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Gruppo Accessi Venosi Pediatrici

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2025 MILANO

Il protocollo ISCaVO per la inserzione dei cateteri venosi ombelicali

Giovanni Barone
Ospedale Infermi di Rimini

GdS Accessi Vascolari Neonatali

GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine

Il protocollo ISCaVO per la inserzione dei cateteri venosi ombelicali

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

Agenda – Parte 1

INDICAZIONI

TECNICA DI INSERZIONE

TEMPO DI PERMANENZA

TAKE HOME MESSAGES

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Infection Control & Hospital Epidemiology (2022), 1–17
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SHEA

SHEA/IDSA/APIC Practice Recommendation

Strategies to prevent central line-associated bloodstream infections in acute-care hospitals: 2022 Update

Niccolò Buetti MD, MSc, PhD[1,2,a], Jonas Marschall MD, MSc[3,4,a], Marci Drees MD, MS[5,6], Mohamad G. Fakih MD, MPH[7], Lynn Hadaway MEd, RN, NPD-BC, CRNI[8], Lisa L. Maragakis MD, MPH[9], Elizabeth Monsees PhD, MBA, RN, CIC[10,11], Shannon Novosad MD MPH[12], Naomi P. O'Grady MD[13], Mark E. Rupp MD[14], Joshua Wolf MBBS, PhD, FRACP[15,16], Deborah Yokoe MD, MPH[17] and Leonard A. Mermel DO, ScM[18,19]

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1. **Provide easy access to an evidence-based list of indications for CVC use to minimize unnecessary CVC placement** (Quality of Evidence: LOW)
2. **Require education and competency assessment of healthcare personnel (HCP) involved in insertion, care, and maintenance of CVCs about CLABSI prevention** (Quality of Evidence: MODERATE)[74–78]
   a. Include the indications for catheter use, appropriate insertion and maintenance, the risk of CLABSI, and general infection prevention strategies.
   b. Ensure that all HCP involved in catheter insertion and maintenance complete an educational program on essential practices to prevent CLABSI before performing these duties.[79,80] Periodic retraining with a competency assessment may be of benefit.[81]
   c. Periodically assess HCP knowledge of and adherence to preventive measures.
   d. Require all HCP who insert a CVC to undergo a credentialing process (as established by the individual healthcare institution) to ensure their competency before independently inserting a CVC and aseptic technique for accessing and maintaining the CVC thereafter.
   e. Re-educate when an institution changes components of the infusion system that requires a change in practice (eg, when an institution's change of the needleless connector requires a change in nursing practice).
   f. Use simulation training for proper catheter insertion and maintenance if available.[82–85]

European Journal of Pediatrics
https://doi.org/10.1007/s00431-023-04984-4

EDITORIAL

The neonatal DAV-expert algorithm: a GAVeCeLT/GAVePed consensus for the choice of the most appropriate venous access in newborns

Giovanni Barone[1] · Vito D'Andrea[2] · Gina Ancora[1] · Francesco Cresi[3] · Luca Maggio[4] · Antonella Capasso[5] · Rossella Mastroianni[6] · Nicola Pozzi[7] · Carmen Rodriguez-Perez[8] · Maria Grazia Romitti[9] · Francesca Tota[10] · Ferdinando Spagnuolo[11] · Francesco Raimondi[5] · Mauro Pittiruti[12]

Received: 13 February 2023 / Revised: 11 April 2023 / Accepted: 15 April 2023

Indicazioni al CVO

1. Appropriate indications for UVC include (a) preterm infants born at or less than 28 weeks of gestation at the time of birth; (b) neonates with severe respiratory distress (intubated or on non-invasive ventilation with FiO2 > 40%), or with hemodynamic instability, or with difficulty in finding peripheral venous access at the time of birth; (c) neonates affected by asphyxia requiring therapeutic hypothermia.
2. UVCs should be in polyurethane.
3. Silver-coated polyurethane UVCs should be considered in selected cases of preterm infants which are expected to require a prolonged dwelling time of the device.
4. Double lumen UVCs should be preferred (a) in infants requiring repeated blood samples; (b) in infants requiring multiple continuous infusions; (c) in infants simultaneously requiring parenteral nutrition (PN) + intravenous drugs not compatible with PN.
5. UVCs should be preferably removed early (within 4–5 days), for the purpose of reducing infective and thrombotic complications.

Agenda

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ISCaVO

l’Impianto Sicuro del Catetere Venoso Ombelicale nel neonato

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

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

The Journal of Vascular Access
1–6

DOI: 10.1177/11297298241236220
journals.sagepub.com/home/jva
Sage

frontiers in Pediatrics

MINI REVIEW
published: 31 January 2022
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Umbilical Venous Catheter Update: A Narrative Review Including Ultrasound and Training

Vito D'Andrea[1], Giorgia Prontera[1], Serena Antonia Rubortone[1], Lucilla Pezza[1], Giovanni Pinna[1], Giovanni Barone[2], Mauro Pittiruti[3] and Giovanni Vento[1]*

[1] Division of Neonatology, Department of Woman and Child Health and Public Health, University Hospital Fondazione Policlinico Gemelli Istituto di Ricovero e Cura a Carattere Scientifico (IRCCS), Rome, Italy, [2] Neonatal Intensive Care Unit, Infermi Hospital, Rimini, Italy, [3] Department of Surgery, University Hospital Fondazione Policlinico Gemelli Istituto di Ricovero e Cura a Carattere Scientifico (IRCCS), Rome, Italy

The umbilical venous catheter (UVC) is one of the most commonly used central lines in neonates. It can be easily inserted soon after birth providing stable intravenous access in infants requiring advanced resuscitation in the delivery room or needing medications, fluids, and parenteral nutrition during the 1st days of life. Resident training is crucial for UVC placement. The use of simulators allows trainees to gain practical experience and confidence in performing the procedure without risks for patients. UVCs are easy to insert, however when the procedure is performed without the use of ultrasound, there is a quite high risk, up to 40%, of non-central position. Ultrasound-guided UVC tip location is a simple and learnable technique and therefore should be widespread among all physicians. The feasibility of targeted training on the use of point-of-care ultrasound (POCUS) for UVC placement in the neonatal intensive care unit (NICU) among neonatal medical staff has been demonstrated. Conversely, UVC-related complications are very common and can sometimes be life-threatening. Despite UVCs being used by neonatologists for over 60 years, there are still no standard guidelines for assessment or monitoring of tip location, securement, management, or dwell time. This review article is an overview of the current knowledge and evidence available in the literature about

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Impianto Sicuro del Catetere Venoso Ombelicale nel neonato

1. Valutazione ecografica pre-procedurale.
2. Utilizzo di un pack procedurale pre-assemblato.
3. Tecnica asettica appropriata: igiene delle mani, massime protezioni di barriera e antisepsi cutanea con clorexidina 2% in IPA 70%.
4. Incannulamento della vena ombelicale usando il catetere più piccolo sulla base delle necessità infusionali del paziente (mono/bilume)
5. Utilizzo dell'ecografo per la tip navigation e la tip location intra-pocedurale (secondo il protocollo NeoECHOTip).
6. Stabilizzazione del catetere e protezione del sito di emergenza (colla in cianoacrilato, membrana semipermeabile trasparente e "sutureless device ?")
7. Controlli seriati della posizione della punta usando l'ecografia (24-48 ore)
8. Rimozione precoce (entro 4-5 giorni)

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Ecografia preprocedurale

- ✓ Identificare varianti anatomiche (azygos continuation (0,2-3%), vena ombelicale destra, etc.
- ✓ Valutazione dell'angolo tra recesso ombelicale e DVA
- ✓ Valutazione della pervietà del DVA
- ✓ Valutazione del diametro del DVA (?)

Ecografia preprocedurale

- ✓ Identificare varianti anatomiche (azygos continuation (0,2-3%), vena ombelicale destra, etc.
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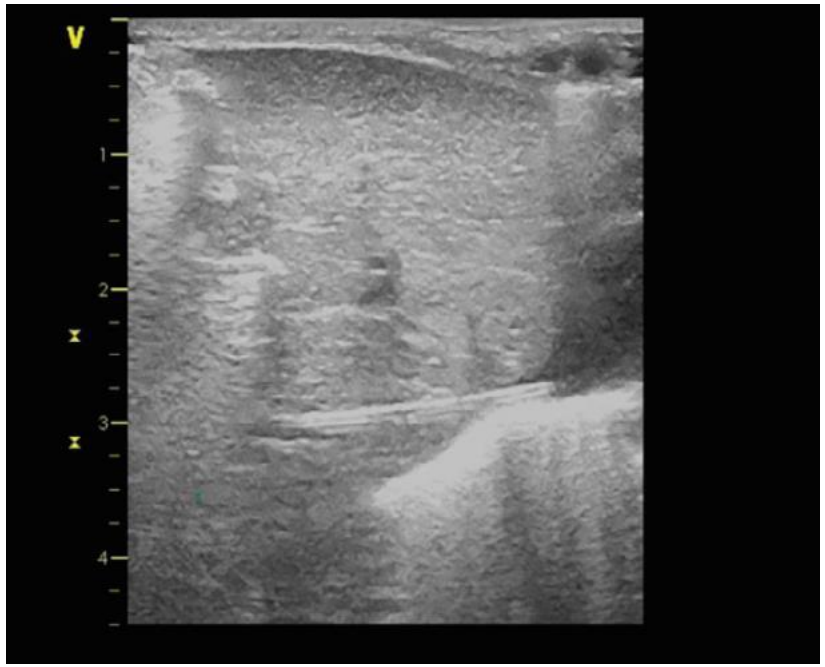
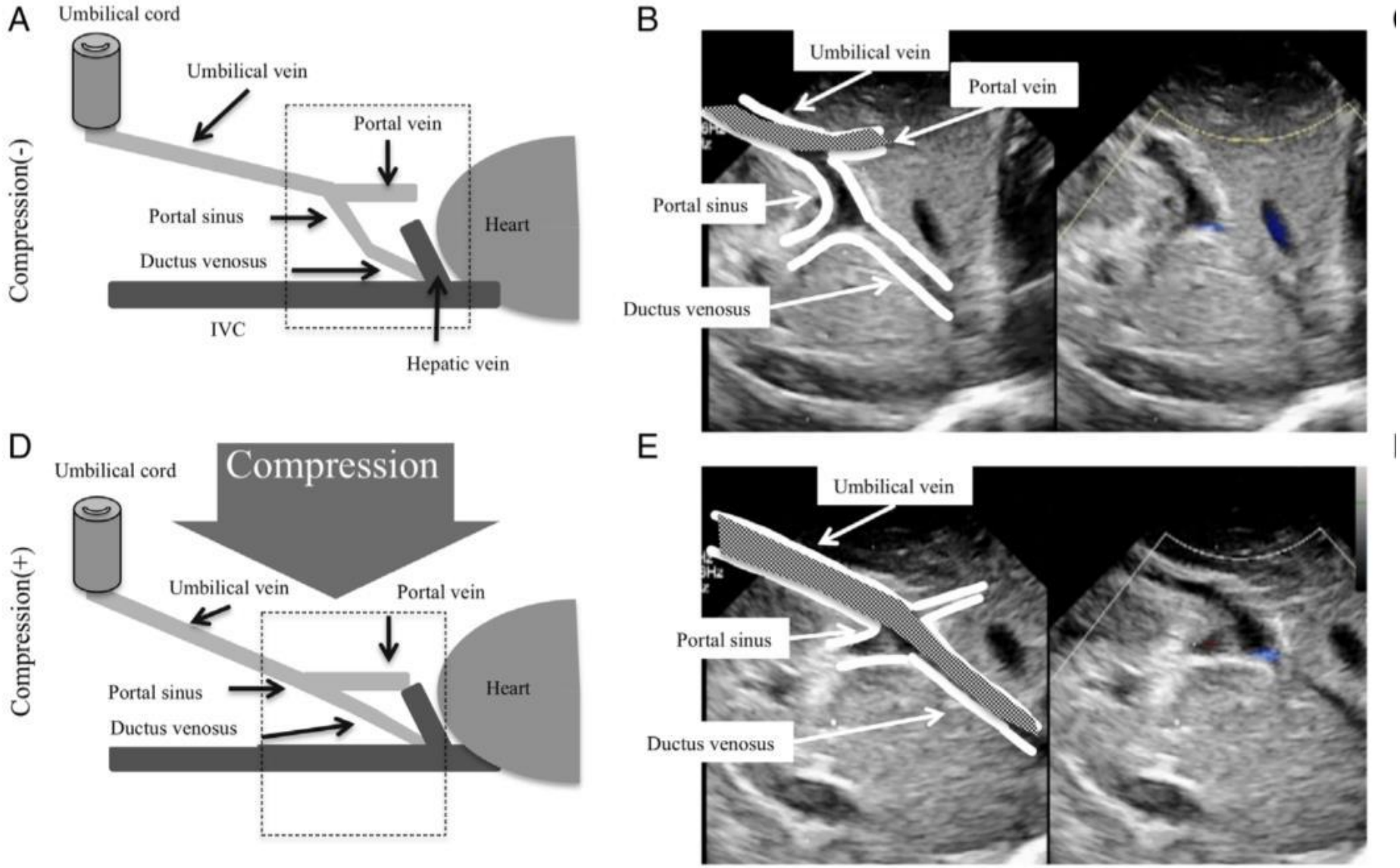
- ✓ Valutazione del diametro del DVA (?)



Inserzione extraepatica della vena ombelicale destra sulla vena iliaca interna

Ecografia preprocedurale

- ✓ Identificare varianti anatomiche (azygos continuation (0,2-3%), vena ombelicale destra, etc.
- ✓ Valutazione dell'angolo tra recesso ombelicale e DVA
- ✓ Valutazione della pervietà del DVA
- ✓ Valutazione del diametro del DVA (?)



Kishigami et al. Ultrasound-Guided Umbilical Venous Catheter Insertion With Alignment of the Umbilical Vein and Ductus Venosus. J of ultrasound Medicine 2019

Ecografia preprocedurale

- ✓ Identificare varianti anatomiche (azygos continuation (0,2-3%), vena ombelicale destra, etc.
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33. VASCULAR ACCESS SITE PREPARATION AND DEVICE PLACEMENT

III. Central Vascular Access Device (CVAD)

A. Implement the central line bundle when placing CVADs, which includes the following interventions:

hand hygiene; skin antisepsis using >0.5% chlorhexidine in alcohol solution; maximal sterile barrier precautions; and avoidance of the femoral vein in obese adult patients during placement under planned and controlled conditions.[3,15,16,33] (I)

Ensure adherence to proper technique through use of and completion of a standardized checklist completed by an educated health care clinician and empower the clinician to stop the procedure for any breaches in aseptic technique. Completion of a checklist should be done by someone other than the CVAD inserter.[15,34]

Use a standardized supply cart or kit that contains all necessary components for the insertion of a CVAD.[15] (IV)

4. **Use an all-inclusive catheter cart or kit** (Quality of Evidence: MODERATE)[118]
   a. A catheter cart or kit that contains all necessary components for aseptic catheter insertion should be available and easily accessible in all units where CVCs are inserted.

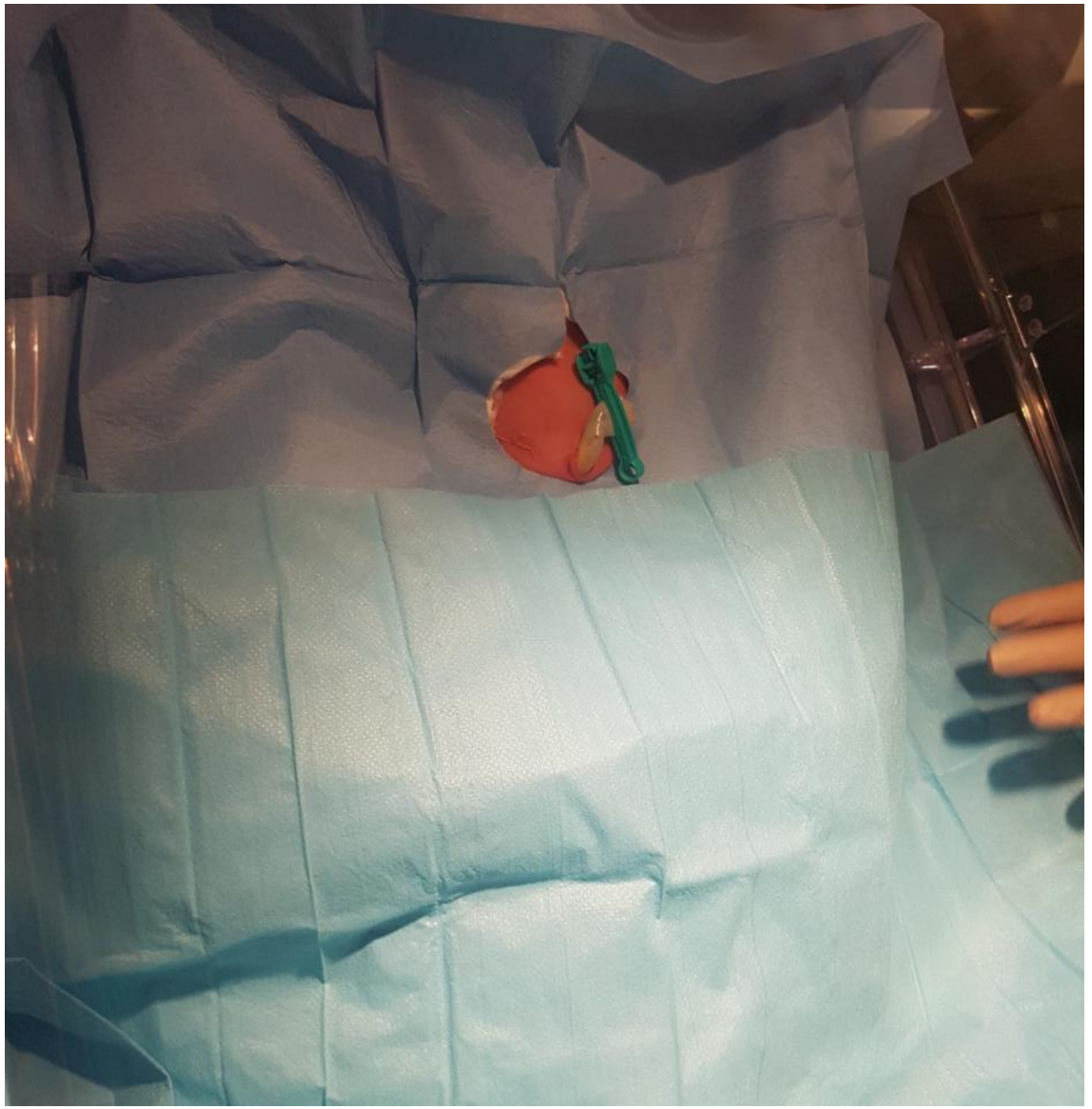

CUSTOMIZE
Macro


CUSTOM
Design
Your
Own
PRODUCTS

“Instruction for use..”

“Instruction for use..”

“Instruction for use..”



“Instruction for use..”

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8. Rimozione precoce (entro 4-5 giorni)

6. **Use maximum sterile barrier precautions during CVC insertion** (Quality of Evidence: MODERATE)[123–128]
   a. Use maximum sterile barrier precautions:
      i. A mask, cap, sterile gown, and sterile gloves are to be worn by all HCP involved in the catheter insertion procedure.
      ii. The patient is to be covered with a large ("full-body") sterile drape during catheter insertion.
   b. These measures should also be followed when exchanging a catheter over a guidewire.

1. **In ICU and non-ICU settings, a facility should have a process in place, such as a checklist, to ensure adherence to infection prevention practices at the time of CVC insertion** (Quality of Evidence: MODERATE)[101]
    a. Ensure and document adherence to aseptic technique
        i. Checklists have been suggested to ensure optimal insertion practices. If used, the documentation should be done by someone other than the inserter.
        ii. Observation of CVC insertion should be done by a nurse, physician, or other HCP who has received appropriate education (see above) to ensure that aseptic technique is maintained.
        iii. HCP should be empowered to stop the procedure if breaches in aseptic technique are observed.
2. **Perform hand hygiene prior to catheter insertion or manipulation** (Quality of Evidence: MODERATE)[102–107]
    a. Use an alcohol-based waterless product or soap and water.
        i. Use of gloves does not obviate hand hygiene.

7. **Use an alcoholic chlorhexidine antiseptic for skin preparation** (Quality of Evidence: HIGH)[42,129–134]
   a. Before catheter insertion, apply an alcoholic chlorhexidine solution containing at least 2% chlorhexidine gluconate to the insertion site.
      i. The antiseptic solution must be allowed to dry before making the skin puncture.
      ii. Alcoholic chlorhexidine for skin antisepsis to prevent CLABSI in NICU patients should be used when the benefits are judged to outweigh potential risk.

Journal of Hospital Infection 86S1 (2014) S1-S70

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England

H.P. Loveday[a]*, J.A. Wilson[a], R.J. Pratt[a], M. Golsorkhi[a], A. Tingle[a], A. Bak[a], J. Browne[a], J. Prieto[b], M. Wilcox[c]

[a] *Richard Wells Research Centre, College of Nursing, Midwifery and Healthcare, University of West London (London).*
[b] *Faculty of Health Sciences, University of Southampton (Southampton).*
[c] *Microbiology and Infection Control, Leeds Teaching Hospitals and University of Leeds (Leeds).*

IVAD14 Decontaminate the skin at the insertion site with a single-use application of 2% chlorhexidine gluconate in 70% isopropyl alcohol (or povidone iodine in alcohol for patients with sensitivity to chlorhexidine) and allow to dry prior to the insertion of a central venous access device.

Class A

IVAD15 Decontaminate the skin at the insertion site with a single-use application of 2% chlorhexidine gluconate in 70% isopropyl alcohol (or povidone iodine in alcohol for patients with sensitivity to chlorhexidine) and allow to dry before inserting a peripheral vascular access device.

New recommendation *Class D/GPP*

La disinfezione cutanea

What is already known on this topic?

- The 2011 guidelines for prevention of intravascular catheter-related infections recommend the use of at least 0.5% chlorhexidine solution with alcohol for skin disinfection.
- No recommendations can be made for the safety or efficacy of chlorhexidine in infants aged <2 months.
- Chlorhexidine skin disinfectants are widely used in neonates, but this solution may cause skin lesions in extremely preterm infants (gestational age <26 weeks).

What this study adds?

- Adverse skin reactions to both 2% chlorhexidine–70% isopropyl alcohol and aqueous 10% povidone–iodine are uncommon.
- Infants whose skin is cleaned with povidone–iodine are at significant risk of thyroid dysfunction.

0.2% chlorhexidine acetate as skin disinfectant prevents skin lesions in extremely preterm infants: a preliminary report. ADC 2017
2% chlorhexidine–70% isopropyl alcohol versus 10% povidone–iodine for insertion site cleaning before central line insertion in preterm infants: a randomised trial. ADC 2017
Healthcare Infection Control Practices Advisory Committee. Guidelines for the prevention of intravascular catheter-related infections. Am J Infect Control 2011;39:S1–S34.

La disinfezione cutanea

Table 1 Patient demographics

	CHX–IA (n=148)	PI (n=156)	p Value
Gestational age (weeks)*	27 (2)	27 (2)	0.558
Birth weight (g)*	1017 (289)	1014 (326)	0.92
Skin damage from IMP*	3 (2)	2 (1.3)	0.677
Raised TSH on screening*	0 (0)	12 (7.7)	<0.001
Raised TSH in serum*	0 (0)	10 (6.4)	0.002
Treatment with thyroxine*	0 (0)	8 (5.1)	0.003

0.2% chlorhexidine acetate as skin disinfectant prevents skin lesions in extremely preterm infants: a preliminary report. ADC 2017
2% chlorhexidine–70% isopropyl alcohol versus 10% povidone–iodine for insertion site cleaning before central line insertion in preterm infants: a randomised trial. ADC 2017
Healthcare Infection Control Practices Advisory Committee. Guidelines for the prevention of intravascular catheter-related infections. Am J Infect Control 2011;39:S1–S34.

La disinfezione cutanea

Aree di disinfezione per applicatore monodose:

- 0.67 ml: 5 cm x 8 cm
- 1 ml: 8 cm x 10 cm
- 1.5 ml: 10 cm x 13 cm
- 3 ml: 15 cm x 15 cm

Instructions for using ChloraPrep® applicators.

La disinfezione cutanea

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Instructions for using ChloraPrep® applicators.

Uso della Clorexidina in TIN…

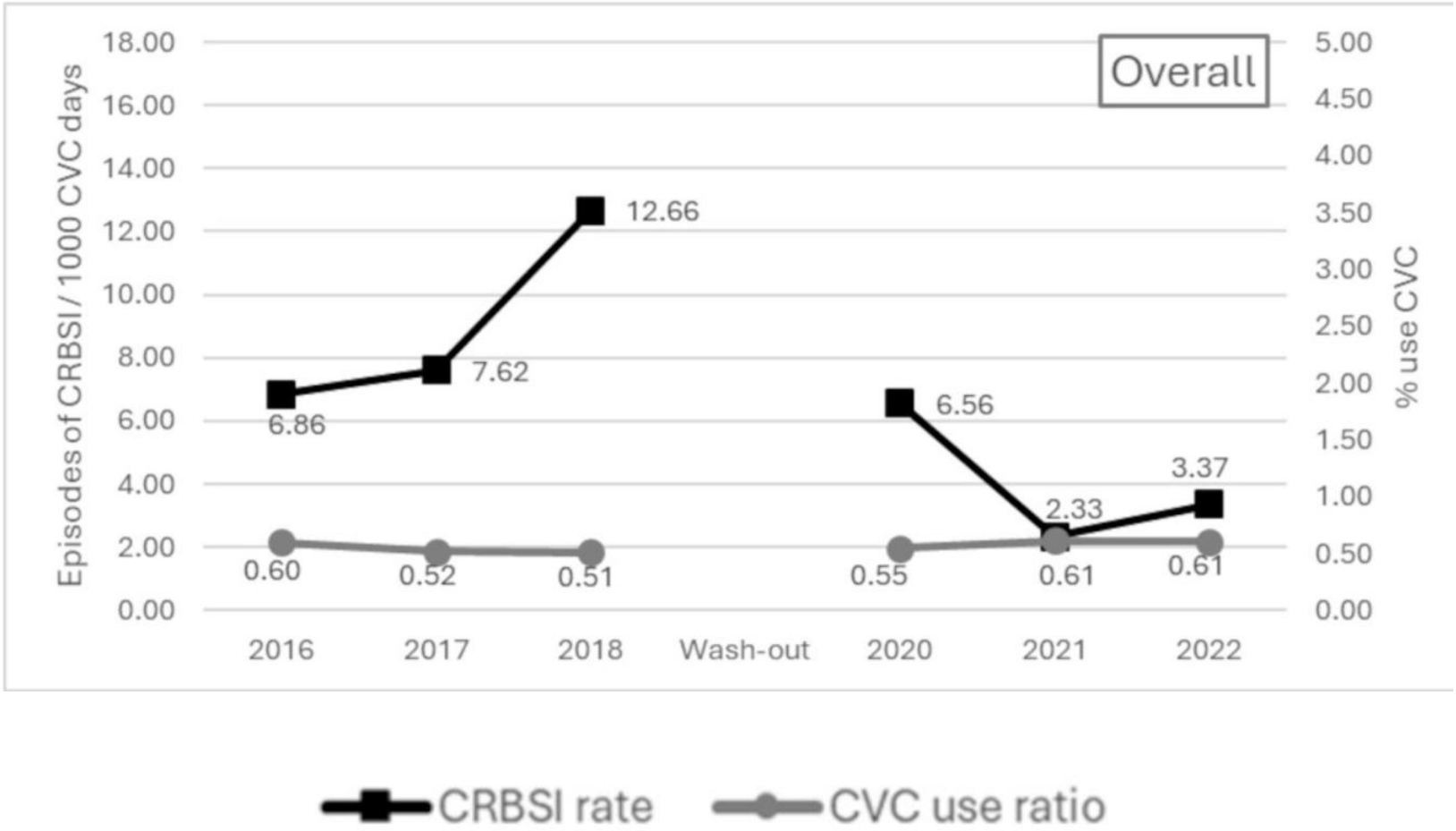
Allo scopo di minimizzare il rischio delle reazioni senza perdere i vantaggi legati all'uso della clorexidina

- Usare le quantità idonee
- Usare applicatori monodose
- Rimuovere la clorexidina in eccesso (no pooling)
- Usare la soluzione fisiologica e l'asciugatura dopo l'applicazione della clorexidina
- Evitare lo scrubbing della cute

Neonatal skin antisepsis with alcohol-based compared to aqueous 2% chlorhexidine, used in moderate preterm infants or extremely preterm infants after the first week of life, is safe and may be associated with a reduced incidence of catheter-related bloodstream infections

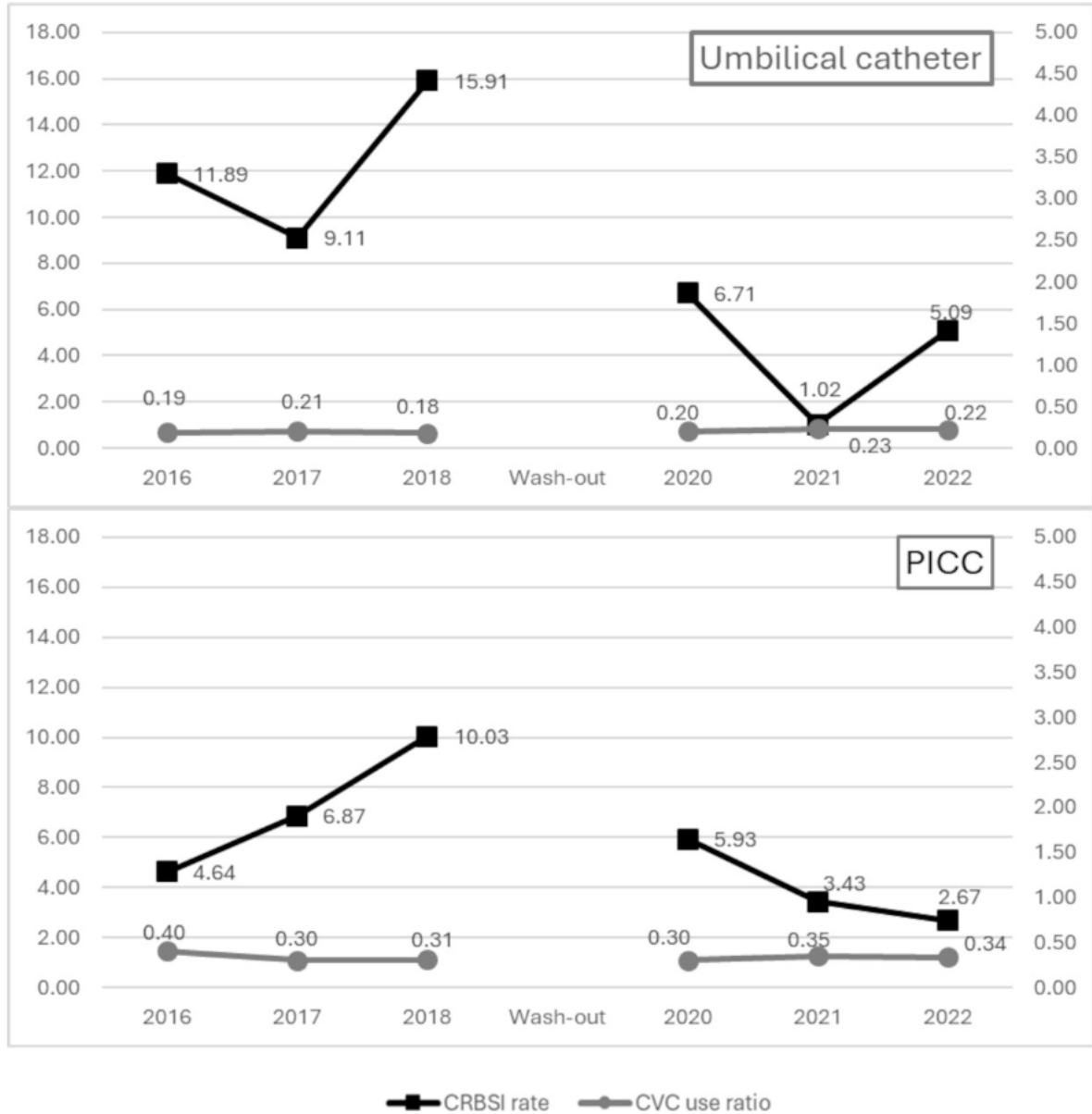
Alejandro Pinilla-González [1,2] Lucía Pérez-Fiérrez [2] Alvaro Solaz-García [1,2] Laura Torrejón-Rodríguez [1,2] Anna Parra-Llorca [2] Teresa Pérez-Oliver [1,2] Ana Gimeno Navarro [1,2] María Dolores Lorena Mocholí Tomás [2] Rosario Ros Navarret [2] Maximo Vento [1,2] Marta Aguar [2] Maria Cernada [1]

Unica limitazione all'uso della CHG in alcol isopropilico al 70%: GA <28 weeks or BW <1000 g nella prima settimana di vita



CRBSI: doppia emocoltura
o emocoltura da periferica e da punta del catetere

CRBSI 4.03 episodes/1000 CL days) vs (9.05 episodes/1000 central line days). **NNT 25**


Umbilical catheter
18.00
16.00
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2016
2017
2018
Wash-out
2020
2021
2022
PICC
4.64
6.87
10.03
5.93
3.43
2.67
0.40
0.30
0.31
0.30
0.35
0.34
CRBSI rate
CVC use ratio

JVA | The Journal of Vascular Access

The Journal of Vascular Access
1–6

Use of 2% chlorhexidine gluconate in 70% isopropyl alc disinfection durin insertion in prem

Antonella Capasso[1], An Fiorentino Grasso[1], Letizi Illiano[1], Serena Salome[1], Melania Rachiglia[1] and Fra

sample size, using a neonatal skin score. With these precautions, we only had two 24 weeks neonates severe skin lesions around the umbilicus or on the lateral side of the abdomen, suggesting that probably the skin in this body's area is most vulnerable immediately post partum. The applicator that contain 1 mL is appropriate for disinfecting an area of 8 × 10 cm that is large for the disinfection of the umbilical area of a 23 or 24 week preterm infant. The 1 mL applicator is the smallest currently available on the market and the side effect they might even be related to the amount of antiseptic used, despite all recommended precautions having been respected. Maybe in such population it would be more wise to avoid using the whole applicator.

As with less severe injuries eith, even the outcome of the two lesions rapidly turned favorable after some days

of 2% Chlorexidine-70%

containing a known

y the antiseptic solution

with gentle pressure

Thirty seconds after disinfection, remove any excess antiseptic solution and any soaked materials or drapes from the area.

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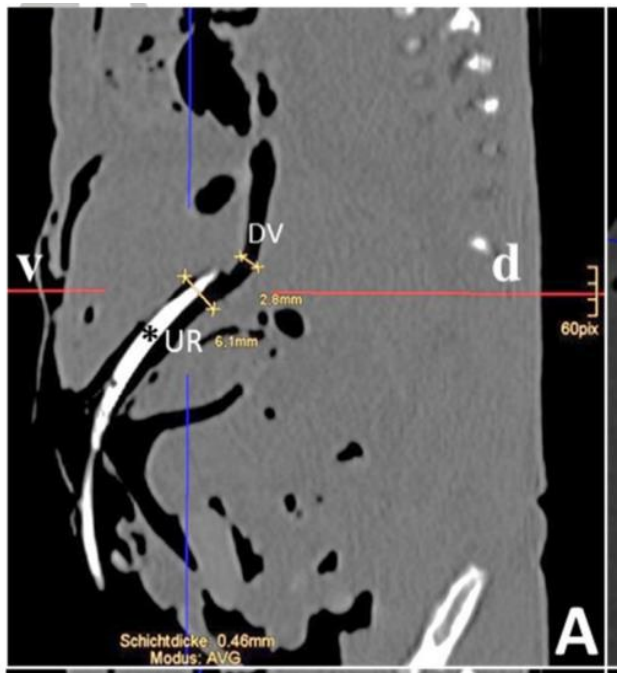
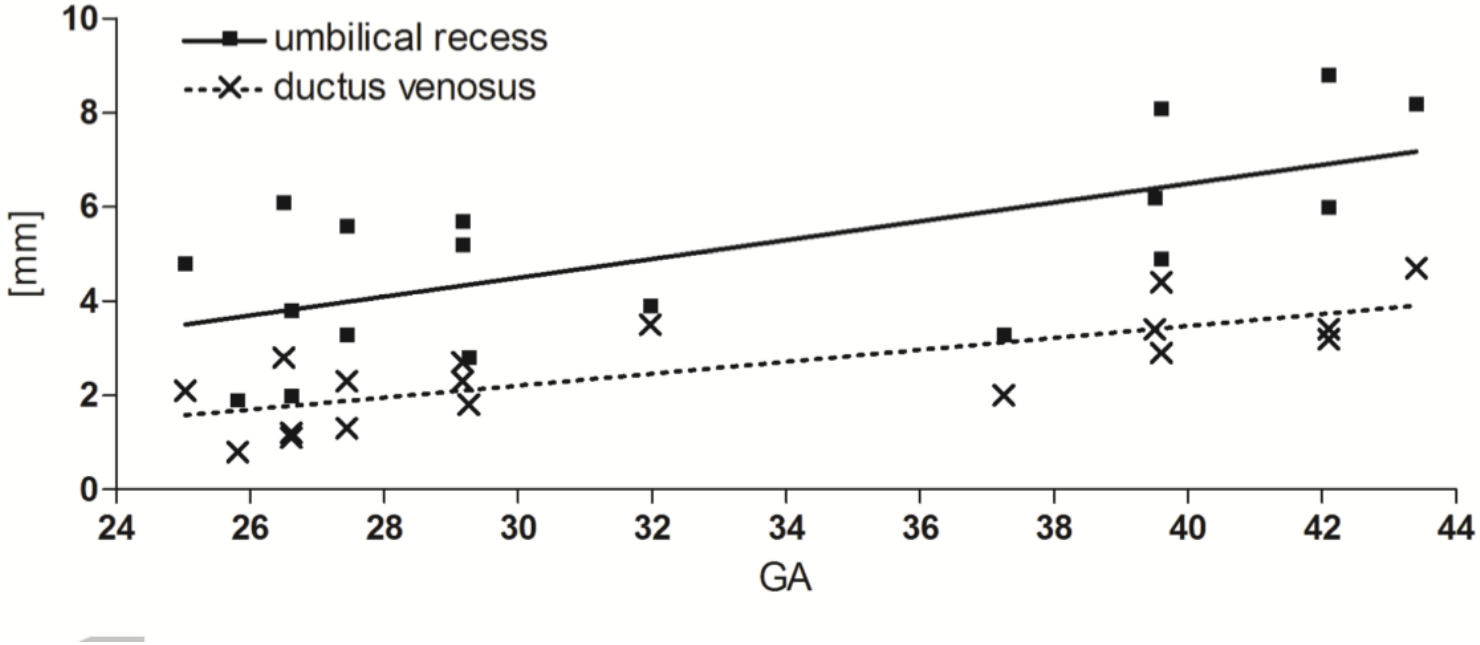
DIMENSIONE DV???

18 neonati sottoposti a TAC 29 W EG





Investigation of umbilical venous vessels anatomy and diameters as a guideline for catheter placement in newborn. Eifinger. Clin Anat 2018

Impianto Sicuro del Catetere Venoso Ombelicale nel neonato

1. Valutazione ecografica pre-procedurale.
2. Utilizzo di un pack procedurale pre-assemblato.
3. Tecnica asettica appropriata: igiene delle mani, massime protezioni di barriera e antisepsi cutanea con clorexidina 2% in IPA 70%.
4. Incannulamento della vena ombelicale usando il catetere più piccolo sulla base delle necessità infusionali del paziente (mono/bilume)
5. Utilizzo dell'ecografo per la tip navigation e la tip location intra-pocedurale (secondo il protocollo NeoECHOTip).
6. Stabilizzazione del catetere e protezione del sito di emergenza (colla in cianoacrilato, membrana semipermeabile trasparente e "sutureless device ?")
7. Controlli seriati della posizione della punta usando l'ecografia (24-48 ore)
8. Rimozione precoce (entro 4-5 giorni)

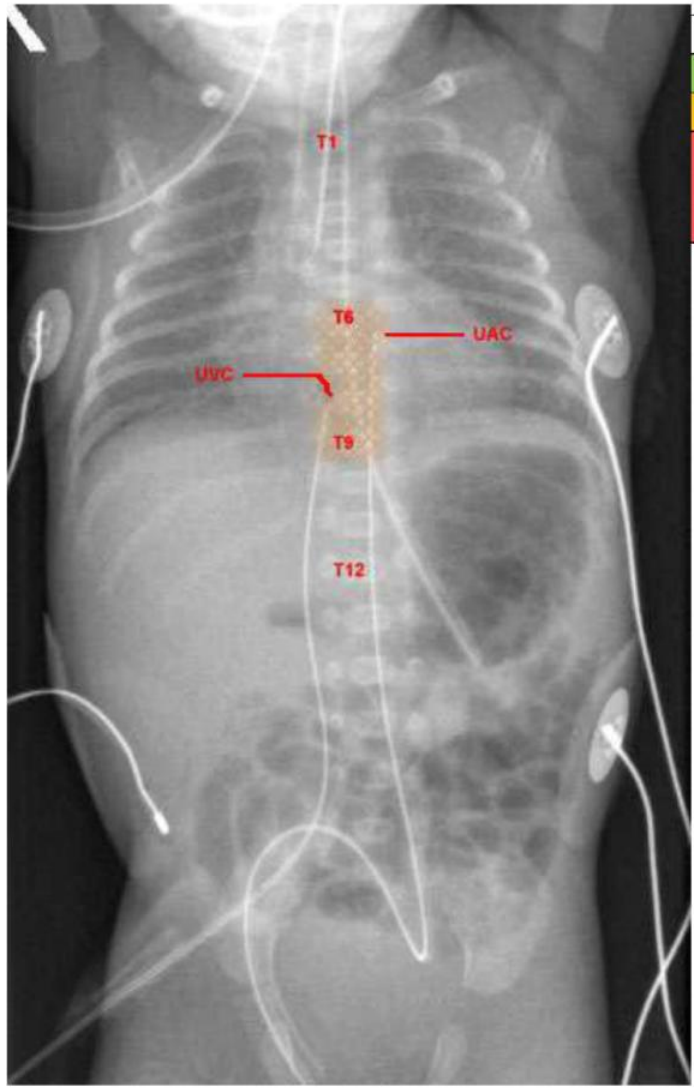
Tip location

Molte delle complicanze da CVO sono legate alla sua malposizione:

- CVO posizionato nel cuore:
    1. Perforazione del cuore
    2. Versamento pericardico con tamponamento cardiaco
    3. Aritme, potenzialmente fatali
    4. Trombosi endocavitarie
    5. Versamento pleurico

- CVO posizionato nel sistema portale:
    1. NEC
    2. Perforazione del colon
    3. Necrosi ed ematomi epatici
    4. Cisti epatiche
    5. Perforazione di vasi del sistema portale
    6. Ipertensione portale

Avery Disease of the Newborn. Neonatology Gomella



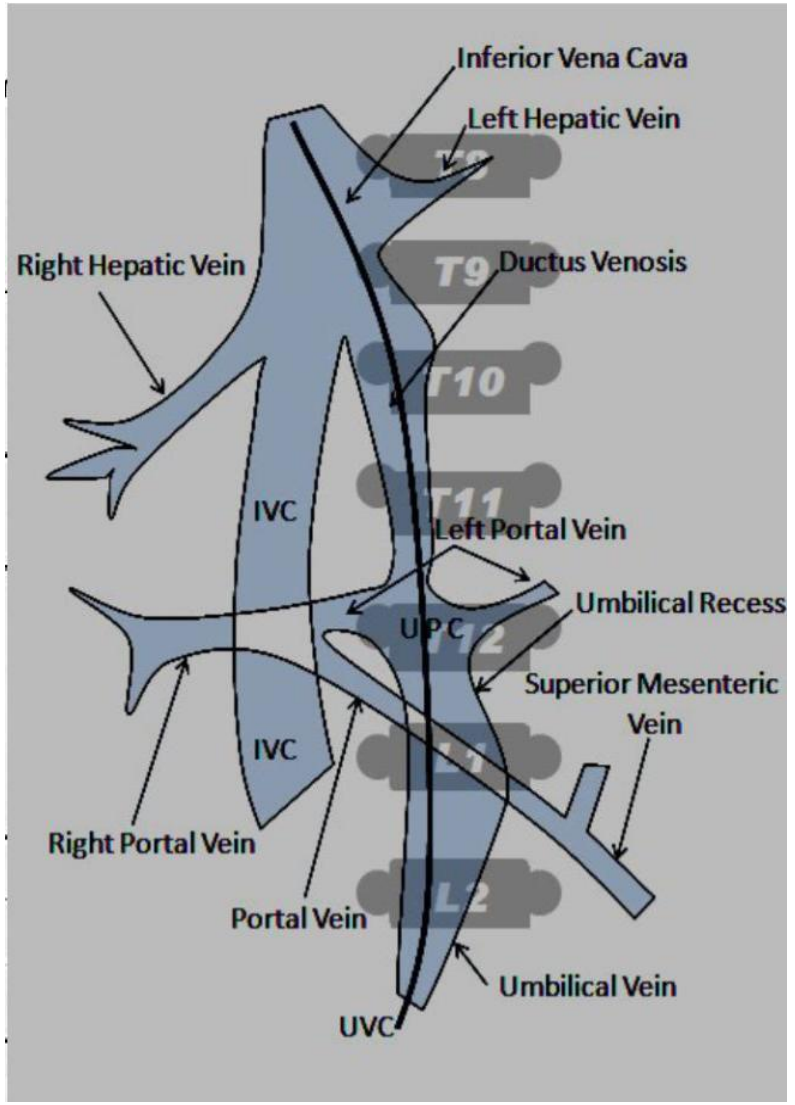
UVC
Optimal above diaphragm T8-10
Acceptable Low position in IVC
Withdraw if in heart or diverted angle into liver, re XRay

UAC
Optimal T6 – T9
Acceptable low position L3 - 4
Withdraw if at T12 -L2 as site of mesenteric and renal arteries

Insertion length:

UAC = 3 x weight + 9cm + stump
or diagonally umbilicus to shoulder length + 1cm + stump

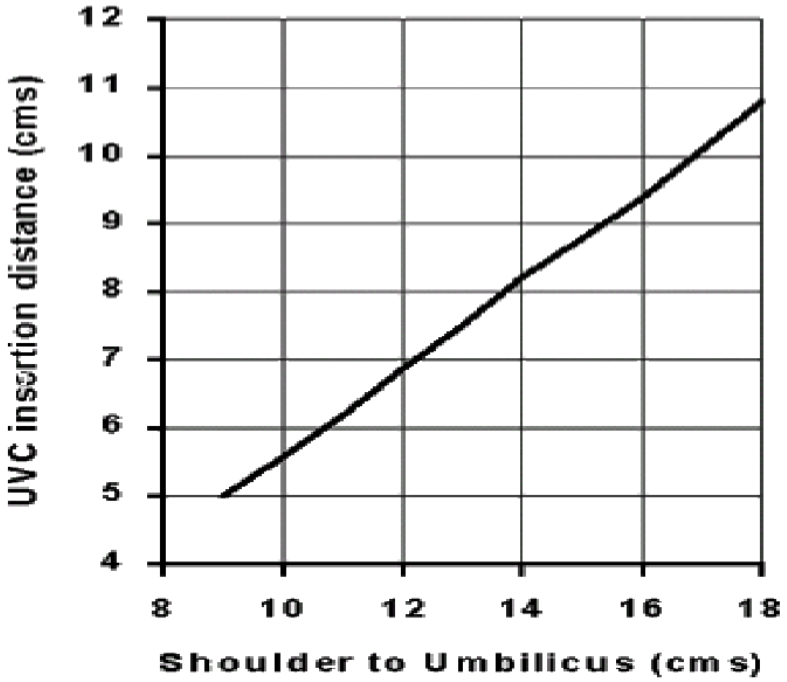
UVC = 1.5 x weight + 5cm+ stump
Emergency UVC access 5cm plus cord length



C. Determine the length of catheter to be inserted by anatomical measurement of shoulder to umbilicus length, by equations based on body weight, or with other research-based protocols to achieve successful tip placement.[12-16] (V)
D. Place the catheter tip for:
   1. UVCs in the inferior vena cava near the junction with the right atrium.

- Formula di Shukla = (3 * Peso (kg) + 9)/2 +1
- Lunghezza ombelico spalla
- Lunghezza ombelico-processo xifoideo et c…

La letteratura e i libri sono pieni di formule e nomogrammi!
Quale usare???



Infusion therapy standard of practice. Journal of infusion nursing 2016

ORIGINAL ARTICLE

Simple measurements to place umbilical catheters using surface anatomy

AO Gupta[1], MR Peesay[2] and J Ramasethu[2]

Table 2. Expected position of umbilical venous catheter with different morphometric measurements and Shukla formula

		Over-insertion			Under-insertion				
Neonates	*UIM*								
Total $N=170$	35 (2								
>1500 g $n=109$	24 (2								
$\leqslant 1500$ g $n=61$	11 (18%)	0	55 (91%)	2 (3%)	30 (49%)	2 (3%)	61 (100%)	0	2 (3%)	3 (5%)

Abbreviations: UIMD, umbilicus to midpoint of inter-mammary distance; UN, umbilicus to nipple distance; UXp, umbilicus to xiphoid process distance.

There is no universal formula, measurement or nomogram available for placement of umbilical catheters, which is satisfactory for infants of all BWs and gestational ages.[6–9] In our

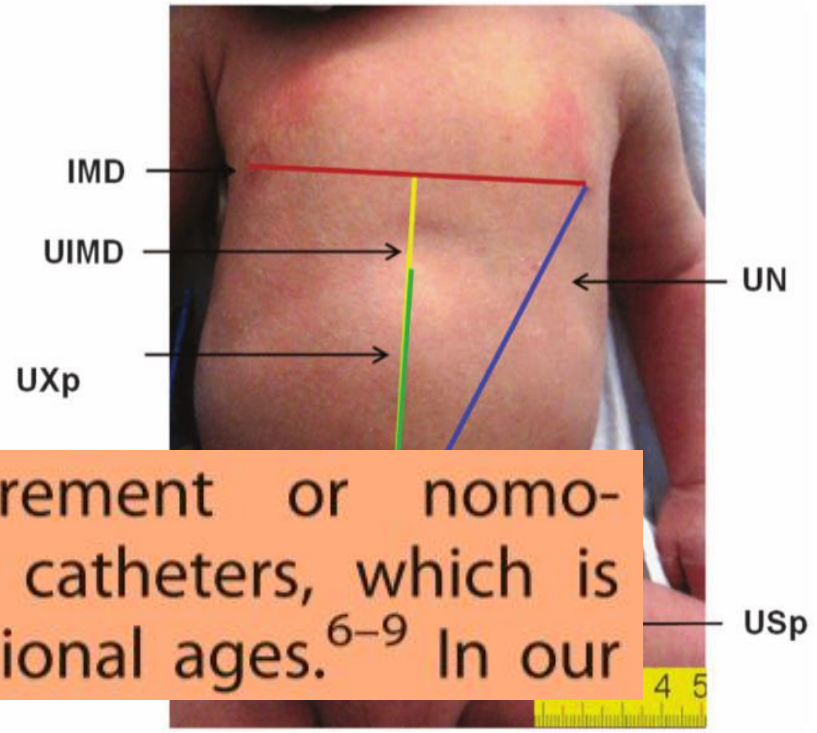


Figure 1. Morphometric measurements. IMD, inter-mammary distance; UIMD, umbilicus to midpoint of IMD; UN, umbilicus to nipple; USp, umbilicus to symphysis pubis; UXp, umbilicus to xiphoid process.

Simple measurements to place umbilical catheters using surface anatomy. JoP 2015

Tip location…cosa dicono le LG

E. 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)
   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.[1,2,4,11,23,24,26,27,43,44,48-61] (II)
   2. Assess patient for known history of cardiac dysrhythmias and the presence of a P wave on ECG (if available) before planning to use ECG technology for placement. Contraindications to the use of ECG technology include patients with an abnormal ECG rhythm with an absence or alteration in the P wave (eg, presence of pacemakers, extreme tachycardia). Recent prospective observational studies have demonstrated safety and efficiency of using ECG to confirm catheter tip position in patients with atrial fibrillation.[1,51,62] (IV)

23. CENTRAL VASCULAR ACCESS DEVICE TIP LOCATION

Infusion Therapy Standards of Practice

Infusion therapy standard of practice. Journal of infusion nursing 2021

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

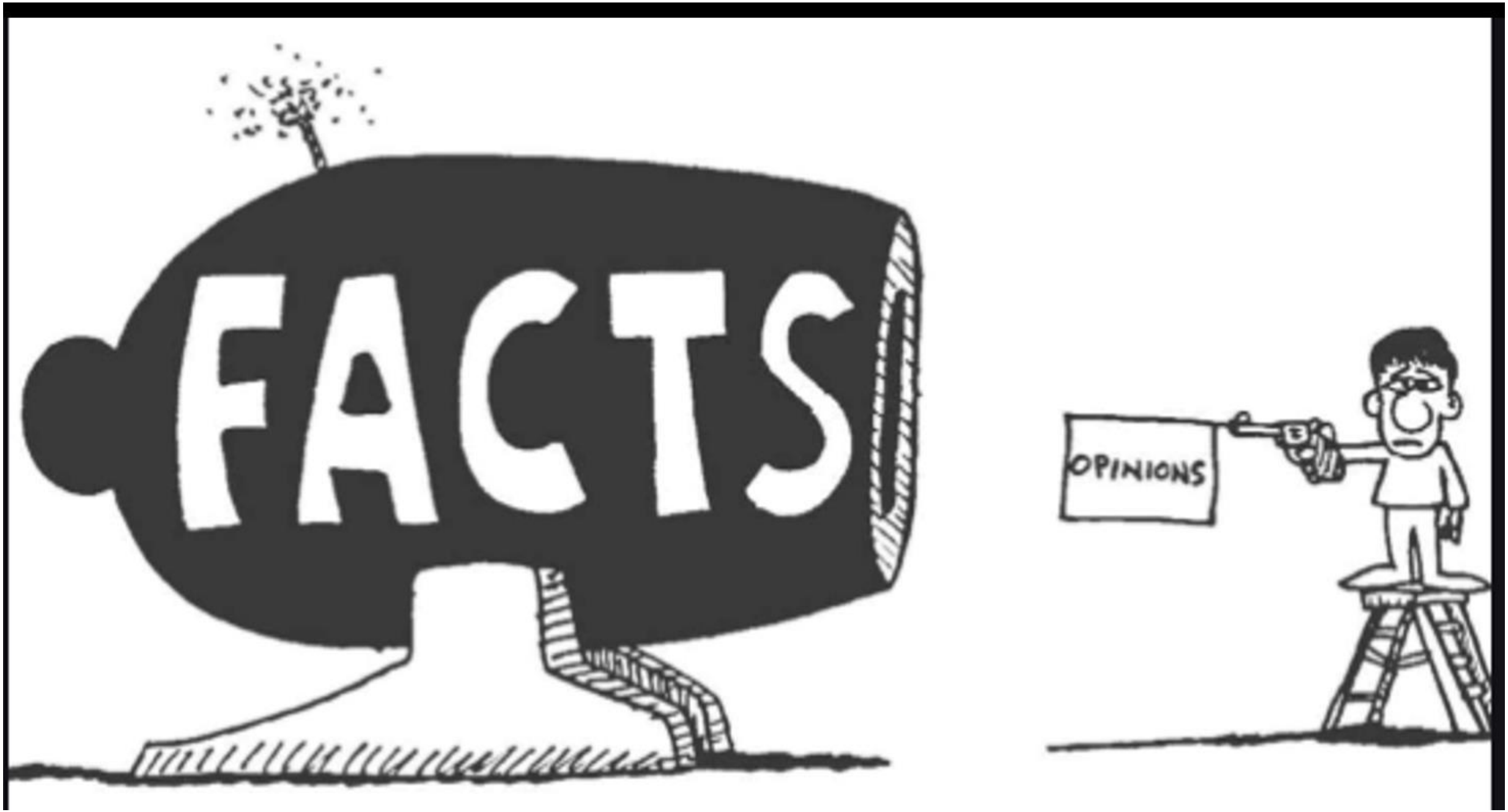
Infusion Therapy Standards of Practice

ECHO TIP Protocol

Infusion therapy standard of practice. Journal of infusion nursing 2021

Why?

Ultrasound


FACTS
OPINIONS

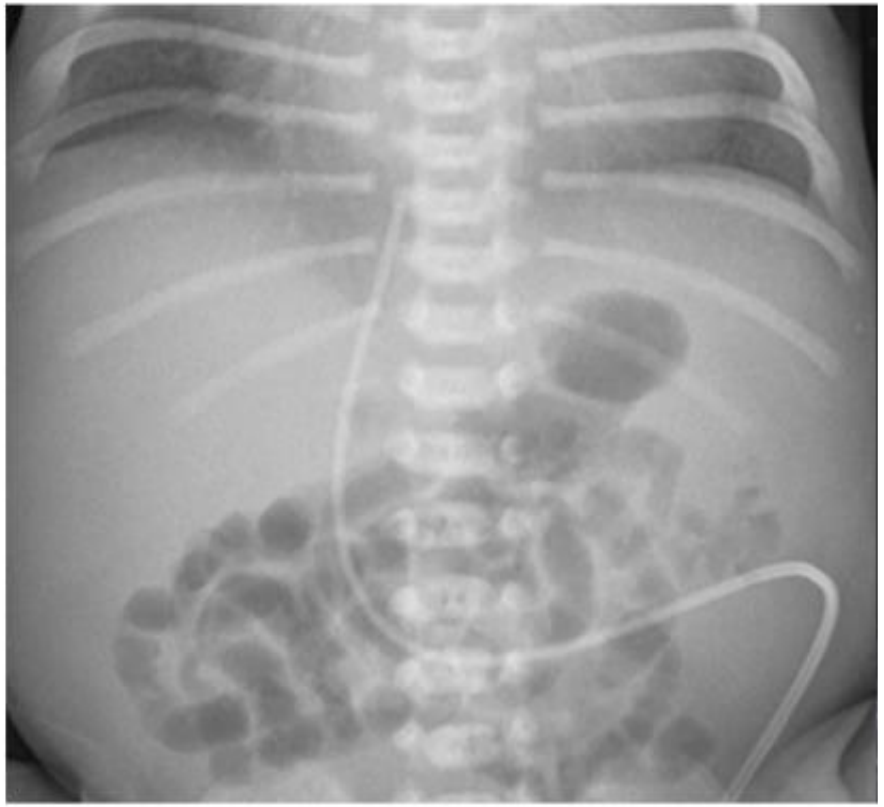
Why not the Chest X Ray?

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

Why not the Chest X Ray?



Why not the Chest X Ray?

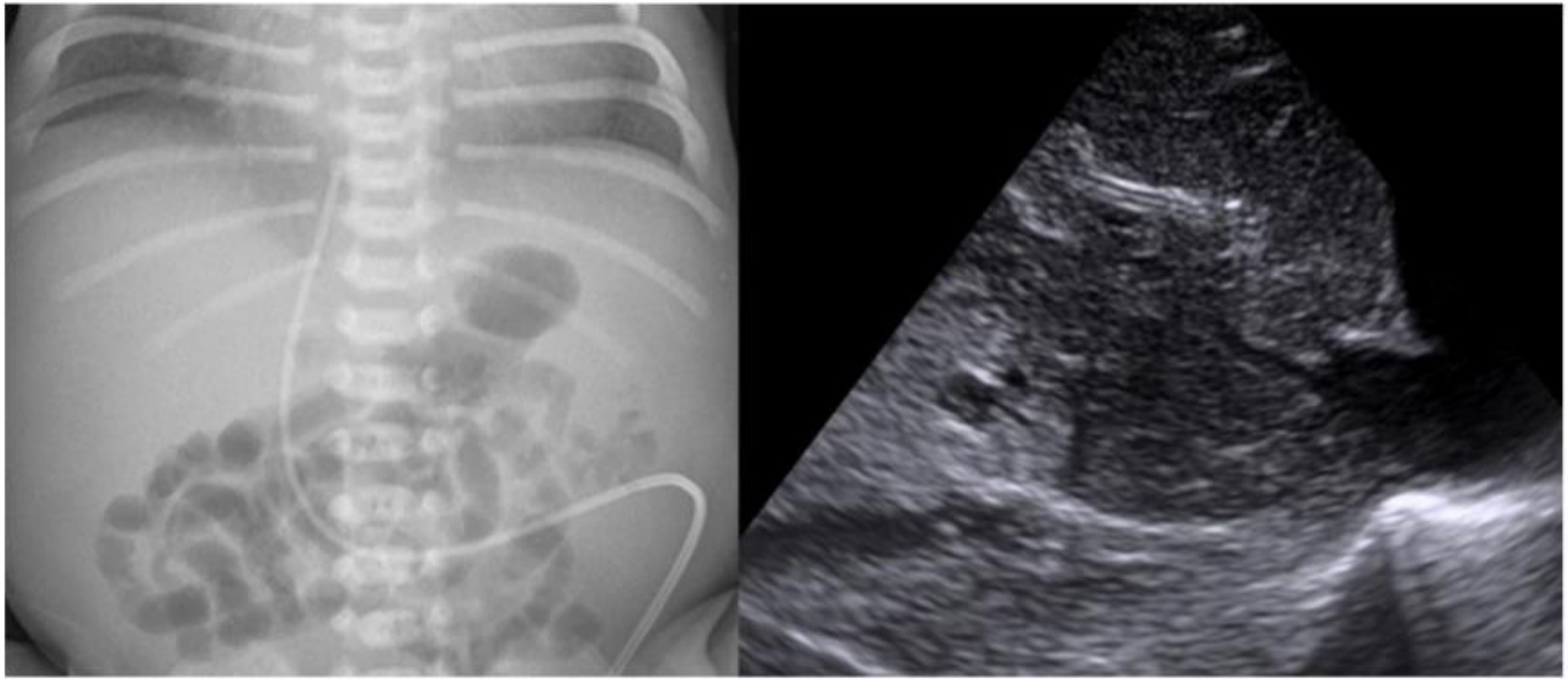


Figure 4 An umbilical venous catheter (UVC) outside the cardiac silhouette, below the level of the diaphragm and pointing towards the base of the right atrium on X-ray (and therefore felt to be in a safe position) which is shown on ultrasound to be penetrating the liver parenchyma.

Why not the Chest X Ray?

Why not the Chest X Ray?

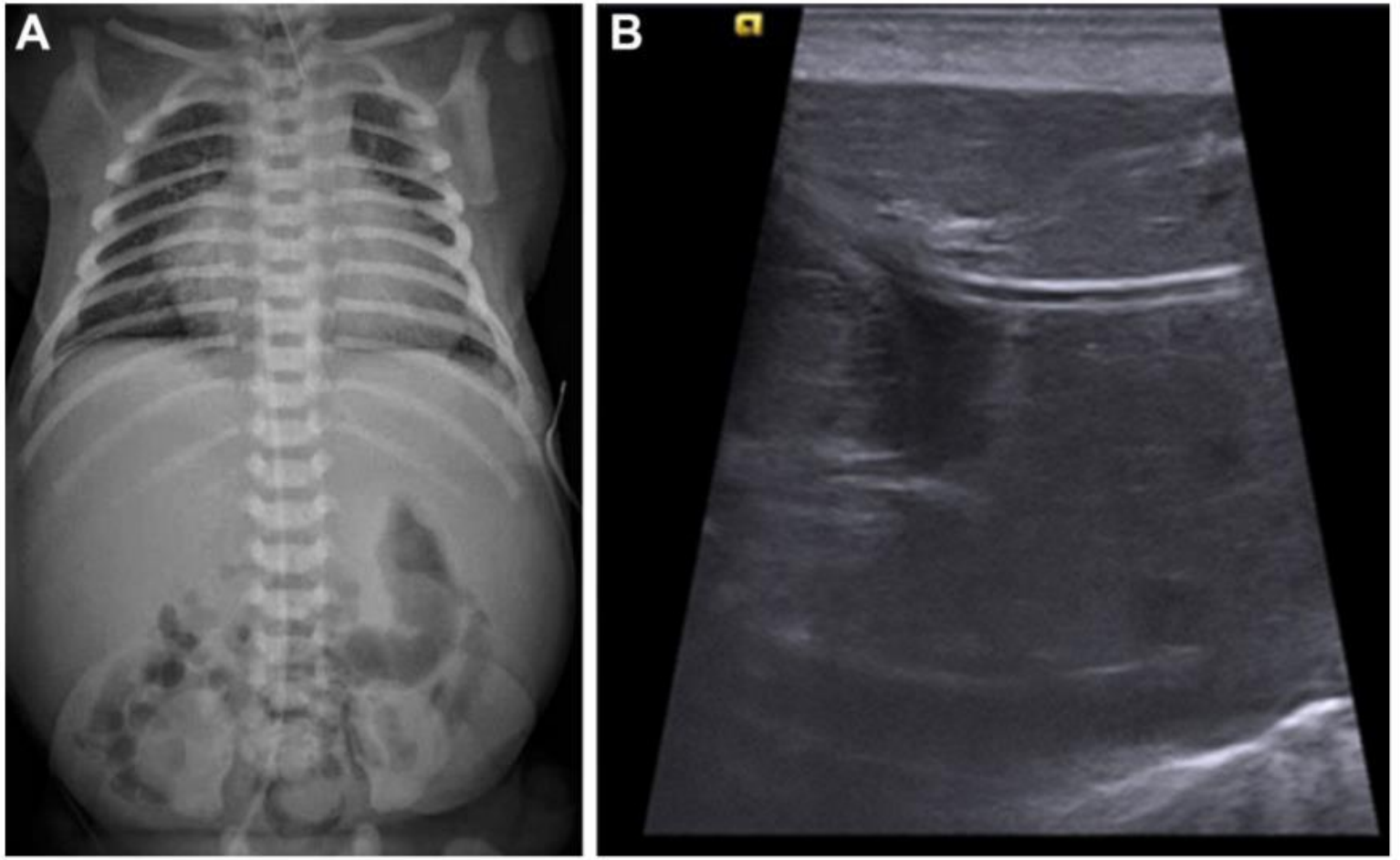


Figure 7 On X-ray the umbilical venous catheter (UVC) lies at T9 but the line curves away from the heart and the tip does not point towards the right atrium (A). On a sagittal ultrasound scan the UVC in this baby has crossed the anterior portal sinus entering a vessel arising from it (B).

Why not the Chest X Ray?

Journal of Paediatrics and Child Health

doi:10.1111/jpc.14

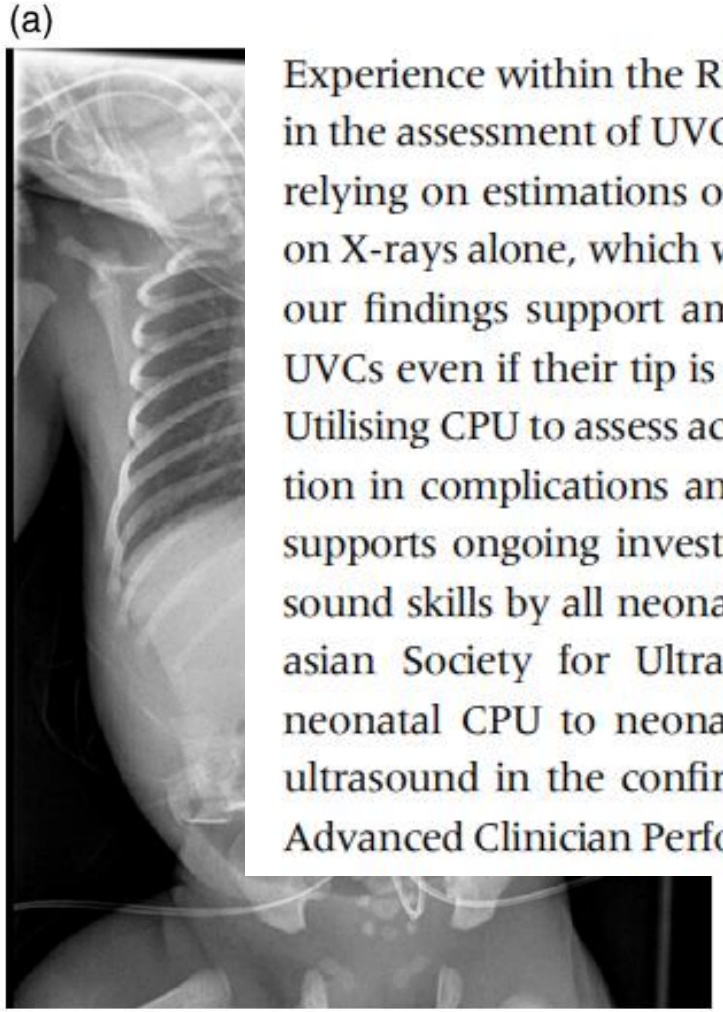
ORIGINAL ARTICLE

Use of clinician-performed ultrasound in the assessment of safe umbilical venous catheter tip placement

Amber Seigel [1], Nick Evans [1,2] and Tracey Lutz [1,2]

[1]Department of Newborn Care, Royal Prince Alfred Hospital and [2]Department of Obstetrics, Gynaecology and Neonatology, University of Sydney, Sydney New South Wales, Australia

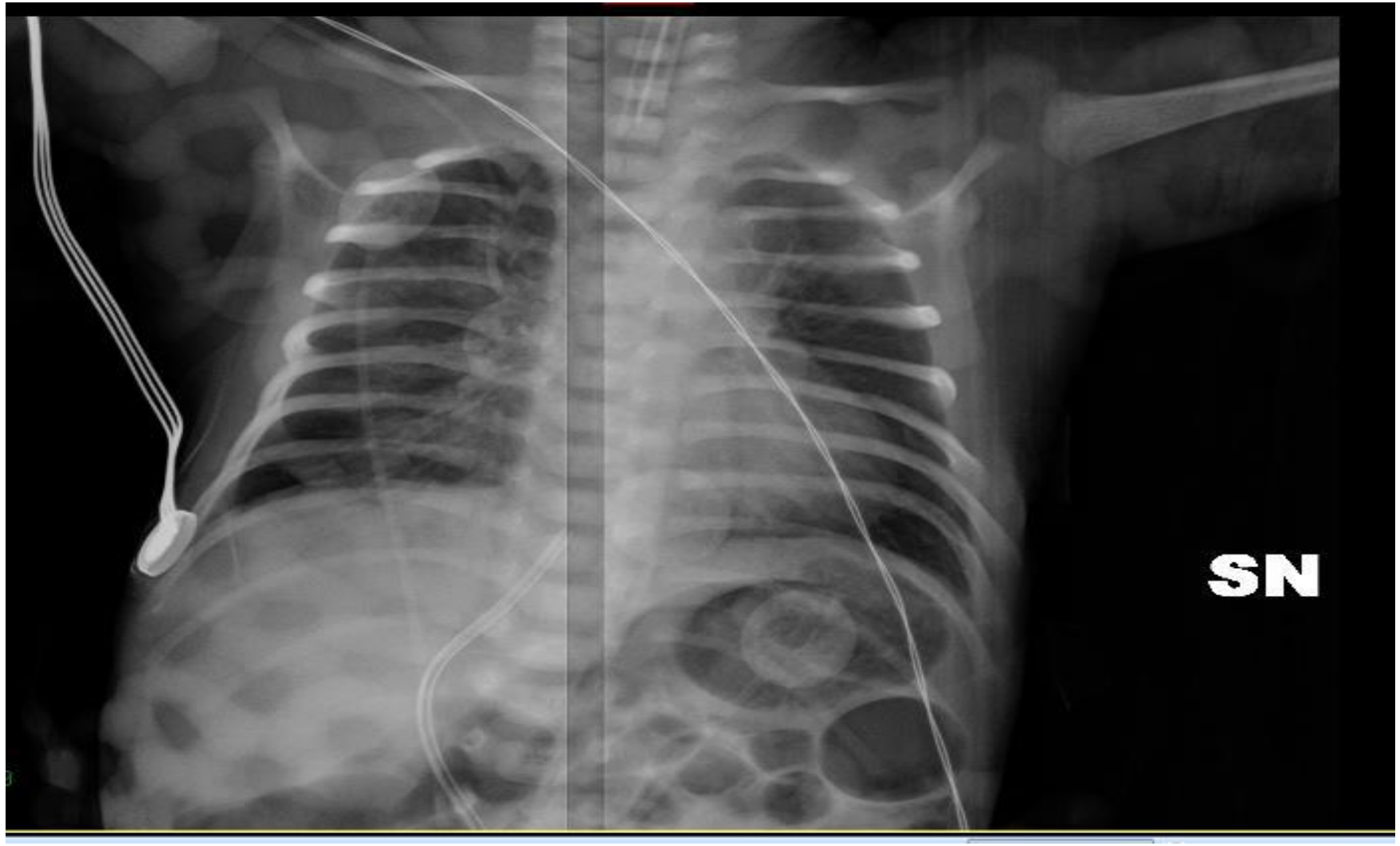
Why not the Chest X Ray?



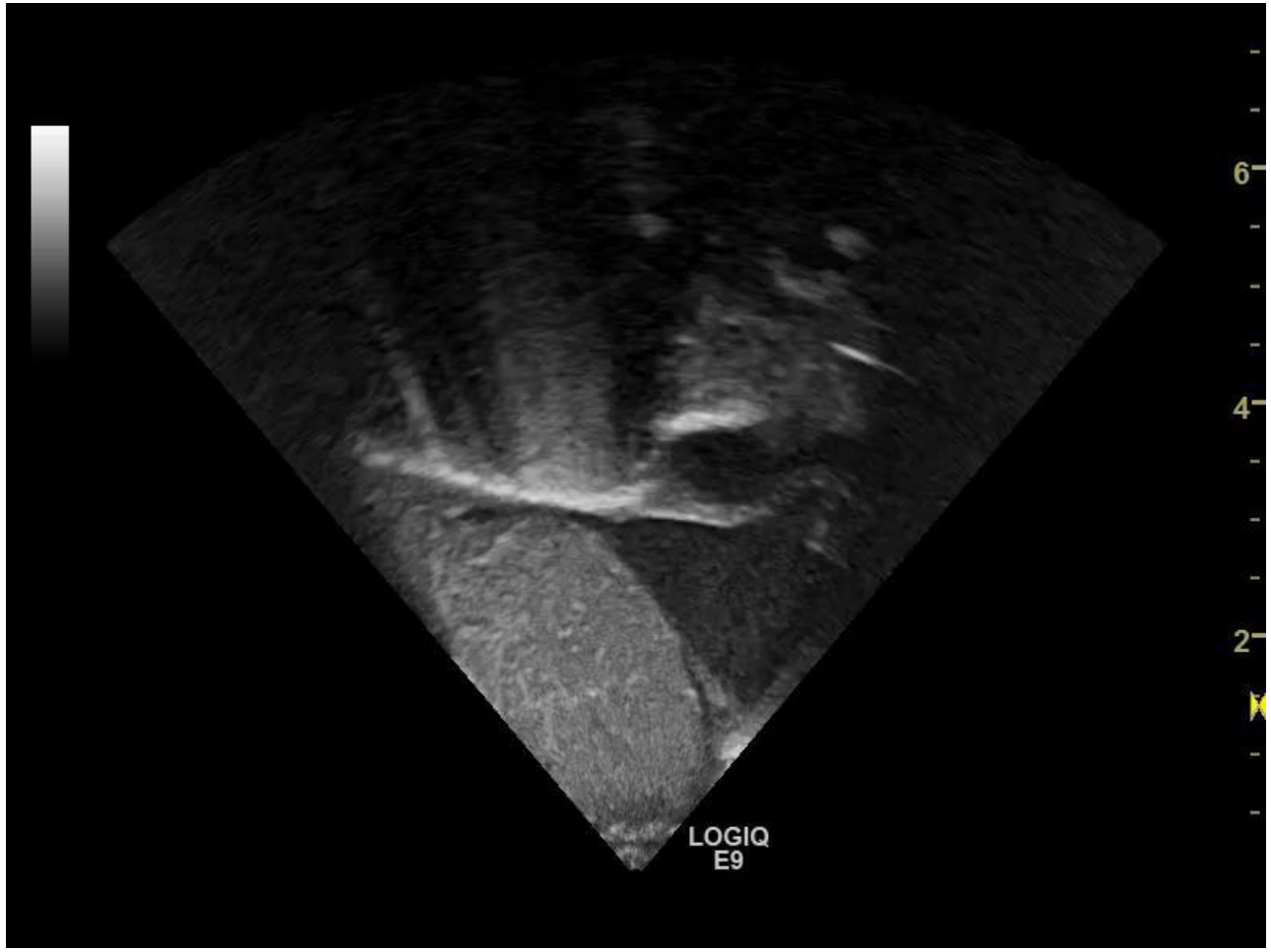
Experience within the RPAH NICU supports the ongoing use of CPU in the assessment of UVC tip position in addition to X-ray rather than relying on estimations of vessel position according to vertebral level on X-rays alone, which we have demonstrated is flawed. In addition, our findings support amending the policy to mandate CPU for all UVCs even if their tip is noted to be above the diaphragm on X-ray. Utilising CPU to assess accurate placement of UVCs results in a reduction in complications and should be standard care. Our experience supports ongoing investment in the development of bedside ultrasound skills by all neonatal fellows and neonatologists. The Australasian Society for Ultrasound in Medicine offers certification in neonatal CPU to neonatologists and neonatal fellows. The use of ultrasound in the confirmation of line placement is covered in the Advanced Clinician Performed Neonatal Ultrasound curriculum.[19]

Fig. 2 Discrepancy between X-ray and clinician-performed ultrasound (CPU) findings of umbilical venous catheter (UVC) tip position below diaphragm. (a) X-ray: UVC tip projects lateral to midline, between T9 and T10 vertebral bodies. (b) CPU: UVC tip in small portal vessel (white crosses), branching from pars umbilicus (⟶), lying anterior to the course of ductus venosus (- - -).

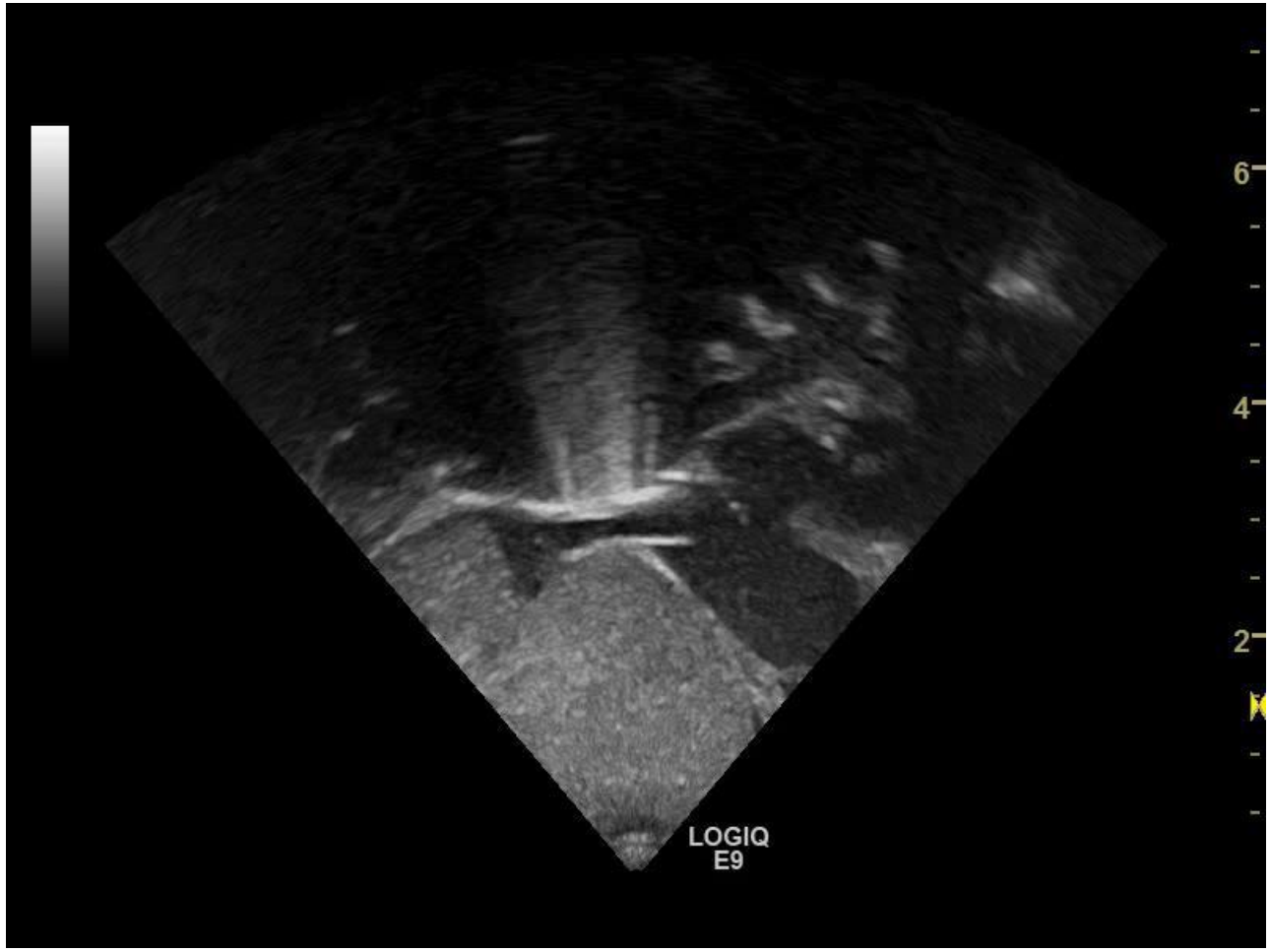
Tip location…Clinical case



Tip location…Clinical case

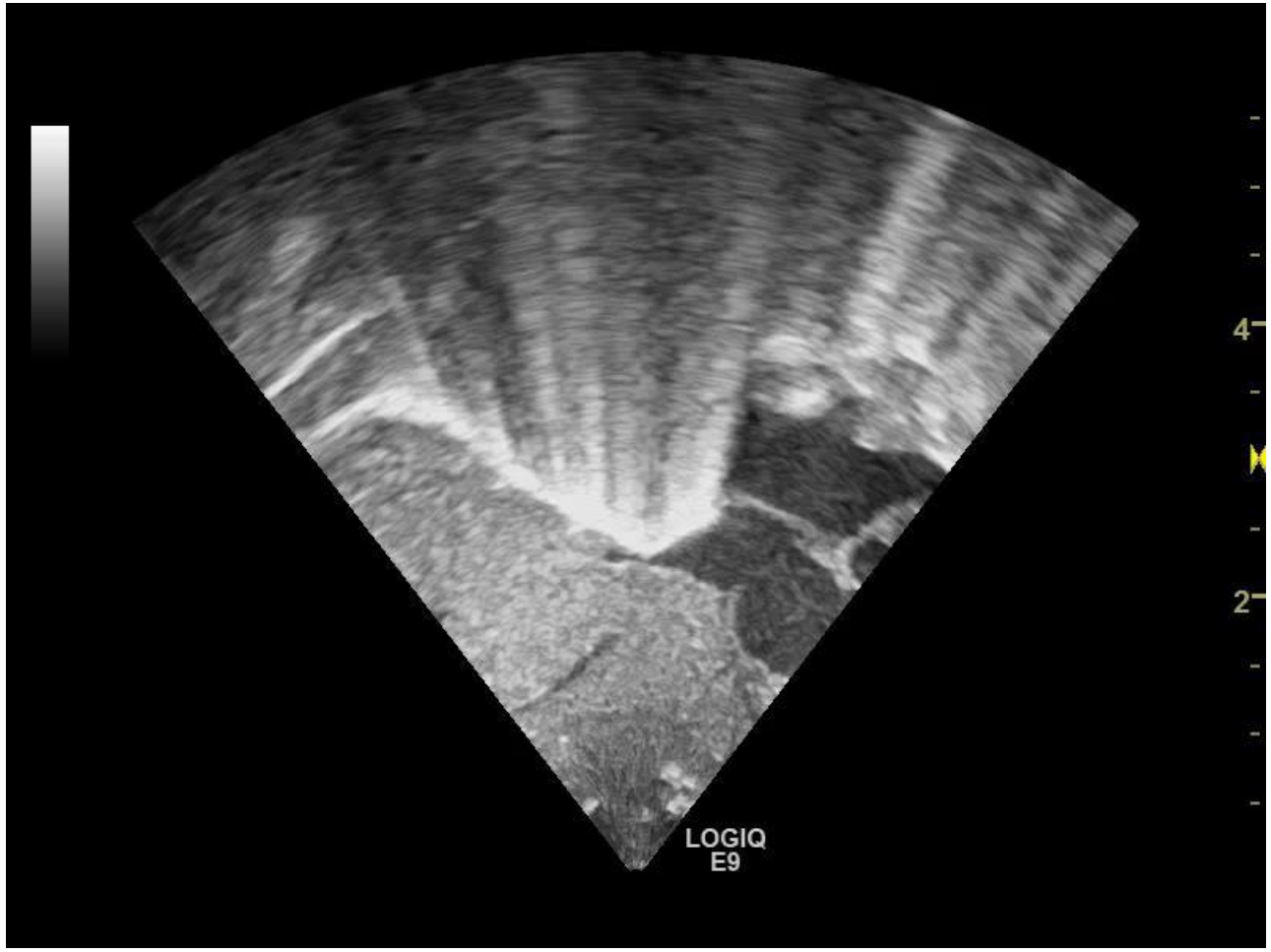


Tip location…Clinical case



Tip location…Clinical case

Tip location…Clinical case



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)

Infusion therapy standard of practice. Journal of infusion nursing 2021

TIP location. RT US. Riassumendo…

1. Gli studi che hanno valutato l'affidabilità della metodica ecografica per la valutazione della posizione della punta sono riusciti a visualizzare la punta del CVO in una percentuale estremamente elevata (tra il 95 e il 100%).
2. Le sonde impiegate sono state:
    - Sonda lineare da 12-13 Mhz
    - Sonda microconvex da 7-8.5 Mhz
    - Sonda microsettoriale
3. La proiezione più utizzata è stata una sottocostale longitudinale sagittale, alcuni autori hanno completato la medodica ecografica con finestre acustiche supplementari quali una apicale o una parasternale in asse corto.
4. In quasi tutti gli studi la visualizzazione della punta è stata accompagnata da un flush di soluzione fisiologica.
5. Esistono pochi dati in letteratura relativamente alla tip navigation durante il posizionamento del CVO

The Journal of Vascular Access
1–10

DOI: 10.1177/11297298211007703
journals.sagepub.com/home/jva

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

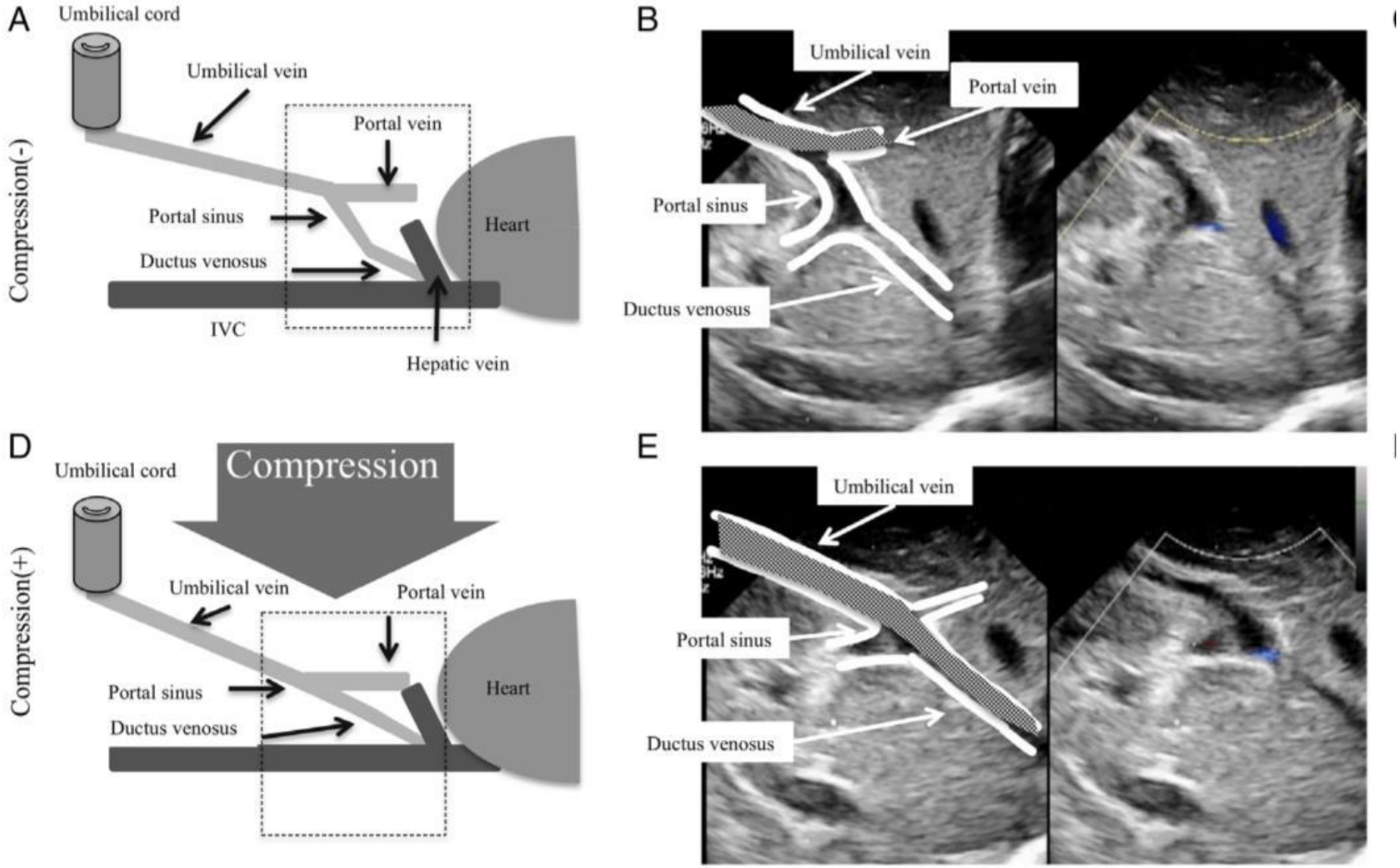
Giovanni Barone[1], Mauro Pittiruti[2], Daniele G Biasucci[3], Daniele Elisei[4], Emanuele Iacobone[4], Antonio La Greca[2], Geremia Zito Marinosci[5] and Vito D'Andrea[6]

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



Kishigami et al. Ultrasound-Guided Umbilical Venous Catheter Insertion With Alignment of the Umbilical Vein and Ductus Venosus. J of ultrasound Medicine 2019

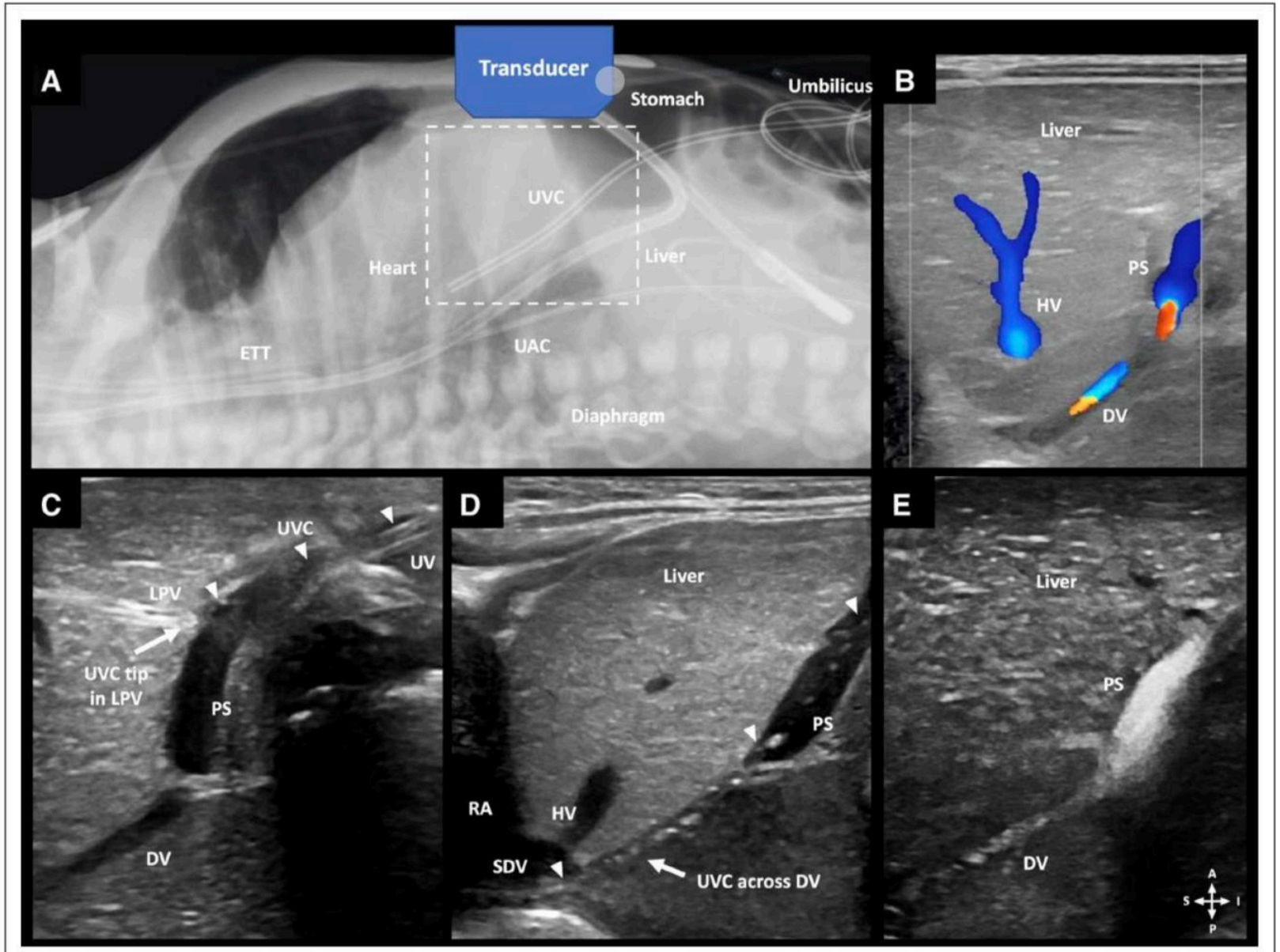

A
Transducer
Stomach
Umbilicus
UVC
Heart
Liver
ETT
UAC
Diaphragm
B
Liver
PS
HV
DV
C
UVC
UV
LPV
UVC tip
in LPV
PS
DV
D
Liver
PS
RA
HV
SDV
UVC across DV
E
Liver
PS
DV
A
S
I
P

Figure 4. Effect of liver pressure. Ultrasound assists in navigating the path through the portal sinus to the ductus venosus (*), avoiding the left (*small arrows*) and right (#) portal veins that readily accept the umbilical venous catheter and result in malposition. **A** and **B**, *Red lines* accentuate the potential, incorrect courses taken by the catheter into the portal veins. The *green line* represents the optimal catheter course. **C**, With titrated liver pressure, the left portal veins are compressed (*large arrows*), the caudal turn into the right portal veins (#) becomes more acute, and the "S-turn" (seen in **B**) through the portal sinus to the ductus venosus becomes flatter and more favorable.

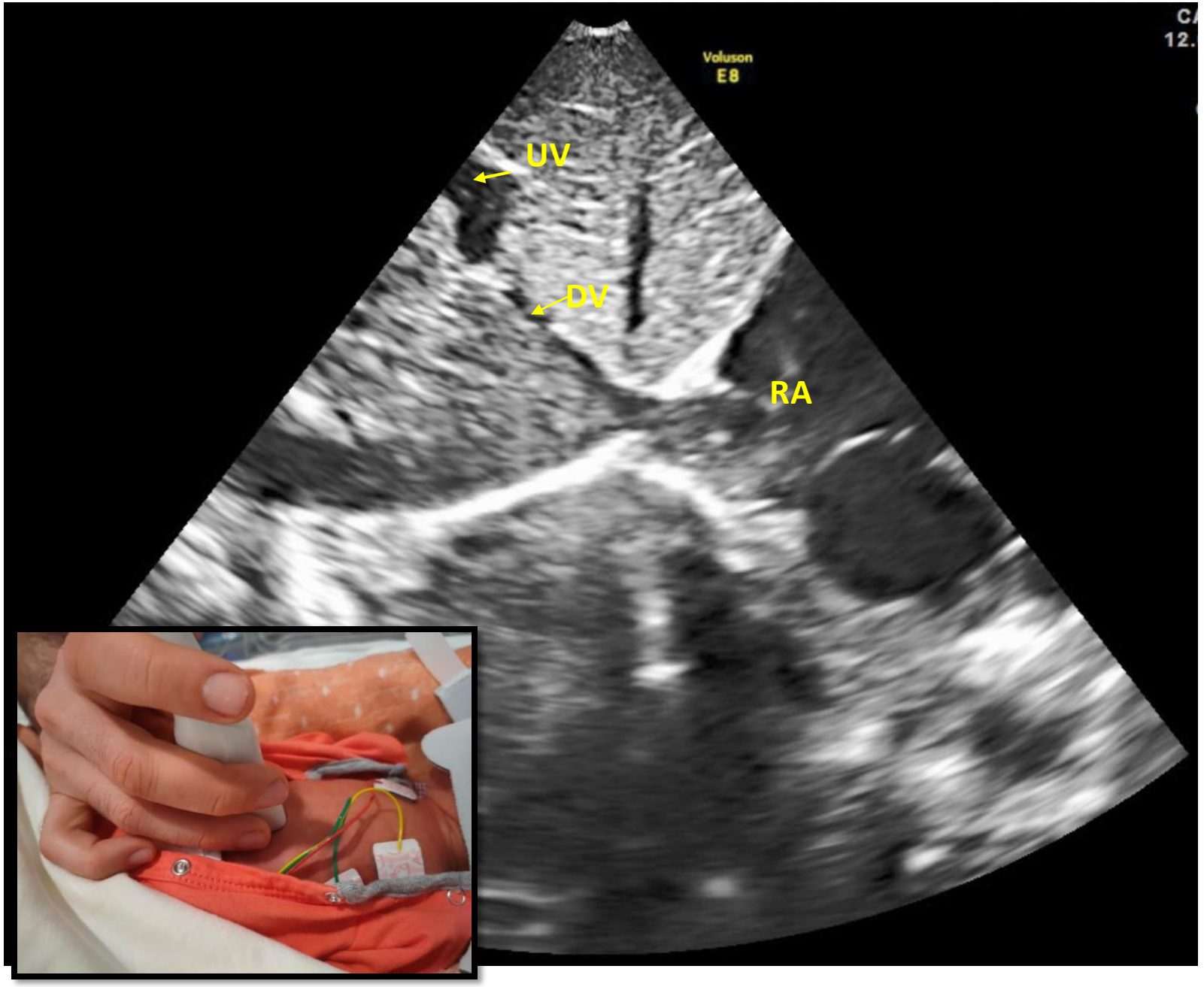
Neo-ECHOTIP for UVC

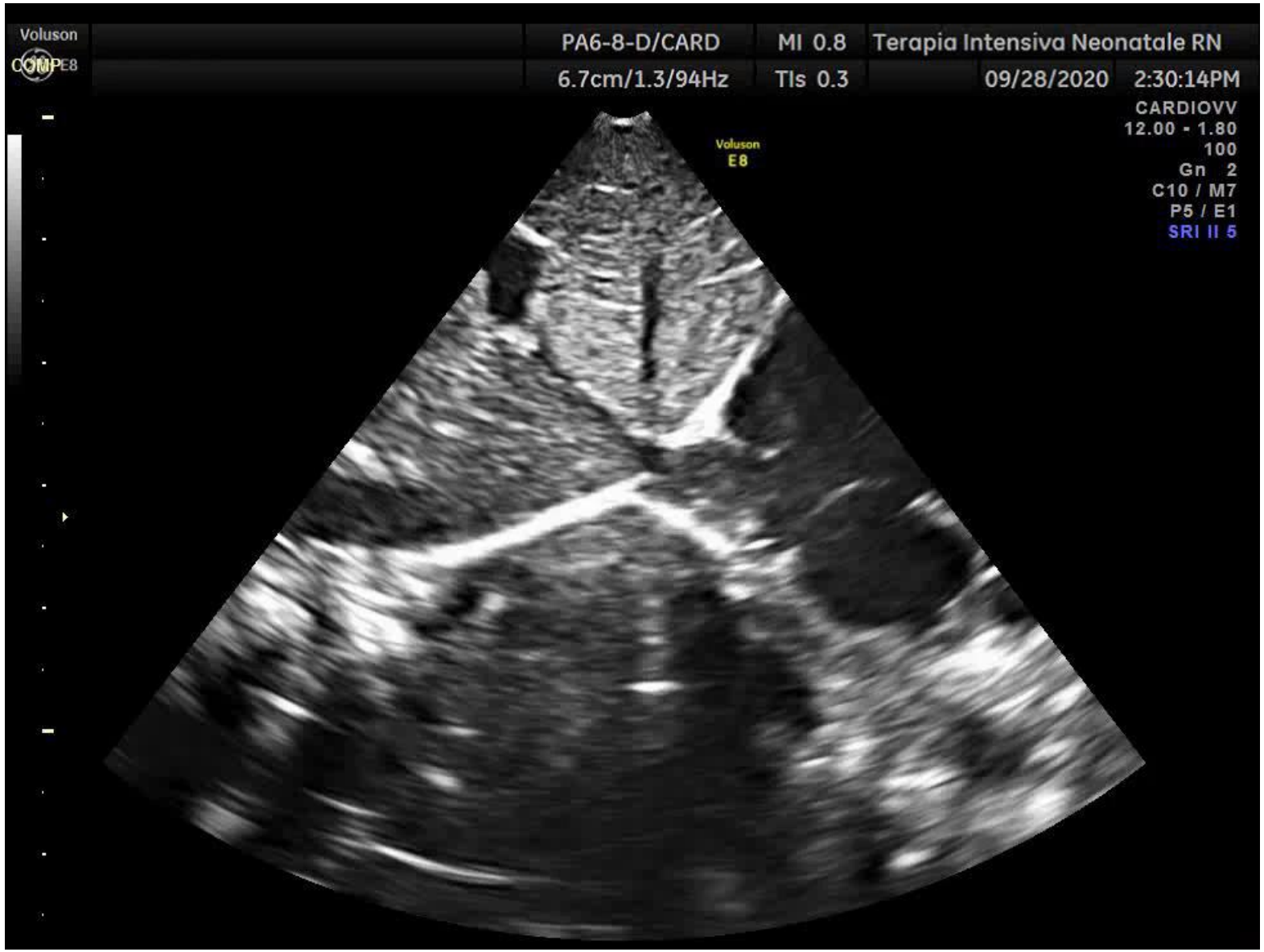
Tip location protocol:

Probe: small sectorial probe, 7-8 MHz.

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

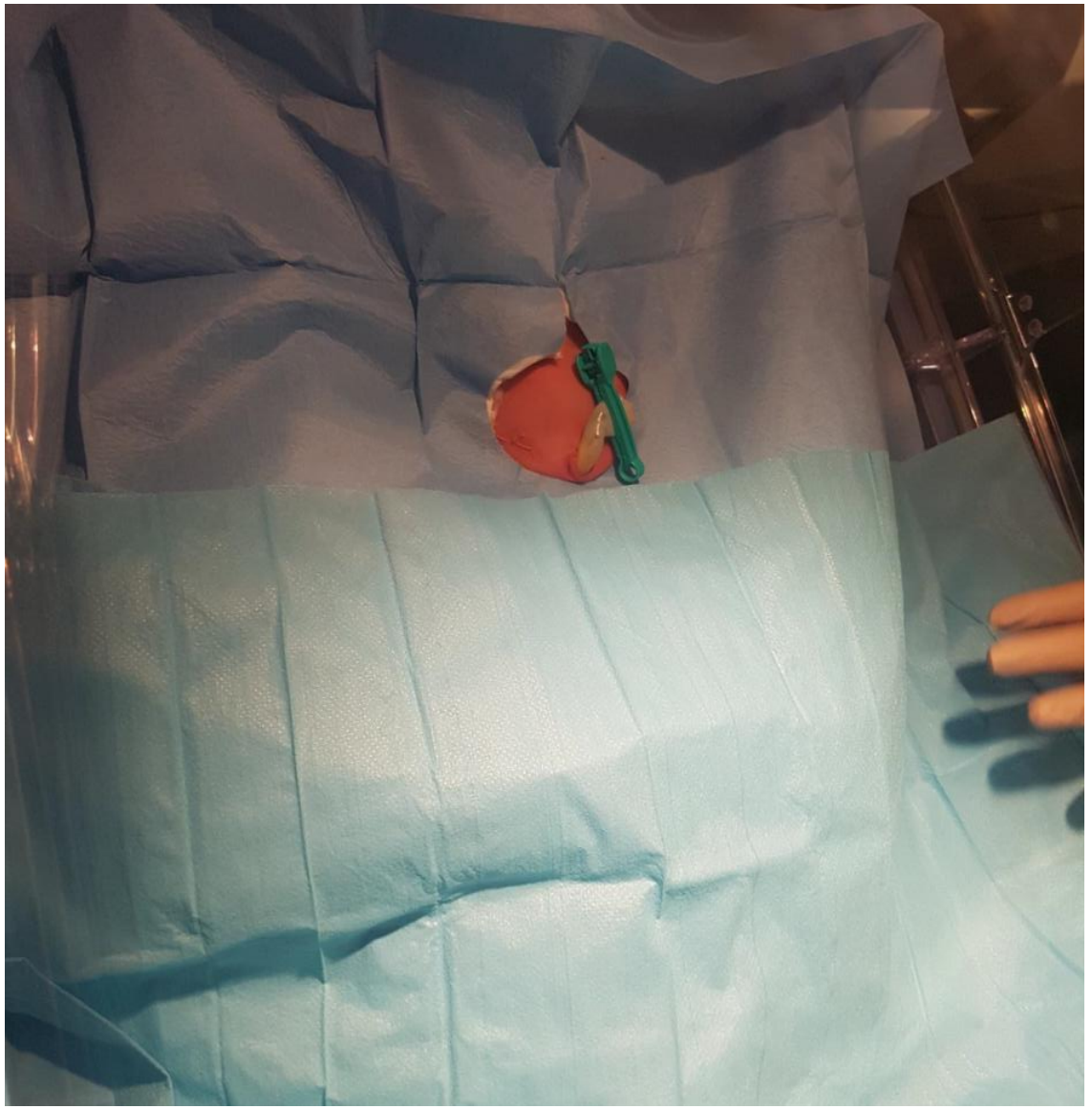
Procedure: the tip is followed until it reaches the target zone, i.e., the junction between the IVC and the RA. A small flush of normal saline (0.5-1 ml) can improve the visualization of the tip


Voluson
E8
UV
DV
RA


Voluson
E8
PA6-8-D/CARD
MI 0.8
Terapia Intensiva Neonatale RN
6.7cm/1.3/94Hz
TIs 0.3
09/28/2020
2:30:14PM
CARDIOVV
12.00 - 1.80
100
Gn 2
C10 / M7
P5 / E1
SRI II 5
Voluson
E8

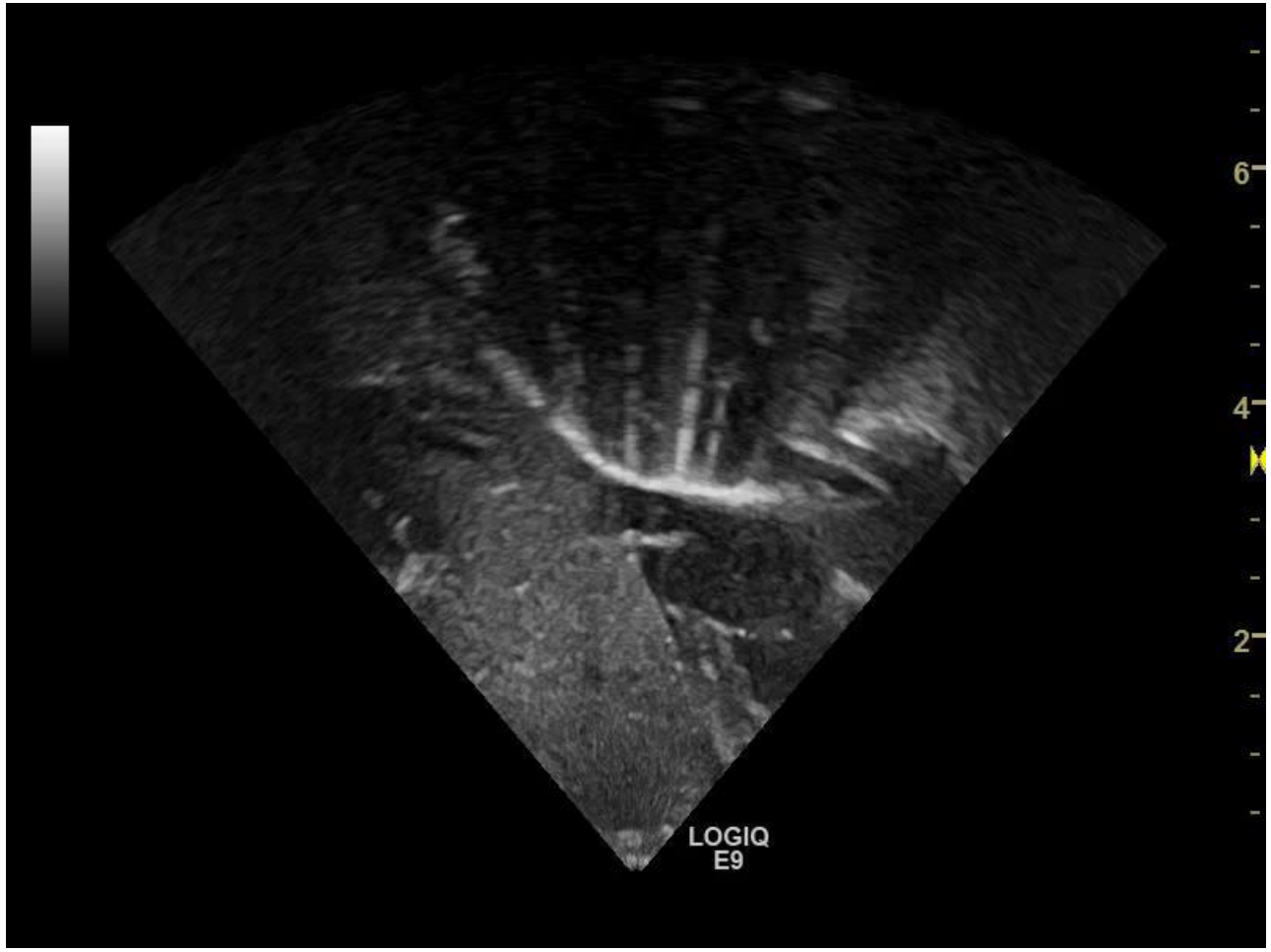
“How we do it better”…

“How we do it better”…

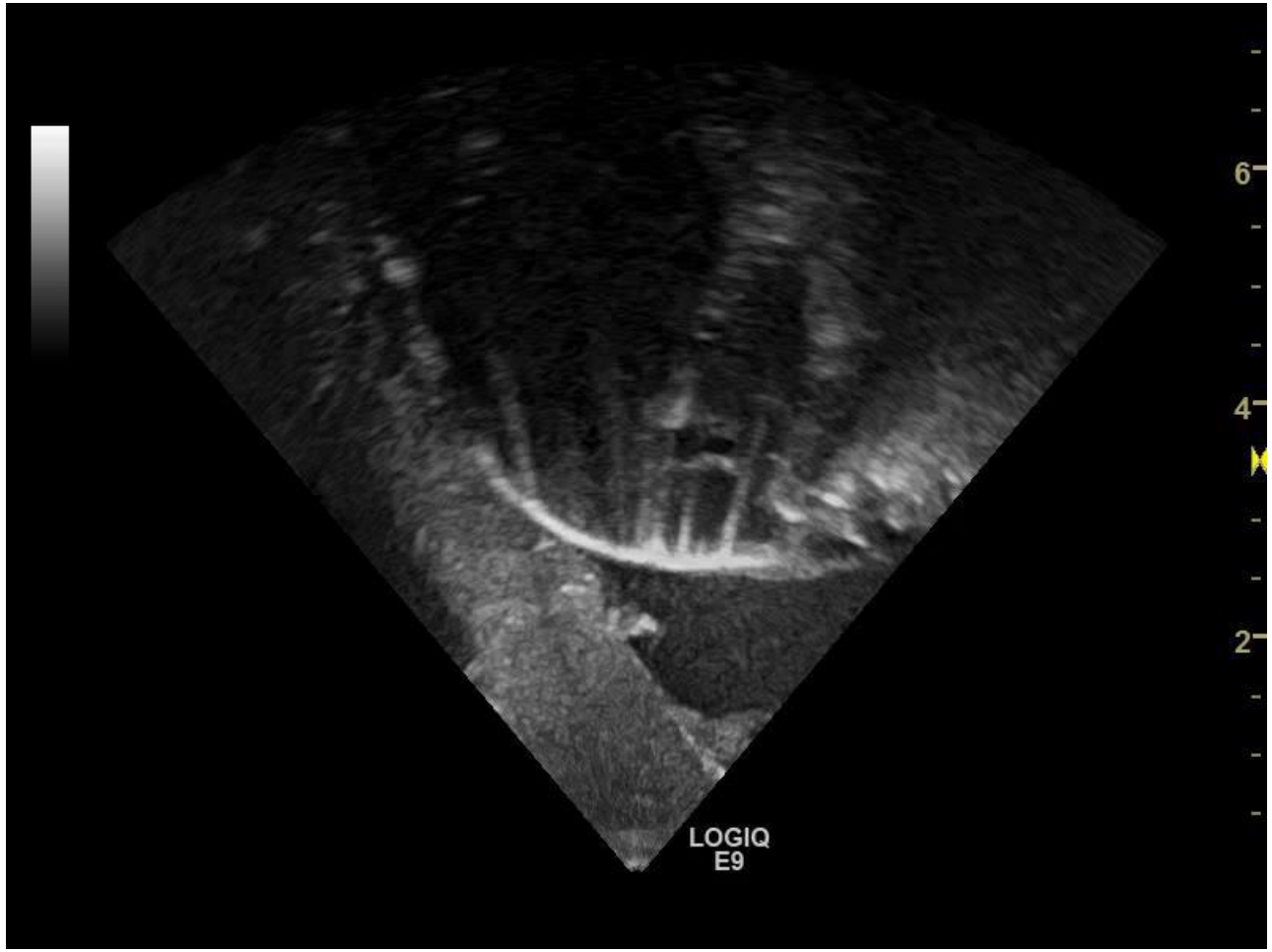


“How we do it better”…

“How we do it better”…

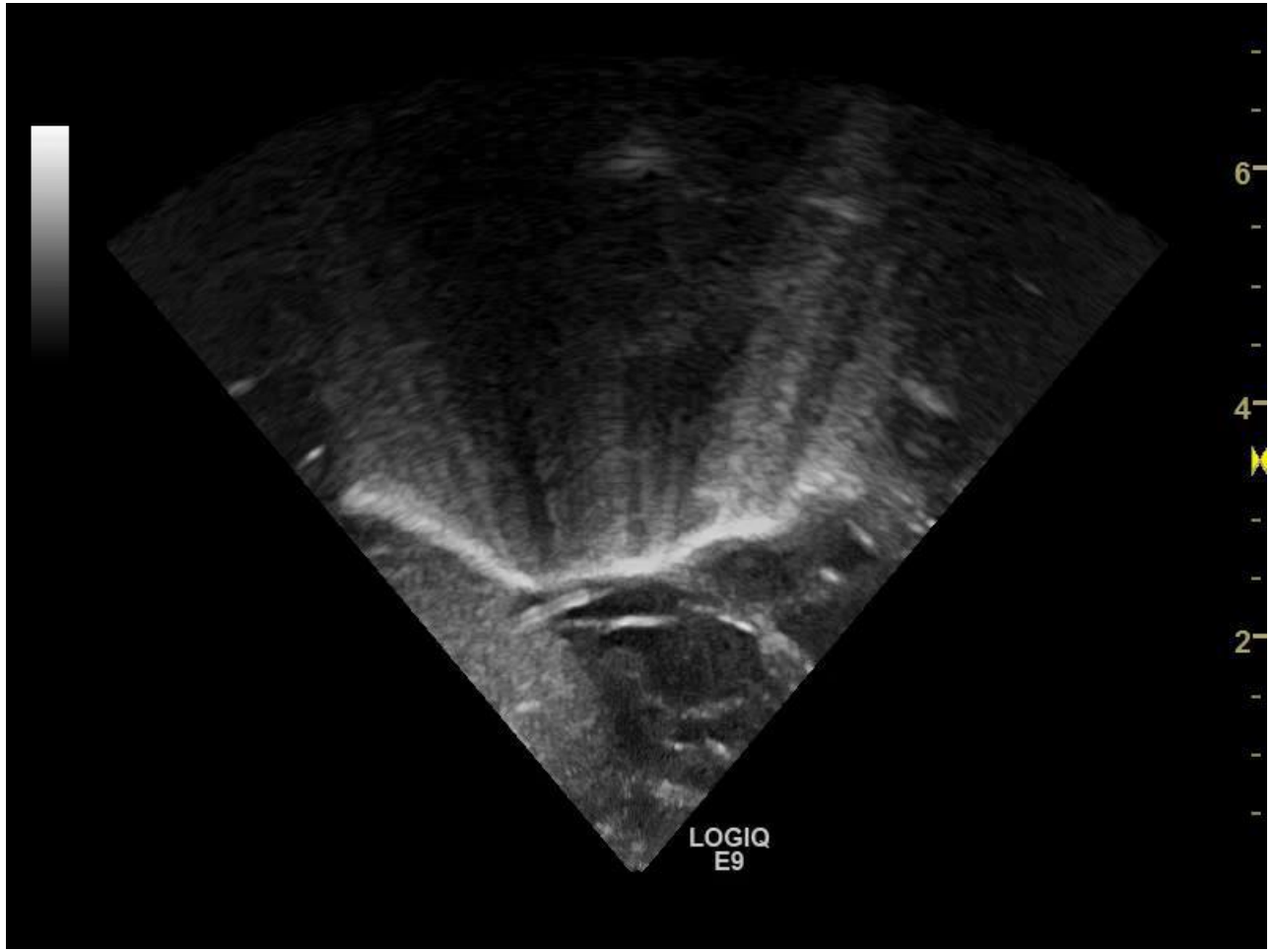


“How we do it better”…

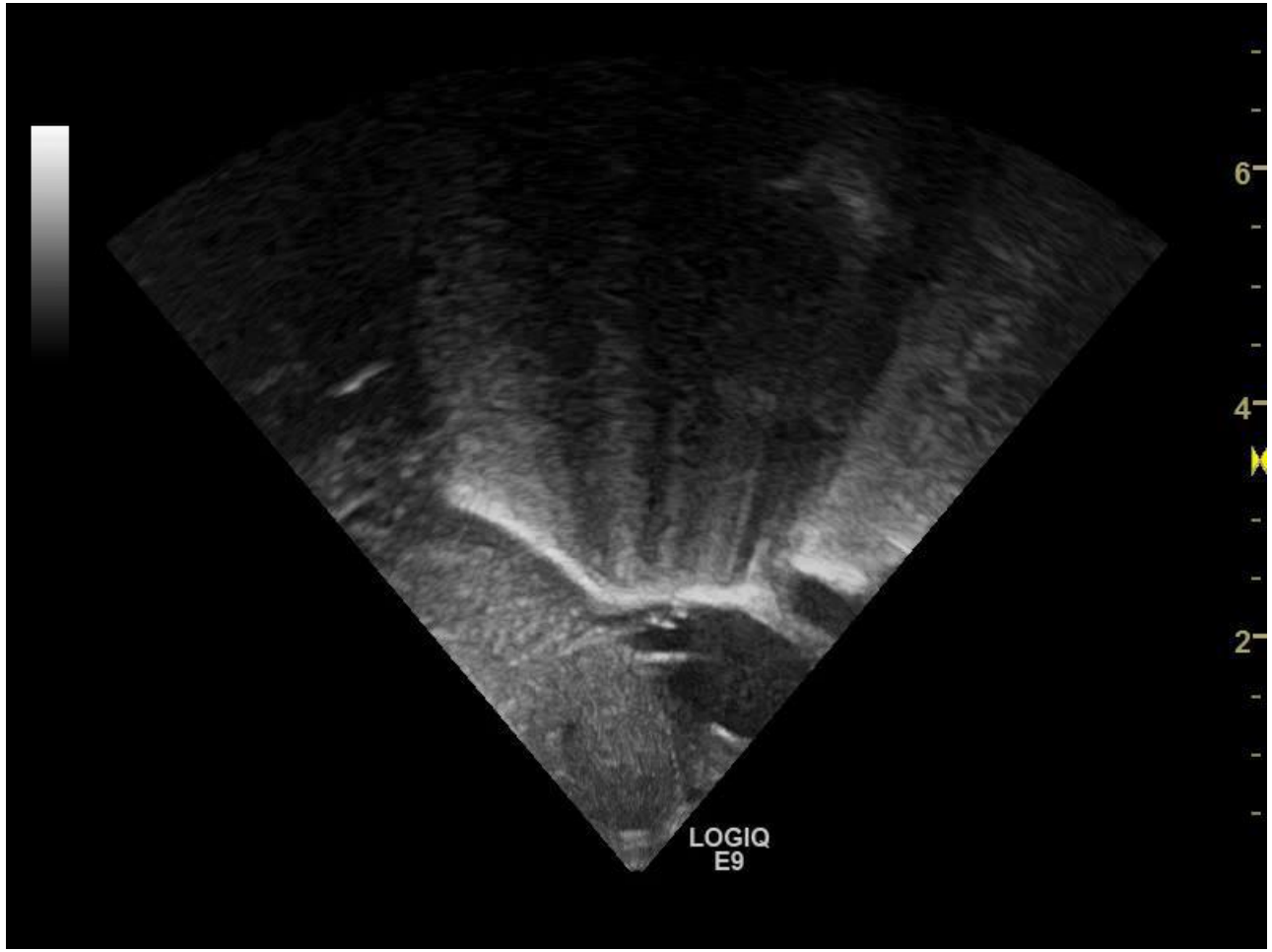


“How we do it better”…

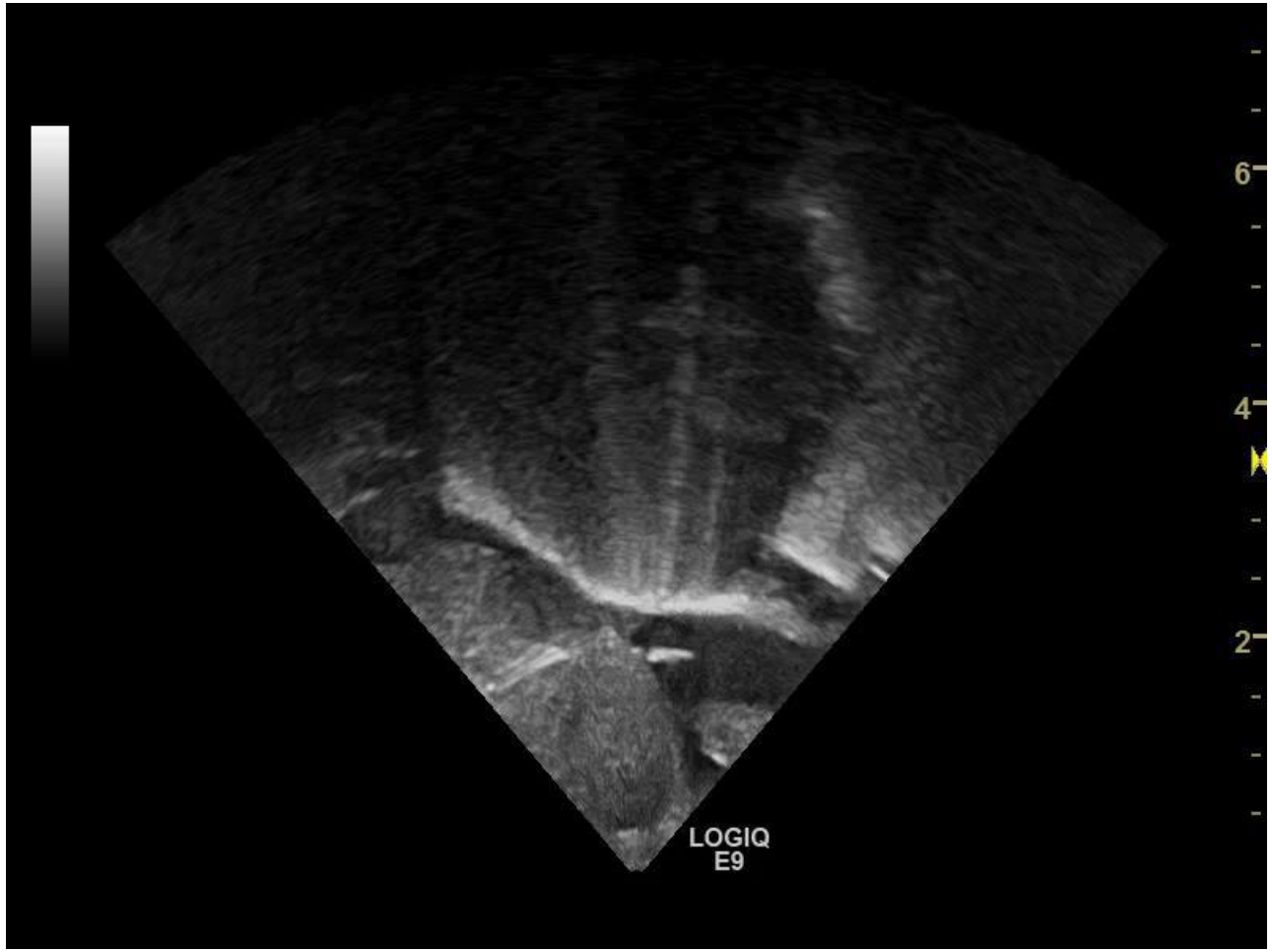
“How we do it better”…

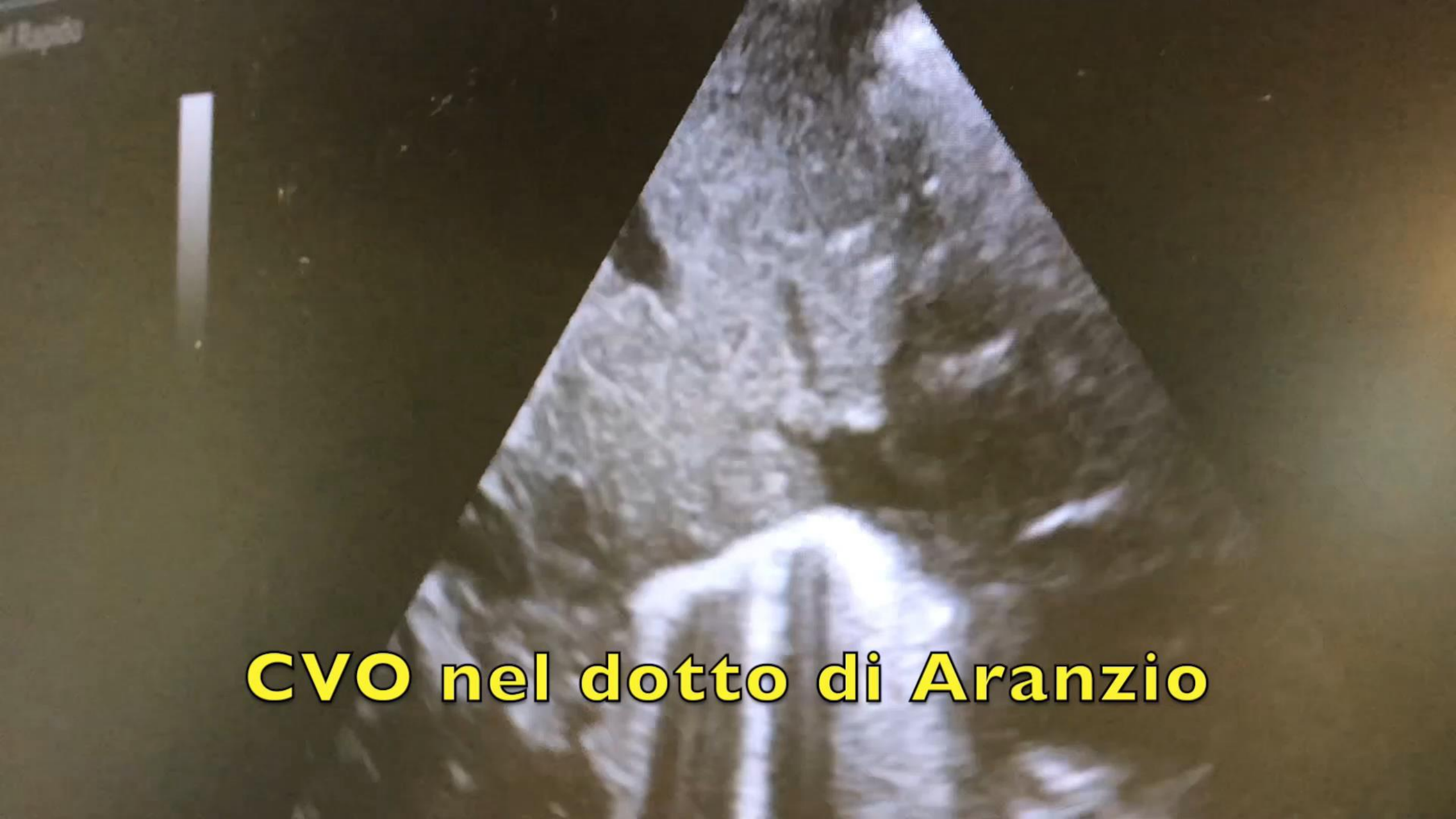


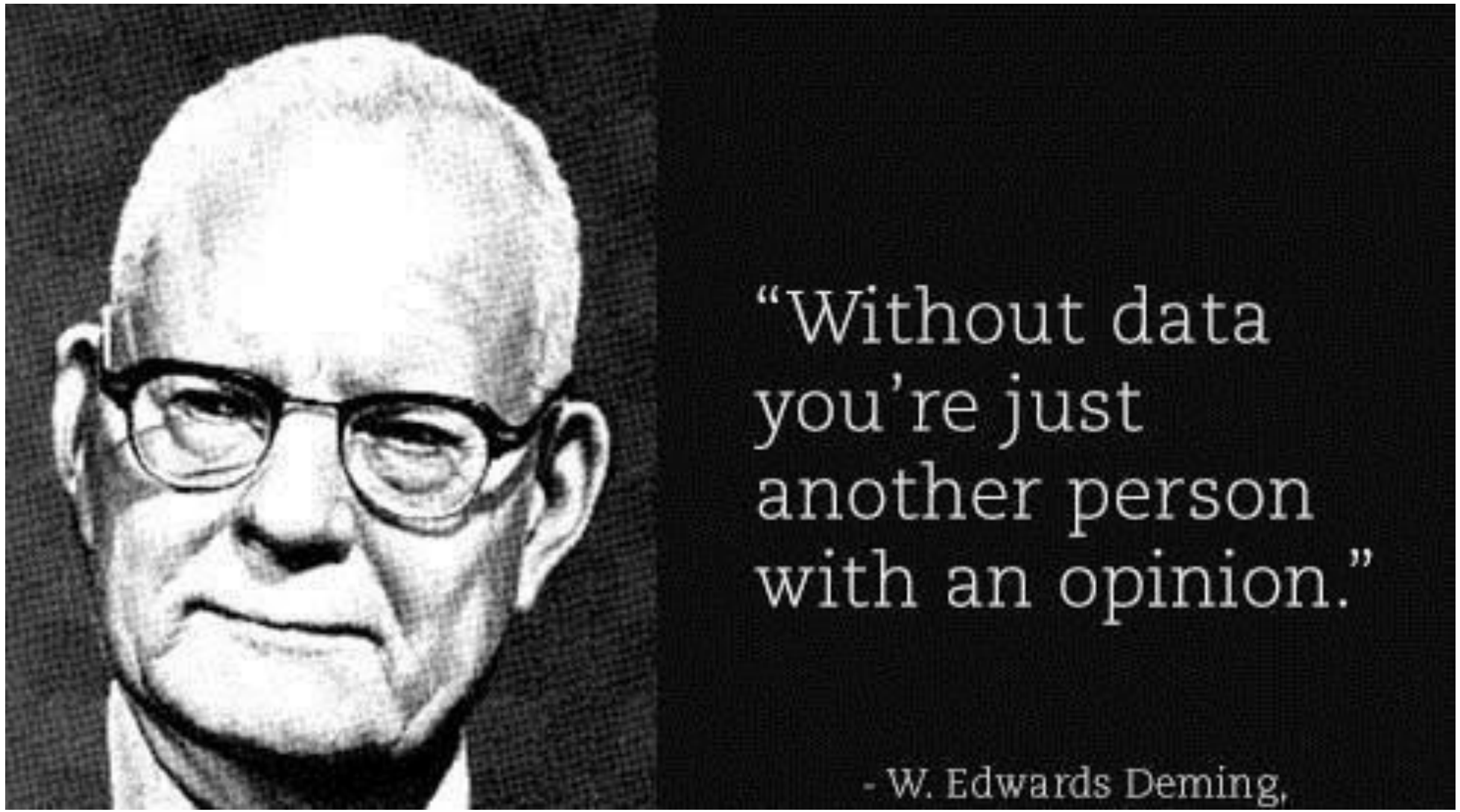
“How we do it better”…



“How we do it better”…




CVO nel dotto di Aranzio


“Without data
you’re just
another person
with an opinion.”
- W. Edwards Deming,

Is Neo-ECHOTIP protocol effective in preventing primary malposition during UVC placement?

Neonatology

Global Neonatal Research

Neonatology
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Published online: June ▪▪▪, 2024

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)	

Anne *et al. The Ultrasound Journal* (2025) 17:4
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The Ultrasound Journal

REVIEW Open Access

Real-time ultrasound for umbilical venous catheter insertion in neonates- a systematic review and meta-analysis

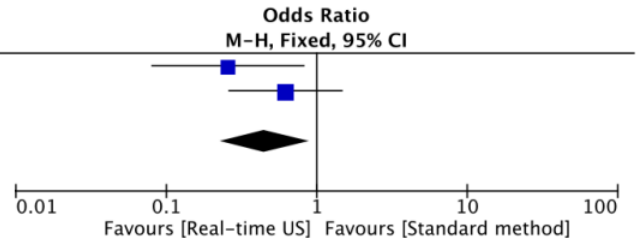
Rajendra Prasad Anne[1*], E

a. Malposition rates

RCTs

Study or Subgroup	Real-time Ultrasound Events	Total	Standard method Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Kaur 2022	11	26	20	27	46.3%	0.26 [0.08, 0.82]
Mishra 2024	12	58	16	54	53.7%	0.62 [0.26, 1.47]
Total (95% CI)		**84**		**81**	**100.0%**	**0.45 [0.23, 0.90]**
Total events	23		36			

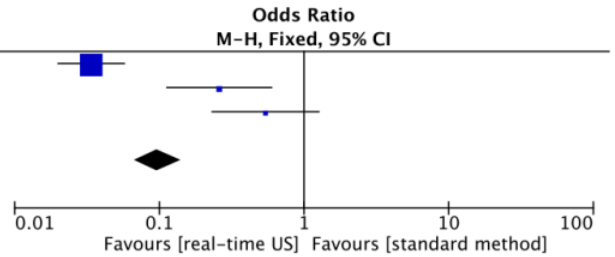
Heterogeneity: $Chi^2 = 1.43$, df = 1 (P = 0.23); $I^2 = 30\%$
Test for overall effect: Z = 2.27 (P = 0.02)



NRSIs

Study or Subgroup	Real-time ultrasound Events	Total	Standard method Events	Total	Weight	Odds Ratio M-H, Fixed, 95% CI
D'Andrea 2024	24	249	161	212	81.1%	0.03 [0.02, 0.06]
Guzmán-de la Garza 2020	27	52	50	62	11.3%	0.26 [0.11, 0.60]
Rossi 2022	14	38	28	54	7.5%	0.54 [0.23, 1.26]
Total (95% CI)		**339**		**328**	**100.0%**	**0.10 [0.07, 0.14]**
Total events	65		239			

Heterogeneity: $Chi^2 = 36.62$, df = 2 (P < 0.00001); $I^2 = 95\%$
Test for overall effect: Z = 12.30 (P < 0.00001)



Impianto Sicuro del Catetere Venoso Ombelicale nel neonato

1. Valutazione ecografica pre-procedurale.
2. Utilizzo di un pack procedurale pre-assemblato.
3. Tecnica asettica appropriata: igiene delle mani, massime protezioni di barriera e antisepsi cutanea con clorexidina 2% in IPA 70%.
4. Incannulamento della vena ombelicale usando il catetere più piccolo sulla base delle necessità infusionali del paziente (mono/bilume)
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7. Controlli seriati della posizione della punta usando l'ecografia (24-48 ore)
8. Rimozione precoce (entro 4-5 giorni)

Securement of Umbilical Venous Catheter Using Cyanoacrylate Glue: A Randomized Controlled Trial

Vito D'Andrea, MD[1], Giorgia Prontera, MD[1], Giovanni Pinna, MD[2], Francesco Cota, PhD[1], Simona Fattore, MD[1], Simonetta Costa, PhD[1], Martina Migliorato, MD[1], Giovanni Barone, MD[3], Mauro Pittiruti, MD[4], and Giovanni Vento, MD[1]

Objective To evaluate the role of cyanoacrylate glue in reducing dislodgement of umbilical venous catheters (UVCs).

Study design This was a single-center, randomized, controlled, nonblinded trial. All infants requiring an UVC according to our local policy were included in the study. Infants with a UVC with a centrally located tip as verified by real-time ultrasound examination were eligible for the study. Primary outcome was the safety and efficacy of securement by cyanoacrylate glue plus cord-anchored suture (SG group) vs securement by suture alone (S group), as measured by reduction in dislodgment of the external tract of the catheter. Secondary outcomes were tip migration, catheter-related bloodstream infection, and catheter-related thrombosis.

Results In the first 48 hours after UVC insertion, dislodgement was significantly higher in the S group than in the SG group (23.1% vs 1.5%; $P < .001$). The overall dislodgement rate was 24.6% in the S group vs 7.7% in the SG group ($P = .016$). No differences were found in catheter-related bloodstream infection and catheter-related thrombosis. The incidence of tip migration was similar in both groups (S group 12.2% vs SG group 11.7%).

Conclusions In our single-center study, cyanoacrylate glue was safe and effective for securement of UVCs, and particularly effective in decreasing early catheter dislodgments. *(J Pediatr 2023;260:113517)*.

Trial registration UMIN-CTR Clinical Trial; Registration number: R000045844.

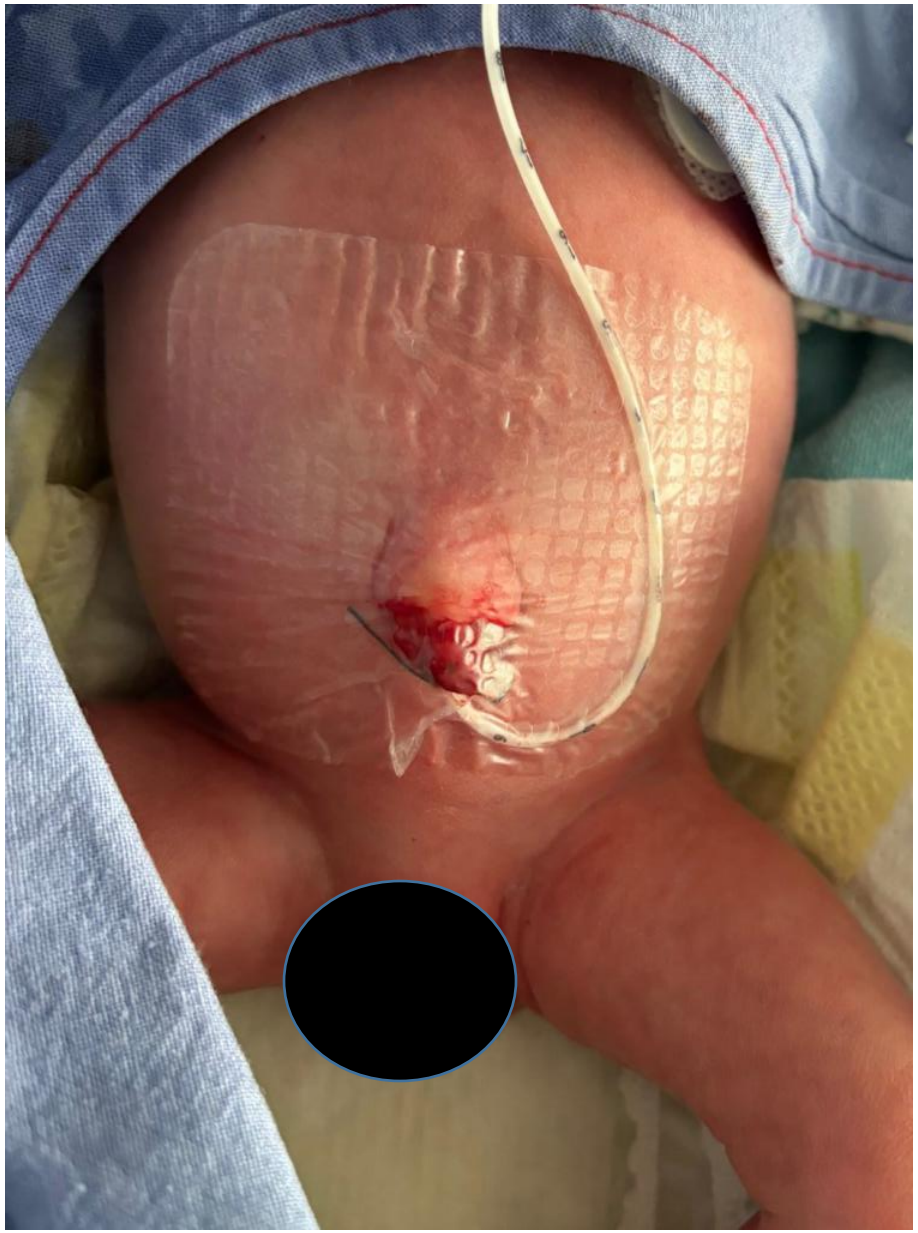
Table III. Incidence of UVC dislodgment at T1/T2/T3

Characteristics	Total	S group	SG group	*P* value
Dislodgments at T1	16/130 (12.3%)	15/65 (23.1%)	1/65 (1.5%)	<.001
Inward	2 (1.5%)	2 (3.1%)	-	.22
Outward	14 (10.8%)	13 (20%)	1 (1.5%)	.003
Dislodged UVC at T1	16	15	1	
Unacceptable site				
Intracardiac*	3	2	1	
Intrahepatic†	7	7	-	
Extra-abdomen‡	2	2	-	
Acceptable site	4	4	-	
Dislodgments at T2§	5/127 (3.9%)	1/63 (1.6%)	4/64 (6.2%)	.37
Inward	1 (0.8%)	1 (1.6%)	-	1
Outward	4 (3.1%)	-	4 (6.2%)	.05
Dislodged UVC at T2:	5	1	4	
Unacceptable site				
Intracardiac*	1	1	-	
Intrahepatic†	4	-	4	
Dislodgments at T3	0	0	0	-
Overall dislodgments	21/130 (16.1%)	16/65 (24.6%)	5/65 (7.7%)	.016
Inward	3 (2.3%)	3 (4.6%)	-	-
Outward	18 (13.8%)	13 (20%)	5 (7.7%)	.27

*Withdrawn to acceptable position (junction between inferior vena cava and right atrium).
†Withdrawn to prehepatic position.
‡Removed.

After assessment of the proper tip position by ultrasound examination, the UVC was secured with suture in the control group (S group) or with suture plus 4 drops of octyl-butyl-cyanoacrylate glue in the intervention group (SG group). The catheter was anchored to the base of the cord

In conclusion, our data from a randomized single-center trial suggest that, in addition to sutures, the use of butyl-octyl-cyanoacrylate for the purpose of securing the catheter on the umbilical cord is feasible and safe. The combined use of suture and cyanoacrylate glue significantly reduces dislodgement of the external tract of the catheter in the first 48 hours compared with suture alone. Late dislodgments (>48 hours) are not decreased by the use of glue. Migration of the tip is not significantly decreased by glue; thus, periodic verification of the position of the tip should be performed routinely, even in absence of dislodgment of the external tract of the catheter. ■



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Daily assessment

- La migrazione del catetere è descritta soprattutto nelle prime 24-48 ore
- La gelatina di Wharton si essicca e il moncone ombelicale si accorcia
- 65 Neonati con cateteri fissati con punto + NeoBridge

Table 1 Ultrasound findings of catheter tip position

	First ultrasound, n=65	Second ultrasound, n=52	Third ultrasound, n=42	Fourth ultrasound, n=24
Good position, n (%)	25 (38.5)	40 (77)	24 (57)	13 (54.2)
Malposition, n (%)	40 (61.5)	12 (23)	18 (43)	11 (45.8)
Right atrium, n (%)	17 (26.2)	6 (11.5)	9 (21)	1 (4.2)
Foramen ovale, n (%)	6 (9.2)	1 (2)	2 (5)	2 (8.3)
Left atrium, n (%)	15 (23.1)	3 (5.7)	–	1 (4.2)
Hepatic vessels, n (%)	2 (3)	2 (3.8)	7 (17)	7 (29.1)
Migration rate, n (%)	–	9 (17)	13 (31)	7 (29.1)

- 29/58 (50%) dei neonati hanno nel complesso avuto fenomeni di migrazione
- Solo il 50% dei neonate avevano un CVO normoposizionato alla fine dello studio

Ultrasound assessment of umbilical venous catheter migration in preterm infants: a prospective study. ADC 2016

Journal of Paediatrics and Child Health

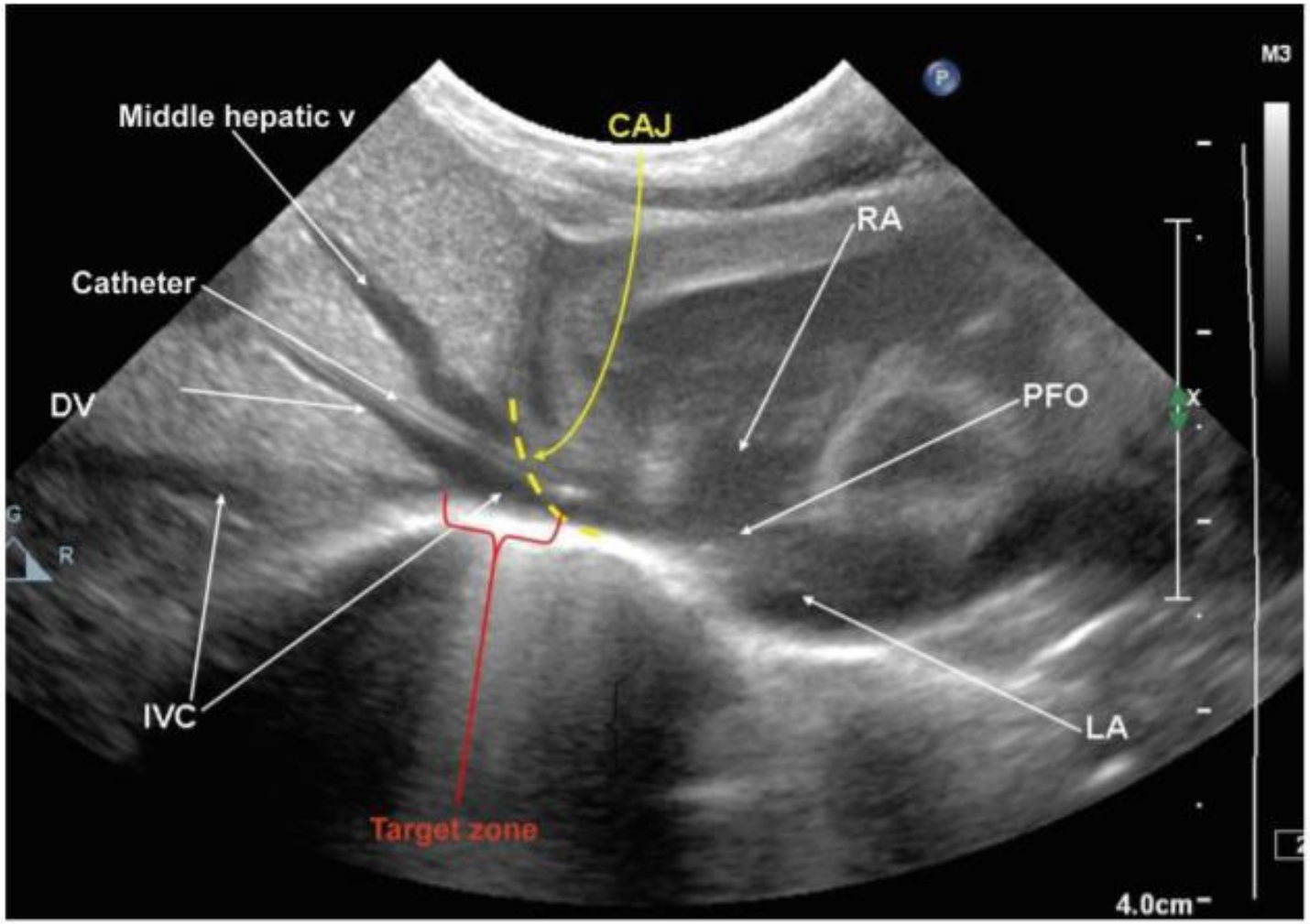
doi:10.1111/jpc.14073

ORIGINAL ARTICLE

Study of movement of umbilical venous catheters over time

Adam Hoellering,[1] Didier Tshamala[1,2] and Mark W Davies[1,3]

[1]Grantley Stable Neonatal Unit, Royal Brisbane and Women's Hospital, [2]Newborn Intensive Care U
[3]Department of Paediatrics and Child Health, University of Queensland, Brisbane, Queensland, Au



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Dwell time UVC

Clinical Bottom Lines

1 Dedicated teams should be used to maintain central lines within the neonatal intensive care unit as part of an overall CLABSI prevention strategy (Level 4 evidence).
2 If longer term (>5–7 days) central venous access is required, replacement of a UVC with a PICC may be beneficial, if combined with a PICC maintenance team (Level 4 evidence).
3 A large multi-centre randomised trial is needed to clearly answer the question of whether routine replacement of UVCs and PICCs at days 5–7 or earlier will result in lower rates of CLABSIs in neonates that require longer term central access.
4 The most effective way to minimise CLABSIs in neonates is not to have a central line in situ. Need for central lines should be assessed on a daily basis and removed as soon as no longer required.

Remove umbilical catheters promptly when no longer needed or if a complication occurs.

1. Consider limiting UVC dwell time to 7 to 14 days; risks of infection are increased with longer dwell times. UVC removal at 7 days followed by insertion of a peripherally inserted central catheter (PICC) for continued infusion therapy is one strategy to reduce central line-associated bloodstream infection.[4,30,32,33] (III)

Infusion therapy standard of practice. Journal of infusion nursing 2016

2. Consider UVC removal at 4 days followed by insertion of a PICC for continued infusion as one infection prevention strategy.[42] (V)

Infusion therapy standard of practice. Journal of infusion nursing 2021

How long should umbilical venous catheters remain in place in neonates who require long-term (≥5–7 days) central venous access JPCH 2014
Infusion therapy standard of practice. Journal of infusion nursing 2016

Recommendations for Prevention and Control of Infections in Neonatal Intensive Care Unit Patients: Central Line-associated Blood Stream Infections

Centers for Disease Control and Prevention
National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

Date: February 2022

Recommendation 9.C. Consider removal of umbilical venous catheters at or before 7 days of dwell time in neonatal intensive care unit (NICU) patients. **Conditional Recommendation**

- **Supporting Evidence:** Four observational studies.[6, 11, 27, 40]
- **Level of Confidence in the Evidence:** The level of confidence in this evidence is very low due to imprecision and inconsistency across studies. Only one study was conducted in the current standard of care.[40]
- **Benefits:** Increasing risk of infection was reported in association with increasing UVC dwell time, suggesting a benefit to removing UVCs at the earliest opportunity. One study suggested the risk of CLABSI was significantly different at 4 days;[11] however, this study used data collected before the

THM

Il protocollo ISCaVO

1. Si fonda su un uso globale dell'ecografo (pre impianto - all'impianto – post impianto).
2. Incrementa la percentuale di bambini con una posizione idonea del CVO al termine della procedura.
3. Incrementa il tasso di rimozione elettiva del CVO.
4. Minimizza le complicanze (infettive e non).


THANK
YOU
GRACIAS
ARIGATO
SHUKURIA
JUSPAXAR
DANKSCHEEN
TASHAKKUR ATU
YAQHANYELAY
SUKSAMA
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BOLZÏN
MERCI
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