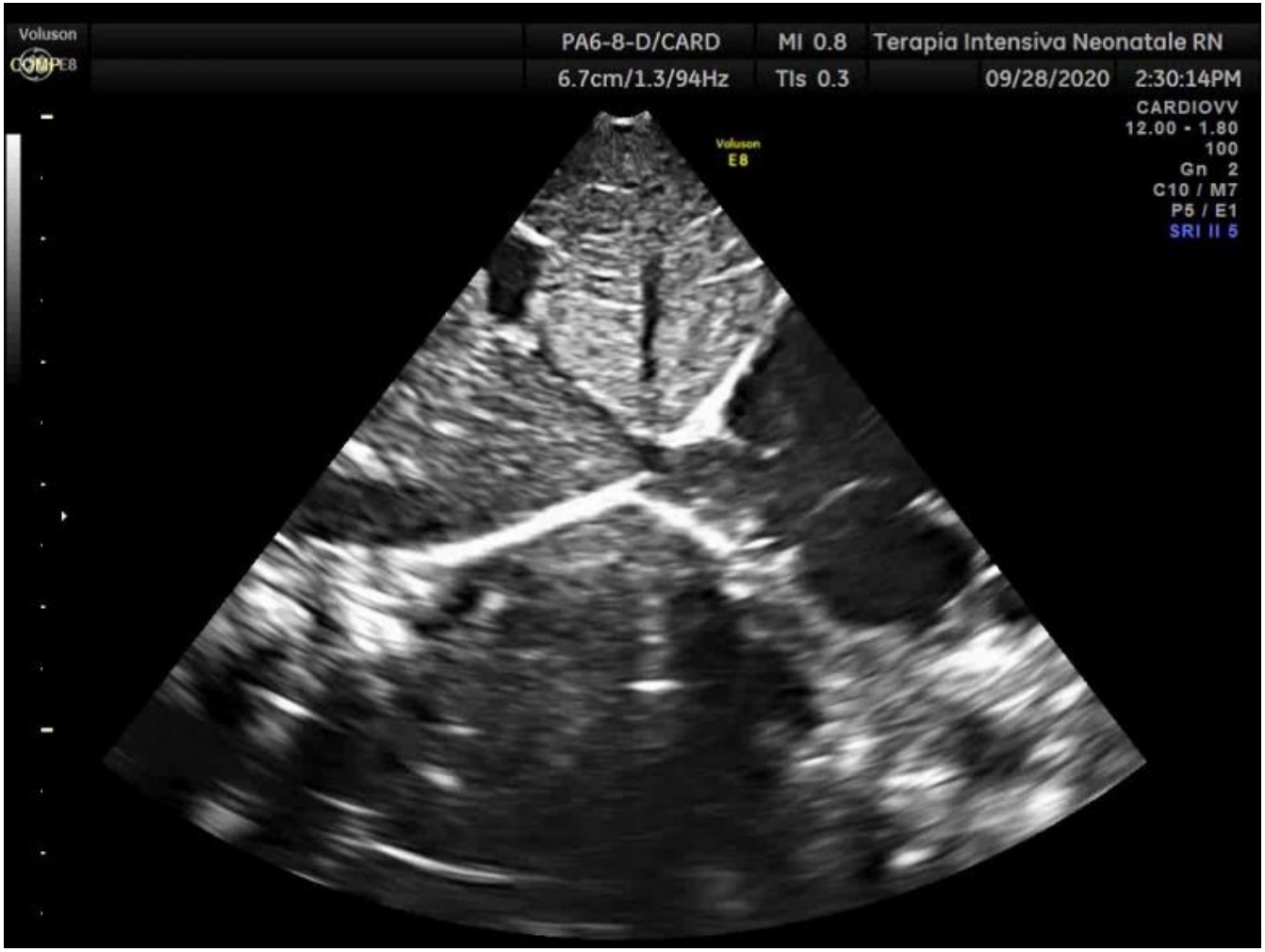
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CARDIOVV
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100
Gn 2
C10 / M7
P5 / E1
SRI II 5

Rubortone et al. Italian Journal of Pediatrics (2021) 47:68
https://doi.org/10.1186/s13052-021-01014-7

Italian Journal of Pediatrics

RESEARCH Open Access

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

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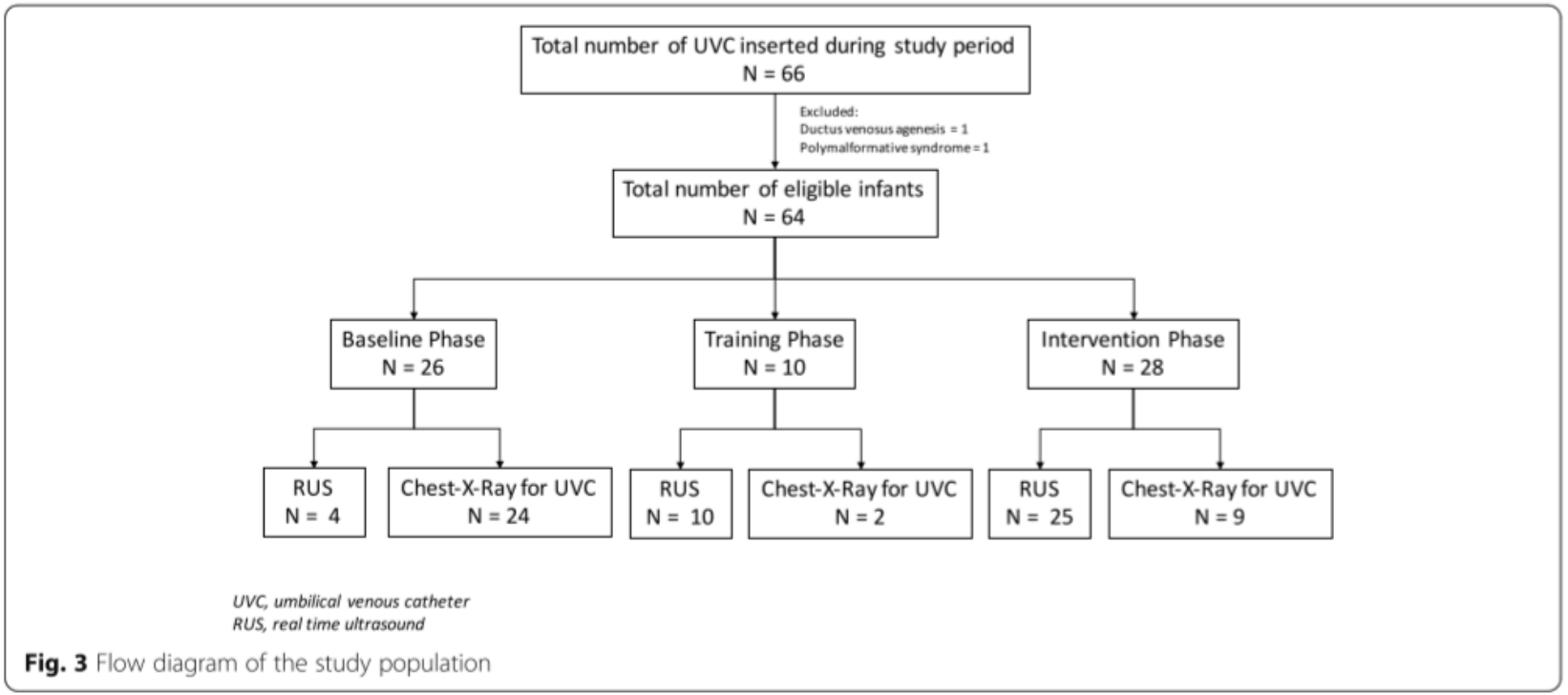

Fig. 3 Flow diagram of the study population

Prevenzione della malposizione primaria

Neonatology

Global Neonatal Research

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Real-Time Ultrasound Tip Location Reduces Malposition and Radiation Exposure during Umbilical Venous Catheter Placement in Neonates: A Retrospective, Observational Study

Vito D'Andrea[a] Giorgia Prontera[a] Francesco Cota[a] Alessandro Perri[a]
Rosellina Russo[b] Giovanni Barone[c] Giovanni Vento[a]

[a]Neonatology Unit, Department of Woman and Child Health and Public Health, Fondazione Policlinico Universitario "Agostino Gemelli" IRCCS, Rome, Italy; [b]Department of Diagnostic Imaging, Oncological Radiotherapy, and Hematology, Fondazione Policlinico Universitario "Agostino Gemelli" IRCCS, Rome, Italy; [c]Neonatal Intensive Care Unit, Infermi Hospital, AUSL Romagna, Rimini, Italy

Table 1. Characteristics of study population and reason of UVC insertion

Birth weight, g	1,909±1,031.67
GA, week	32.9±5.14
Reason of UVC insertion, *n* (%)	
Prematurity	91 (19.7)
Respiratory disease	148 (32.1)
SGA/AED/ARED	64 (13.9)
Asphyxia	75 (16.3)
Infectious	5 (1.1)
Cardiologic disease	26 (5.6)
Difficult IV access	11 (2.4)
Surgical	7 (1.5)
Hypoglycemia	4 (0.9)
Other disease	30 (6.5)

AED, absent end-diastolic flow; ARED, absent and reverse end-diastolic flow; IV, intravenous; SGA, small for gestational age.

Table 2. UVC tip location at insertion

	X-ray group (212)	RT-US group (249)	*p* value
Safe position, *n* (%)	51 (24.1)	225 (90.4)	<0.001
Primary malposition, *n* (%)	161 (75.9)	24 (9.6)	<0.001
In the heart position	41 (25.4)	–	
Intrahepatic position	100 (62.1)	–	
Prehepatic position	20 (12.4)	24 (100)	

Techniques in vascular access

JVA | The Journal of Vascular Access

A novel neonatal protocol for Safe Insertion of Umbilical Venous Catheters (SIUVeC): Minimizing complications in placement and management

The Journal of Vascular Access
1–6

DOI: 10.1177/11297298241236220
journals.sagepub.com/home/jva
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Giovanni Barone[1], Mauro Pittiruti[2], Giorgia Prontera[3], Gina Ancora[1] and Vito D'Andrea[3]

Table 1. The eight steps of the SIUVeC protocol.

Pre-procedural evaluation (including US evaluation).
Adoption of pre-assembled insertion kits.
Appropriate aseptic technique (hand hygiene, maximal barrier precautions, skin antisepsis with 2% chlorhexidine in 70% isopropyl alcohol).
Vein cannulation using the smallest catheter that may meet the infusion requirements and choosing widely between single versus double lumen UVC.
Real-time tip navigation and tip location by US (according to the NeoECHOTIP protocol).
Securement of the catheter and protection of the exit site (combining sutureless devices, cyanoacrylate glue, semipermeable transparent membranes).
Post-procedural serial assessment of tip location by US.
Early removal of the device (within 4–5 days).

In sintesi: tip location del CVO

- Ecocardioscopia intraprocedurale rappresenta la metodica di scelta.
- Consente di prevenire efficacemente la malposizione primaria.
- Tip navigation e tip location sono un *continuum.*
- Facile da applicare e da insegnare.

Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

ECC

Tip location degli ECC

Table 1. Tip location by intracavitary ECG.

Vascular Access Device	Applicability	Feasibility	Accuracy
UVC	Applicable, but not recommended	Yes	Low
ECC – upper limbs	Applicable, but not recommended	Not always feasible	High
ECC – lower limbs	Not always applicable	Not always feasible	Low
CICC	Applicable and highly recommended	Yes	High
FICC	Not always applicable	Not always feasible	Low

IC-ECG = never applicable for tip navigation.

Table 2. Tip location by real time ultrasound.

Vascular Access Device	Applicability	Feasibility	Accuracy
UVC	Applicable, highly recommended	Yes	High
ECC – upper limbs	Applicable, recommended	Yes	High
ECC – lower limbs	Applicable, recommended	Yes	High
CICC	Applicable	Yes	High
FICC	Applicable, recommended	Yes	High

Real time ultrasound = always applicable for tip navigation.

Tip location degli ECC- ECG endocavitario

IC-ECG for ECC: Evidence from the literature

Several studies have explored the applicability, the feasibility, and the accuracy of IC-ECG for ECC inserted in veins of the upper limbs or the scalp.[58–62] Though, only in one study IC-ECG has been applied to small-caliber 1 Fr catheters, which are the most common ECCs used in NICU.[58] Furthermore, until now, this aforementioned study is the only one comparing the accuracy of IC-ECG to ultrasound-based tip location. Unfortunately, it is a very small study, which included only 26 patients. Due to this scarce evidence, IC-ECG cannot be recommended as first choice for intraprocedural tip location of ECCs inserted in the upper limbs. Two other studies evaluated the IC-ECG method for 2 Fr ECCs inserted in veins of the lower limbs, using as comparison conventional radiology.[63,64] The results of these studies are limited by the consideration that IC-ECG—as already mentioned—is quite inaccurate in detecting the IVC/RA junction.

Tip location degli ECC- ECG endocavitario

Editorial

An Italian expert consensus on the choice of the method of tip location for central venous access devices

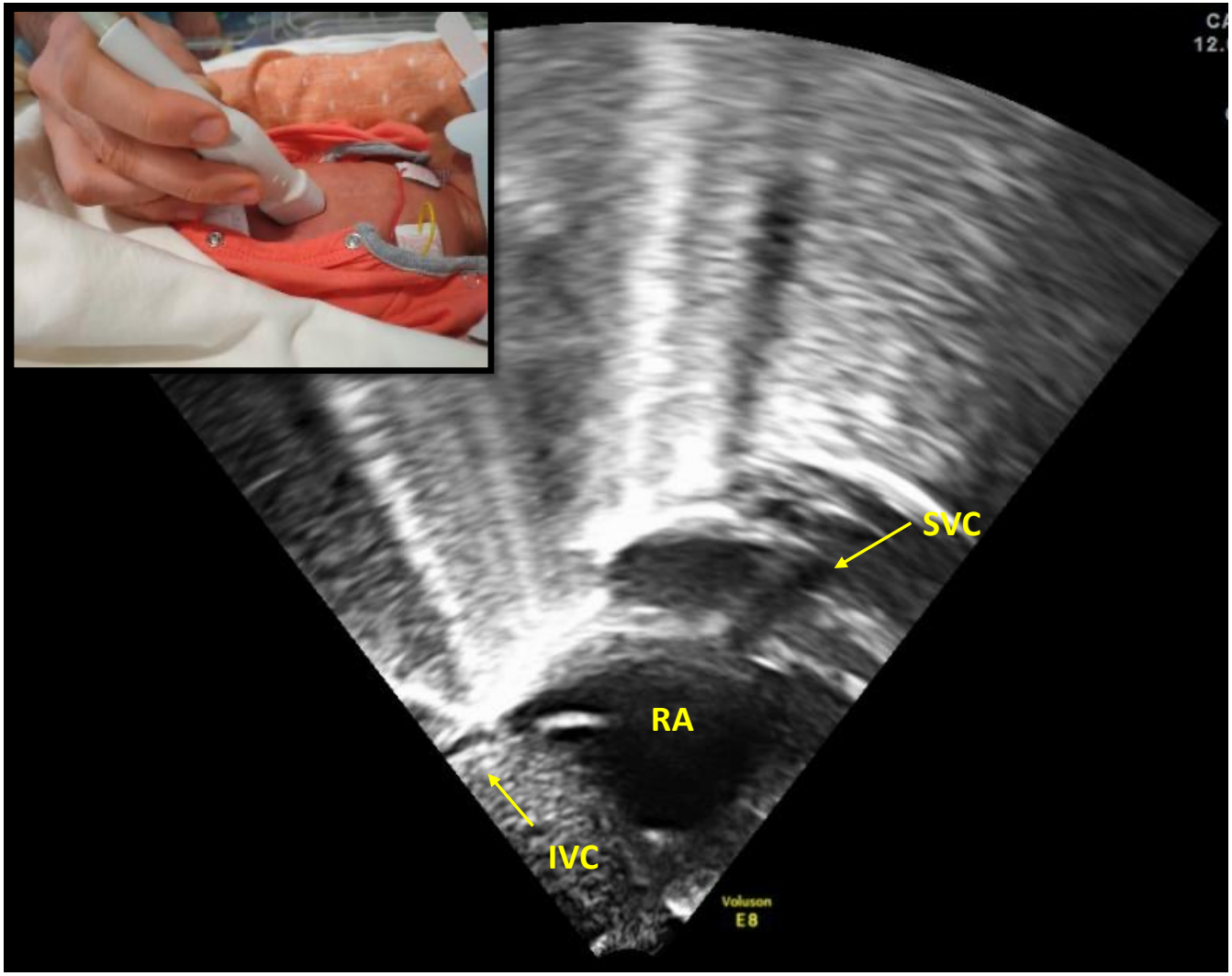
- The IC-ECG method is also applicable in ECC from the superior vena cava, although in this case the method of first choice is TTE with bubble test.

(100% agreement: 90.9% strongly agree, 9.1% agree)

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.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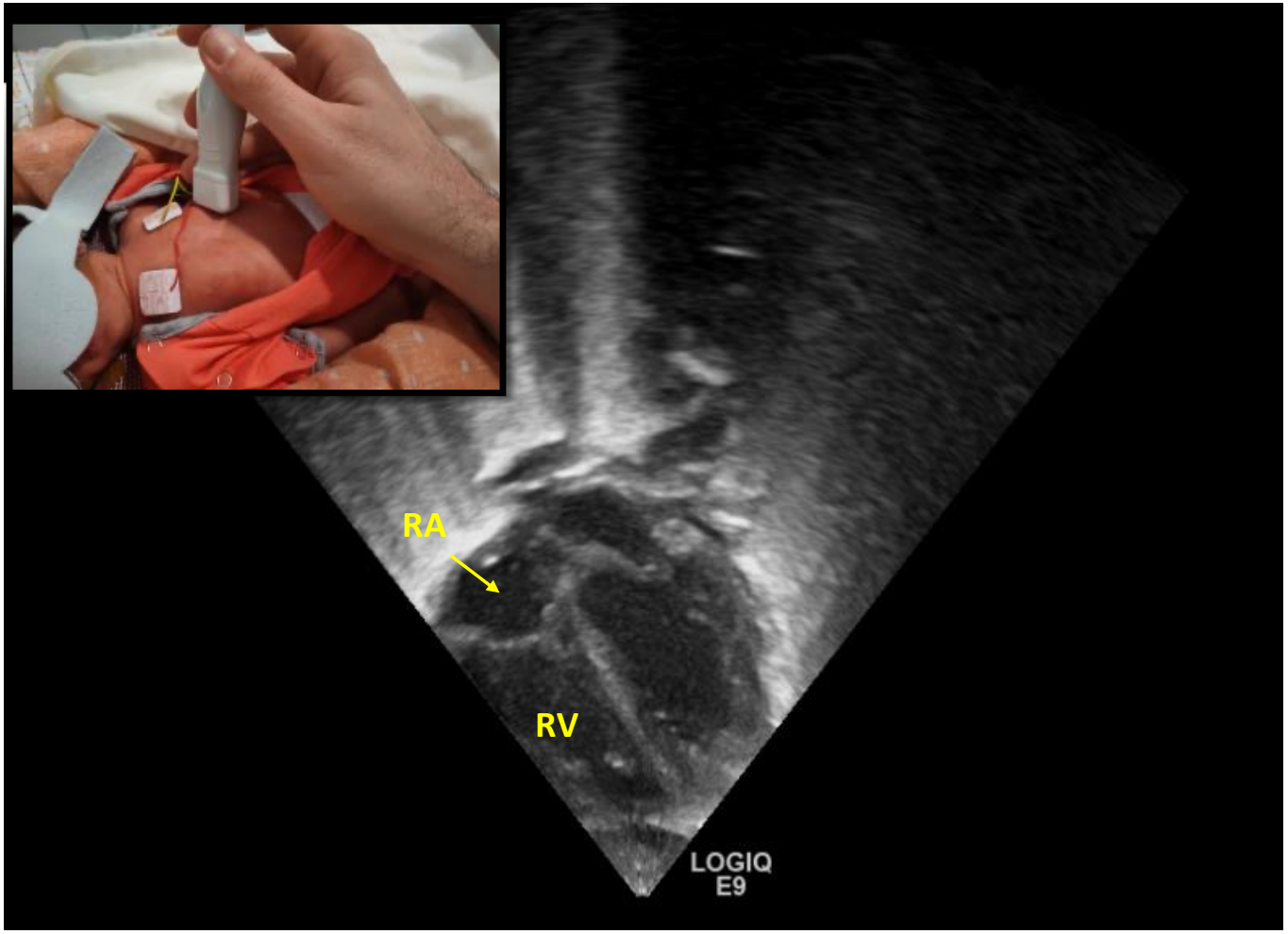
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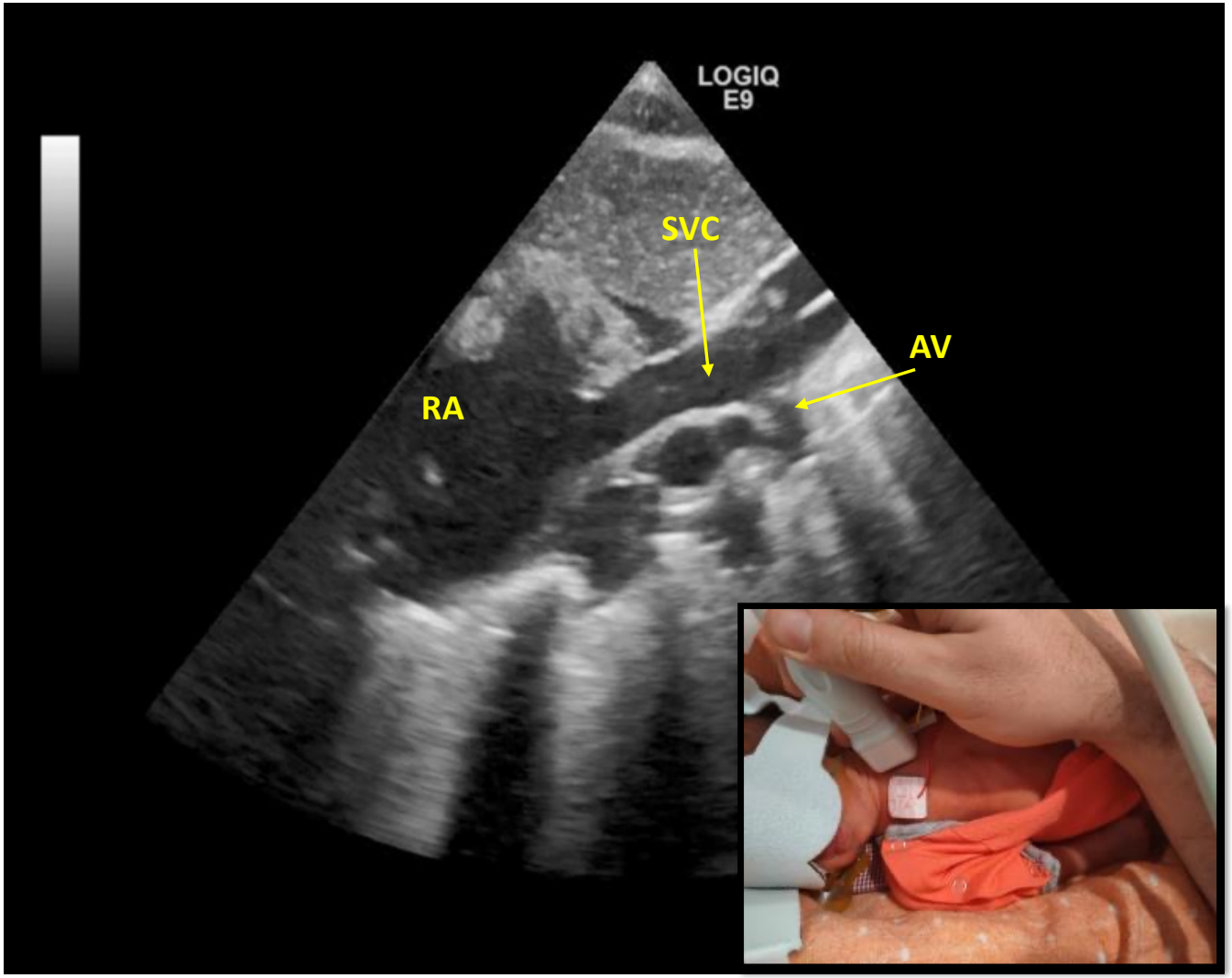
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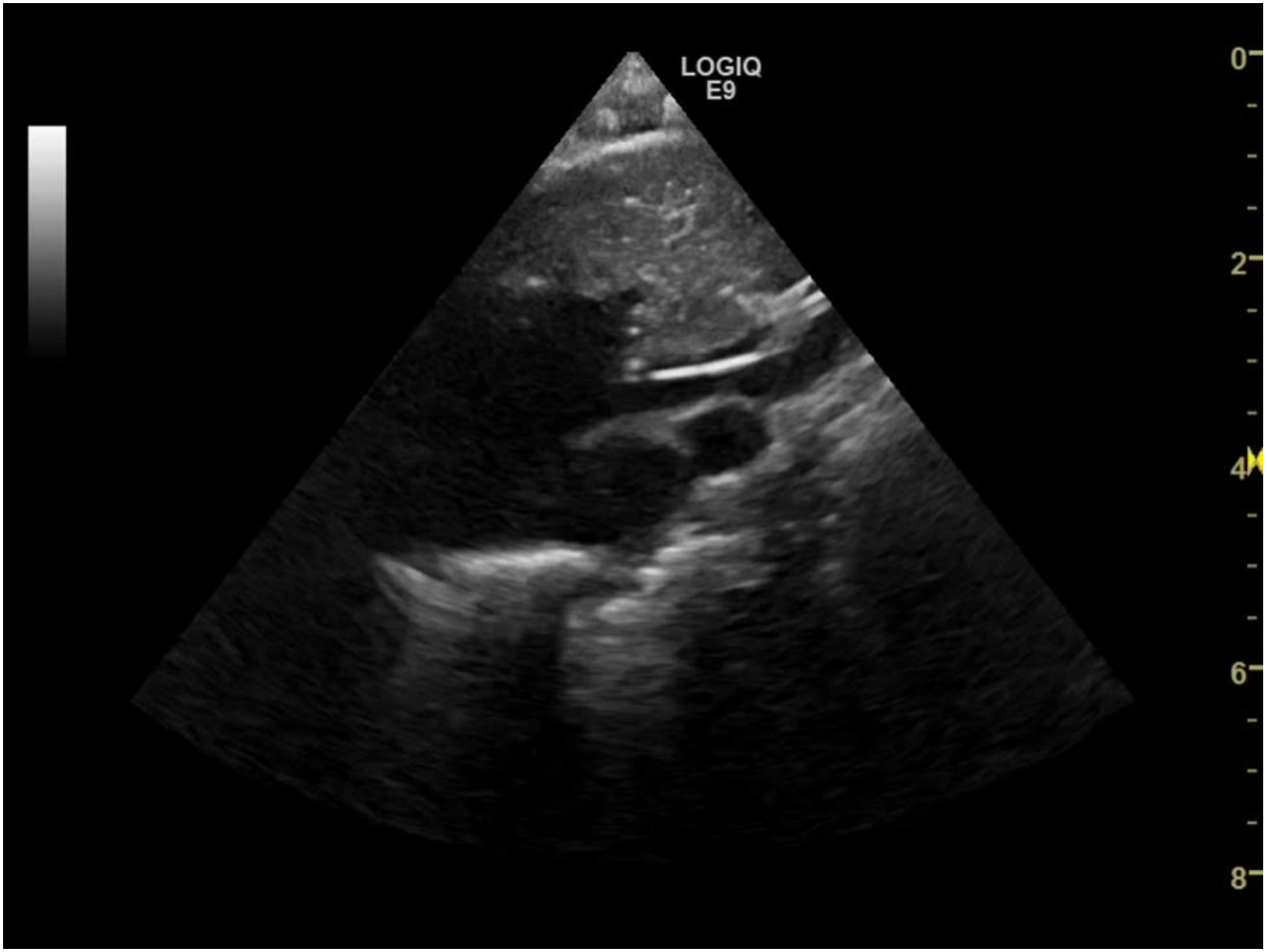
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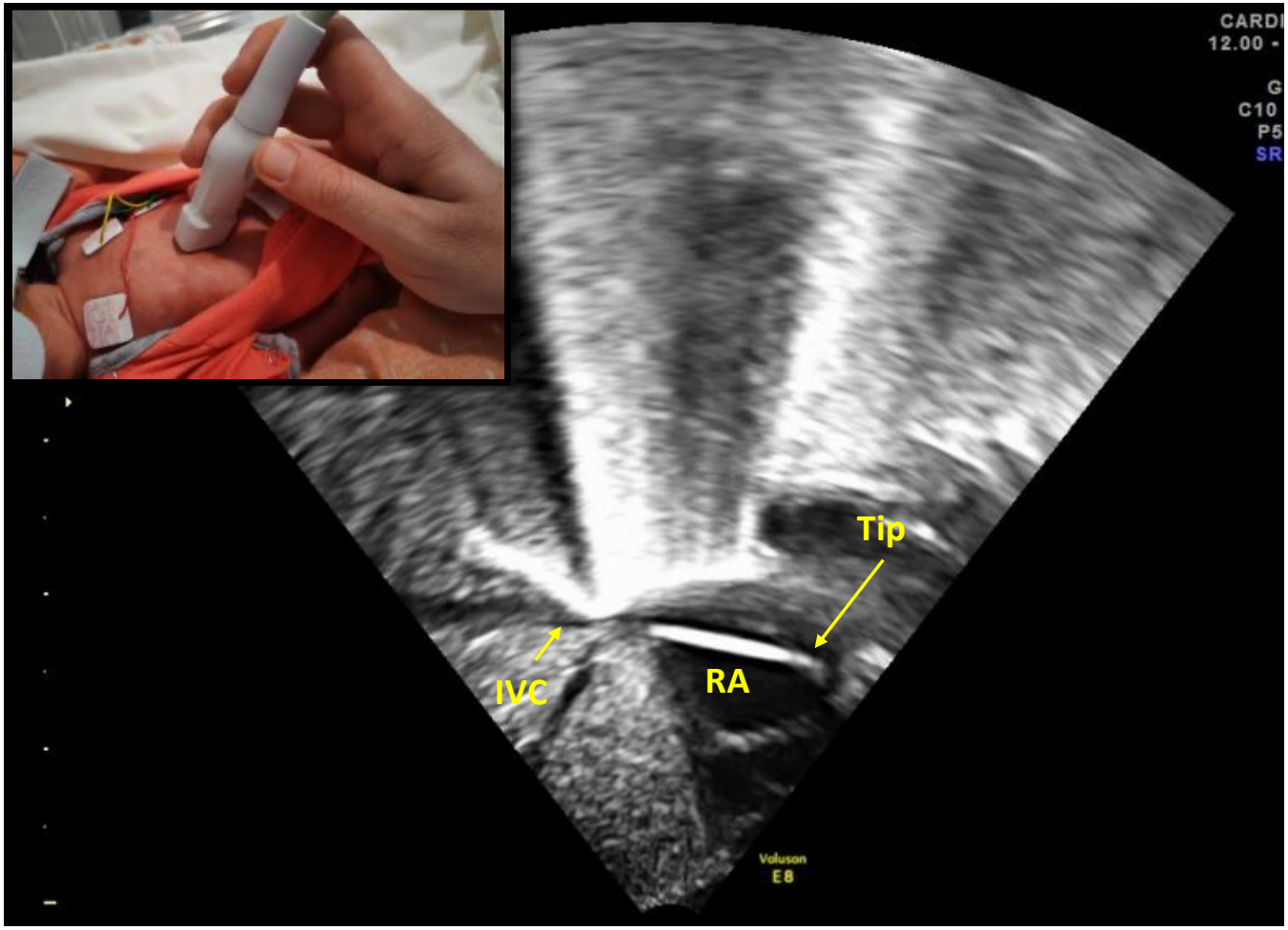
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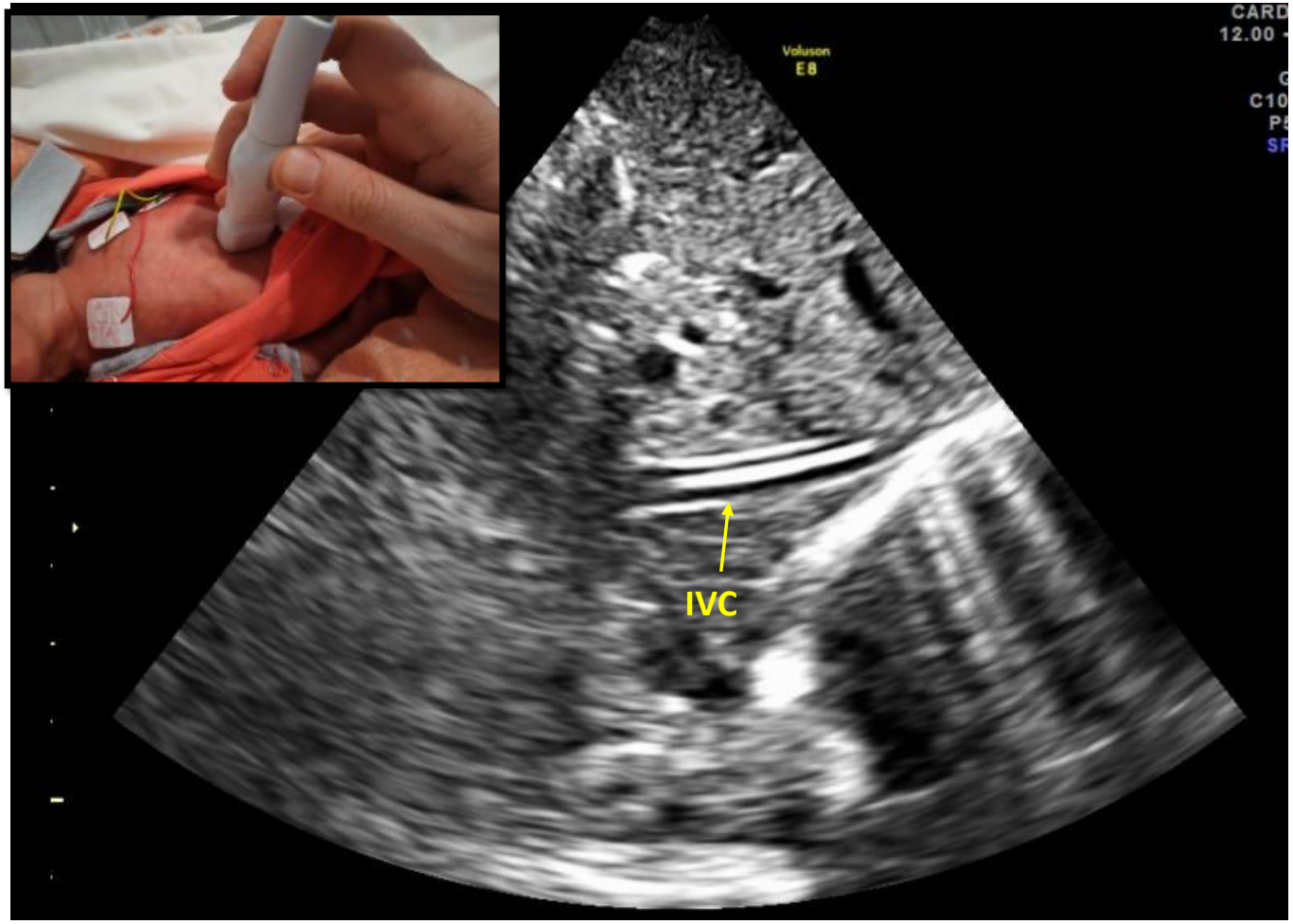

Table 1. Summary of Neo-ECHO tip.

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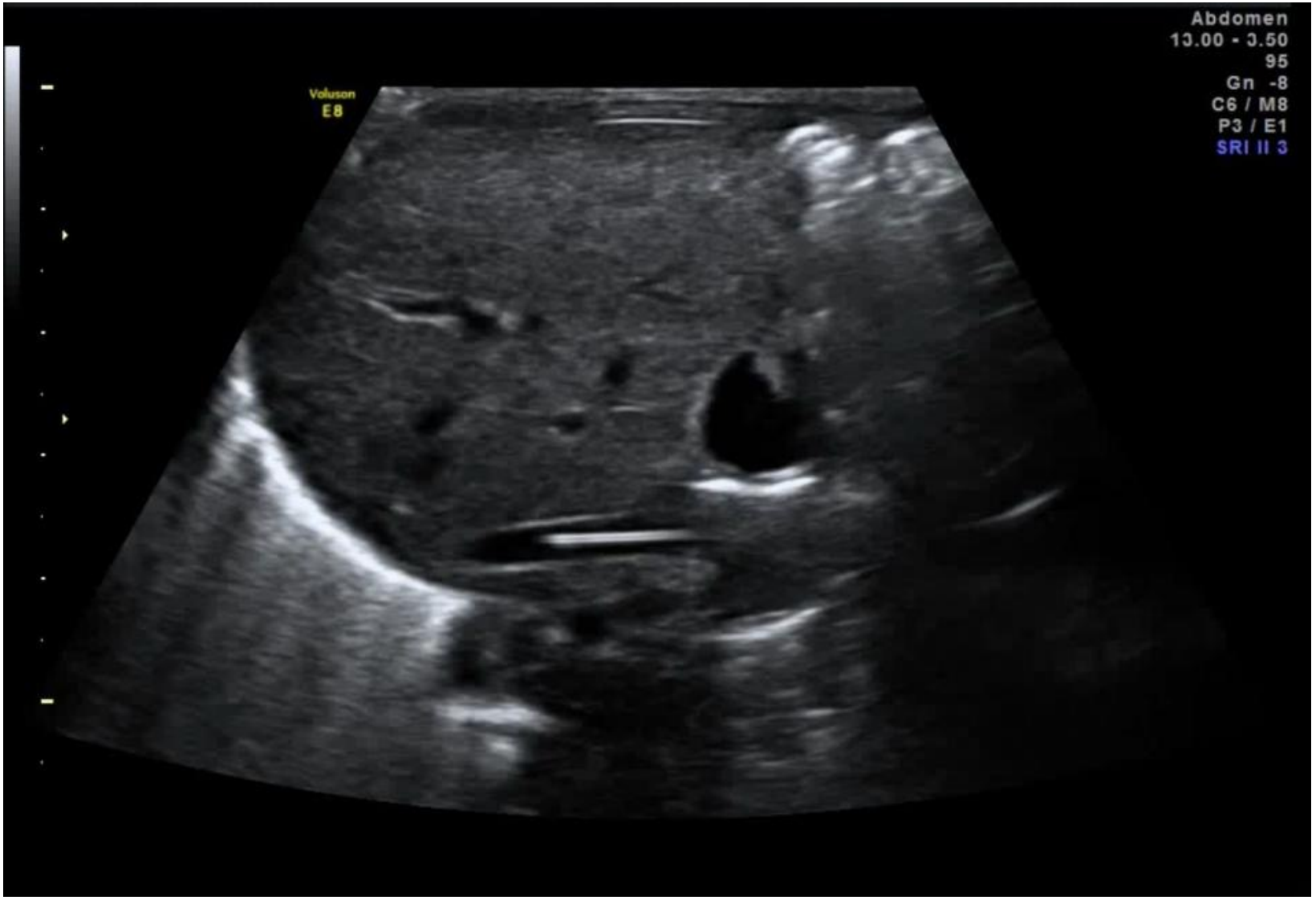
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
ECCs inserted via veins of the scalp or of the upper limbs	Tip navigation	Linear "hockey stick" probe, 10–14 MHz	Acoustic windows of RaCeVA and RaPeVA
	Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical 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	
	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

+ TRANSEPATICA

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.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95
Gn -8
C6 / M8
P3 / E1
SRI II 3

Ultrasound guided Catheter Tip Location in Neonates: A Prospective Cohort Study

Fiorentino Grasso, MD[1], Antonella Capasso, MD[1], Daniela Pacella, PhD[2], Francesco Borgia, MD[3], Serena Salomè, MD[1], Letizia Capasso, MD, PhD[1], and Francesco Raimondi, MD, PhD[1]

Objective To assess point-of-care-ultrasound (POCUS) guided catheter tip location in a neonatal cohort after insertion of percutaneously inserted central catheters (PICCs) from the upper part of the body.

Study design This was a prospective, observational study on PICC tip location. Tip site was assessed by radiological landmarks or direct ultrasound (US) visualization of the cardiovascular structures.

Results One hundred eighteen PICCs (28Gauge/1French) were studied in 102 neonates (mean postmenstrual age 31 weeks, range 25-43 weeks; mean weight at positioning 1365 g, range 420-4180 g). Feasibility of POCUS guided tip location was 92.3% in our population. Failures were significantly associated with mechanical ventilation (aOR 5.33; 95% CI 1.13-29.5; $P = .038$). Agreement between US and radiographic methods was found in 88 of 109 cases (80.7%). Fifteen of 21 discordant cases led to a change in clinical management.

Conclusions POCUS guided localization of small bore PICC is a non-invasive and effective alternative to the conventional radiogram. The latter should be recommended when US examination fails to locate the catheter tip. *(J Pediatr 2022; ■:1-5)*.

Ultrasound-guided catheter tip location in neonatal central venous access. Focus on well-defined protocols and proper ultrasound training

To the Editor:

We read with great interest the report by Grasso et al regarding the use of point-of-care ultrasound scanning to assess the catheter tip location in a neonatal intensive care unit.[1] As pointed out by the authors, the advantages in the use of point-of-care ultrasound scanning are maximal accuracy of tip location, avoidance of x-ray exposure, and use of a real-time, intraprocedural method that completely avoids the risk of primary malposition.

In our opinion, the most interesting finding of this study is the high success rate in tip location. This is probably secondary to the appropriate training of the health care providers in the use of ultrasound scans and to the adoption of a well-defined protocol for tip location. We have previously proposed a very similar approach,[2] developing a protocol, "Neo-ECHOTIP," which includes the use of 3 different acoustic windows (apical 4-chamber view, bicaval subcostal view, high right parasternal longitudinal view) plus a small flush of normal saline (so-called "bubble test"), so to increase the accuracy of tip visualization.

The Neo-ECHOTIP protocol should be further evaluated in prospective studies before being regarded as a standard of care; hopefully, it may be included as part of training programs for all neonatologists, providing a solid foundation for intraprocedural tip location during catheter insertion.

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The authors declare no conflicts of interest.

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2. Barone G, Pittiruti M, Biasucci DG, Elisei D, Iacobone E, La Greca A, et al. Neo-ECHOTIP: a structured protocol for ultrasound-based tip navigation and tip location during placement of central venous access devices in neonates. J Vasc Access 2021. https://doi.org/10.1177/11297298211007703

Prevenzione della malposizione primaria

Real-Time Ultrasound Tip Location Reduces Malposition and Radiation Exposure during Epicutaneo-Caval Catheter Placement in Neonates

Vito D'Andrea, MD[1,*] Giorgia Prontera, MD[1,*] Francesco Cota, MD[1] Rosellina Russo, MD[2]
Giovanni Barone, MD[3] Giovanni Vento, MD[1]

	X-ray	RT-US	*p*-Value
Primary malposition	107 (65.4%)	11 (13.25%)	<0.001
Single repositioning	79 (47.88%)	10 (12.5%)	<0.001
Multiple repositioning	28 (16.97%)	1 (1.2%)	<0.001

Techniques in vascular access

JVA | The Journal of Vascular Access

The SIECC protocol: A novel insertion bundle to minimize the complications related to epicutaneo-cava catheters in neonates

The Journal of Vascular Access
1–6

DOI: 10.1177/11297298241239699
journals.sagepub.com/home/jva
Sage

Vito D'Andrea[1], Mauro Pittiruti[2], Giorgia Prontera[1], Gianni Vento[1] and Giovanni Barone[3]

Table 1. The seven steps of the SIECC protocol.

1. Pre-procedural evaluation of superficial veins (including the RaSuVA protocol)
2. Adoption of pre-assembled insertion kits
3. Appropriate aseptic technique (hand hygiene, maximal barrier precautions, skin antisepsis with 2% chlorhexidine in 70% isopropyl alcohol)
4. Intra-procedural assessment of tip navigation and tip location by ultrasound (adopting the Neo-ECHOTIP protocol)
5. Securement of the catheter and protection of the exit site
6. Post-procedural serial assessments of tip location by ultrasound
7. Removal of the device within 2 weeks

In sintesi: tip location dell'ECC

- Ecocardioscopia intraprocedurale rappresenta la metodica di scelta.
- Consente di prevenire efficacemente la malposizione primaria.
- Utilizzare il protocollo Neo-Echotip + transepatica per i cateteri provenienti dagli arti inferiori.
- Necessita di training.

Metodologie di tip location nel neonato: ECG intracavitario vs. ECHOTIP

CICC e FICC

Tip location di CICC e FICC

Table 1. Tip location by intracavitary ECG.

Vascular Access Device	Applicability	Feasibility	Accuracy
UVC	Applicable, but not recommended	Yes	Low
ECC – upper limbs	Applicable, but not recommended	Not always feasible	High
ECC – lower limbs	Not always applicable	Not always feasible	Low
CICC	Applicable and highly recommended	Yes	High
FICC	Not always applicable	Not always feasible	Low

IC-ECG = never applicable for tip navigation.

Table 2. Tip location by real time ultrasound.

Vascular Access Device	Applicability	Feasibility	Accuracy
UVC	Applicable, highly recommended	Yes	High
ECC – upper limbs	Applicable, recommended	Yes	High
ECC – lower limbs	Applicable, recommended	Yes	High
CICC	Applicable	Yes	High
FICC	Applicable, recommended	Yes	High

Real time ultrasound = always applicable for tip navigation.

An Italian expert consensus on the choice of the method of tip location for central venous access devices

Panel recommendation

Statement 3.1: The IC-ECG method is recommended as the intraprocedural method of first choice for the tip location of any CVAD whose tip is to be placed near the junction between superior vena cava and right atrium, or inside the right atrium (with the exception of ECC in the newborn).

Original research article

JVA | The Journal of Vascular Access

The intracavitary ECG method for tip location of ultrasound-guided centrally inserted central catheter in neonates

The Journal of Vascular Access
1–6

DOI: 10.1177/11297298211068302
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SAGE

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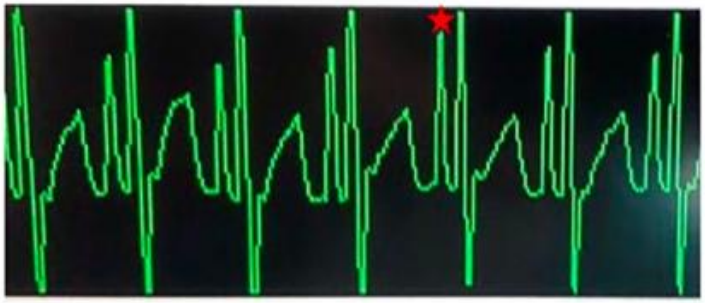
2022



The applicability of IC-ECG was 100%, since a P wave was evident on the surface ECG of all neonates recruited for the study.

The feasibility of IC-ECG was also 100%, since a peak of the P wave was identified during all procedures.

The match between IC-ECG based tip location and ultrasound-based tip location was optimal, since all catheters were properly located at the CAJ as judged by ultrasound. All catheter tips were identified at ultrasound tip location, using one or more of the windows as described above.

Tip location di CICC e FICC

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CICC	Applicable	Yes	High
FICC	Applicable, recommended	Yes	High

Real time ultrasound = always applicable for tip navigation.

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.


6.0cm
2D
67%
C 50
P Off
AGen
PLAX
6 M4
X2
5
4
3
2
1
G
P
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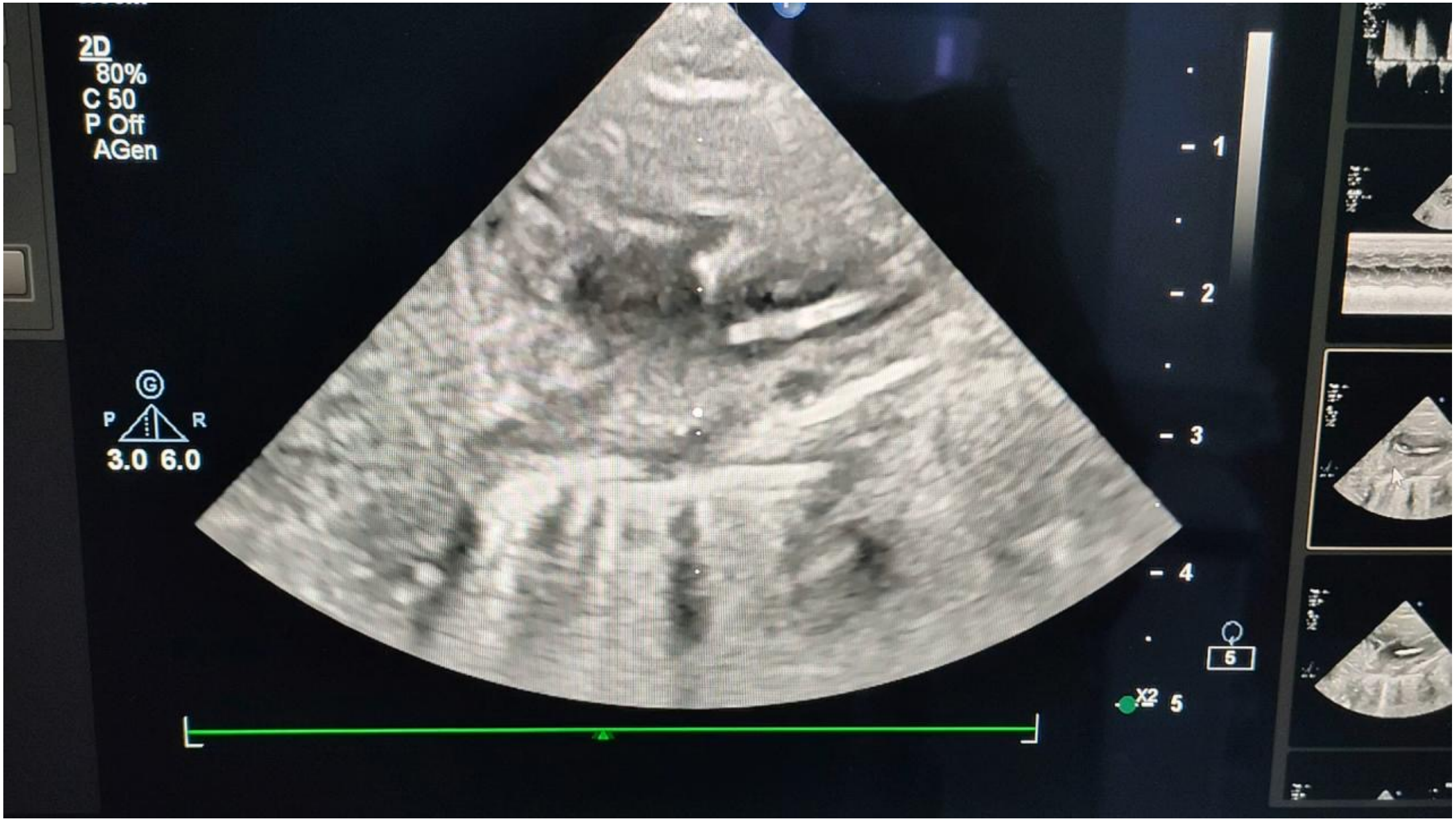
3.0 6.0
15


2D
80%
C 50
P Off
AGen
G
P
R
3.0 6.0
1
2
3
4
6
X2 5

Clinical trial protocol

JVA The Journal of Vascular Access

A GAVeCeLT bundle for central venous catheterization in neonates and children: A prospective clinical study on 729 cases

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1–12

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SAGE

Mauro Pittiruti[1], Davide Celentano[2], Giovanni Barone[3], Vito D'Andrea[4], Maria Giuseppina Annetta[5] and Giorgio Conti[2]

Ultrasound pre-puncture evaluation of central veins (RaCeVA)
Hand hygiene and maximal barrier precautions
Skin antisepsis with 2% chlorhexidine in alcohol
Ultrasound-guided venipuncture
Tip location by intracavitary echocardiography and/or echocardiography
Tunneling the catheter so as to obtain an exit site in the infraclavicular area
Securement with the sutureless device
Sealing of the exit site with glue
Coverage with transparent semipermeable dressing

Table 1. Summary of Neo-ECHO tip.

Catheter	Protocol	Probe	Windows
UVC	Tip navigation	Small sectorial probe, 7–8 MHz	Low subcostal longitudinal view
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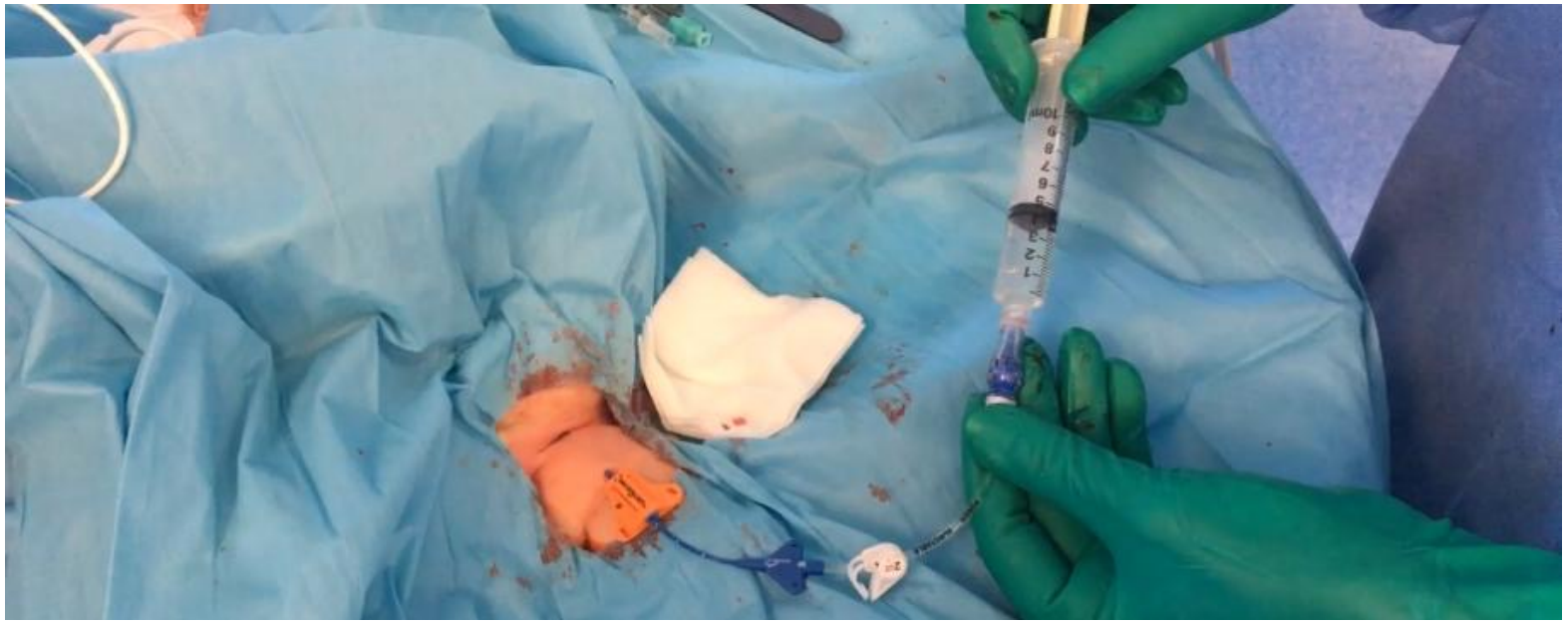
ECCs inserted via veins of the lower limbs	Tip navigation	Linear "hockey stick" probe, 10–14 MHz	Short and long axis view of the femoral vein
	Tip location	Small sectorial probe, 7–8 MHz	Subcostal longitudinal view
CICC	Tip navigation	Linear "hockey stick" probe, 10–14 MHz	Acoustic windows of RaCeVA
	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; nt; CICC: centrally inserted central catheter; FICC: femoral inserted central catheter.

+ TRANSEPATICA



In sintesi: tip location di CICC e FICC

- L’ECG è il gold standard per la tip location durante il posizionamento di CICC, in quanto è applicabile, accurato, fattibile, economico e richiede solo un **training minimo**.
- L’ECG può essere effettuato dallo stesso impiantatore e senza necessità di cambiare sonda.
- L’ecografia ha un suo ruolo fondamendale nella diagnosi corretta della malposizione primaria e per la tip location dei FICC.

Conclusioni

- Il controllo radiologico post-procedurale non è mai indicato se non nei rarissima casi in cui il controllo intraprocedurale sia fallito.
- La verifica della posizione della punta deve sempre essere **intraprocedurale**.
- **L'ecocardioscopia** rappresenta il gold standard per l'impianto di CVO, ECC e FICC.
- L'utilizzo di **protocolli standardizzati (Neo-Echo tip)** incrementa il successo della metodica.
- **L'ECG endocavitario** è la metodica di scelta per il posizionamento di CICC anche se l'integrazione con l'ecocardioscopia è consigliabile.

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SIN
Società Italiana di Neonatologia

GAVePed
Gruppo Accessi Venosi Pediatrici

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