Il protocollo ISiCEC per l'Impianto Sicuro del Catetere Epicutaneo Cavale nel neonato

Vito D'Andrea

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SHEA

SHEA/IDSA/APIC Practice Recommendation

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

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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]

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.

Impianto Sicuro del Catetere Epicutaneo Cavale

1. Valutazione pre-procedurale (utilizzo del protocollo RaSuVA, preferibilmente impiegando la NIR)
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. Utilizzo dell'ecografo per la tip navigation e la tip location intra-procedurale (secondo il protocollo NeoECHOTip).
5. Stabilizzazione del catetere e protezione del sito di emergenza (colla in cianoacrilato, membrana semipermeabile trasparente e "sutureless device")
6. Controlli seriati della posizione della punta usando l'ecografia (48 ore; ogni 7 giorni e al cambio di medicazione)
7. Valutazione rimozione dell'ECC entro due settimane

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Techniques in vascular access

JVA The Journal of Vascular Access

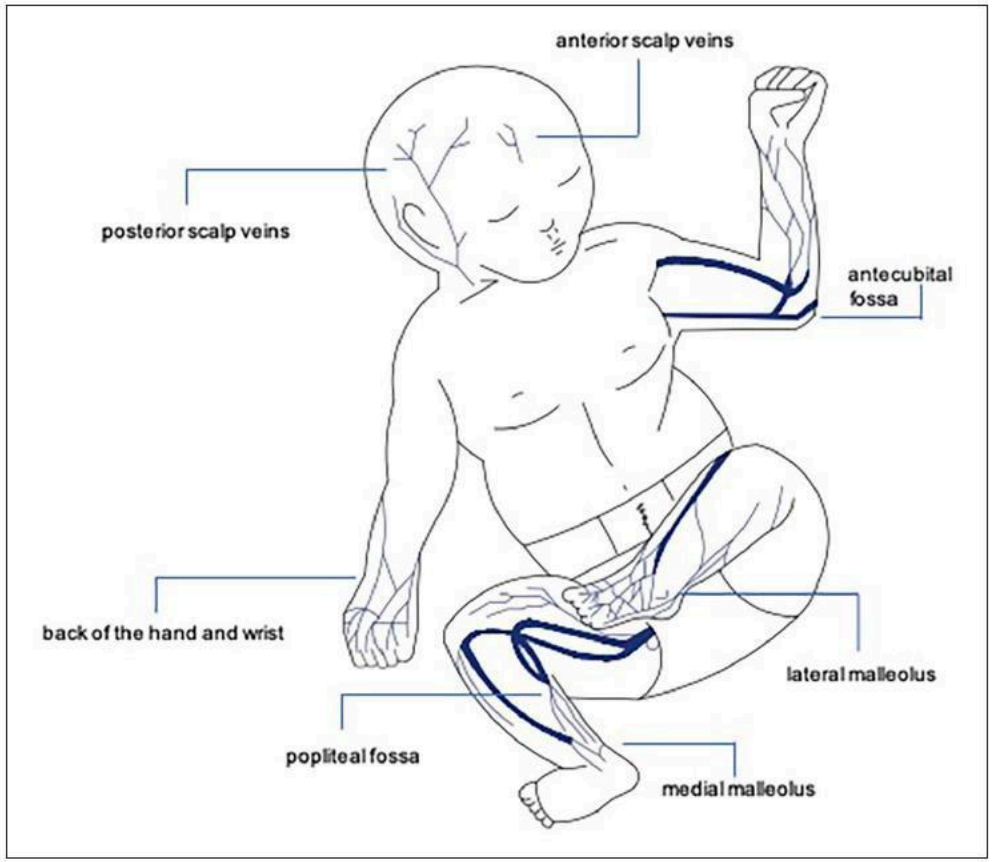
Rapid Superficial Vein Assessment (RaSuVA): A pre-procedural systematic evaluation of superficial veins to optimize venous catheterization in neonates

The Journal of Vascular Access
1–5

DOI: 10.1177/11297298221098481
journals.sagepub.com/home/jva
SAGE

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

1. Medial malleolus
2. Lateral malleolus
3. Retro-popliteal fossa
4. Back of the hand and wrist
5. Antecubital fossa
6. Anterior scalp surface
7. Posterior scalp surface



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ARTICLE

Risk factors for peripherally inserted central catheter complications in neonates

Gillian C. Pet[1] · Jens C. Eickhoff[2] · Kate E. McNevin[3] · Julie Do[3] · Ryan M. McAdams[4]

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	Upper extremity *n*/total (%)	Lower extremity *n* (%)	OR of complication with UE compared with LE PICC (95% CI) *p* value
Any complications	210/524 (40.1%)	215/710 (30.3%)	1.54 (1.22–1.94) <0.001
Nonelective line removal	183/524 (34.9%)	168/710 (23.7%)	1.73 (1.35–2.21) <0.001
Associated with PICC clot	18/524 (3.4%)	40/710 (5.6%)	0.6 (0.33–1.06) NS
Malposition in 1st 72 h	33/524 (6.3%)	17/710 (2.4%)	2.74 (1.51–4.97) <0.001
Malposition over time	35/524 (6.7%)	14/710 (2.0%)	3.56 (1.89–6.71) <0.001
Dislodgement	20/524 (3.8%)	17/710 (2.4%)	1.62 (0.83–3.16) NS
Crack/Broken/Fracture	23/524 (4.4%)	39/710 (5.4%)	0.79 (0.47–1.34) NS
Extravasation/Infiltration	13/524 (2.5%)	4/710 (0.6%)	4.49 (1.44–13.96) 0.001
Phlebitis/Edema/ Erythema/Perfusion changes	18/524 (3.4%)	44/710 (6.2%)	0.54 (0.31–0.93) 0.03
Malfunction/Occlusion	37/524 (7.1%)	40/710 (5.6%)	1.27 (0.8–2.01) NS
Failed insertion	35/524 (6.7%)	25/710 (2.3%)	1.96 (1.19–3.24) 0.009
Infection	11/524 (2.0%)	7/710 (1.0%)	2.15 (0.8–5.79) NS

Research Article

Risk Factors Related to Peripherally Inserted Central Venous Catheter Nonselective Removal in Neonates

Xiaohe Yu, Shaojie Yue, Mingjie Wang, Chuanding Cao, Zhengchang Liao, Ying Ding, Jia Huang, and Wen Li

We aimed to investigate the incidence and risk factors associated with nonselective removal of peripherally inserted central venous catheter (PICC) in neonates. In this prospective cohort study, neonates who underwent PICC placement at neonatal intensive care units (NICUs) in China from October 2012 to November 2015 were included. The patient demographics, catheter characteristics, catheter duration, PICC insertion site, indication for PICC insertion, infuscate composition, PICC tip location, and catheter complications were recorded in a computerized database. Risk factors for nonselective removal were analyzed. A total of 497 PICCs were placed in 496 neonates. Nonselective removal occurred in 9.3% of PICCs during 10,540 catheter-days (4.6 nonselective removals per 1,000 catheter-days). These included occlusion (3%), infection (1.4%), leakage (2.0%), phlebitis (0.6%), displacement (1%), pleural effusion(0.6%), and breaks (0.6%). Noncentral tip position was independently associated with an increased risk of nonselective removal (odds ratio 2.621; 95% confidence interval, 1.258-5.461) after adjusting for gestational age, sex, birth weight, and PICC dwell time. No significant differences in the rate of complications occurred between silastic and polyurethane PICC or different insertion sites. Noncentral PICC tip position was the only independent risk factor for nonselective removal of PICC.

Use of peripherally inserted central catheters (PICC) via scalp veins in neonates

Allison Callejas, MD, Horacio Osiovich, MD, FRCPC, Joseph Y Ting, MBBS, MPH, FRCPC

Doi: 10.3109/14767058.2016.1139567

Abstract

Objective To describe the use and complications of peripherally inserted central catheters (PICC) via scalp veins in neonates.

Methods A retrospective review of neonates who had PICCs inserted, between January 2010 and June 2013, in the NICU at Childreńs and Womeńs Health Centre of British Columbia.

Results During the study period, 689 PICCs were inserted over a total of 46728 NICU patient days. The PICC insertion sites were: scalp veins (69), upper limb veins (471) and lower limb veins (149). The mean catheter durations were 17 days, 19 days and 18 days for PICCs inserted through scalp, upper limb and lower limb veins, respectively. The complication rates were 23%, 23% and 15% for insertion via scalp, upper and lower limb veins, respectively. Centrally placed PICCs at the time of insertion were more likely to remain in situ for longer than one week ($p < 0.001$). The incidence of central line-associated blood stream infection was 4.4, 6.4 and 3.4 per 1000 catheter days, respectively, for scalp, upper and lower limb PICCs.

Insertion Site	Scalp	Upper limb	Lower limb
No. of PICCs (% of total PICCs)	69 (10%)	471 (68%)	149 (22%)
End of therapy	40 (58%)	296 (63%)	94 (63%)
*Death or transferred to other NICUs	9 (13%)	45 (10%)	18 (12%)
Infectious complications	5 (8%)	56 (13%)	8 (6%)
	- CoNS. [1] - Unidentified Staph. [1] - Enterococcus [1] - Group B Strep. [1] - E Coli [1]	- CoNS. [42] - Enterococcus [3] - E Coli [3] - Kleb. pneumoniae [2] - Unidentified Staph. [2] - Candida lustiniae [1] - Klebsiella oxytoca [1]	- CoNS. [3] - Enterococcus [3] - E Coli [1] - Staph. Aureus [1]

European Journal of Pediatrics
https://doi.org/10.1007/s00431-022-04480-1

ORIGINAL ARTICLE

Near-infrared system's efficiency for peripheral intravenous cannulation in a level III neonatal intensive care unit: a cross-sectional study

Silvia Ferrario[1] · Gabriele Sorrentino[1] · Giacomo Cavallaro[1] · Ivan Cortinovis[2] · Silvia Traina[1] · Salvatore Muscolo[1] · Alessandro Agosteo[1] · Germana Santini[1] · Elisa Lagostina[1] · Fabio Mosca[1,3] · Laura Plevani[1]

	NIR group ($n = 124$)	Control group ($n = 101$)	p
Gestational age (weeks), median (Q1–Q3)	34.6 (33.8–35.2)	34.4 (34.6–36.2)	0.136
Birth weight (g), median (Q1–Q3)	2471 (2300–2641)	2624 (2440–2808)	0.229
Weight at the study (g), median (Q1–Q3)	3943 (3724–4162)	3668 (3504–3833)	0.058
Ethnic group (Caucasian), *n* (%)	102 (82.3)	87 (86.1)	0.8359
Drugs taken, *n* (%)	60 (48.4)	48 (47.5)	0.8975
Years of nurses' experience, *n* (%)			0.4124
<1 year	22 (17.7)	13 (12.9)	
1–5 years	35 (28.2)	25 (24.7)	
>5 years	67 (54.1)	63 (62.4)	
Proportion of one attempt (CI 95%)	64.5 (56.1; 72.9)	55.5 (45.8; 65.1)	0.2136
Proportion of one attempt based on the nurses' years of experience (CI 95%)			
<1 year	72.7 (54.1; 91.3)	23.1 (0.2; 46.0)	*0.0125*
1–5 years	60.0 (43.8; 76.2)	52.0 (32.4; 71.6)	0.7246
>5 years	64.2 (52.7; 75.7)	63.5 (51.6; 75.4)	0.9206
Average pain score (CI 95%)	5.5 (4.9–6.1)	4.9 (4.3–5.4)	0.147
Average pain score based on the nurses' years of experience (CI 95%)			
<1 year	5.8 (4.0; 7.8)	4.1 (2.4; 5.7)	0.191
1–5 years	5.6 (4.7; 6.4)	5.3 (3.8; 6.9)	0.756
>5 years	5.3 (4.8; 6.2)	4.8 (4.2; 5.2)	0.366

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www.nature.com/jp

ORIGINAL ARTICLE

A randomized trial of the Vein Viewer versus standard technique for placement of peripherally inserted central catheters (PICCs) in neonates

K Phipps, A Modic, MA O'Riordan and M Walsh

Division of Neonatology, Department of Pediatrics, Rainbow Babies and Children's Hospital, University Hospitals of Cleveland Case Medical Center, Cleveland, OH, USA

	Standard (N = 56)	*Vein Viewer (N = 59)*	P
Gestational age (weeks)	28.0 (23–40)	30.0 (23–40)	0.08
Birthweight (g)	1030 (320–4160)	1160 (300–4700)	0.06
Gender, male, *N* (%)	35 (62.5)	32 (54.2)	0.37
African American, *N* (%)	29 (51.8)	27 (45.8)	0.52

	Unadjusted odds ratio (95% CI)	*Adjusted odds ratio (95% CI)*
Success on first attempt	1.26 (0.59, 2.68)	1.57 (0.71, 3.50)
Any success	2.33 (0.90, 6.04)	3.05 (1.10, 8.42)

showed a trend to more successful placement 86 versus 75%; unadjusted odds ratio 2.33 (0.90, 6.04; $P = 0.08$). Infants randomized to the Vein Viewer were more mature (30 ± 2 weeks gestational age (GA) versus 28 ± 2 weeks GA; $P = 0.08$). After adjusting for GA, use of the Vein Viewer was significantly more likely to lead to successful line placement (adjusted odds ratio 3.05 (1.10, 1.82)).

ORIGINAL ARTICLE

Increased frequency of peripheral venipunctures raises the risk of central-line associated bloodstream infection in neonates with peripherally inserted central venous catheters

Hao-Yuan Cheng [a], Chun-Yi Lu [a], Li-Min Huang [a], Ping-Ing Lee [a], Jong-Min Chen [b], Luan-Yin Chang [a,*]

Background/Purpose: Central-line associated bloodstream infection (CLA-BSI), which is mostly caused by coagulase-negative staphylococcus, is an important morbidity in neonatal intensive care units. Our study is aimed to identify the risk factors of CLA-BSI in neonates with peripherally inserted central venous catheters (PICCs).

Methods: A retrospective cohort study of neonatal intensive care unit patients with a PICC insertion between January 1, 2011 and December 31, 2012 was conducted. We performed univariate and multivariate analyses with a logistic regression model to investigate the risk factors and the association between increased frequency of peripheral venipunctures during PICC use and the risk of CLA-BSI while adjusting for other variables.

Results: There were 123 neonates included in our study. Thirteen CLA-BSIs were recorded within the follow-up period. The incidence of PICC-associated CLA-BSI was 4.99 per 1000 catheter-days. There was no statistically significant association between the risk of CLA-BSI and gestational age, birth weight, chronological age, or other comorbidities. However, the odds of CLS-BSI increased to 12 times if the patient received six or more venipunctures within the period without concurrent antibiotic use [odds ratio (OR), 11.94; $p < 0.001$]. The OR of CLA-BSIs increased by 16% per venipuncture during PICC use (OR, 1.14; $p = 0.003$).

NIR ed ECC

- La NIR permette la corretta visualizzazione e la valutazione di vene superficiale ma non visibili e/o palpabili
- La NIR è di aiuto nella scelta della vena
- La NIR può essere di aiuto nei DIVA come tecnica elettiva

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4. Utilizzo dell'ecografo per la tip navigation e la tip location intra-procedurale (secondo il protocollo NeoECHOTip).
5. Stabilizzazione del catetere e protezione del sito di emergenza (colla in cianoacrilato, membrana semipermeabile trasparente e "sutureless device")
6. Controlli seriati della posizione della punta usando l'ecografia (48 ore; ogni 7 giorni e al cambio di medicazione)
7. Valutazione rimozione dell'ECC entro due settimane

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)

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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]

Essential Practices

Before insertion

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 HCP involved in insertion, care, and maintenance of CVCs about CLABSI prevention (Quality of Evidence: MODERATE)[74–78]
3. Bathe ICU patients aged >2 months with a chlorhexidine preparation on a daily basis (Quality of Evidence: HIGH)[86–90]

At insertion

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]
2. Perform hand hygiene prior to catheter insertion or manipulation (Quality of Evidence: MODERATE)[102–107]
3. The subclavian site is preferred to reduce infectious complications when the catheter is placed in the ICU setting (Quality of Evidence: HIGH)[33,37,108–110]
4. Use an all-inclusive catheter cart or kit (Quality of Evidence: MODERATE)[118]
5. Use ultrasound guidance for catheter insertion (Quality of Evidence: HIGH)[119,120]
6. Use maximum sterile barrier precautions during CVC insertion (Quality of Evidence: MODERATE)[123–128]
7. Use an alcoholic chlorhexidine antiseptic for skin preparation (Quality of Evidence: HIGH)[42,129–134]

After insertion

1. Ensure appropriate nurse-to-patient ratio and limit use of float nurses in ICUs (Quality of Evidence: HIGH)[34,35]
2. Use chlorhexidine-containing dressings for CVCs in patients over 2 months of age (Quality of Evidence: HIGH)[45,135–142]
3. For non-tunneled CVCs in adults and children, change transparent dressings and perform site care with a chlorhexidine-based antiseptic at least every 7 days or immediately if the dressing is soiled, loose, or damp. Change gauze dressings every 2 days or earlier if the dressing is soiled, loose, or damp (Quality of Evidence: MODERATE)[145–148]
4. Disinfect catheter hubs, needleless connectors, and injection ports before accessing the catheter (Quality of Evidence: MODERATE)[150–154]
5. Remove nonessential catheters (Quality of Evidence: MODERATE)
6. Routine replacement of administration sets not used for blood, blood products, or lipid formulations can be performed at intervals up to 7 days (Quality of Evidence: HIGH)[164]
7. Perform surveillance for CLABSI in ICU and non-ICU settings (Quality of Evidence: HIGH)[13,165,166]

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.


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“Instruction for use..”

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7. Valutazione rimozione dell'ECC entro due settimane

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.

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.

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Instructions for using ChloraPrep® applicators.

Uso della Clorexidina in TIN…riassumendo

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

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6. Controlli seriati della posizione della punta usando l'ecografia (48 ore; ogni 7 giorni e al cambio di medicazione)
7. Valutazione rimozione dell'ECC entro due settimane

Journal of Perinatology (2019) 39:95–101
https://doi.org/10.1038/s41372-018-0249-x

ARTICLE

Does ultrasound guidance for peripherally inserted central catheter (PICC) insertion reduce the incidence of tip malposition? – a randomized trial

Tejopratap Oleti[1] · M. Jeeva Sankar[1] · Anu Thukral[1] · V. Sreenivas[2] · Arun Kumar Gupta[3] · Ramesh Agarwal[1] · Ashok K. Deorari[1] · Vinod K. Paul[1]

	Ultrasound group ($N = 40$)	Conventional group ($N = 40$)	p value	Relative risk RR (95% CI)
PICC tip malposition	13 (32.5)	27 (67.5)	0.002	0.48 (0.29–0.79)
Longevity of PICC (hrs)	154 ± 14.9	133 ± 9.4	0.23	—

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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

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.

foundation for intraprocedural tip location during catheter insertion.

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https://doi.org/10.1016/j.jpeds.2022.05.035

The authors declare no conflicts of interest.

References

1. Grasso F, Capasso A, Pacella D, Borgia F, Salomè S, Capasso L, et al. Ultrasound-guided catheter tip location in neonates: a prospective cohort study. J Pediatr 2022;244:86-91.e2.

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

Objective Epicutaneo-caval catheters are essential for the care of sick infants who require long-term medical and nutritional management. The aim of this study was to investigate the use of real-time ultrasound as an alternative to X-rays to reduce the incidence of primary malpositions during catheter insertion.

Study Design Data on epicutaneo-caval catheters were retrospectively collected in a tertiary neonatal intensive care unit. Catheter were analyzed considering the tip location technique (standard chest–abdominal radiograph vs real-time ultrasound)

Results A total of 248 epicutaneo-caval catheters were analyzed. Of these, 118 catheters had primary malposition (47.6%). The tip of 165 catheters was assessed using standard chest–abdominal X-rays and 107 (64.8%) were found to be in an inappropriate location. In the group of 83 catheters that were placed using real-time ultrasound for tip location, only 11 catheters (13.2%) had primary malposition. The rate of malposition among the two groups showed a statistically significant difference ($p < 0.001$). Hypothetically, 300 chest X-rays could have been saved if real-time ultrasound had been used to locate the tip, reducing radiation exposure to infants.

Conclusion The use of a real-time ultrasound may be beneficial in reducing primary catheter malpositions compared with conventional radiography. In addition, secondary malpositions and catheter-related complications can be monitored over time.

Table 1 Q7 Characteristics of the study catheters

Reason for insertion	Number of ECCs		
Parental nutrition	122 (49.1%)		
Respiratory disease	29 (11.7%)		
SGA/AED/ARED	25 (10.1%)		
Infectious	24 (9.7%)		
Asphyxia	22 (8.9%)		
Cardiologic	10 (4.1%)		
Surgical	9 (3.6%)		
Difficult intravenous access	1 (0.4%)		
Other disease	6 (2.4%)		
	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
Removal reason			
Dislocation	4 (2.4%)	–	0.304
Phlebitis	10 (6.1%)	5 (6%)	1
Infection	20 (12.1%)	15 (18.1%)	0.246
Malposition	7 (4.2%)	–	0.099
Occlusion	6 (3.6%)	4 (4.8%)	0.736
Rupture	15 (9.1%)	3 (3.6%)	0.193
Extravasation	7 (4.2%)	1 (1.2%)	0.274
Cardiac tamponade	1 (0.6%)	1 (1.2%)	1

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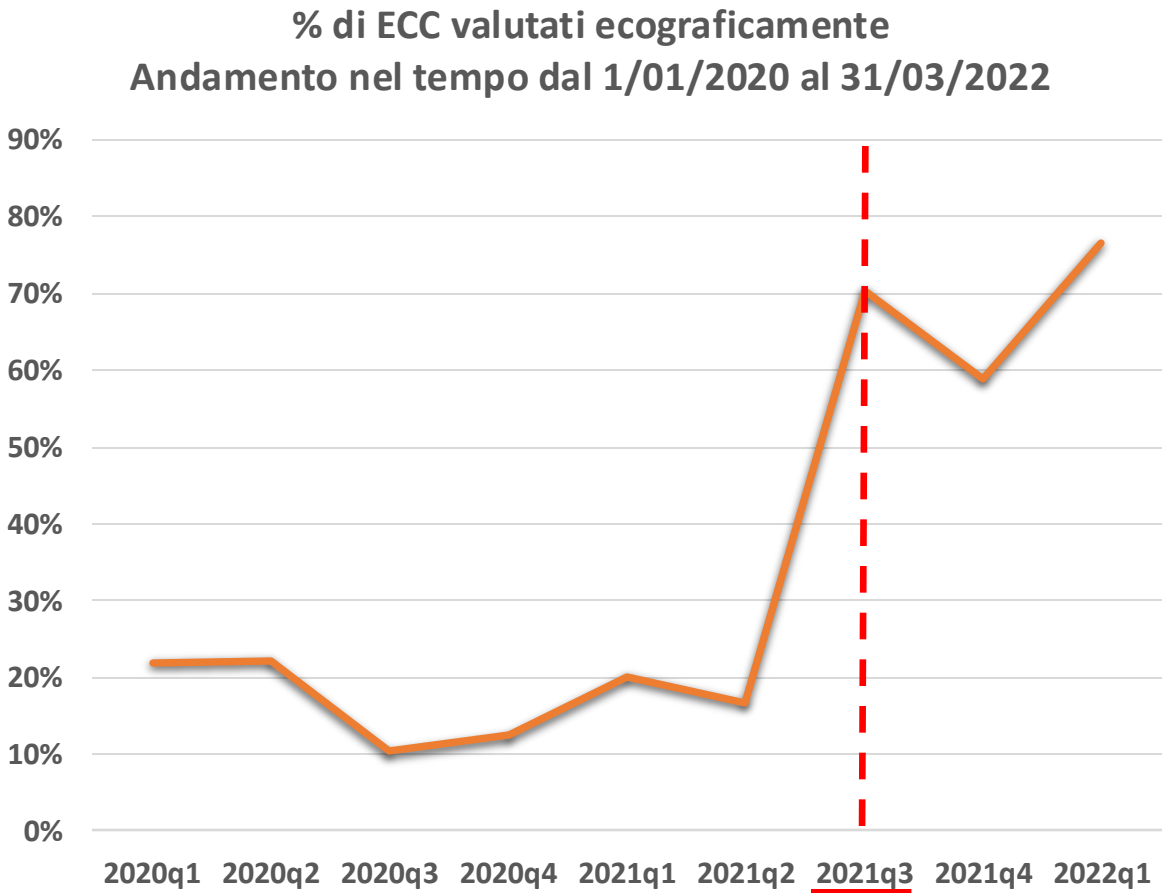
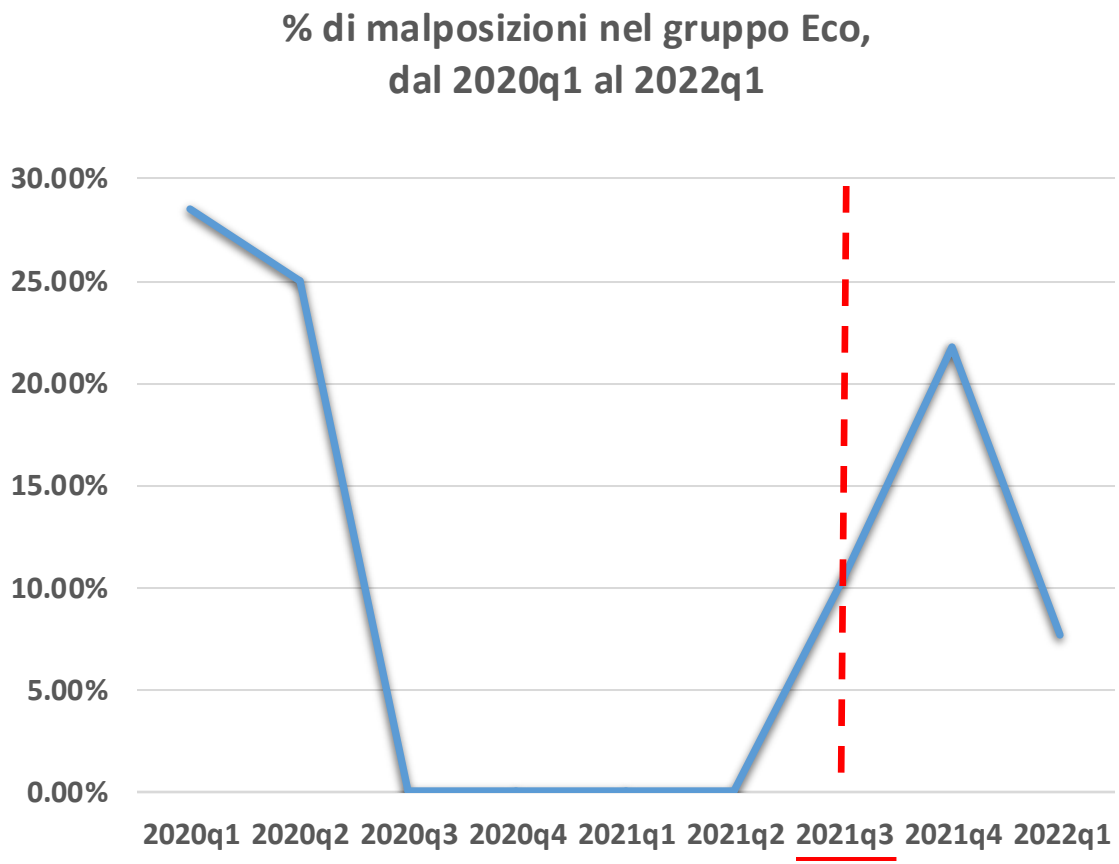
RISULTATI





"Ultrasound"

Table 1 Ultrasonography during catheter insertion

	Population	*n* RTUS-guided insertions	US operator	Probe	Technique	Tips visualized by US	Average time savings with US	Average manipulations per patient prevented with US	Average XRs per patient saved with US
Brissaud et al (2010)[16]	BW: 1,305 (620–3,550) g GA: 30 (26–40) wk	36 PICCs	Pediatric intensivist	Not specified	Not specified	89%	15 min	Not reported	Not reported
Katheria et al (2013)[15]	Weight at procedure: 1,185 ± 538 g. CGA 31 ± 4 wk	20 PICCs	Neonatologists	13 MHz linear	UE: right parasternal sagittal view. LE: subcostal sagittal view. Saline or nonionic, isotonic contrast used	90%	30 min	1	1

Abbreviations: BW, birth weight; CGA, corrected gestational age; GA, gestational age; LE, lower extremity; PICC, peripherally inserted central catheter; RTUS, real-time ultrasound; SAX, short axis; UAC, umbilical artery catheter; UE, upper extremity; US, ultrasound; UVC, umbilical venous catheter; XR, radiograph.
Note: Population expressed as ranges, means ± standard deviation, and median (range).

Ultrasonography for Central Catheter Placement in the Neonatal Intensive Care Unit—A Review of Utility and Practicality. Am J Per 2015

Table 2 Ultrasonography after catheter insertion

	Population	*n*	US operator	Probe	Technique	Tips visualized by US	Clinical utility
Madar and Deshpande (1996)[17]	BW: 1,210 (640–3,530) g GA: 28 (23–40) wk	18 UACs, 3 UVCs, 19 PICCs	Not specified	7.5 MHz	Suprasternal, subcostal, and parasternal SAX views	95%	US detected two venous catheters passed through the foramen ovale which was not evident on XR
Ohki et al (2000)[7]	"Neonates"	57 PICCs	Not specified	10 and 12 MHz	Not specified	95%	US could detect 78% of cases of catheter tip dislodgement by changes in extremity position
Jain et al (2012)[6]	BW: 833 (710–1,930) g GA: 26.5 (25.4–28.8) weeks.	22 PICCs	Neonatologists	10 MHz	UE: Subcostal, parasternal LAX, high parasternal, and apical views. LE: subcostal sagittal view. Saline contrast used	100%	XR incorrectly deemed 4 of 11 malpositioned tips in good position, and 5 of 11 well-positioned tips in bad position. In nine infants, a second XR was avoided with US-guided manipulation
Tauzin et al (2013)[8]	BW: < 1,800 g Weight: ~1,130 (828–1,452) g CGA: 27–33 weeks.	109 PICCs	"US specialist"	12 MHz	Subcostal, apical, parasternal LAX, high parasternal, and abdominal parasternal views	100%	US evaluation determined 25% of PICCs extended into the heart even though deemed to be in good position by XR. 21% PICCs repositioned after US evaluation without complications

Abbreviations: BW, birth weight; CGA, corrected gestational age; GA, gestational age; LAX, long axis; LE, lower extremity; PICC, peripherally inserted central catheter; SAX, short axis; UAC, umbilical artery catheter; UE, upper extremity; US, ultrasound; UVC, umbilical venous catheter; XR, radiograph.
Note: Population expressed as ranges, means ± standard deviation, and median (range).

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E. Confirm the catheter tip location by radiography, echocardiography, or ultrasonography before catheter use.

5. Neonatal echocardiography may be superior to chest and abdominal radiography for identifying malpositioned catheters or in extremely low-birth-weight neonates.[24,25] (V)

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

The Journal of Vascular Access
1–10

DOI: 10.1177/11297298211007703
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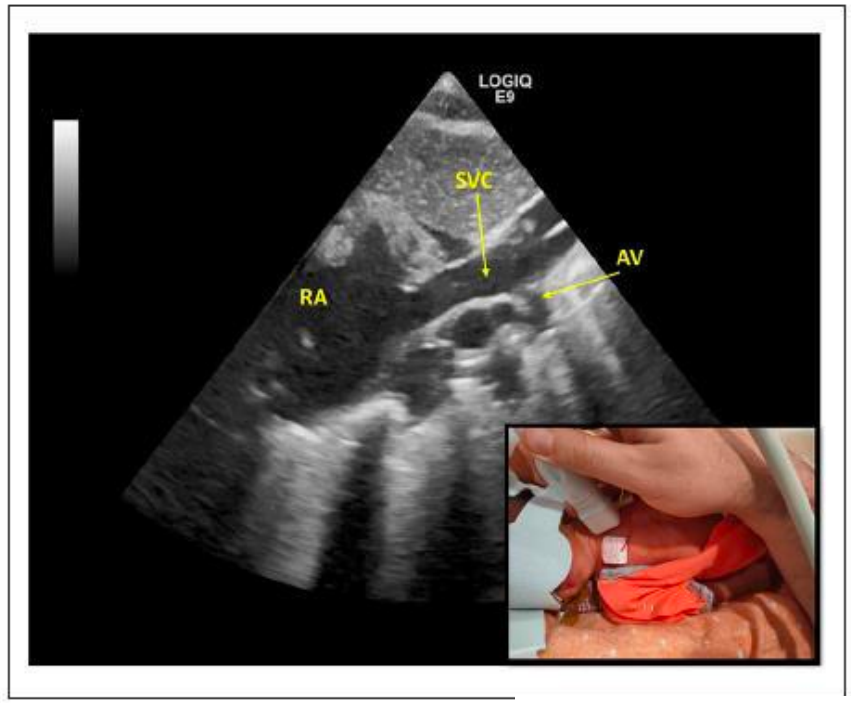
Giovanni Barone[1], Mauro Pittiruti[2], Daniele G Biasucci[3], Daniele Elisei[4], Emanuele Iacobone[4], Antonio La Greca[2], Geremia Zito Marinosci[5] and Vito D'Andrea[6]

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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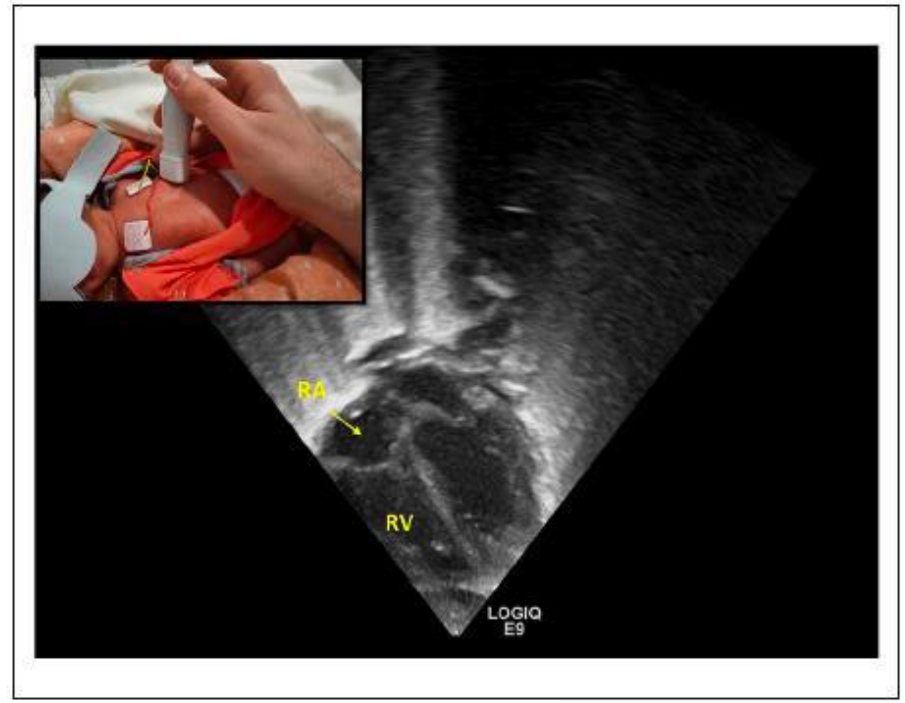
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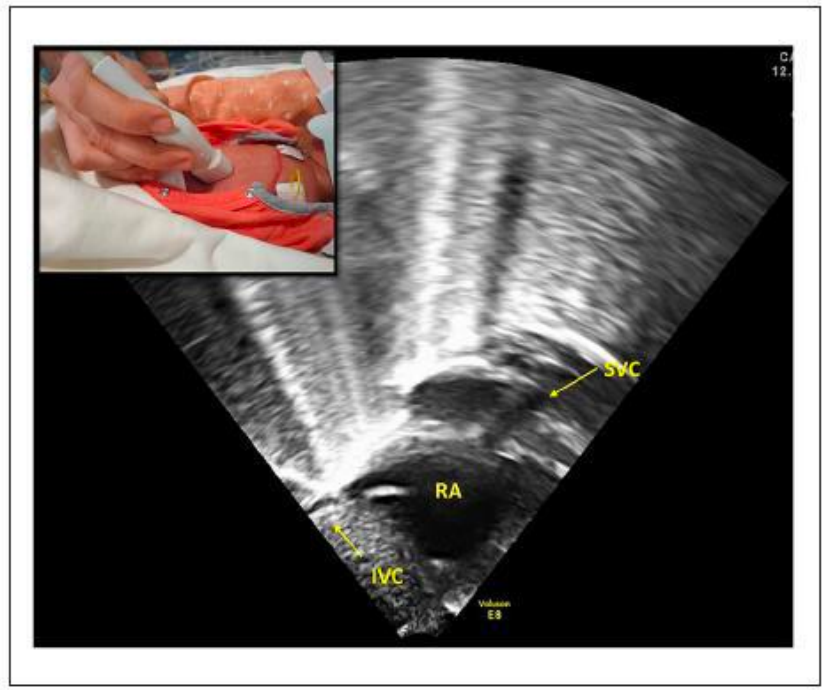
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Protocollo Echo Tip per gli ECC inseriti dagli arti superiori e dallo scalpo

Il protocollo Echotip prevede il posizionamento ecoguidato dell'ECC mediante l'ausilio dell'ecografia sia come strumento di **tip navigation** che come strumento di **tip location**:

Tip navigation:

Sonda: lineare hockey stick, impostare una frequenza di 10-14MHz

Finestra acustica: usare le finestre acustiche previste dal RaCeVa e dal RaPeVa.

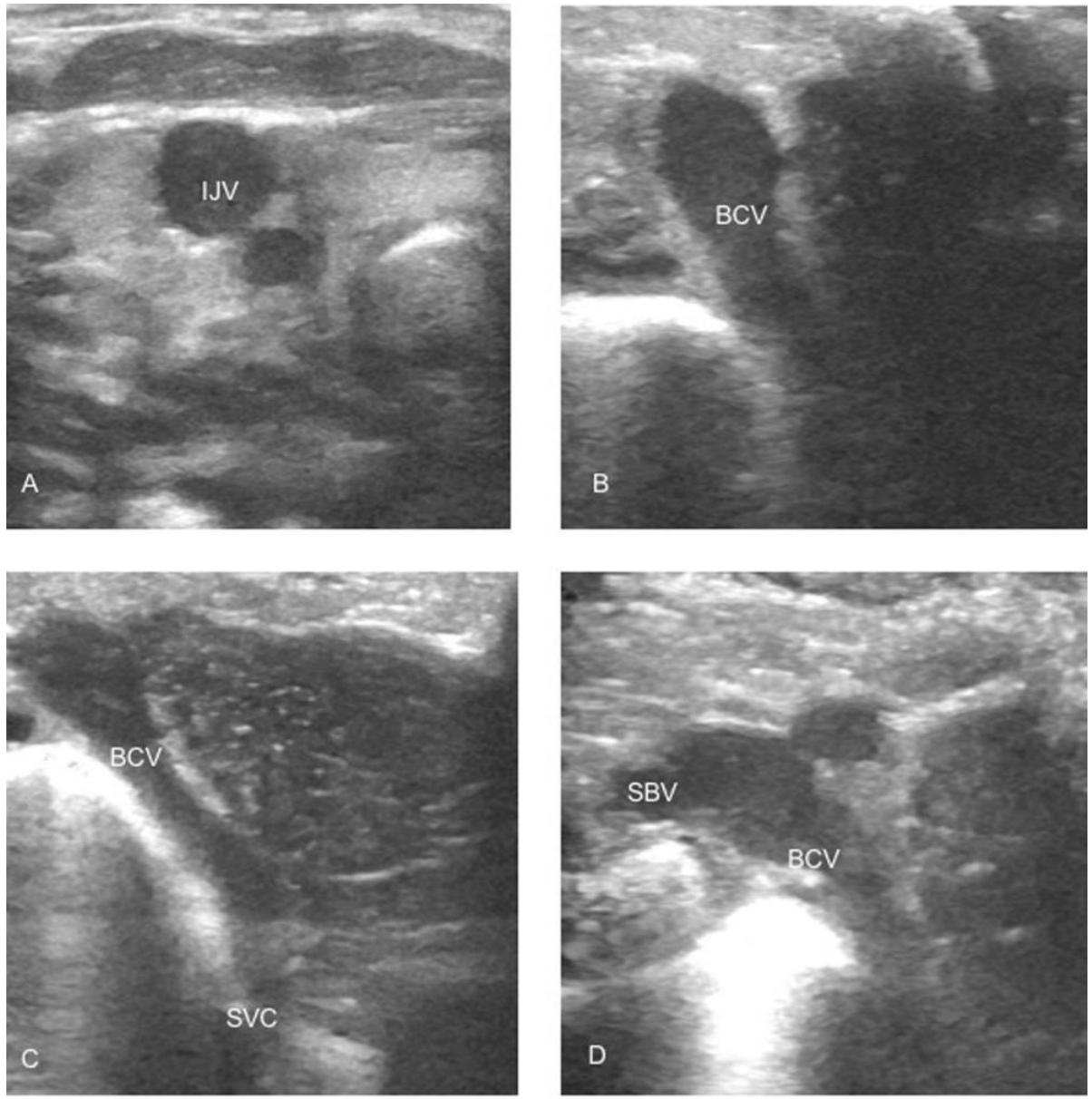
Procedura:

Il RaPeVA va utilizzato in caso di difficile progressione del CVC nelle vene profonde dell'arto superiore.

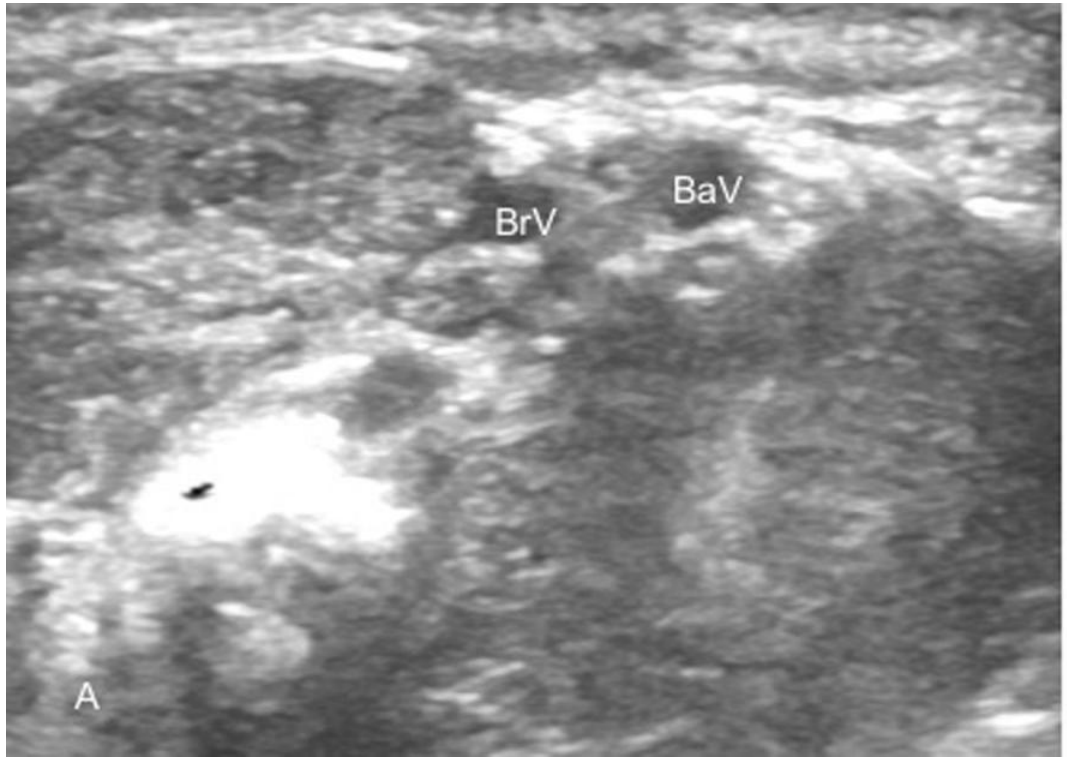
In caso di ECC inserito dagli arti superiori il RaCeVa permette di fare una corretta tip navigation del CVC durante il suo passaggio dalla vena succlavia, nella vena anonima e da qui nella VCS. Consente inoltre di prevenire malposizioni primarie (es vena anonima controlaterale o vena giugulare interna).

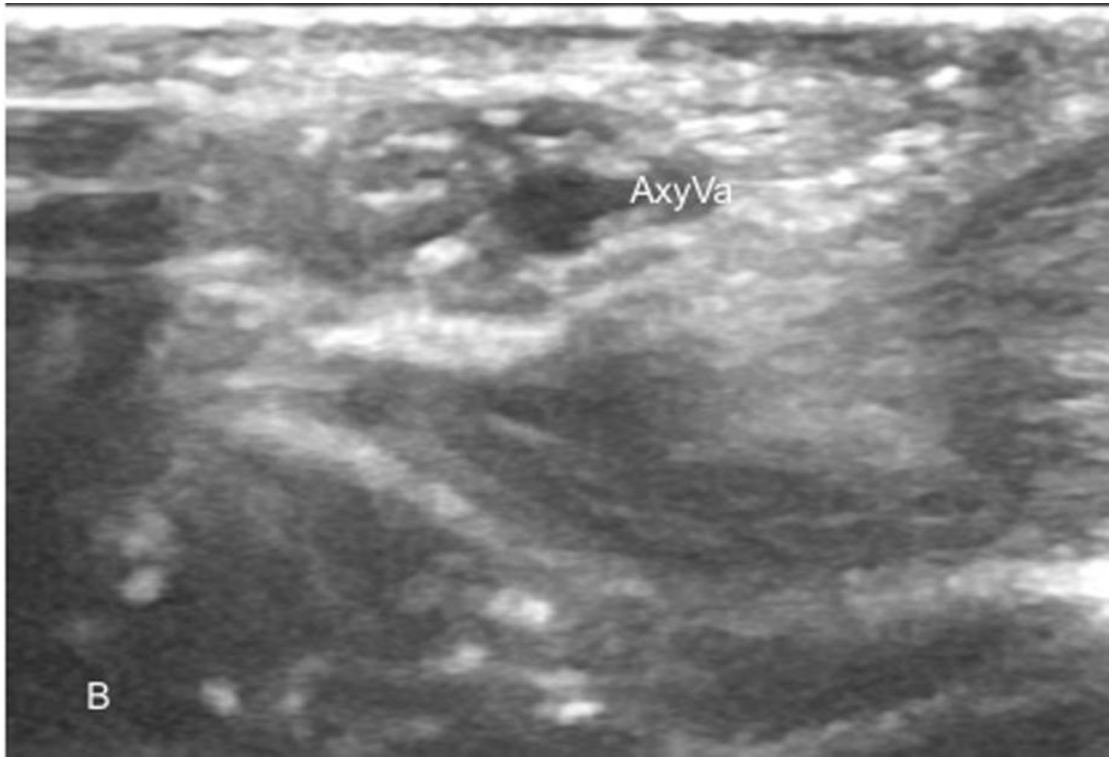
In caso di ECC inserito dallo scalpo il RaCeVa permette di fare una corretta tip navigation del CVC durante il suo passaggio dalla vena giugulare interna, nella vena anonima e da qui nella VCS

RaCeVa



RaPeVa





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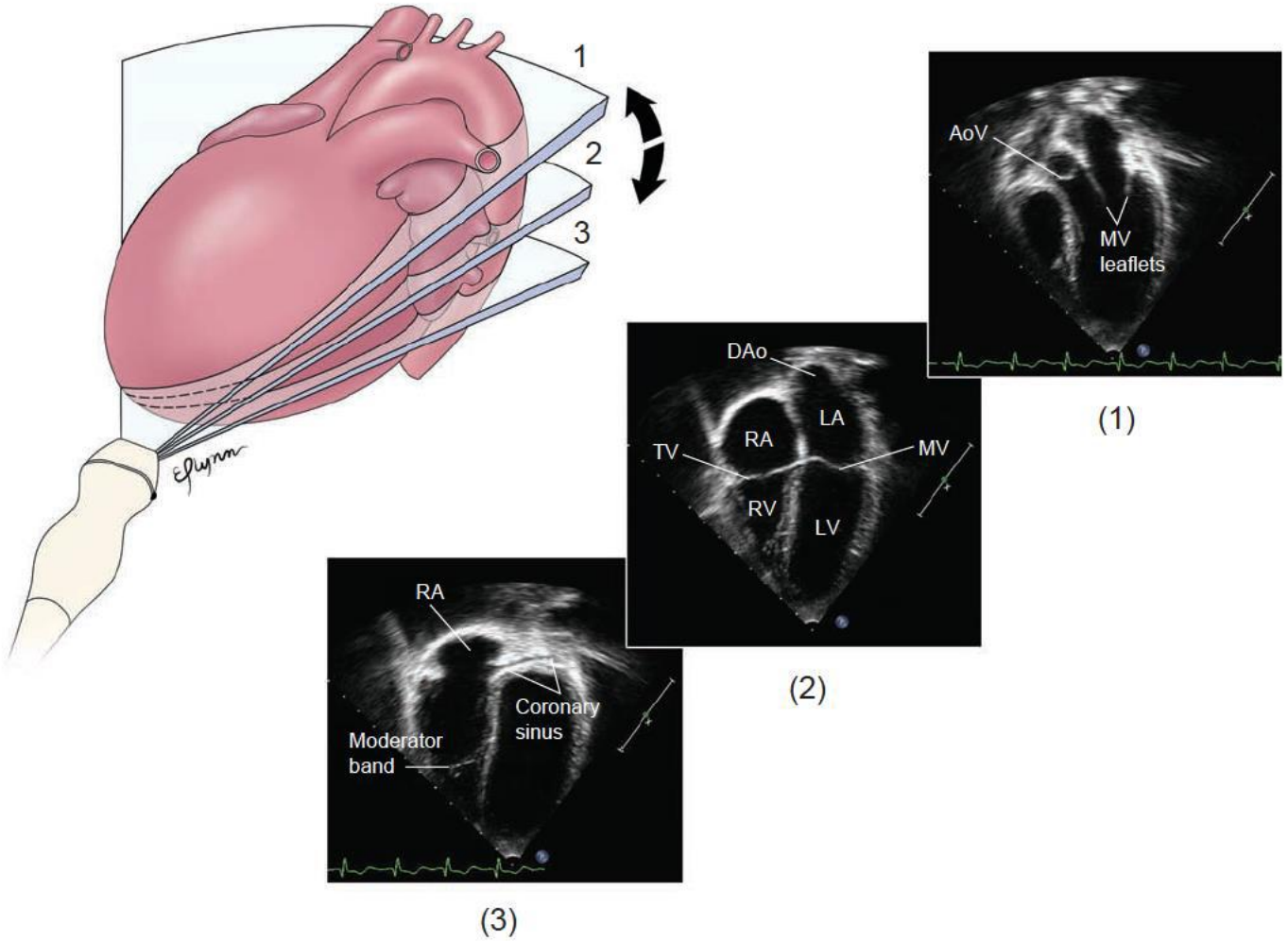
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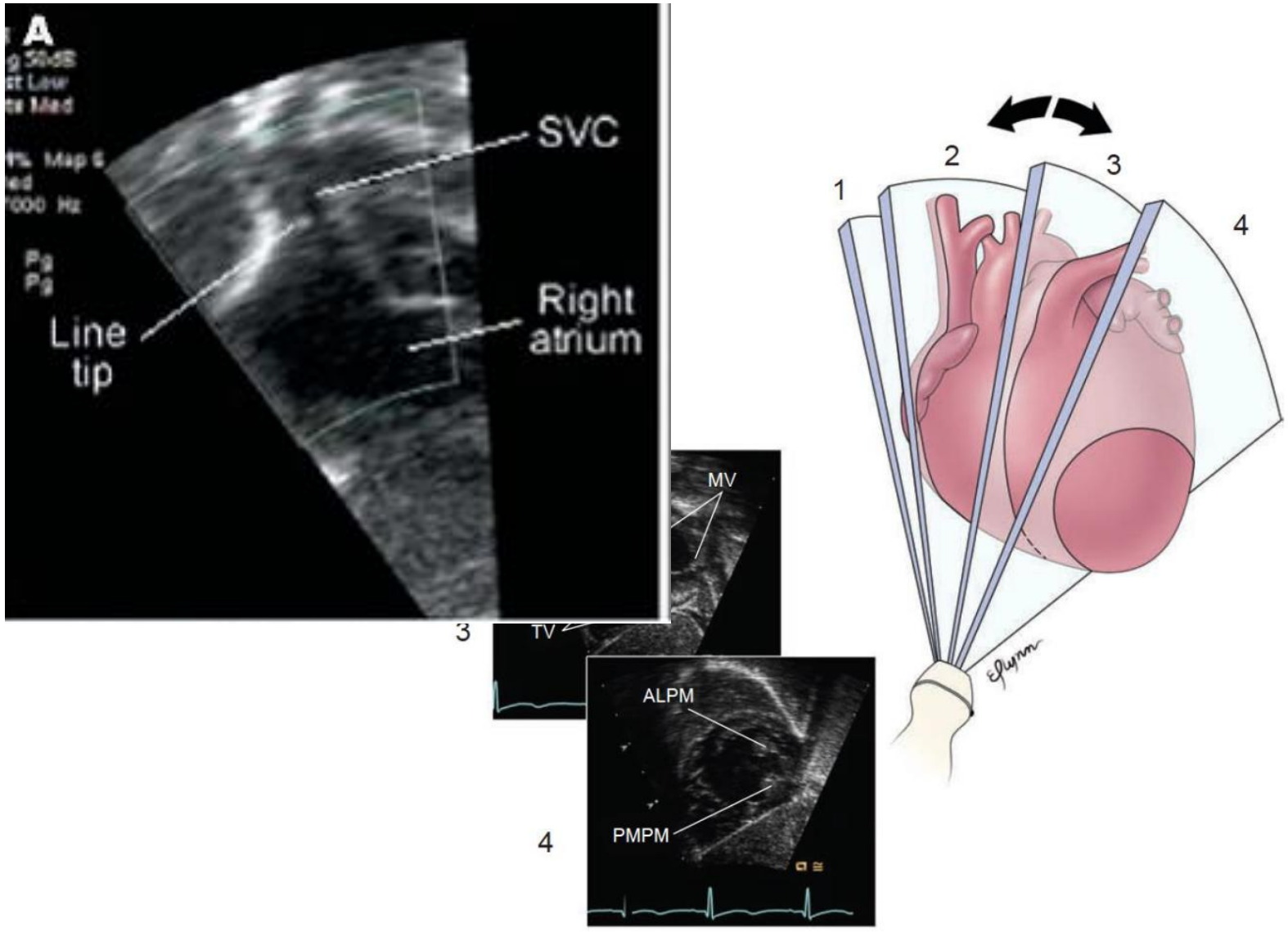

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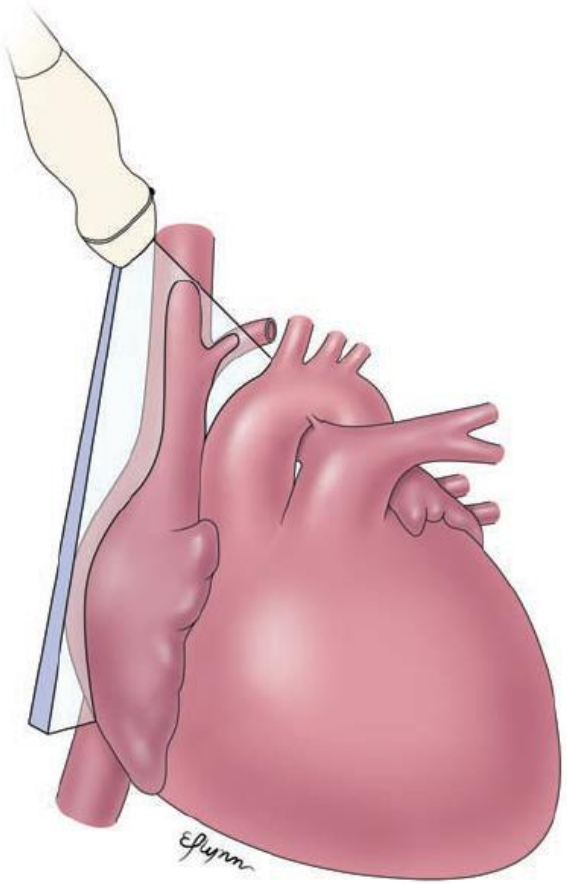

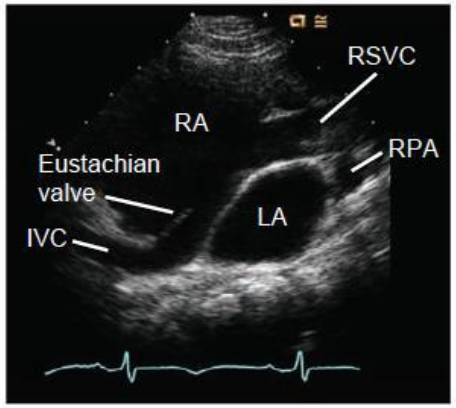


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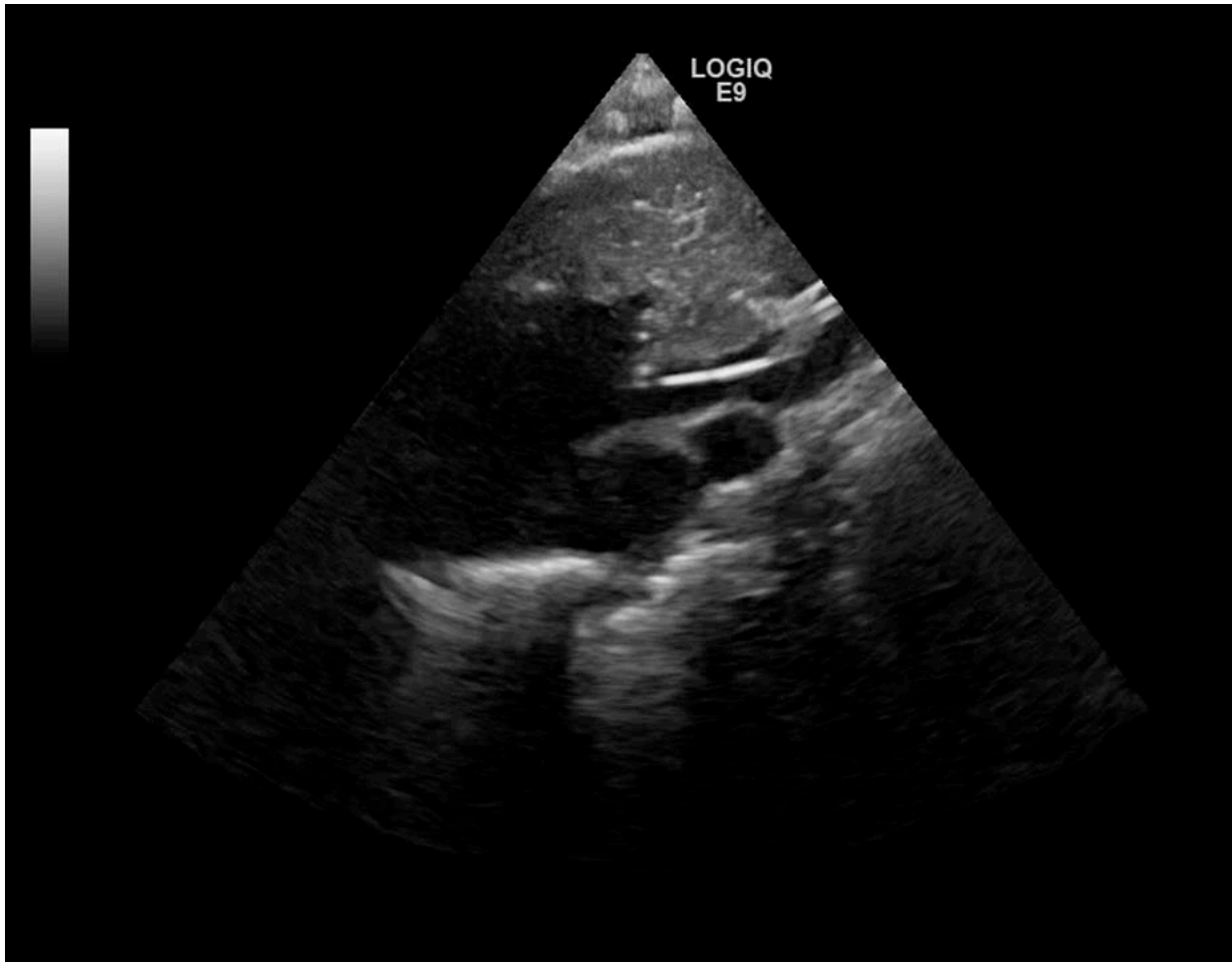
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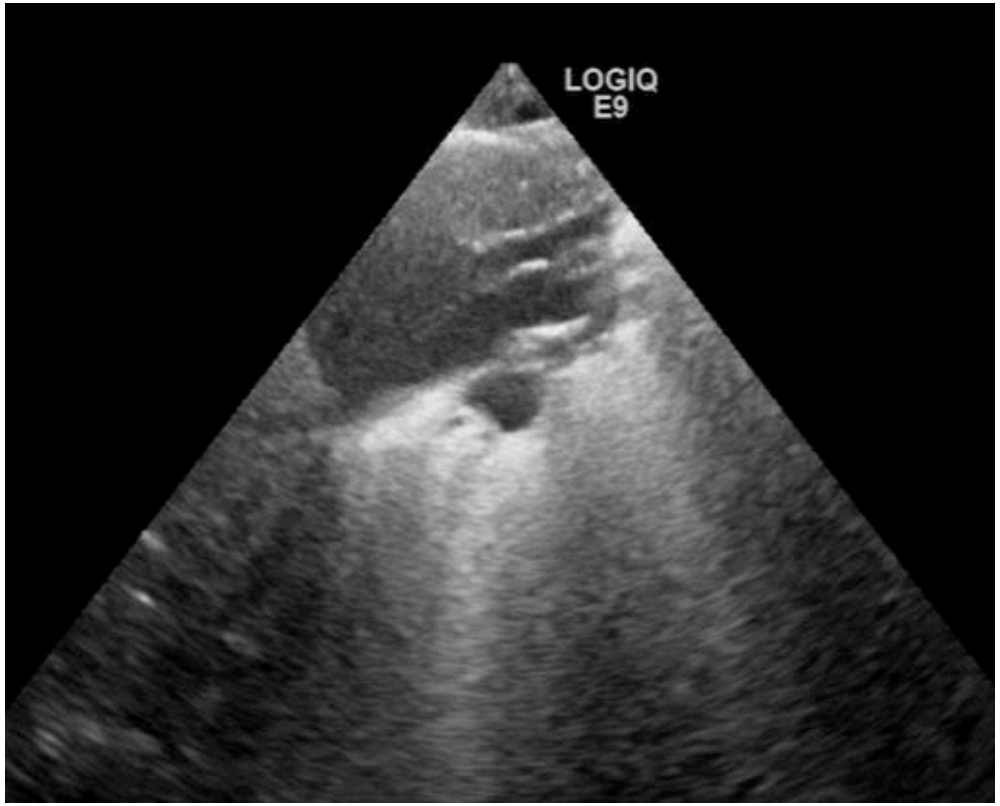
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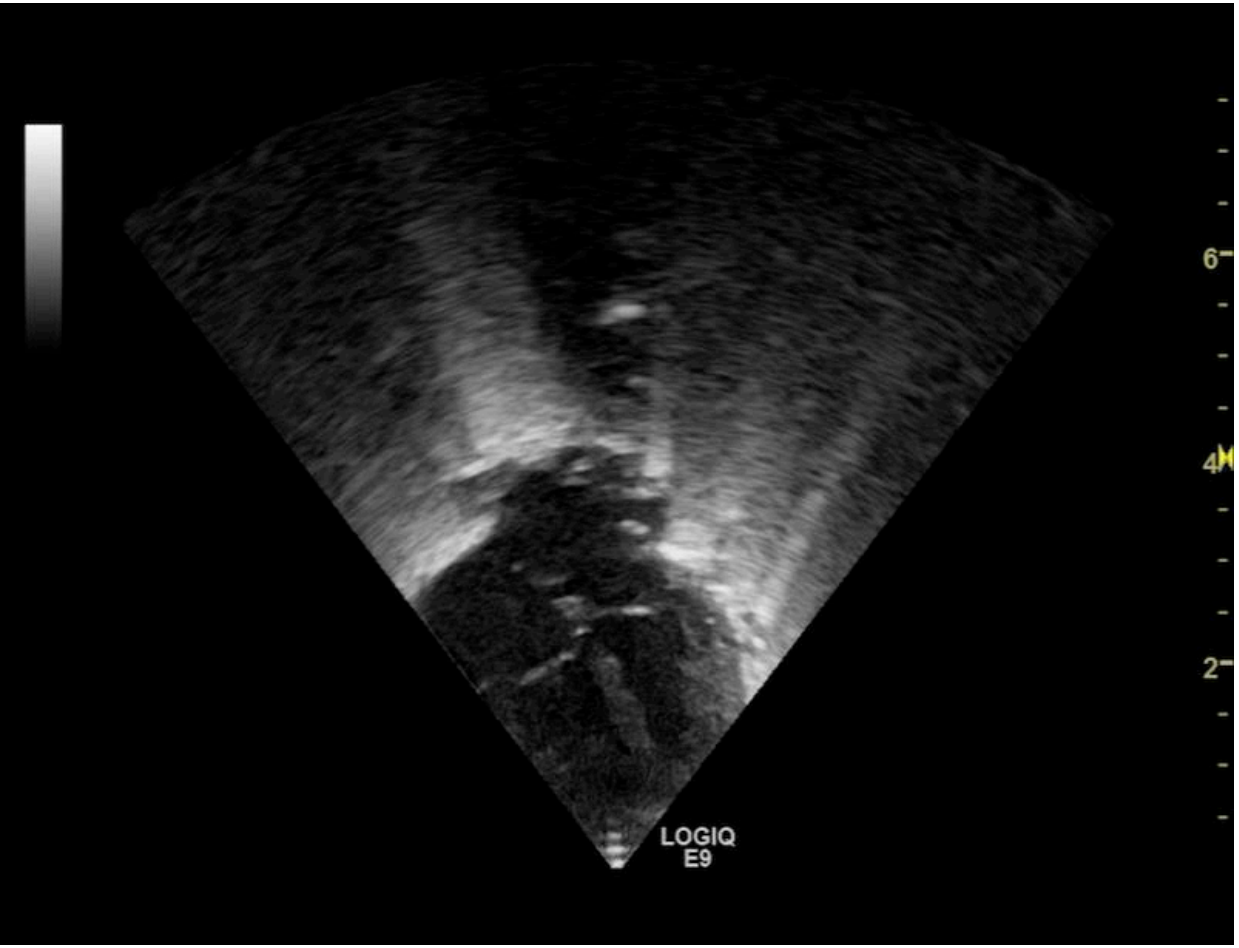
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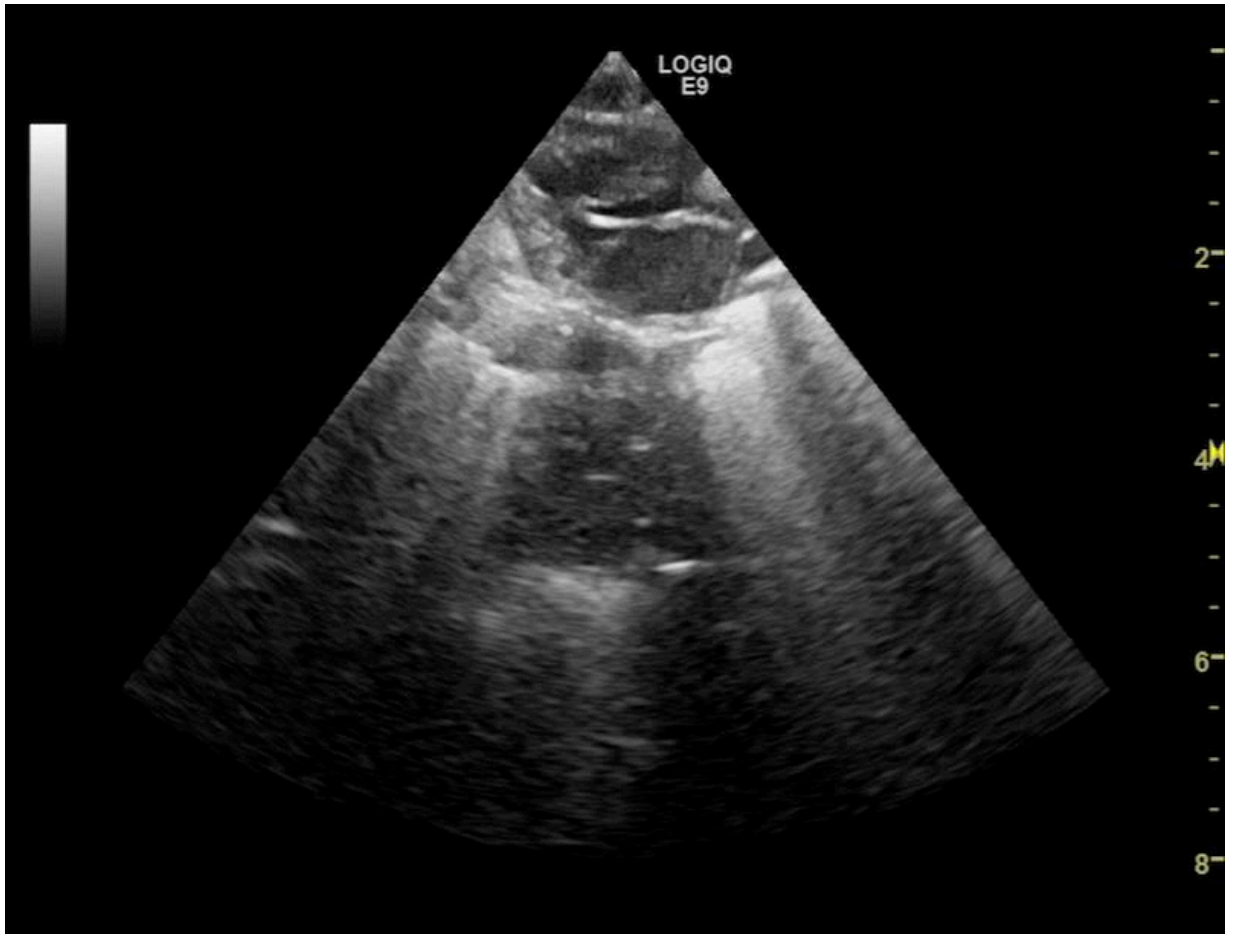
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Impianto Sicuro del Catetere Epicutaneo Cavale

1. Valutazione pre-procedurale (utilizzo del protocollo RaSuVA, preferibilmente impiegando la NIR)
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. Utilizzo dell'ecografo per la tip navigation e la tip location intra-procedurale (secondo il protocollo NeoECHOTip).
5. Stabilizzazione del catetere e protezione del sito di emergenza (colla in cianoacrilato, membrana semipermeabile trasparente e "sutureless device")
6. Controlli seriati della posizione della punta usando l'ecografia (48 ore; ogni 7 giorni e al cambio di medicazione)
7. Valutazione rimozione dell'ECC entro due settimane

The Art and Science of Infusion Nursing

A Revolutionary, Proven Solution to Vascular Access Concerns: A Review of the Advantageous Properties and Benefits of Catheter Securement Cyanoacrylate Adhesives

Sheng Zhang, PhD • Bethany S. Lingle, BS • Shannon Phelps, BS

Catheter type	Securement method	Securement strength (N)
BD Autoguard catheter	CSCAs	12.473
	Tegaderm 1683	8.283
	Opsite	3.216
	HubGuard	2.905
	Durapore	3.381
BD Nexiva catheter	CSCAs	13.380
	Tegaderm 9525HP	7.090
	Opsite	1.392
	HubGuard	1.552
	Durapore	1.348

Abbreviations: CSCAs, catheter securement cyanoacrylate adhesives; N, newton.

Catheter Type	Securement Method	Securement Strength (N)
BD Autoguard catheter	CSCAs + Tegaderm 1683	19.501
	CSCAs + Opsite	15.453
	CSCAs + HubGuard	12.451
	CSCAs + Durapore	12.362
BD Nexiva catheters	CSCAs + Tegaderm 9525HP	14.893
	CSCAs + Opsite	16.000
	CSCAs + HubGuard	10.840
	CSCAs + Durapore	15.035

Abbreviations: CSCAs, catheter securement cyanoacrylate adhesives; N, newton.

JVA | The Journal of Vascular Access

Use of cyanoacrylate glue for the sutureless securement of epicutaneo-caval catheters in neonates

The Journal of Vascular Access
1–4

DOI: 10.1177/11297298211008103
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Vito D'Andrea[1], Lucilla Pezza[1], Giovanni Barone[2], Giorgia Prontera[1], Mauro Pittiruti[3] and Giovanni Vento[1]

Table 1. Demographics population and Epicutaneo-Caval Catheters caratteristics.

	Intervention	Control	
Infants (*n*)	92	80	
Gestational age weeks	29	29	
Birth weigth grams	1280	1200	
Catheters (*n*)	134	124	
Day of life at the insertion	6	6	
Weight at insertion gramms	1230 (520–3000)	1180 (480–3270)	
Days ECC in place	10.4	11	
Elective ECC removal *n* (%)	95 (70.8)	89 (71.7)	
Dislodgement *n* (%)	1 (0.7)	14 (11.3)	0.0003

Cyanoacrylate Securement in Neonatal PICC Use

A 4-Year Observational Study

Matheus van Rens, RN, MaANP, NNP; Nuha Abdelghafar M. A. Nimeri, MD, CABP;

TABLE 3. Reasons for Device Removal, Dwell Time, and Therapy Failure

	Tissue Adhesive			
	Total (N = 1842) n (%)	No (n = 975) n (%)	Yes (n = 867) n (%)	*P* Value
Reason for removal				
1. Therapy completed	1313 (71.3)	637 (65.3)	676 (78.0)	<.001
2. Therapy failure[a]				
Catheter-related complications[b]	43 (2.3)	24 (2.5)	19 (2.2)	
Extravasation/infiltration	50 (2.7)	47 (4.8)	3 (0.3)	
Maintenance-related complications[c]	75 (4.1)	53 (5.4)	22 (2.5)	
Phlebitis	56 (3.0)	42 (4.3)	14 (1.6)	
Suspected sepsis	118 (6.4)	87 (8.9)	31 (3.6)	
Death (CLABSI)	8 (0.4)	6 (0.6)	2 (0.2)	
3. Administrative censoring				
Death (other causes)	44 (2.4)	31 (3.2)	13 (1.5)	
Transferred	135 (7.3)	48 (4.9)	87 (10.0)	
Dwell time, median, (IQR), d	11 (7-16)	11 (7-17)	10 (7-14)	.074
Therapy failure[a]	350 (20.5)	259 (27.9)	91 (11.7)	<.001

Azione emostatica

- Incidenza di sanguinamento nel posizionamento dei PICC: 40% ad 1 h, e 15% a 25 h.
- L'uso costante della colla in cianoacrilato abbatte l'incidenza di sanguinamento (0%) ad 1 e 25 h dal posizionamento del CVC
- Questo ha un notevole impatto logistico e sui pazienti.

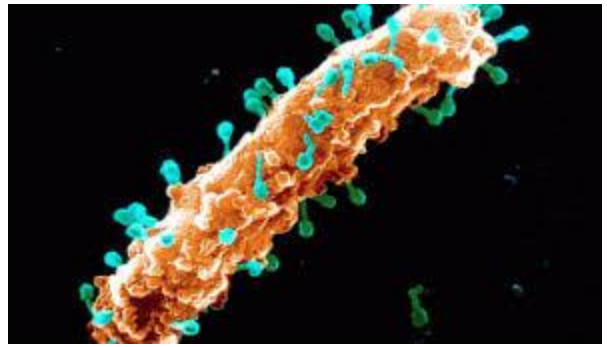
Elimination of the 24-hour dressing: a quick win

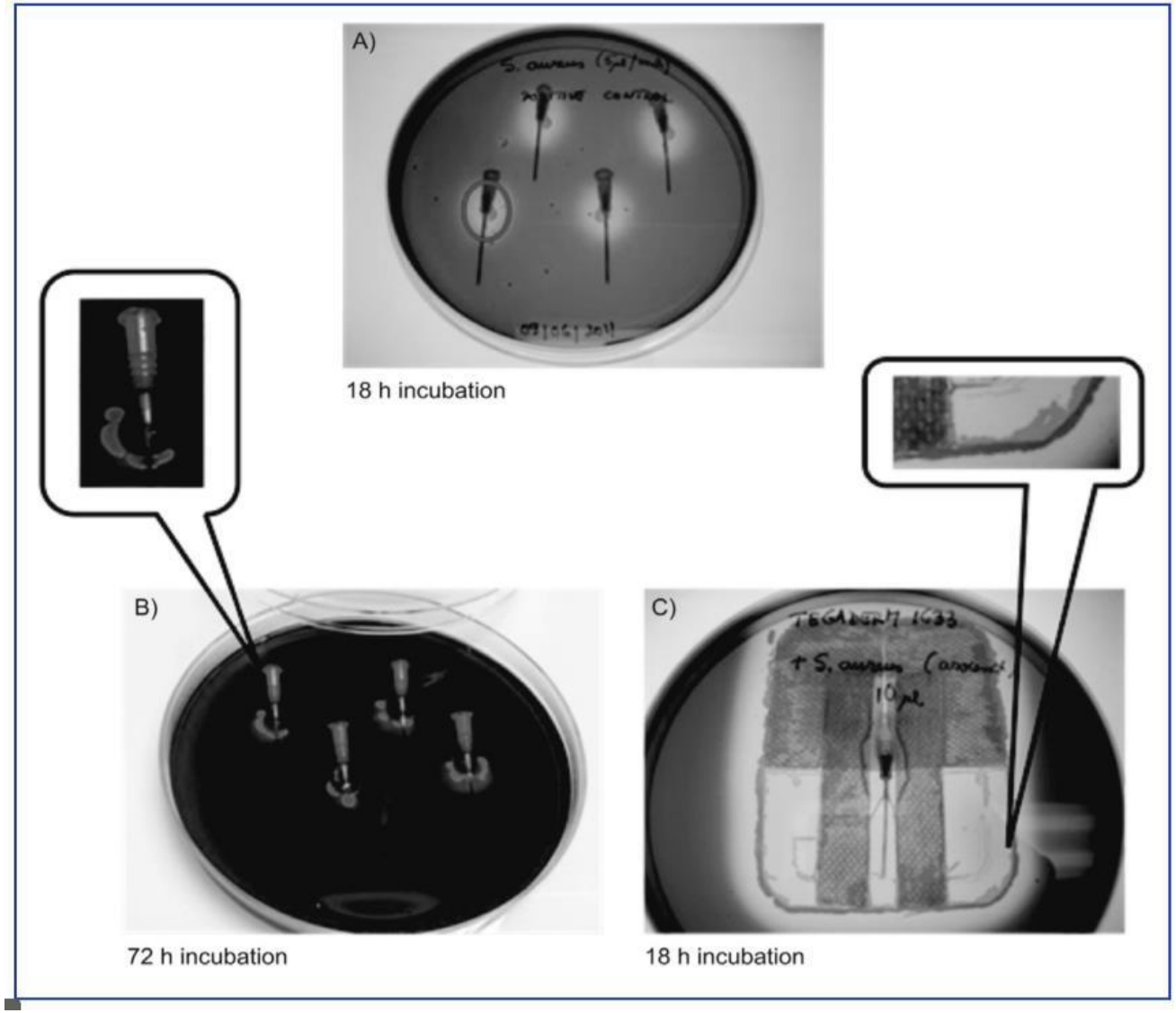
be inspected. It is, however, common practice to apply gauze over the insertion site initially to absorb any post-insertion bleeding. A 24-hour, post-insertion dressing would then be applied (Royal College of Nursing, 2016). By using tissue adhesive, it is possible to eliminate the need for this 24-hour, post-insertion dressing as haemostasis can be achieved before the transparent film dressing is applied.

Scoppettuolo. Anaesthesia 2015

Cyanoacrylate tissue adhesive: a new tool for the vascular access toolbox. Jackie Nicholson. British Journal of Nursing, 2019

Azione antibatterica…BCA





Simonova G. Cyanoacrylate tissue adhesives—effective securement technique for intravascular catheters: in vitro testing of safety and feasibility. Anaesth Intensive Care. 2012;40(3):460–466

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PROTOCOLLO

INDAGINI CLINICHE CON DISPOSITIVO MEDICO

Titolo dello Studio:	La colla di cianoacrilato per la riduzione della colonizzazione extraluminale dei cateteri venosi centrali e delle CLABSI in Terapia Intensiva Neonatale: studio pilota randomizzato controllato. **NEO-GLUE STUDY.**

Impianto Sicuro del Catetere Epicutaneo Cavale

1. Valutazione pre-procedurale (utilizzo del protocollo RaSuVA, preferibilmente impiegando la NIR)
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. Utilizzo dell'ecografo per la tip navigation e la tip location intra-procedurale (secondo il protocollo NeoECHOTip).
5. Stabilizzazione del catetere e protezione del sito di emergenza (colla in cianoacrilato, membrana semipermeabile trasparente e "sutureless device")
6. Controlli seriati della posizione della punta usando l'ecografia (48 ore; ogni 7 giorni e al cambio di medicazione)
7. Valutazione rimozione dell'ECC entro due settimane

Infusion Therapy Standards of Practice

Change transparent semipermeable membrane (TSM) dressings at least every 7 days (except neonatal patients) or immediately if dressing integrity is disrupted (eg, lifted/detached on any border edge or within transparent portion of dressing; visibly soiled; presence of moisture, drainage, or blood) or compromised skin integrity is present under the dressing.[2,4,5,8-10] (III)

1. In neonatal patients, perform dressing change as needed per patient or clinical indications due to risk of catheter dislodgement, patient discomfort, or skin injury.[10-14] (V)

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)

Franta J, *et al*. *Arch Dis Child Fetal Neonatal Ed* 2017;**102**:F251–F255. doi:10.1136/archdischild-2016-311202

Line type	*N*	Migration 1 h	Migration 24 h
		% (*n*) (95% CI)	% (*n*) (95% CI)
UVC	41	36% (15) (21–51%)	23% (9) (9–36%)
PICC (total)	63	23% (15) (12–33%)	11% (7) (3–18%)
UE PICC	25	28% (7) (10–46%)	28% (7) (10–46%)
LE PICC	38	21% (8) (7–38%)	0

	N°	Rimoz Non elettiva
Central catheters	413	7.5%
Non central cathet.	83	18.1%

Xiaohe Yu,Bio Med Research Intern, 2018

	N°	Complicanze	Durata catet
Central catheters	97	19%	17.7 gg
Non central cathet.	79	49%	11.4 gg

Goldwasser, Pediatr Radiol 2017

	N°	Complicanze	Rimozione Non elettiva
Central catheters	203	29%	27%
Non central cathet.	116	47%	45%

Jain, J of Perinatology, 2013

	N°	Complicanze
Central catheters	889	15.9 per 1000 line days
Non central cathet.	91	51.7 per 1000 line days

Colacchio, J of Perinatology, 2012

Impianto Sicuro del Catetere Epicutaneo Cavale

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7. Valutazione rimozione dell'ECC entro due settimane

ECC duration: tempo tra inserzione e rimozione o CLABSI
EG 31 W PN 1600 gr
ECC duration mediana 12 giorni (IQR: 6 –21)

TABLE 4 Risk Factors for CLA-BSIs in NICU Patients With PICCs

Risk Factor	Univariate			Multivariable	
				95% CI	*P*
Gestational age, w					
<32					
≥32				.08–3.18	.46
Birth weight, g					
<1500					
≥1500				.17–5.18	.94
Chronological age					
≤7					
>7				.56–3.25	.51
Days since PICC in					
<19				.04–1.25	<.01

TABLE 3 Incidence of CLA-BSIs Over 10-Day Time I

	Days 1–10	Days 11–20
No. of events	6	8
No. of catheters[a]	315	192
No. of catheter-days[b]	5563	2883
Incidence rate per 1000 catheter-days	1.08	2.77

[a] Number of catheters at the end of the time bin.
[b] Catheter-days for catheters extending beyond 60 days are

Tempo mediano di infezione 18 giorni (IQR 9-21)

Catheter Duration and Risk of CLA-BSI in Neonates With PICCs. Pediatrics 2009

DWELL Time: tempo tra inserzione e rimozione o CLABSI
CLABSI: Emocoltura positive senza evidenza di infezione in altro sito

TABLE 2 Effect of Dwell Time on CLABSI

Week of Dwell Time	PICCs, *N*	CLABSI, *N* (%)	PICCs, HR[a] (95% CI)	Ca
1	14 451	82 (0.6)	Reference	
2	8250	56 (0.7)	1.2 (0.9–1.7)	
3	4061	31 (0.8)	1.3 (0.8–1.9)	
4	2209	5 (0.2)	0.4 (0.1–0.9)	
5	1290	7 (0.5)	0.9 (0.4–1.9)	
6	765	7 (0.9)	1.5 (0.7–3.2)	
7	453	4 (0.9)	1.4 (0.5–4.0)	
8	278	3 (1.1)	1.6 (0.5–5.2)	
9	183	2 (1.1)	1.5 (0.4–6.3)	
10	125	0		

CI, confidence interval; HR, hazard ratio.
[a] HRs are adjusted for PMA, year of catheter insertion, and site.

TABLE 3 Effect of PMA on CLABSI

PMA, wk	PICCs, *N*	PICCs, HR[a] (95% CI)	Tunneled Catheters, *N*	Tunneled Catheters, HR[a] (95% CI)
≥37	1835	Reference	314	Reference
34–36	1340	1.0 (0.3–3.8)	193	0.6 (0.1–2.8)
30–33	3315	1.3 (0.4–3.6)	130	0.3 (0.04–3.0)
26–29	5251	3.9 (1.6–9.7)	203	1.5 (0.5–5.0)
<26	2707	6.1 (2.5–15.2)	274	1.3 (0.4–3.8)

Sample sizes indicate number of patients with each type of catheter at each PMA. CI, confidence interval; HR, hazard ratio.
[a] HRs are adjusted for line week, year of catheter insertion, and site.

TABLE 1 Catheter Dwell Time

Dwell Time, d	PICCs, Median (IQR)
Overall	11 (7–18)

Effect of Catheter Dwell Time on Risk of Central Line–Associated Bloodstream Infection in Infants. Greenberg. Pediatrics 2015

DWELL Time: tempo tra inserzione e rimozione o CLABSI
CLABSI: Emocoltura positive senza evidenza di infezione in altro sito
ECC duration mediana 14 giorni (IQR: 7 –23)

TABLE 4 Unadjusted and Adjusted Risk Factors for CLABSIs in Neonates With PICCs

Variable	CLABSI, *n* = 149, *n* (%)	No CLABSI, *n* = 4648, *n* (%)	Unadjusted IRR (95% CI)	*P* Value	aIRR[a] (95% CI)
Age at line insertion, d			1.00 (0.99–1.00)	.19	1.00 (0.99–1.00)
Birth weight, 100 g			0.98 (0.96–0.99)	.006	0.97 (0.95–0.99)
Concurrent PICCs					
No	134 (89.9)		(reference)		1.0 (reference)
Yes	15 (10.1)		(0.97–2.84)	.06	2.04 (1.12–3.71)
CLABSI from previous PICC					
No	143 (96.0)		(reference)		1.0 (reference)
Yes	6 (4.0)		(1.00–4.90)	.05	1.66 (0.69–3.98)
Catheter dwell time					
≤7 d	25 (16.6)	1071 (25.0)	1.0 (reference)		—
8–13 d	32 (21.2)	1257 (27.1)	2.02 (1.21–3.38)	.007	—
14–22 d	39 (25.8)	1090 (23.5)	3.27 (2.04–5.24)	<.001	—

DISCUSSION

These data confirm that the daily risk of infection is higher in PICCs that have been in place for >2 weeks as compared with those that have been in place for <2 weeks. However, we found no

Catheter Dwell Time and CLABSIs in Neonates With PICCs: A Multicenter Cohort Study Pediatrics 2013

EG 27 W PN 900 gr
ECC rimossi elettivamente ad un tempo mediano di193 h (142–287) 8 giorni
ECC rimossi non elettivamente ad un tempo mediano 154 h (102–260) 6.5 giorni

Table 3 The odds ratios for non-elective PICC removal per tip position, correcting for birth weight, gestational age and sex, using the tip in the SVC as reference position

Tip position	Odds for non-elective removal	*p* value
SVC	1	Reference
Brachiocephalic vein	0.88	0.67
Subclavian vein	1.46	0.069
Axillary vein	2.08	0.041
Cephalic vein	8.93	<0.001
IVC	1.24	0.38
Common iliac vein	1.59	0.24
External iliac vein	4.99	<0.001
Femoral vein	10.31	<0.001

Dwell times and risk of non-elective removal of 1-French peripherally inserted central catheters according to catheter tip position in very preterm infant. Eur J of Pediatrics 2017

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TABLE 1 Demographic Characteristics of the 3 Study Groups

Characteristics	PICC Group (n = 180)	UVC Group (n = 180)	UVC + PICC Group (n = 180)	P		
				PICC Versus UVC	PICC Versus UVC + PICC	UVC Versus UVC + PICC
Gestational age, mean (SD), wk	27.2 (1.5)	27.2 (1.5)	27.2 (1.5)	.99	.99	.99
Birth weight, mean (SD), g	1019 (244)	1023 (250)	1023 (243)	.88	.88	.99
Boy, n (%)	106 (59)	106 (59)	106 (59)	.99	.99	.99
Small for gestational age, n (%)	22 (12)	18 (10)	16 (9)	.50	.30	.72
Apgar at 5 min < 7, n (%)	54 (31)	67 (39)	53 (30)	.18	.82	.12
SNAP-II score >20, n (%)	26 (20)	55 (40)	49 (32)	<.01	.03	.17
Mechanical ventilation on day 1, n (%)	89 (49)	116 (64)	126 (70)	<.01	<.01	.26
Duration of mechanical ventilation, median (IQR), d	2 (0–10)	2 (0–6)	5 (1–13.5)	.34	.02	<.01
Duration of CPAP, median (IQR), d	7 (1–18)	10 (1–29)	18 (5–29)	.05	<.01	<.01
Duration of UVC, median (IQR), d	NA	8 (6–10)	7 (5–9)	NA	NA	<.01
Duration of PICC, median (IQR), d	13 (9–19)	NA	13 (8–22)	NA	0.49	NA

CPAP, continuous positive airway pressure; IQR, interquartile range; NA, not applicable.

Risk of Infection Using Peripherally Inserted Central and Umbilical Catheters in Preterm Neonates.Pediatrics 2015

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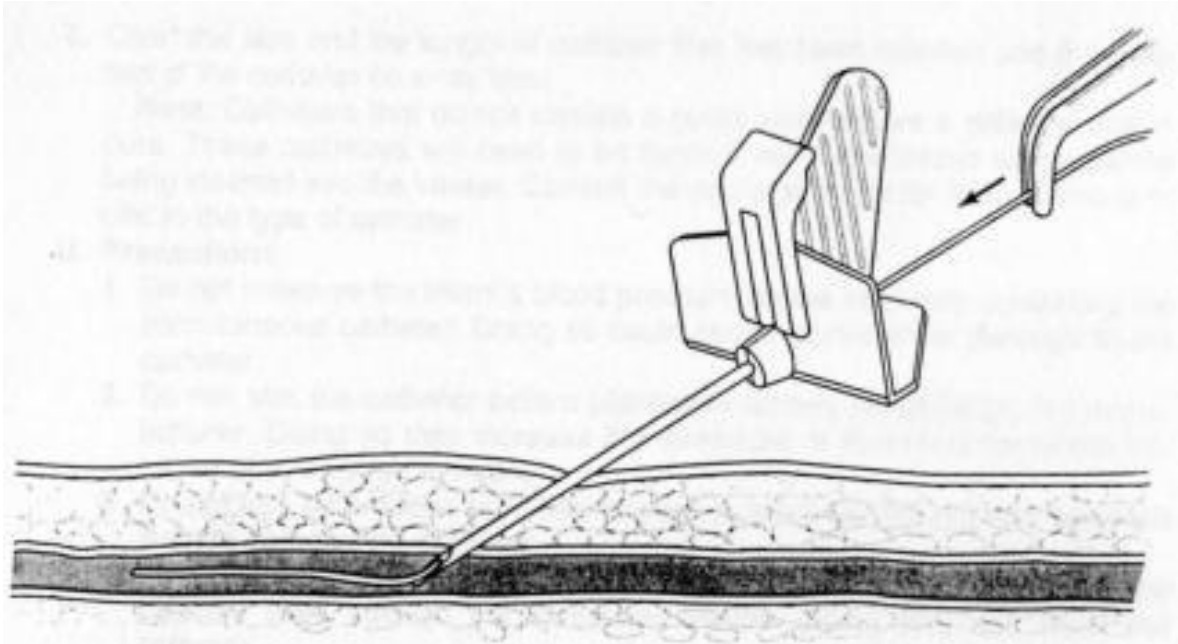
Table 1
Demographic characteristics of the groups according to the fulfilment of treatment

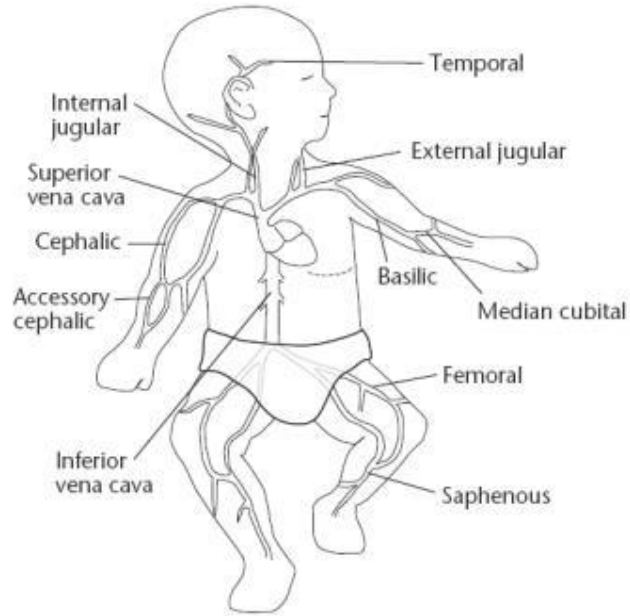
	Treatment fulfilled Mean (SD)	Treatment not fulfilled Mean (SD)	Total Mean (SD)	*p*-value*
Birth weight, grams	733 (206)	719 (190)	727 (199)	0.450
Weight at insertion, grams	791 (231)	803 (241)	796 (235)	0.612
Gestational age, weeks	25.2 (1,4)	25.1 (1,4)	25.2 (1,4)	0.453
Gender, Male/Female, *n*	113 / 110	97 / 69	210 / 169	0.350
Dwell time (duration of catheter stay), days	16 (11)	10 (11)	13 (11)	<0.001

**P*-values were determined by the chi-square test for the differences between two treatment groups.

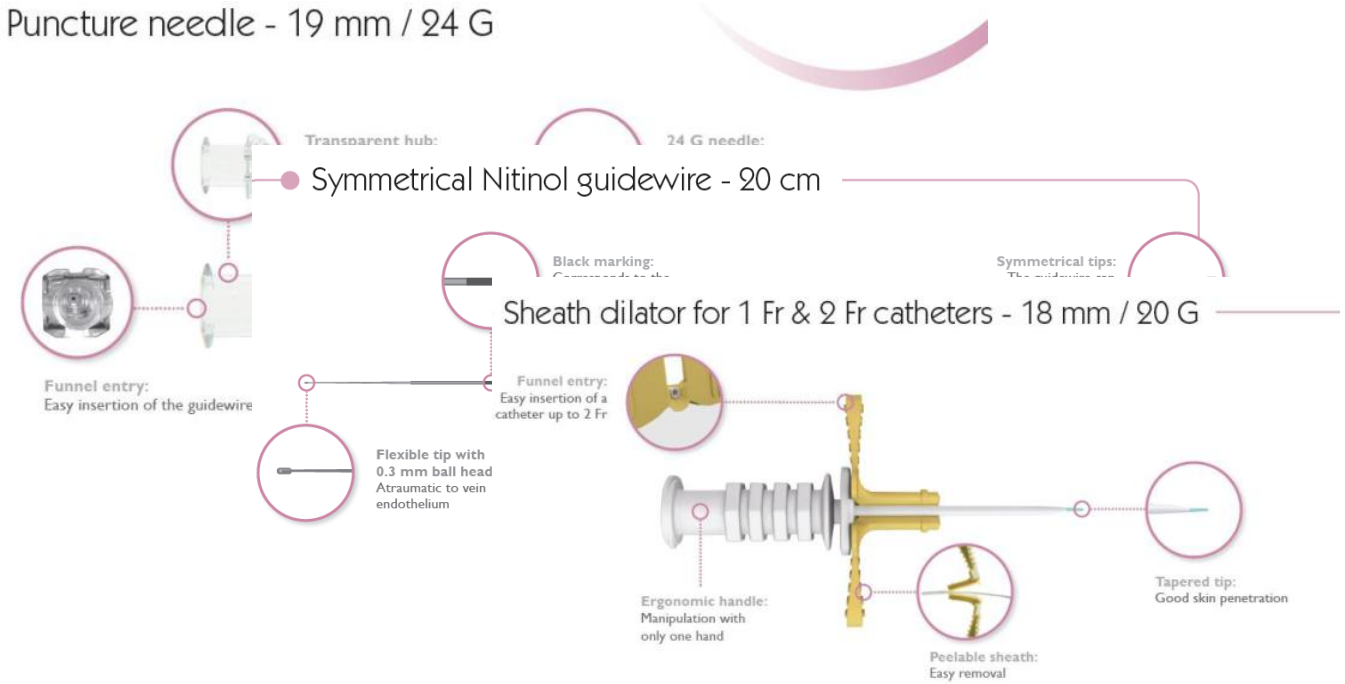
Peripherally inserted central catheter in extremely preterm infants: Characteristics and influencing factors. Journal of Neonatal perinatal Medicine 2017



■ Venous anatomy.



Seldinger


Puncture needle - 19 mm / 24 G
Transparent hub:
24 G needle:
Symmetrical Nitinol guidewire - 20 cm
Black marking:
Symmetrical tips:
Funnel entry:
Easy insertion of the guidewire
Sheath dilator for 1 Fr & 2 Fr catheters - 18 mm / 20 G
Funnel entry:
Easy insertion of a catheter up to 2 Fr
Flexible tip with 0.3 mm ball head
Atraumatic to vein endothelium
Ergonomic handle:
Manipulation with only one hand
Tapered tip:
Good skin penetration
Peelable sheath:
Easy removal

Original research article

JVA | The Journal of Vascular Access

Modified Seldinger technique for neonatal epicutaneo-caval catheter insertion: A non-randomised retrospective study

The Journal of Vascular Access
1–6

DOI: 10.1177/11297298211054637
journals.sagepub.com/home/jva
SAGE

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Abstract

Background: Epicutaneo-Caval Catheters (ECCs) are critical for good neonatal care. No previous studies have evaluated which insertion method provides the highest likelihood of success.

Methods: This study aimed to compare the success rates and cost of modified Seldinger technique (MST) and split needle technique (SNT). MST was introduced to St Michael's Neonatal Unit, SNT was already in use. Routinely documented data on ECC insertion was retrospectively collected from the clinical notes. Practitioners were able to use their preferred insertion method. A sub-group analysis of success rates in patients born at ⩾35-weeks GA was performed.

Results: There was a significantly higher first pass (53% vs 26%; $p=0.014$) and overall (72% vs 40%; $p=0.0046$) successful ECC insertion rate with fewer venipunctures per successful ECC with MST (2.5 vs 6.5; $p=0.002$). Logrank test demonstrated a significantly higher successful ECC insertion with MST for patients of all GA ($p=0.003$) and for neonates born at ⩾35 weeks ($p=0.015$). The cost per successful MST ECC was £156.41 versus £152.51 for SNT.

Conclusion: In this uncontrolled retrospective study, there was a higher chance of successful ECC insertion with MST, with a reduced number of venipunctures and similar costs per successful ECC. Further work in randomised studies is needed to verify this finding and should focus on other clinical outcomes, including rates in central line associated blood stream infections.

frontiers | Frontiers in Pediatrics

Comparing conventional and modified Seldinger techniques using a micro-insertion kit for PICC placement in neonates: a retrospective cohort study

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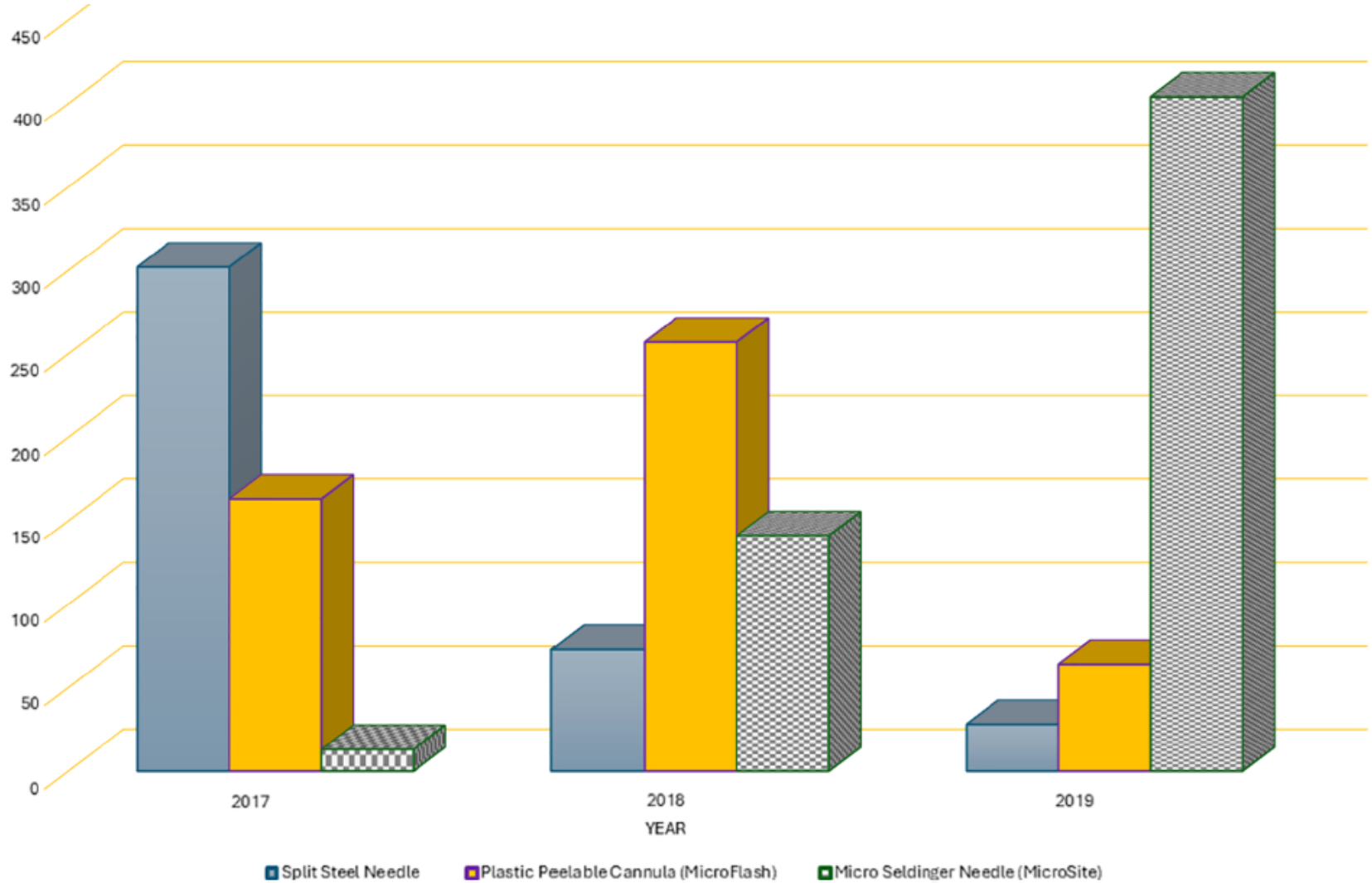
Reason for insertion	Total $n = 1{,}445$	Conventional insertion ($n = 887$)	Micro-MST ($n = 558$)	p-value
Duration of therapy	1,368	865 (97.5%)	503 (90.1%)	<0.001
Fluid characteristics[a]	27	7 (0.8%)	20 (3.6%)	
Patient characteristics[b]	50	15 (1.7%)	35 (6.3%)	
Targeted blood vessel				
Limb extremity inserted				
Upper	421	292 (33%)	129 (23%)	<0.001
Lower	1,024	595 (67%)	429 (77%)	
Vein inserted				
Axillary	2	1 (0.1%)	1 (0.2%)	0.011
Basilic	34	21 (2.4%)	13 (2.3%)	
Brachial	10	8 (0.9%)	2 (0.4%)	
Cephalic	56	39 (4.4%)	17 (3.0%)	
Cubital	310	216 (24.4%)	94 (16.8%)	
Dorsal	7	5 (0.6%)	2 (0.4%)	
Femoral	1	0 (–)	1 (0.2%)	
Jugular	2	2 (0.2%)	0 (–)	
Saphenous	1,023	595 (67.0%)	428 (76.7%)	

		Conventional insertion ($n = 887$)	Micro-MST ($n = 558$)	p-value
Sex				
Male	792	479 (54%)	313 (56%)	0.437
Female	653	408 (46%)	245 (44%)	
Age (days) at insertion, mean ± SD		11 ± 26	7 ± 15	0.001
Gestational age (GA) at birth (weeks)				
23–27	359	222 (25%)	137 (25%)	
28–31	655	412 (47%)	243 (44%)	
32–36	224	110 (12%)	114 (20%)	
≥37	207	143 (16%)	64 (11%)	
GA mean ± SD (weeks)		29.5 ± 3.9	29.8 ± 3.9	0.051
Birth weight (g)				
≤999	504	342 (39%)	162 (29%)	<0.001
1,000–1,499	632	383 (43%)	249 (45%)	
1,500–2,499	202	90 (10%)	112 (20%)	
≥2,500	107	72 (8%)	35 (6%)	
Birth weight, mean ± SD		1,269 ± 639	1,344 ± 681	

	Totals	Conventional insertion ($n = 781$)	Micro-MST ($n = 505$)	p-value
Reason for removal				
1. Therapy completed	952 (74%)	551 (71%)	401 (79%)	0.001
2. Therapy failure[a]	242 (19%)	171 (22%)	71 (14%)	
Catheter-related complications[b]	100	72	28	
Maintenance-related complications[c]	142	99	43	
3. Administrative censoring[d]	92 (7%)	59 (7%)	33 (7%)	
Dwell time in days, mean ± SD		14.5 ± 8.7	14.9 ± 8.2	0.356
	Microflash $n = 432$	Splitting needle $n = 349$	Microsite $n = 505$	p-value
1. Therapy completed	316 (73%)	235 (67%)	401 (79%)	<0.001
2. Therapy failure[a]	84 (20%)	87 (25%)	71 (14%)	
Catheter-related complications[b]	31	41	28	
Maintenance-related complications[c]	53	46	43	
3. Administrative censoring[d]	32 (7%)	27 (8%)	33 (7%)	
Dwell time in days, mean ± SD	14.8 ± 8.4	14.1 ± 9.0	14.9 ± 8.2	0.343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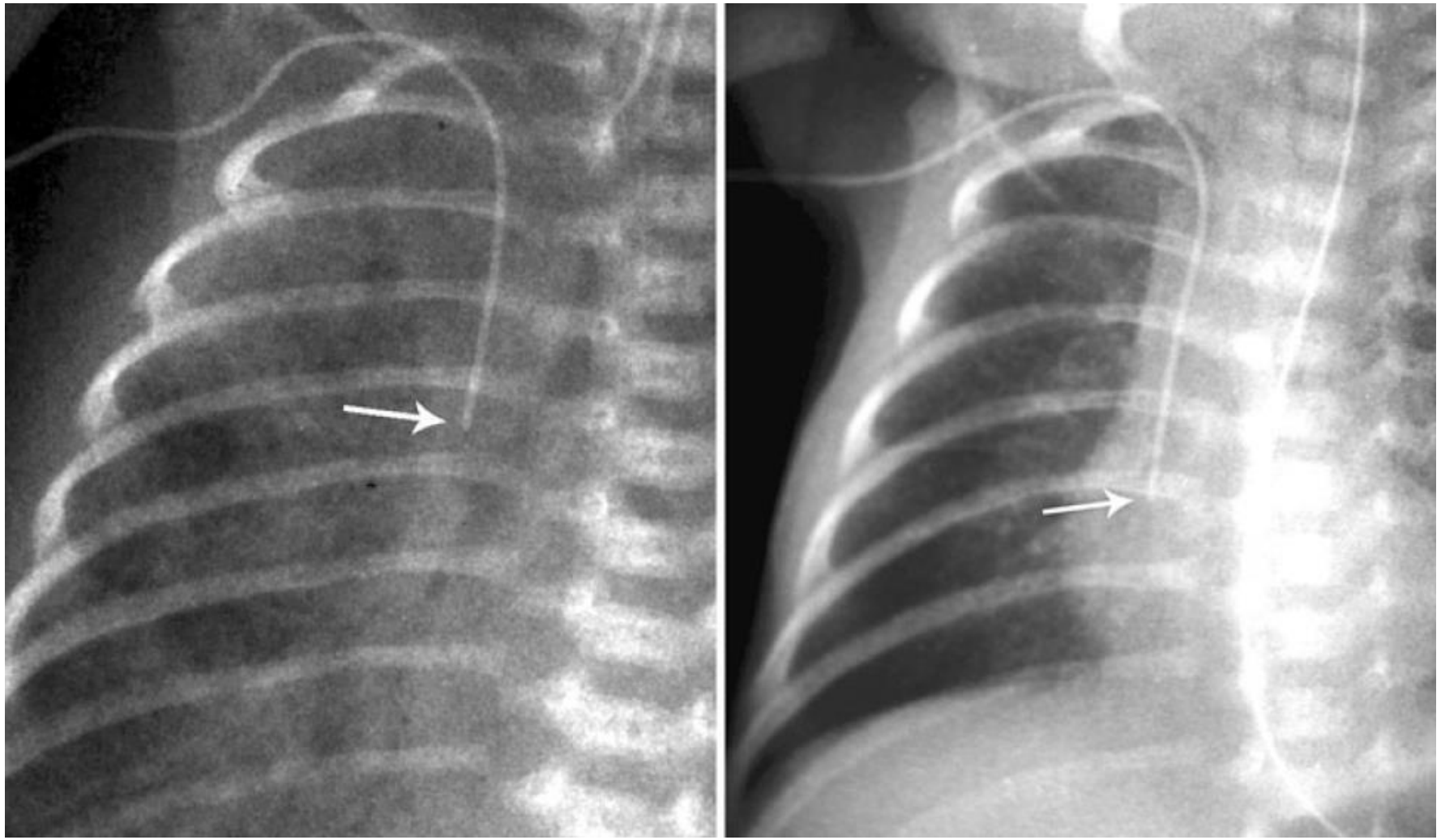
Split Steel Needle
Plastic Peelable Cannula (MicroFlash)
Micro Seldinger Needle (MicroSite)



Pediatr Radiol (2012) 42:1000–1008

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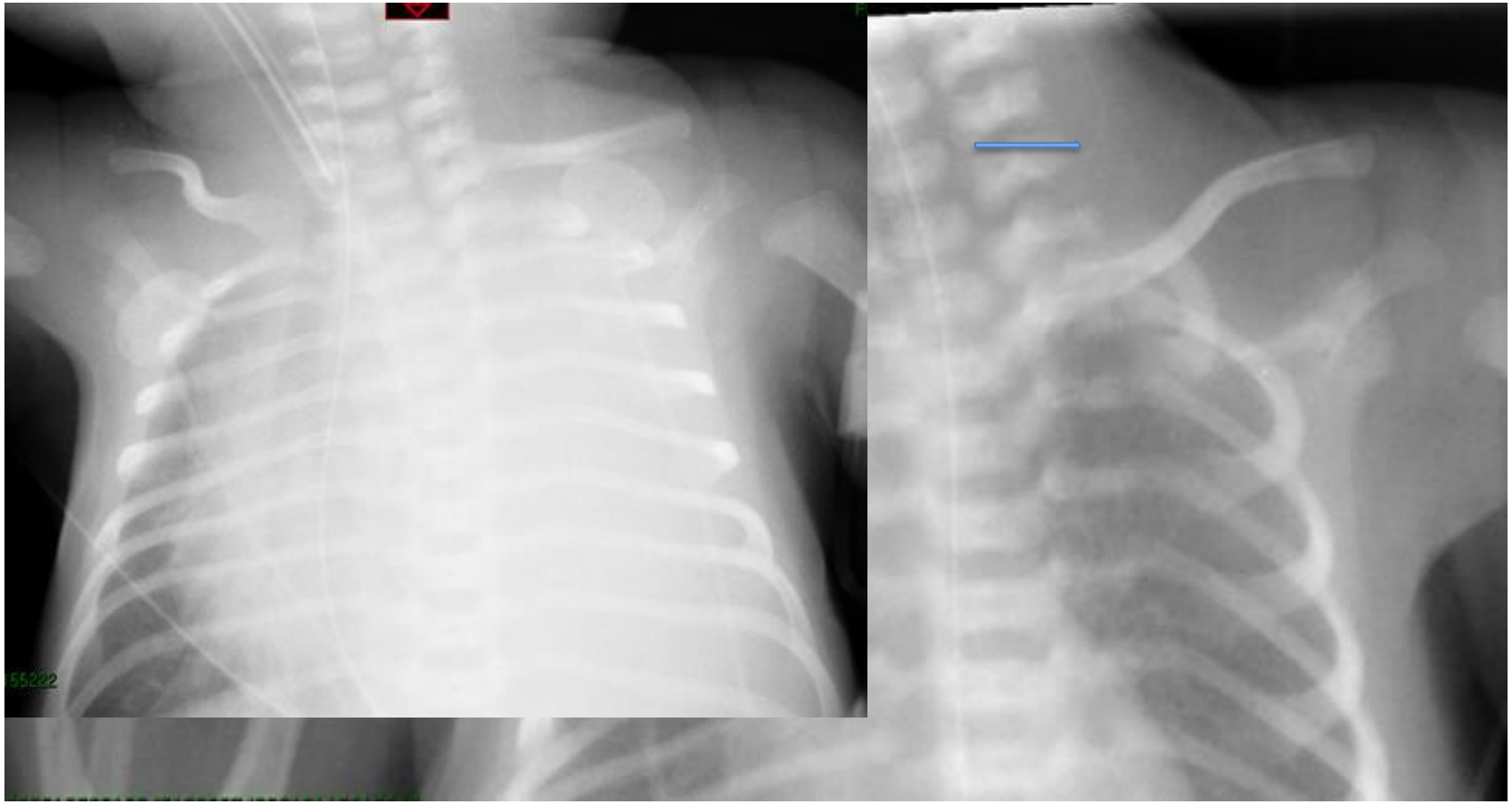

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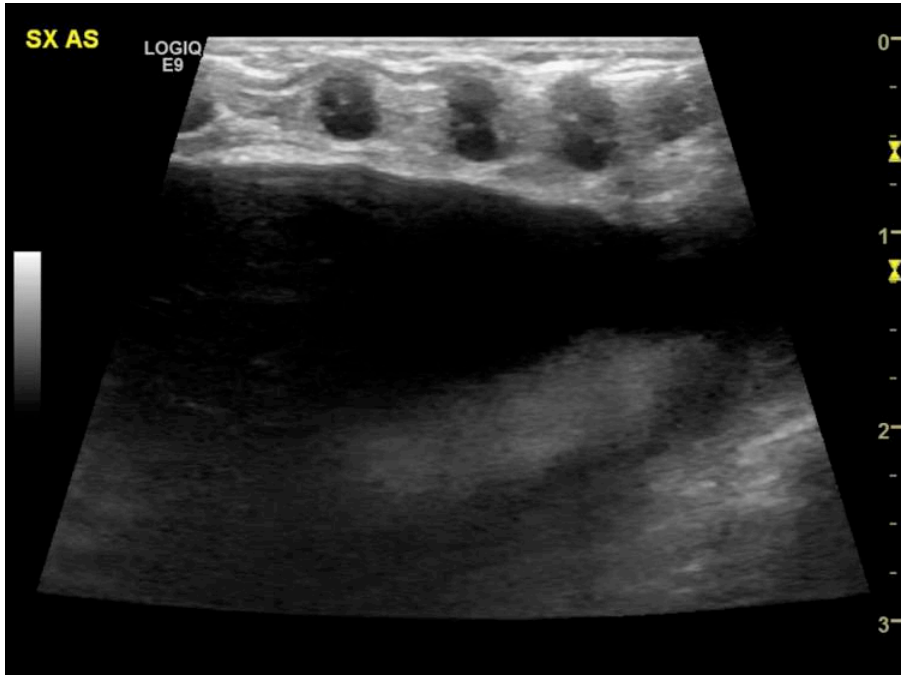
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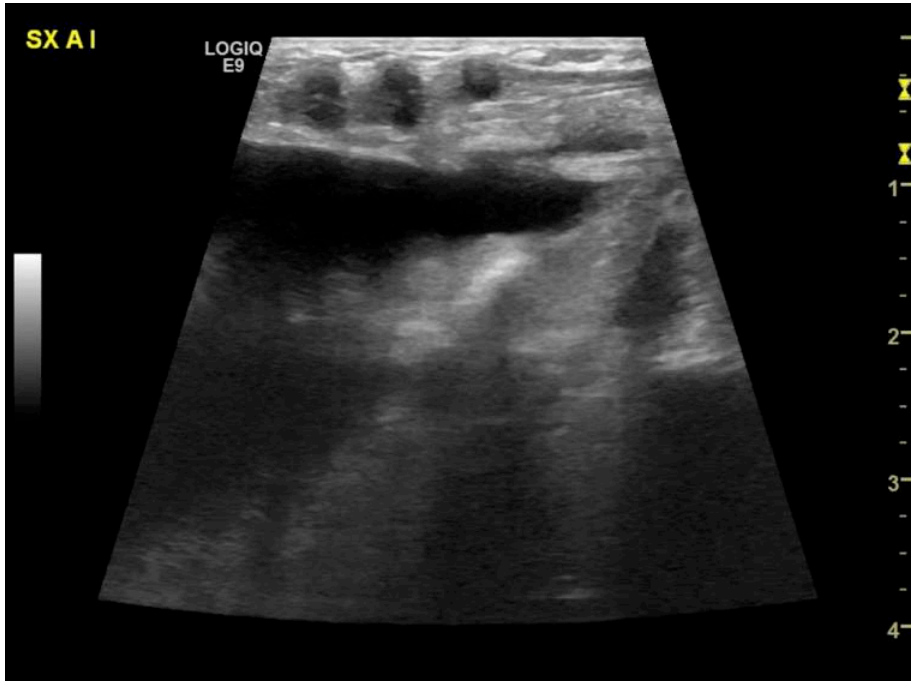
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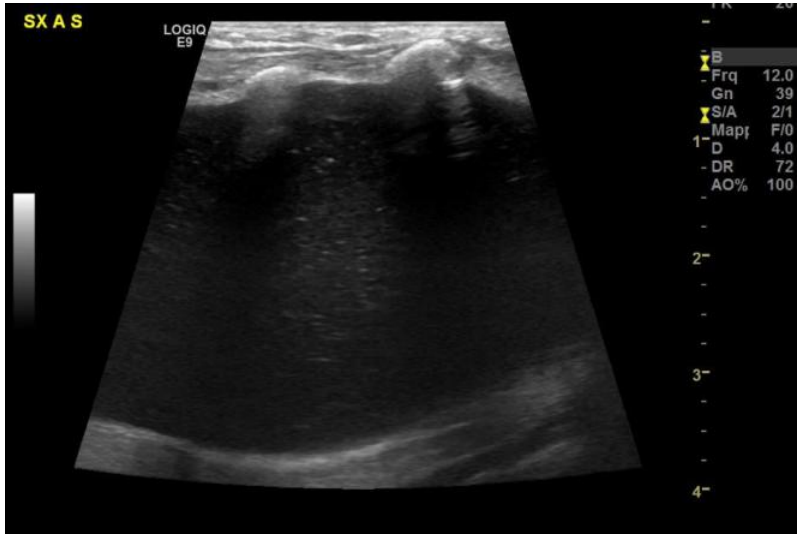
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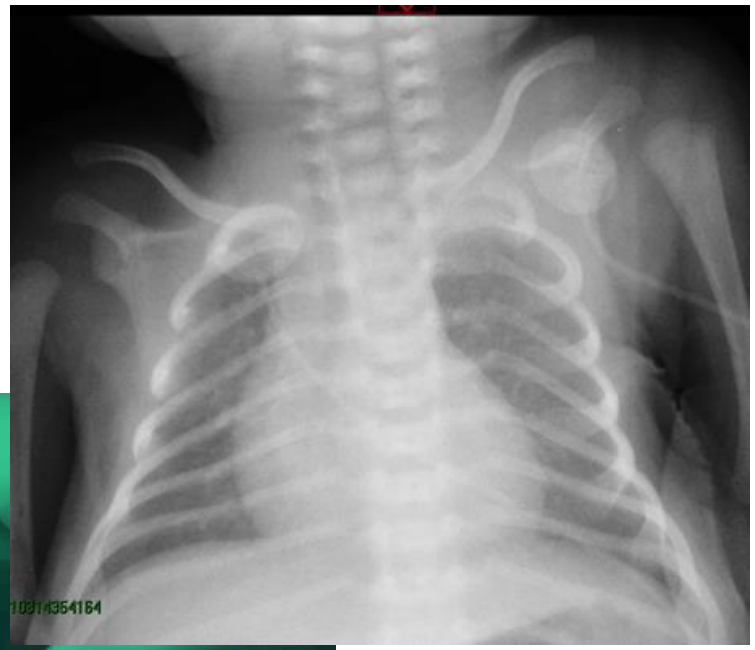

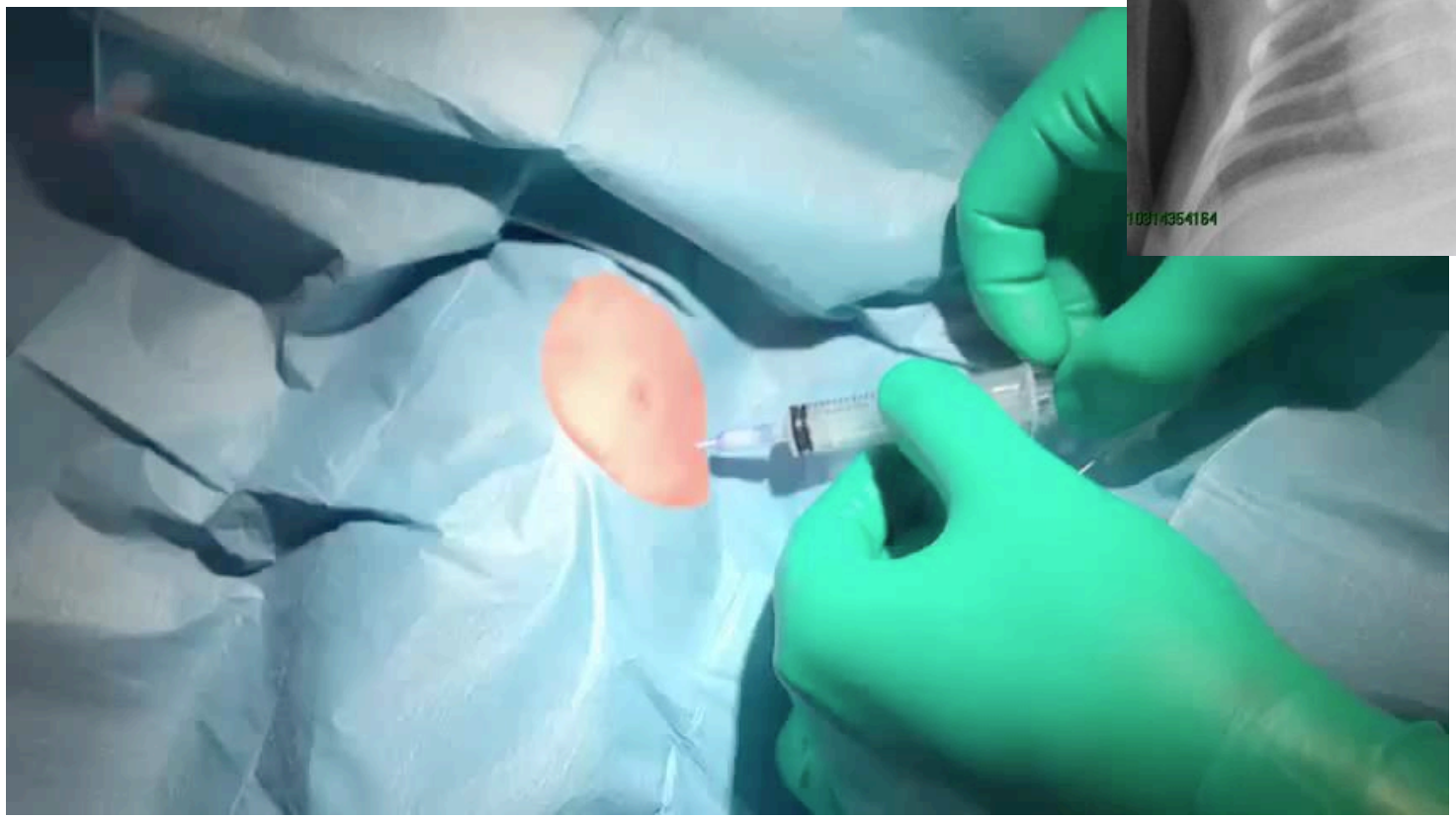

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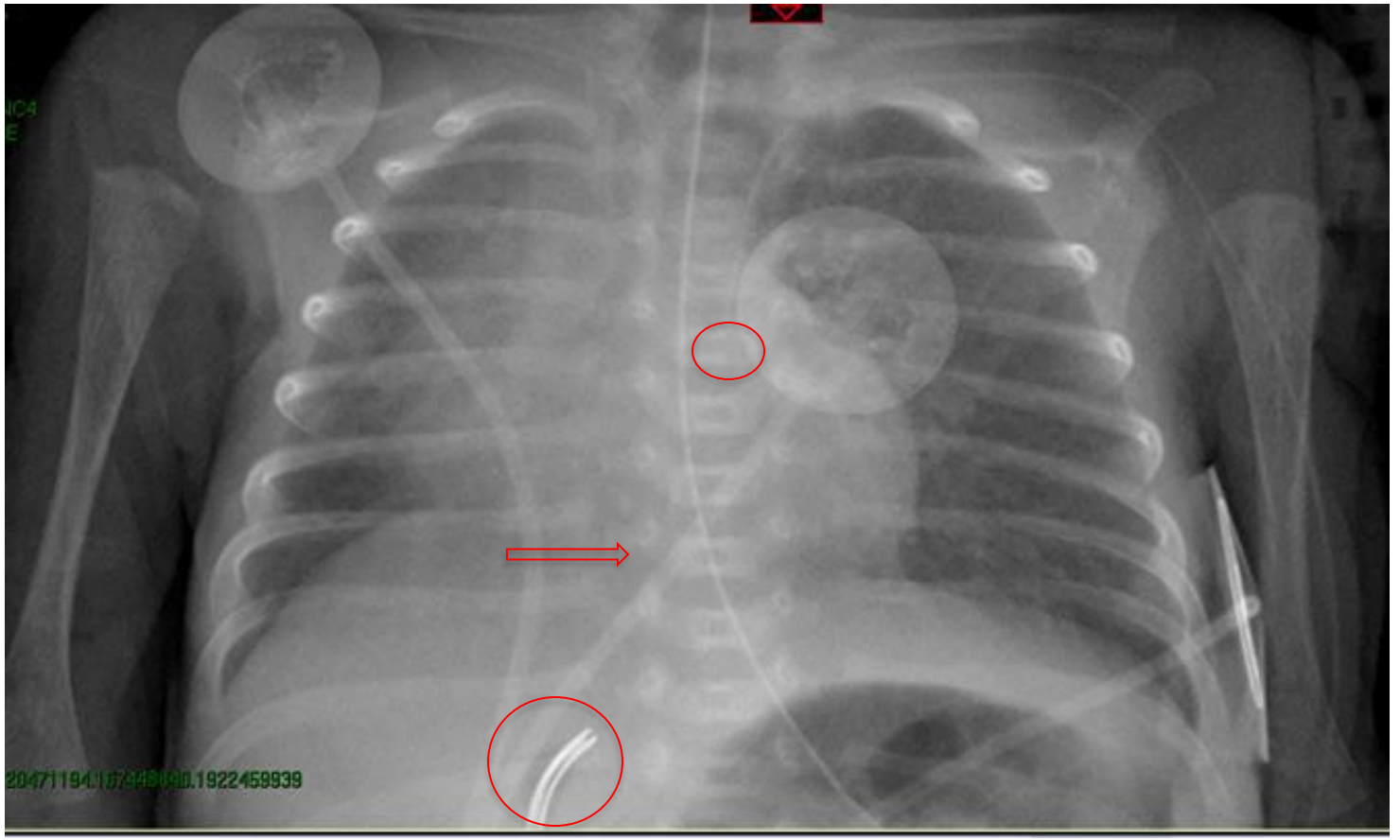

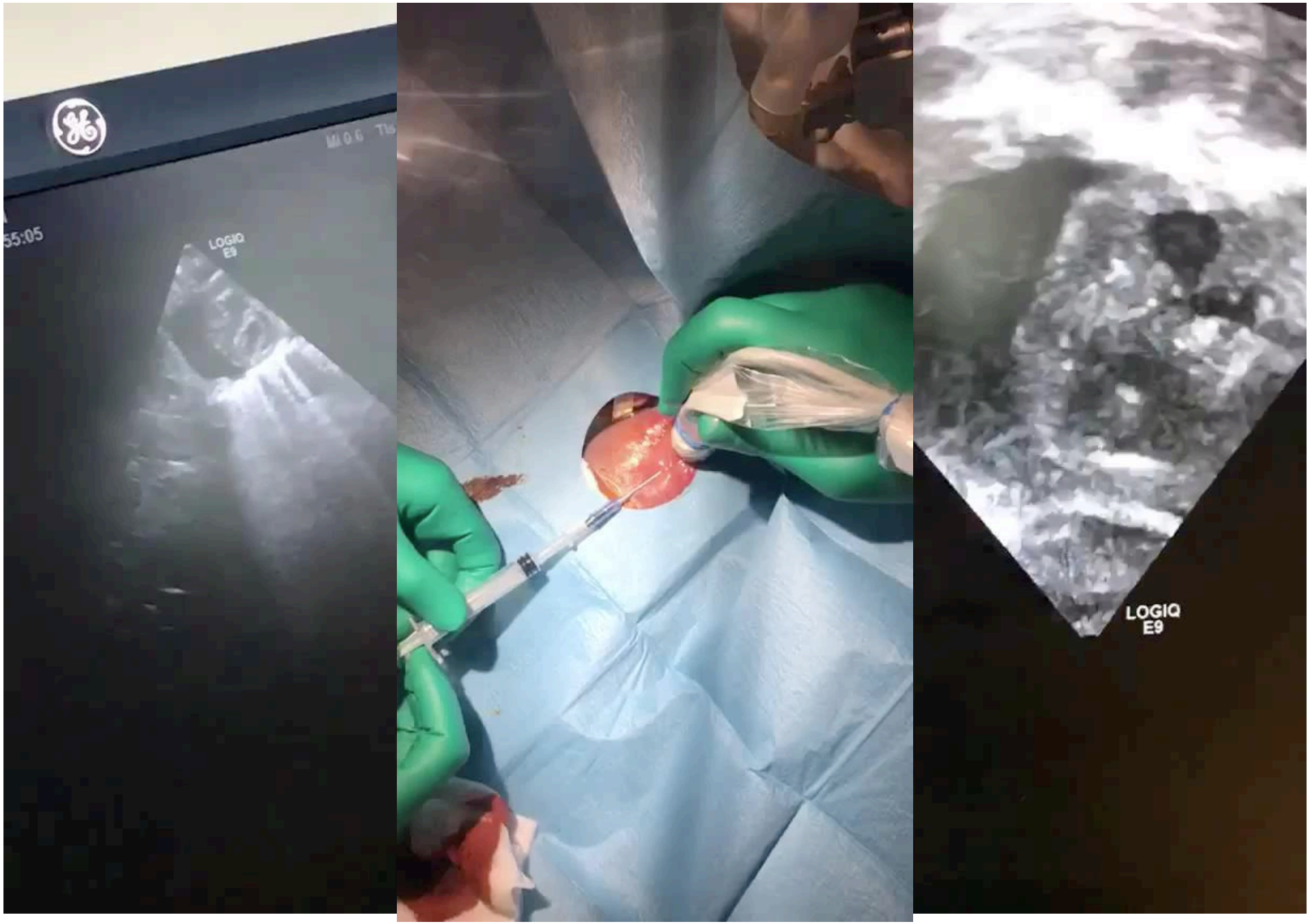
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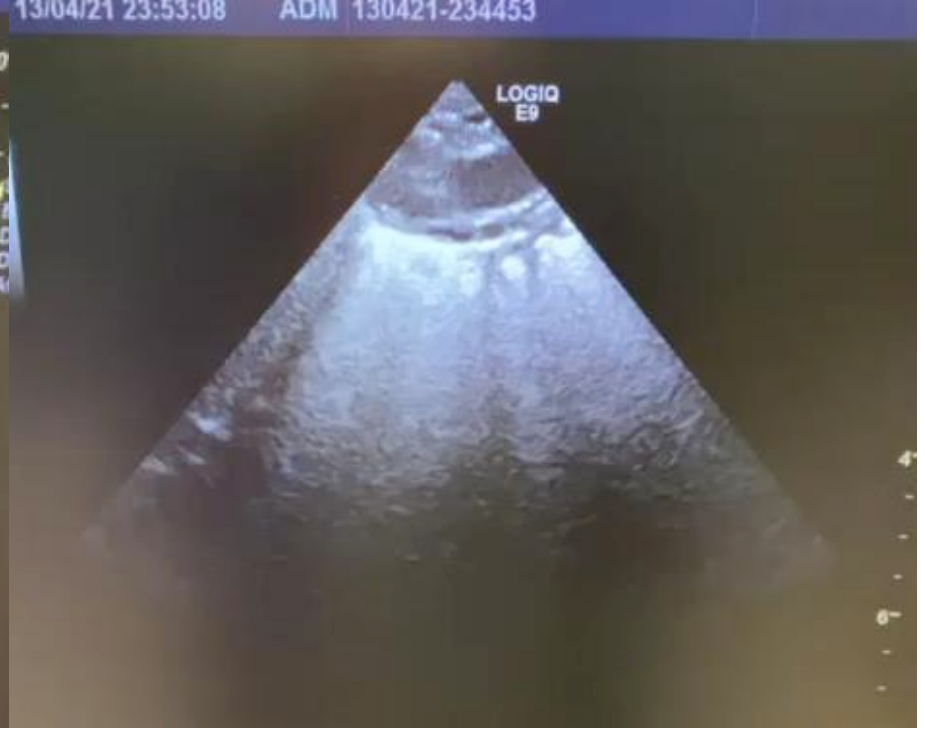
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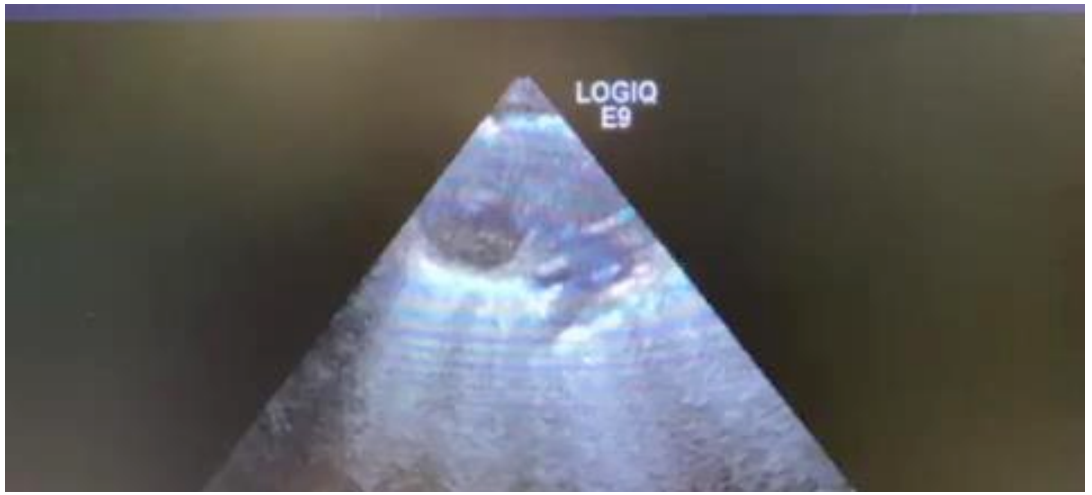
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E9

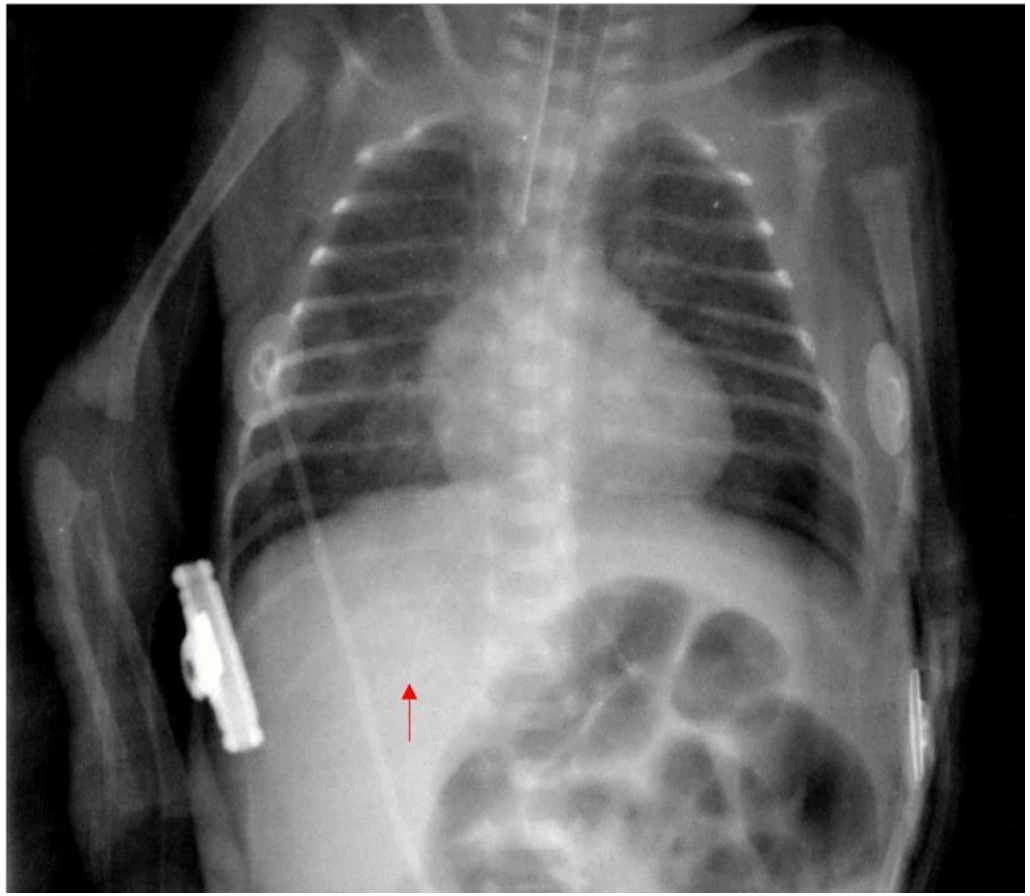
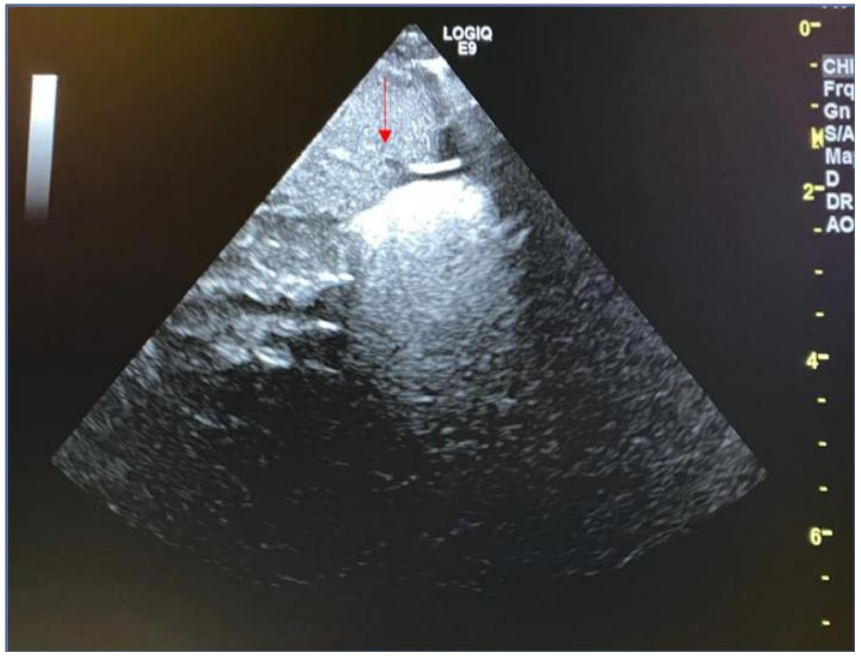


Figure 2



рахмат
danke
謝謝
ngiyabonga
spas
teşekkür ederim
Баярлалаа
mersi
kia ora
barka
welalin
tack
mahalo
спасибо
faafetai lava
vinaka
blagodaram
dank je
misaotra
paldies
grazzi
tapadh leat
спасибі
matondo
kiitos
dankie
nanni
nandri
dhanyavad
thank you
gracias
хвала
mauruuru
asante
manana
bedankt
hvala
köszönöm
aciu
obrigada
tenki
gràçie
bayarlalaa
dankon
murakoze
enkosi
akun
djiere dieuf
tau
mochchakkeram
дякую
mamnun
dziękuję
chnorakaloutioun
gratias ago
gràcies
sulpäy
go raibh maith agat
chokrane
sobodi
dėkuji
taiku
sagolun
sukriya
kop khun krap
arigatô
takk
dakujem
trugarez
obrigado
mèsi
didi madloba
ありがとう
tanemirt
grazie
najis tuke
terima kasih
rahmet
shukriya
mercé
мерси
kam sah hamnida
rahmat
diolch
dhanyavadagalu
তোমাকে ধন্যবাদ
감사합니다
xièxie
ευχαριστώ
merci