



La ecografia: il nuovo standard



V Convegno Nazionale
GAVePed
2023 **RIMINI**
15-16 Maggio

Tip Location dei PICC e dei CICC

Tip location for PICCs & CICCs

Daniele G. Biasucci



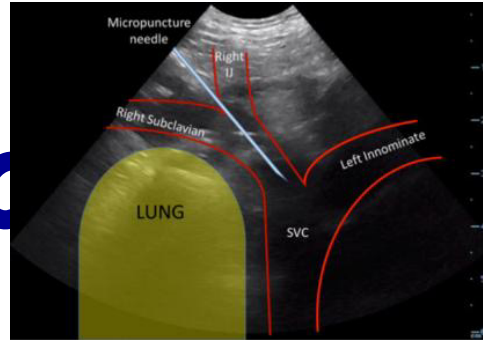
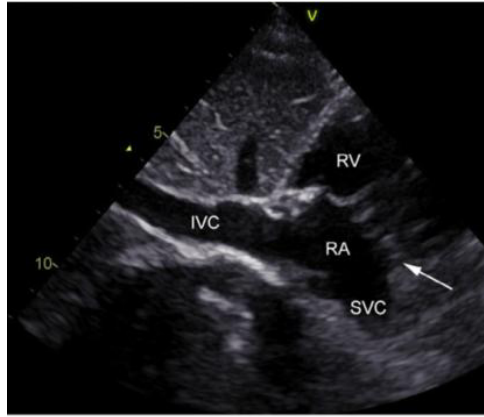
TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA



Ultrasound-based tip location for PICCs & CICC

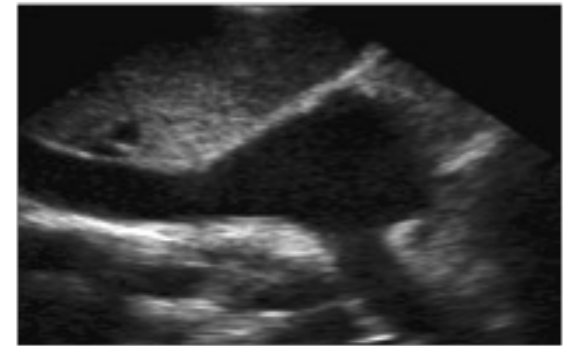
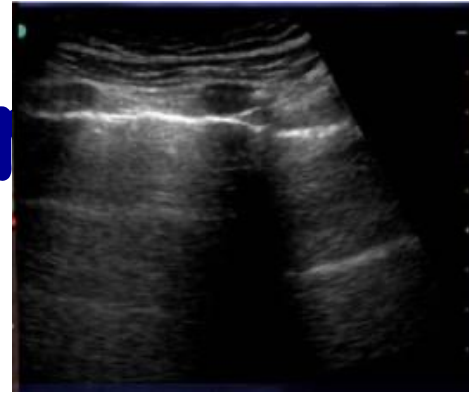
- Rationale
- Recommendations and Guidelines
- Published Evidence (EBM)
- Ultrasound Views
- Bubble Test
- Training





How an old technology has become a disruptive innovation

Resa Lewis, TEDMED Talks

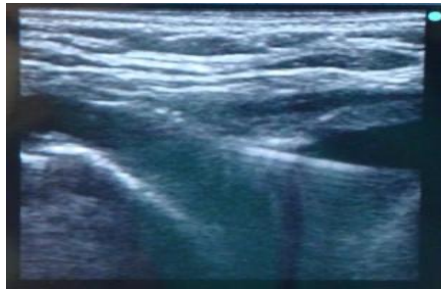


**has become
disruptive innovation!**



Pre-procedural US evaluation

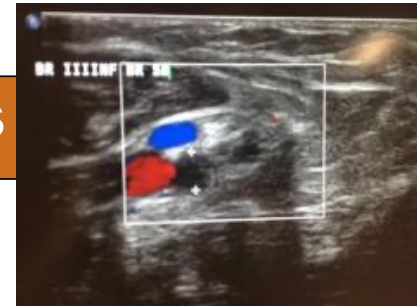
US guided puncture



Tip navigation and Tip location



Exclusion of early and late complications

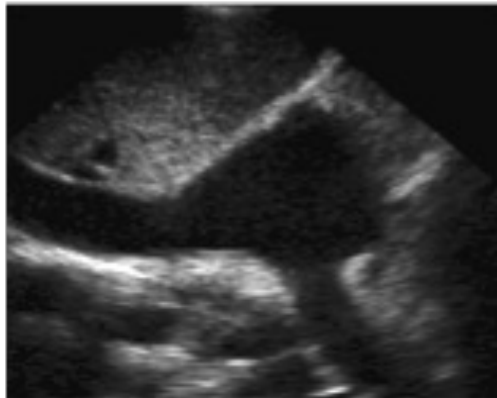


CLINICALLY-INTEGRATED POCUS in VA placement

- Answer simple clinical questions
- Focused ultrasound view
 - Clinically guided
- Rapid
 - exam time approximately 2 min
- Simple interpretation
 - Which is the safest vein to be punctured?
 - Which is the proper and safe approach?
 - Is the needle inside the vein?
 - ***Is the guidewire and/or the catheter travelling towards the right direction?***
 - ***Where is located the tip?***
 - Is there any complications?
 - ...

Rationale – Common Sense

- In regard to the prevention of primary malposition US may play two roles:
 - As a „tip navigation“ technique
 - As a „tip location“ technique
- Rule-out a suspected *late* malposition



EJA**2020***Eur J Anaesthesiol* 2020; **37**:344–376**GUIDELINES****European Society of Anaesthesiology guidelines on peri-operative use of ultrasound-guided for vascular access (PERSEUS vascular access)**

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

Evidence Based**RESEARCH****Open Access**

International evidence-based guidelines on Point of Care Ultrasound (POCUS) for critically ill neonates and children issued by the POCUS Working Group of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC)

2020

Buone pratiche cliniche SIAARTI

Autori

Cerotte V, Vailati D, Mentrucchio G, Capozzoli G, Bazzoli L, Gori F

Guidelines**2016**

Association of Anaesthetists of Great Britain and Ireland*
Safe vascular access 2016

A. Bodenham (Chair),¹ S. Babu,² J. Bennett,³ R. Binks,⁴ P. Fee,⁵ B. Fox,⁶ A. J. Johnston,⁷ A. A. Klein,⁸ J. A. Langton,⁹ H. McIure¹⁰ and S. Q. M. Tighe¹¹

JVA
ISSN 1129-7298

J Vasc Access 2014; 00 (00): 000-000
DOI: 10.5301/jva.5000314

ORIGINAL ARTICLE**2014****Central venous access devices in pediatric malignancies: a position paper of Italian Association of Pediatric Hematology and Oncology**

Alessandro Crocchi¹, Assunta Tornesello², Mauro Pittiruti³, Angelica Barone⁴, Paola Muggeo⁵, Alessandro Inerra⁶, Angelo Claudio Molinari⁶, Valeria Grillenzoni⁷, Viviana Durante⁸, Maria Pia Cicalese⁹, Giulio Andrea Zanazzo¹⁰, Simone Cesaro⁷

Intensive Care Med
DOI 10.1007/s00134-012-2597-x

CONFERENCE REPORTS AND EXPERT PANEL

Massimo Lamperti
Andrew R. Bodenham
Mauro Pittiruti
Michael Blaivas
John G. Augoustides
Mahmoud Elbarbary
Thierry Pirotte
Dimitrios Karakitsos
Jack LeDonne
Stephanie Doniger
Giancarlo Scoppettuolo
David Feller-Kopman
Wolfram Schummer
Roberto Biffi
Eric Desruennes
Lawrence A. Melniker
Susan T. Verghese

**International evidence-based
recommendations on ultrasound-guided
vascular access**

Evidence Based**2012****8TH EDITION****REVISED 2021****INS**

INFUSION NURSES SOCIETY
SETTING THE STANDARD FOR INFUSION CARE®

GRADE – RAND or... DELPHI

EJA

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

GUIDELINES

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

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

Singh et al. *Critical Care* (2020) 24:65
<https://doi.org/10.1186/s13054-020-2787-9>

Critical Care

RESEARCH

Open Access

International evidence-based guidelines on Point of Care Ultrasound (POCUS) for critically ill neonates and children issued by the POCUS Working Group of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC)



Yogen Singh^{1,2*} , Cecile Tissot^{3†}, María V. Fraga⁴, Nadya Yousef⁵, Rafael Gonzalez Cortes⁶, Jorge Lopez⁶, Joan Sanchez-de-Toledo⁷, Joe Brierley⁸, Juan Mayordomo Colunga⁹, Dusan Raffaj¹⁰, Eduardo Da Cruz¹¹, Philippe Durand¹², Peter Kenderessy¹³, Hans-Joerg Lang¹⁴, Akira Nishisaki¹⁵, Martin C. Kneyber¹⁶, Pierre Tissieres¹², Thomas W. Conlon¹⁵ and Daniele De Luca^{5,17}

2020

International evidence-based guidelines on Point of Care Ultrasound (POCUS) for critically ill neonates and children issued by the POCUS Working Group of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC)



Yogen Singh^{1,2*}, Cecile Tissot^{3†}, María V. Fraga⁴, Nadya Yousef⁵, Rafael Gonzalez Cortes⁶, Jorge Lopez⁶, Joan Sanchez-de-Toledo⁷, Joe Brierley⁸, Juan Mayordomo Colunga⁹, Dusan Raffaj¹⁰, Eduardo Da Cruz¹¹, Philippe Durand¹², Peter Kenderessy¹³, Hans-Joerg Lang¹⁴, Akira Nishisaki¹⁵, Martin C. Kneyber¹⁶, Pierre Tissieres¹², Thomas W. Conlon¹⁵ and Daniele De Luca^{5,17}

23.	POCUS-guided technique should be used for internal jugular vein (IJV) line placement in neonates and children	Strong agreement	A
24.	POCUS-guided technique is helpful for subclavian vein line placement in neonates and children	Strong agreement	B
25.	POCUS-guided technique is helpful for femoral line placement in neonates and children	Strong agreement	B
26.	POCUS-guided technique is helpful for arterial catheters placement in children	Agreement	B
27.	POCUS-guided technique is helpful for peripherally inserted central catheters in children	Agreement	B
28.	POCUS is helpful to locate catheter tip position in neonates and children	Strong agreement	C

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

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

Recommendations

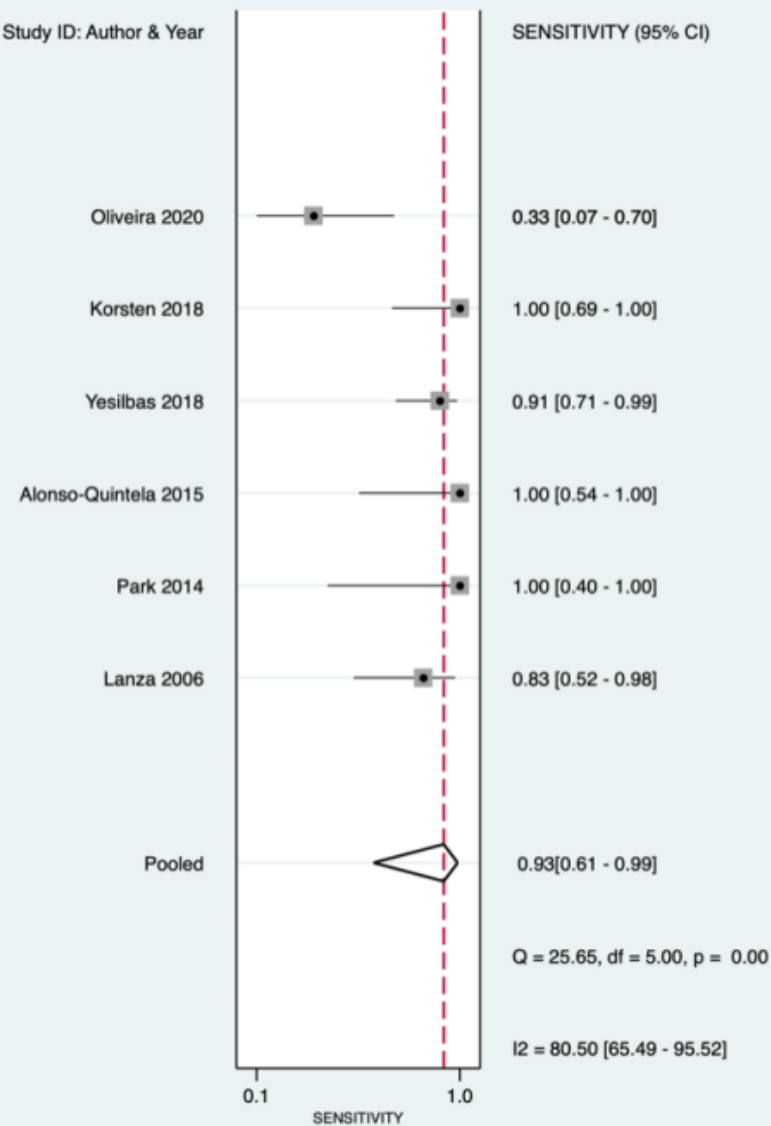
- (1) The quality of evidence on which to base recommendations is generally weak, with relatively small RCTs and prospective cohort studies that have a high degree of heterogeneity
- (2) When an intracardiac electrocardiogram is not applicable, we recommend using real-time ultrasound to detect and prevent central venous catheter malposition, as it has been shown to be well tolerated, feasible, quickly performed and interpreted at bedside, and more accurate and faster than a chest radiograph **(1C)**.
- (3) We recommend combining vascular ultrasound for guidewire and central venous line tip navigation with transthoracic echocardiography for tip location **(1C)**.

Table 1. Summary of the six studies on ultrasound-based tip location in children (2000–2020).

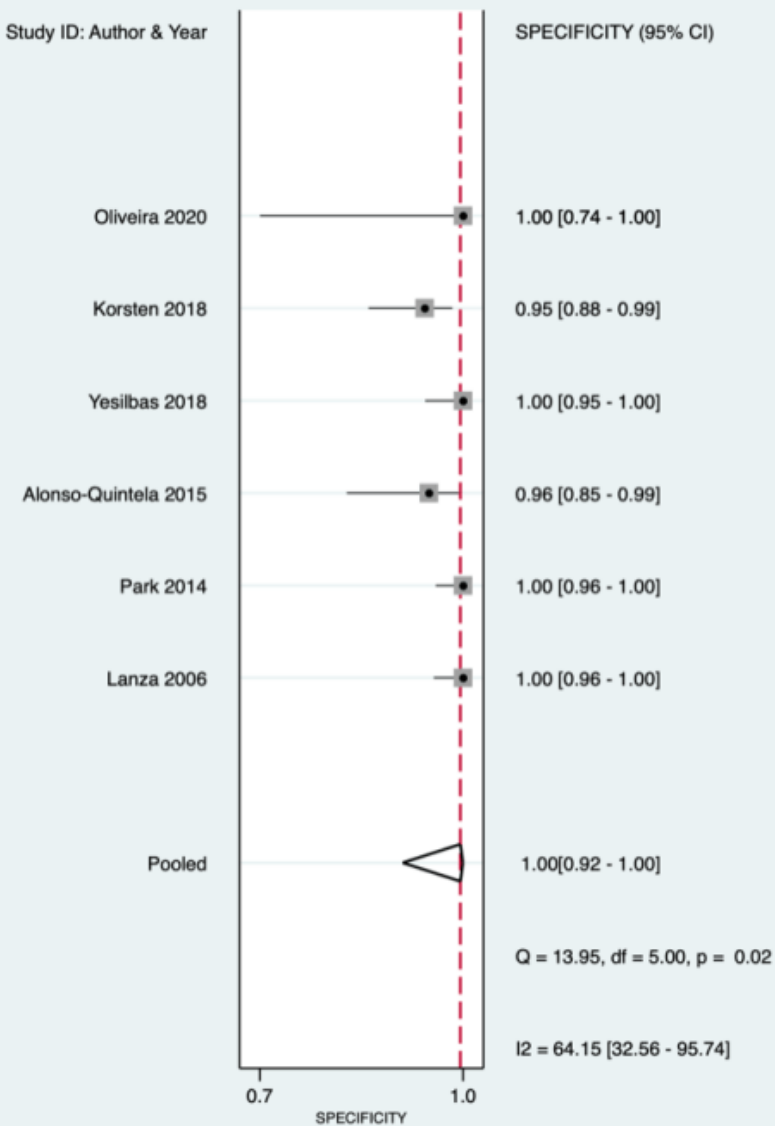
Study	Sample size	Protocol	Probe	Windows
Lanza et al. ²⁵	107	Tip navigation	Linear	Short axis of neck veins
			Convex	Coronal view of SVC
		Tip location + "bubble" test	Convex	Subcostal four-chambers view
Park et al. ²⁶	106	Tip location, no "bubble"	Small sectorial	Right parasternal in long and short axis
Alonso-Quintela et al. ²⁷	40	Tip navigation	Linear	Short and long axis view of IJV, SV, BCV, and FV
			Small sectorial	Coronal view of SVC (for CICC)
				Subcostal longitudinal view of IVC (for FICC)
		Tip location	Small sectorial	Subcostal bi-caval or right parasternal (as alternative)
Yesilbas et al. ²⁸	77	Tip location + "bubble" test	Small sectorial	Subcostal four-chambers or apical four-chambers (as alternative)
Korsten et al. ²⁹	100	Tip location + "bubble" test	Small sectorial	Subcostal four-chambers or apical four-chambers (as alternative)
Oliveira et al. ³⁰	21	Tip location + "bubble" test	Convex	Apical four-chambers

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

Study ID: Author & Year



Study ID: Author & Year

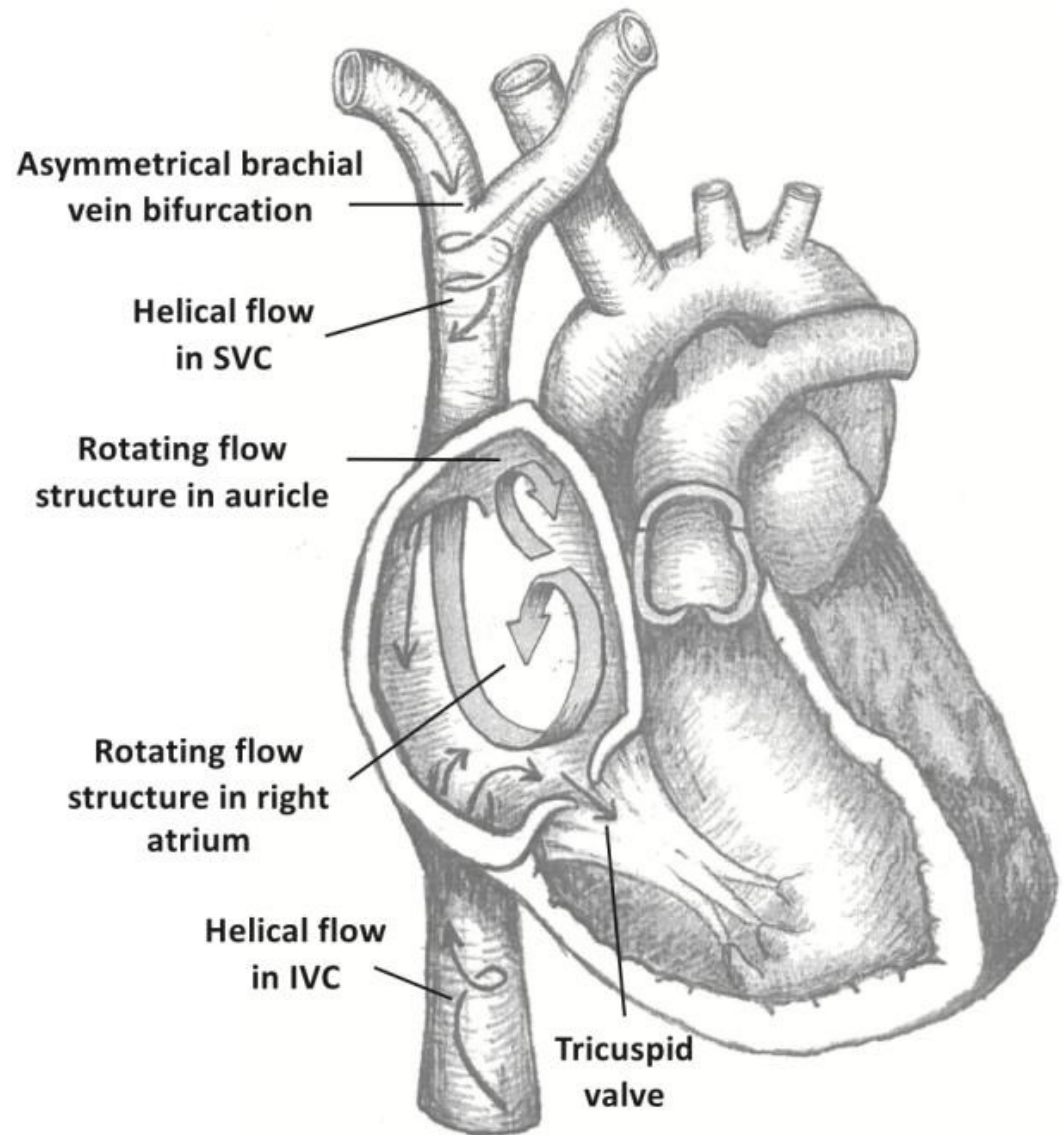
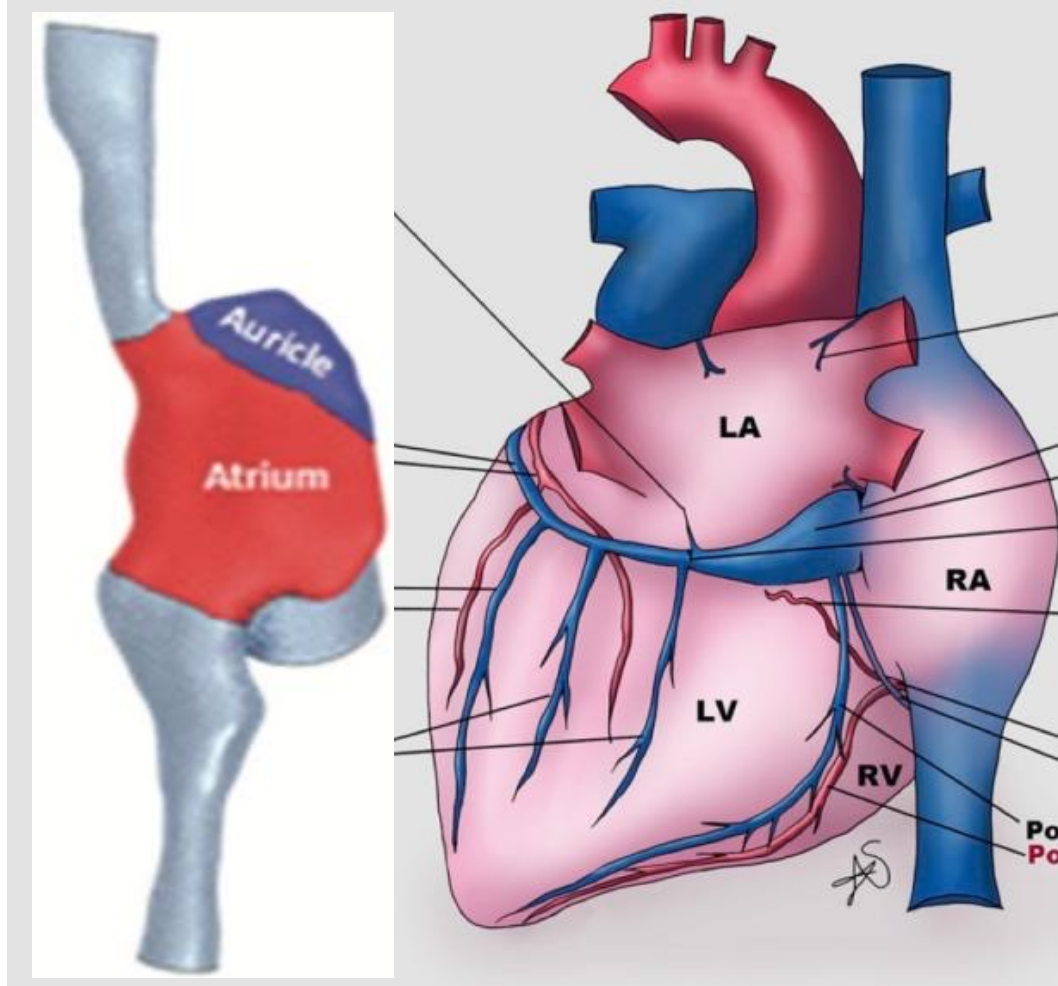


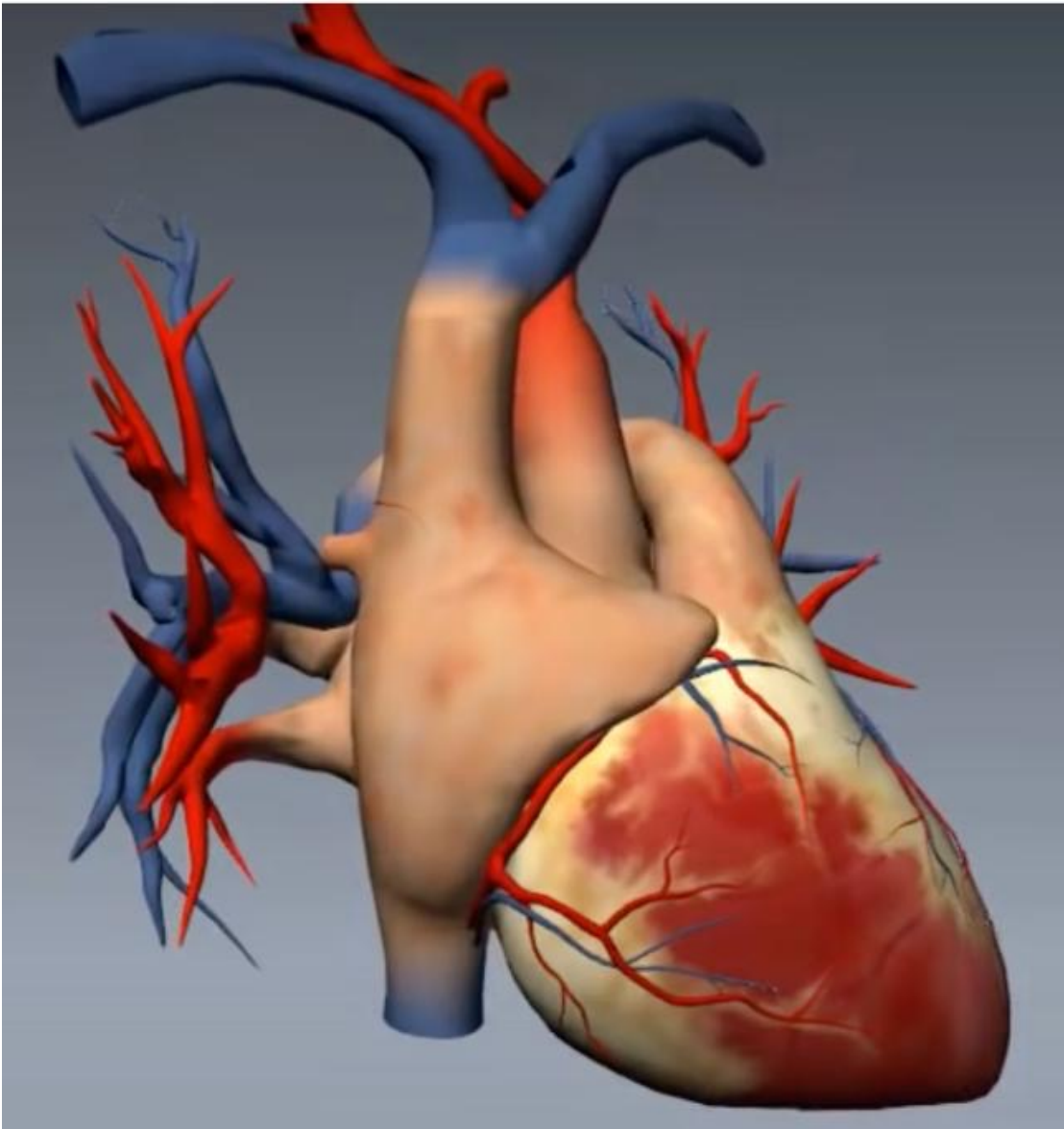
Limitations

- Lack of standardization
 - Ultrasound View Protocol
 - Possible Solution → ECHOTIP protocol
 - Bubble test
 - Further studies needed
 - Possible Solution → Pittiruti et al. 1 second
- Imperfect Reference standard
 - CXR
 - 1 study on children US vs IC-ECG (*Pittiruti et al.*)
- Small Sample Size



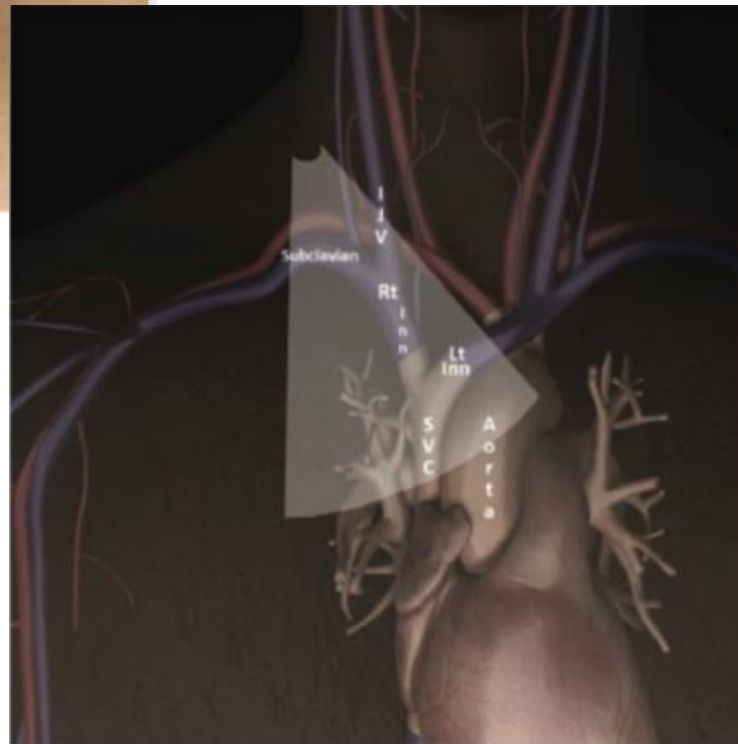
Ultrasound Views





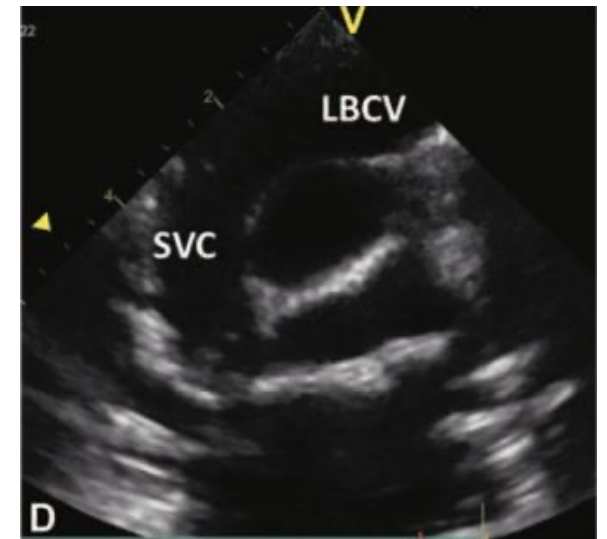
- **Modified Suprasternal**
- **Modified Parasternal**
- **Apical 4 Ch**
- **Modified Apical 5 Ch**
- **Subcostal 4 Ch**
- **Subcostal bicaval**
- **Modified Subcostal**

Modified Suprasternal

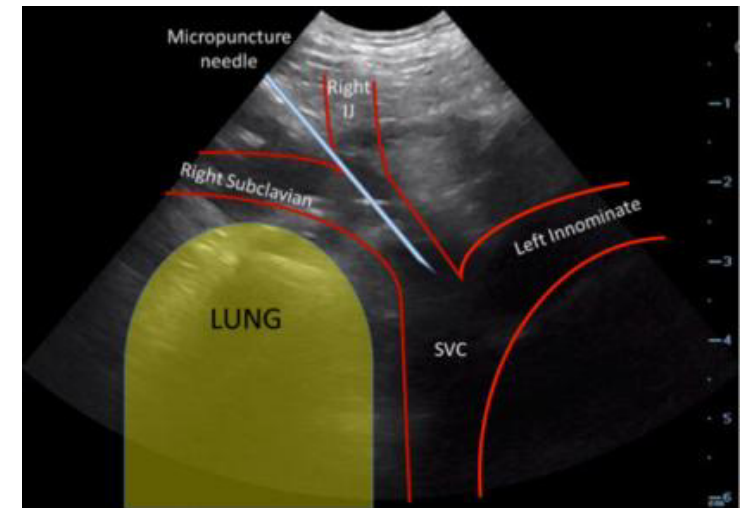
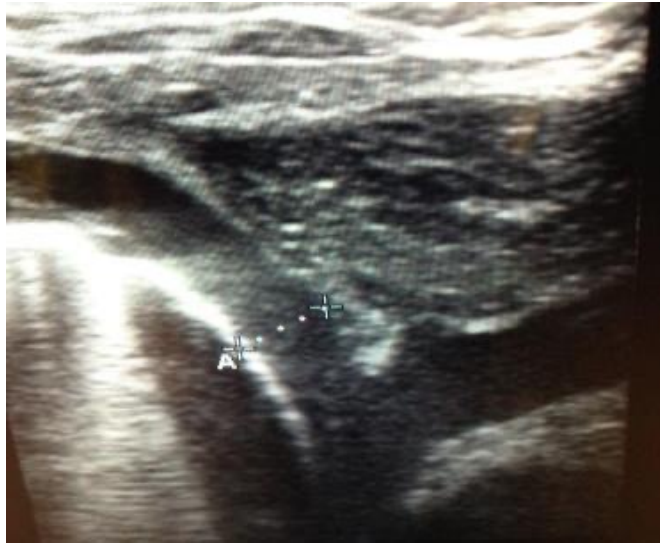


Location of the Central Venous Catheter Tip With Bedside Ultrasound in Young Children: Can We Eliminate the Need for Chest Radiography?*

Paula Alonso-Quintela, MD^{1,2}; Ignacio Oleaga-Errea, MD^{2,3}; Silvia Rodríguez-Blanco, MD;
Manuel Muñoz-Fontán, MD⁴; Santiago Lapuerta-López-de Armentia, MD, PhD^{5,6}
Antonio Rodríguez-Núñez, MD, PhD^{1,2}



Modified Suprasternal



Obtaining central access in challenging pediatric patients

Cory N. Criss¹ · Jake Claflin² · Matthew W. Ralls¹ · Samir K. Gadepalli¹ · Marcus D. Jarboe¹

Modified Right Parasternal

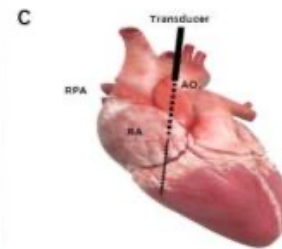


Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645



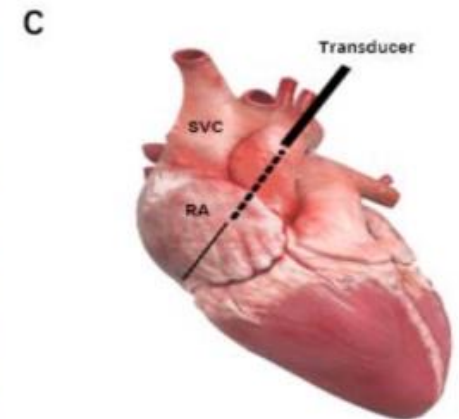
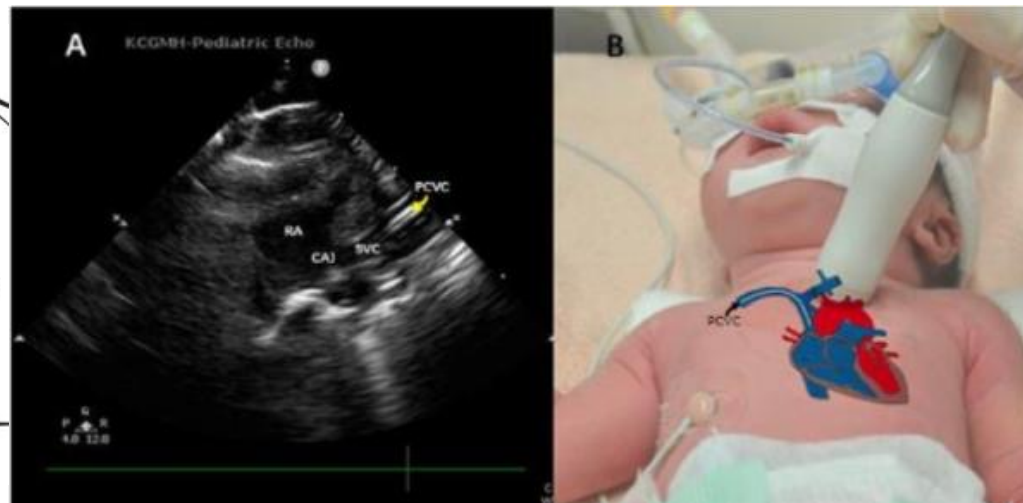
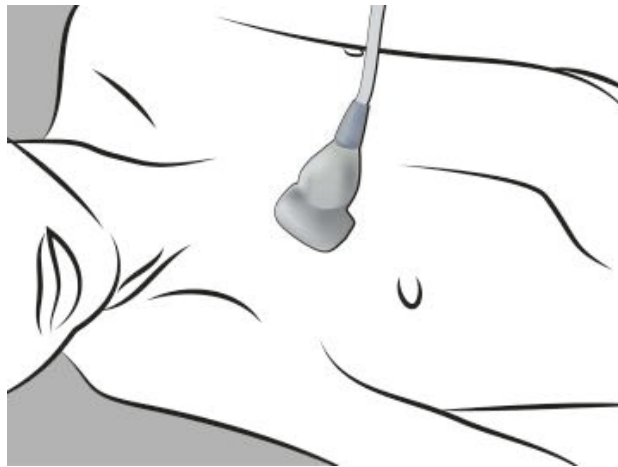
Modified Right Parasternal



Article

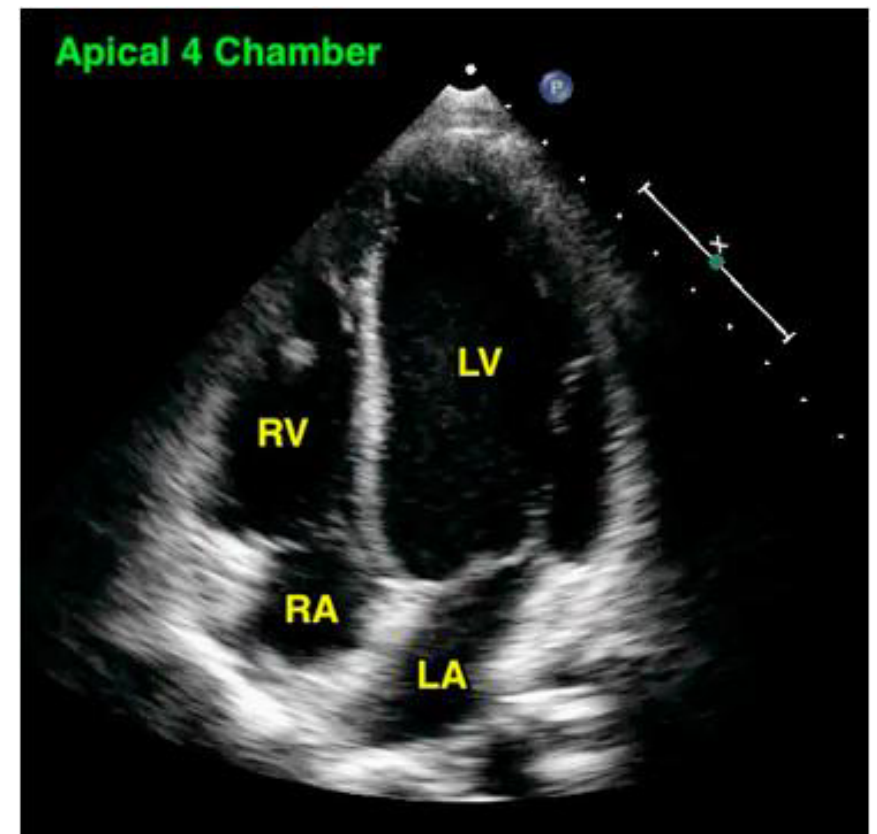
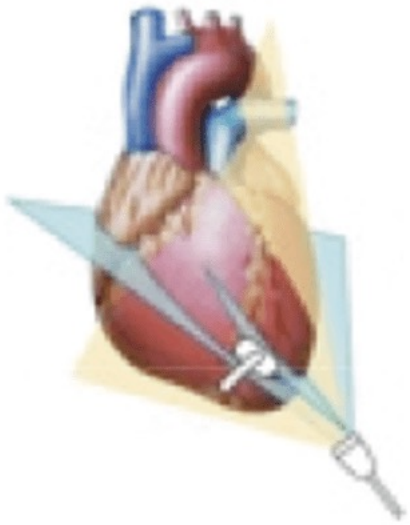
Echocardiographic Determination of Percutaneous Central Venous Catheters in the Superior Vena Cava: A Prospective Cohort Study

Yao-Sheng Wang ¹, Hsin-Chun Huang ^{2,3}, Yu-Chen Liu ^{2,3} and I-Lun Chen ^{2,3,*}

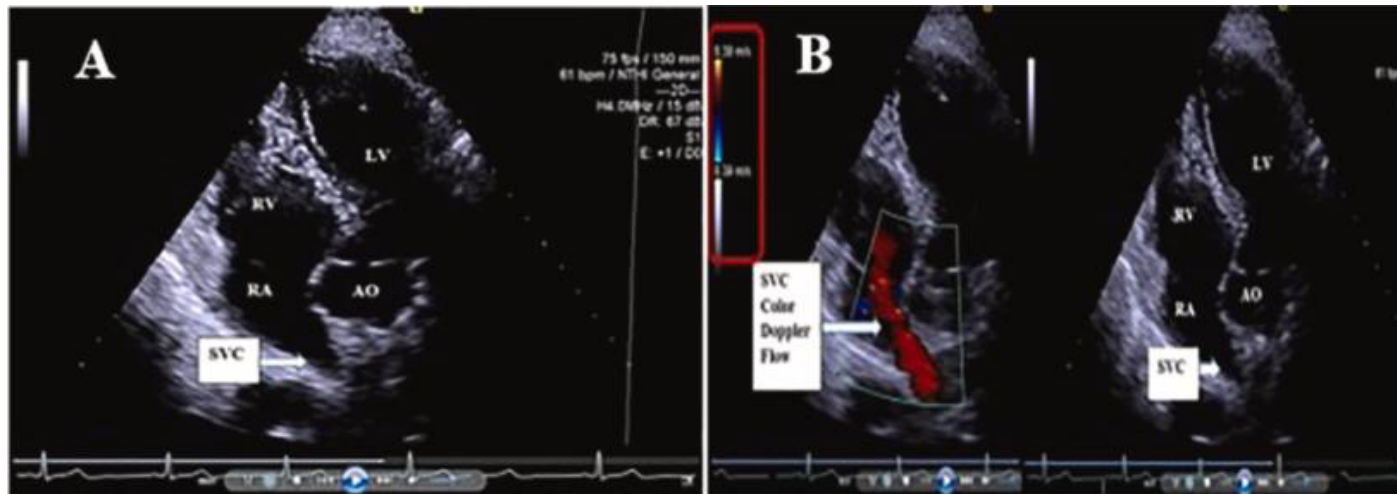


Apical 4 Chambers View

Apical Views



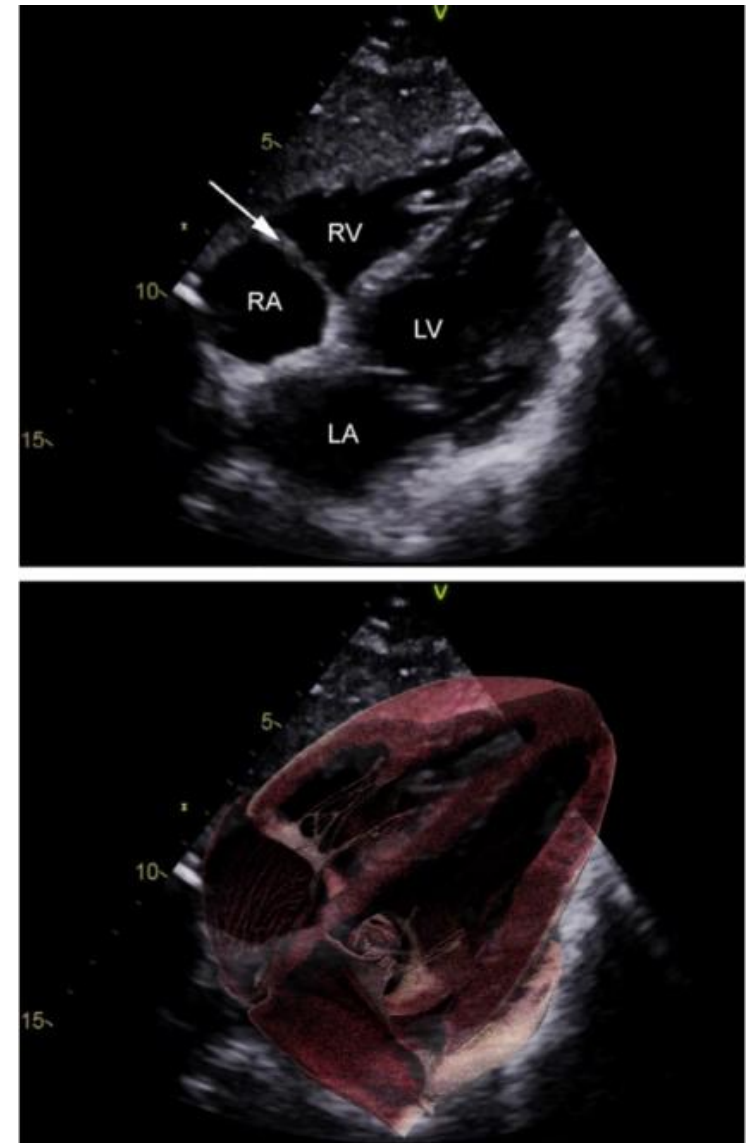
Modified Apical 5 Ch View



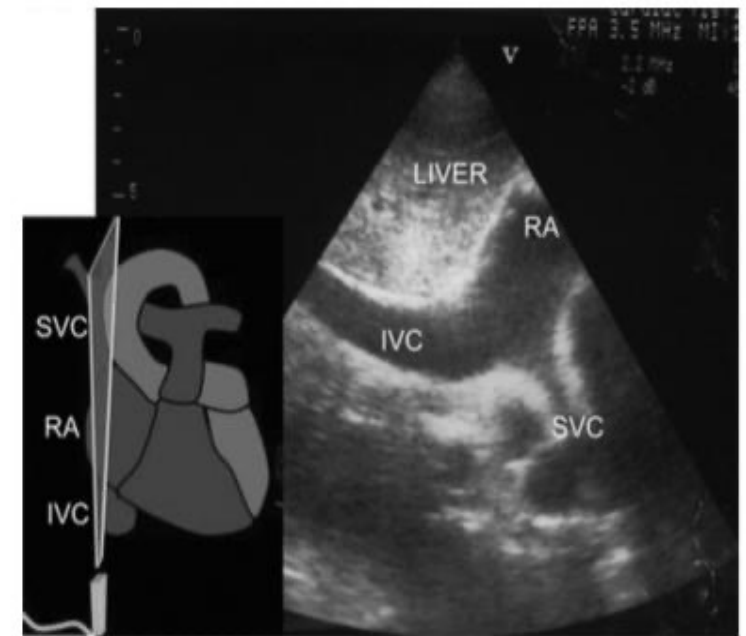
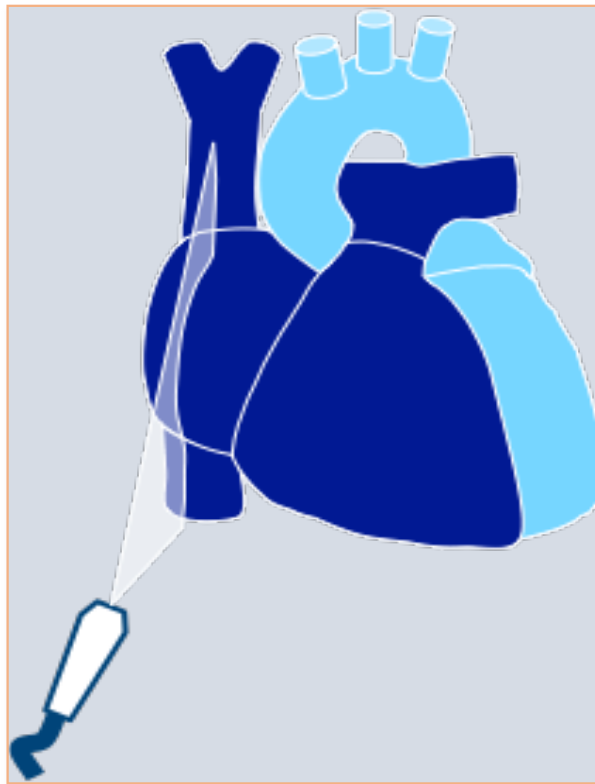
Three simple but interesting transthoracic echocardiographic road maps for proximal superior vena cava visualisation in healthy young adults

Mohammadbagher Sharifkazemi^{*}, Gholamreza Rezaian, Elham Hosseinienejad, Alireza Arjangzadeh

Subcostal 4 Ch view



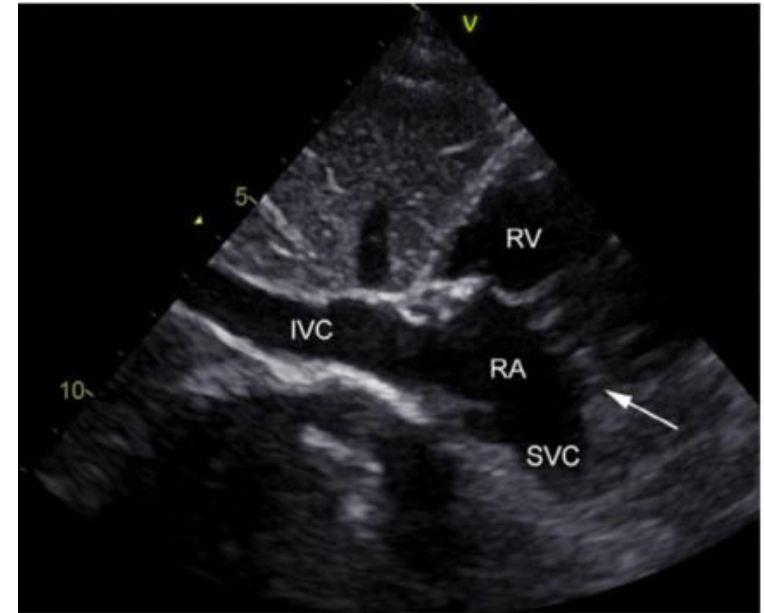
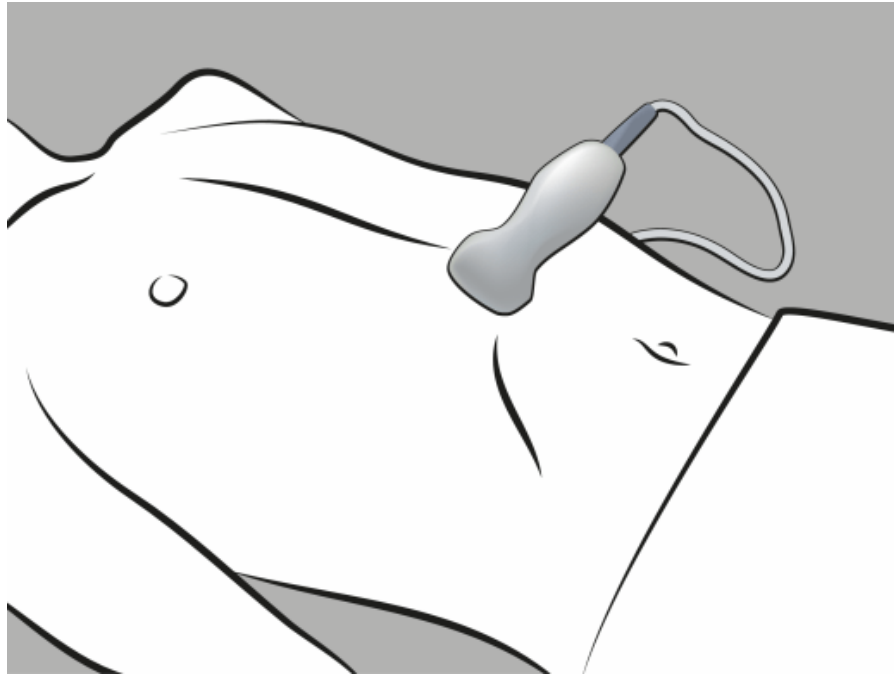
Subcostal Bicaval View



Ultrasound localization of central vein catheter and detection of postprocedural pneumothorax: An alternative to chest radiography*

Antonella Vezzani, MD; Claudia Brusasco, MD; Salvatore Palermo, MD; Claudio Launo, MD; Mario Mergoni, MD; Francesco Corradi, MD, PhD

Modified Subcostal



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

Giovanni Barone¹ , Mauro Pittiruti² , Daniele G Biasucci³,
Daniele Elisei⁴, Emanuele Iacobone⁴ , Antonio La Greca²,
Geremia Zito Marinosci⁵ and Vito D'Andrea⁶ 

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

Antonio La Greca¹, Emanuele Iacobone² , Daniele Elisei²,
Daniele Guerino Biasucci³ , Vito D'Andrea⁴ ,
Giovanni Barone⁵, Geremia Zito Marinosci⁶
and Mauro Pittiruti¹ 

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

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

JVA | The Journal of
Vascular Access

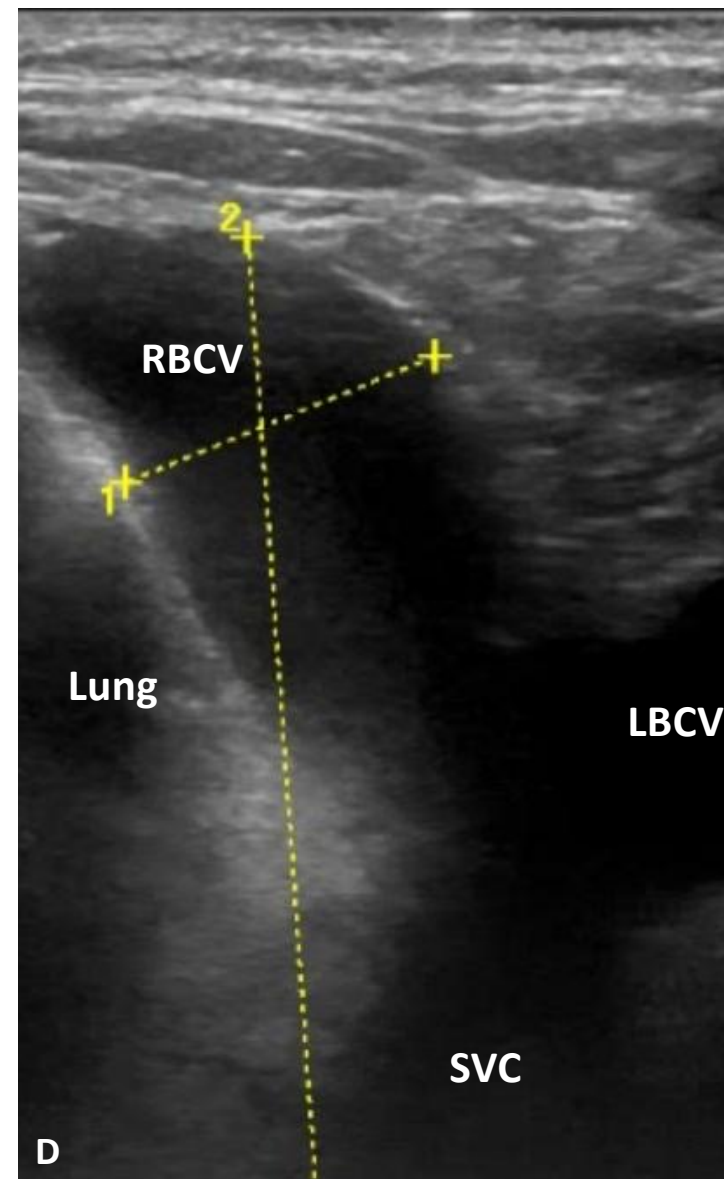
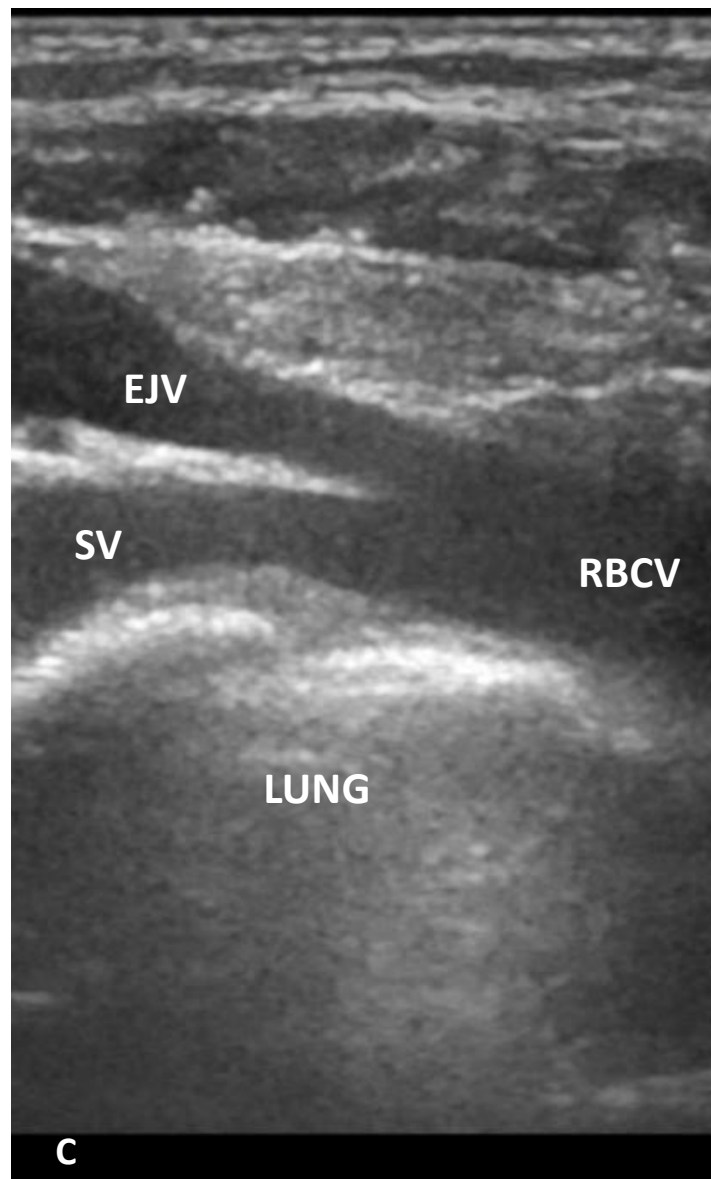
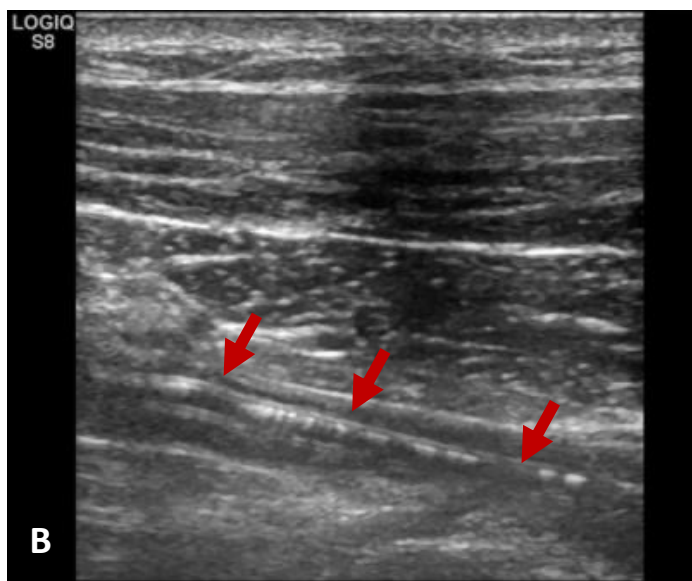
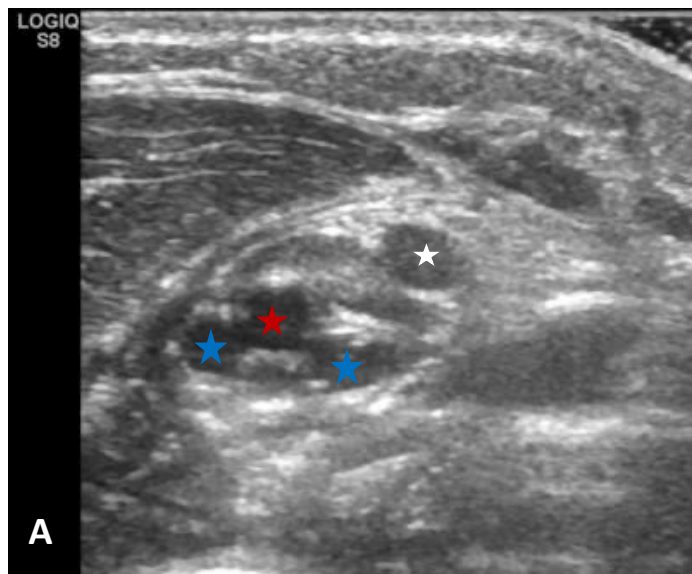
ECHOTIP-Ped: A structured protocol for ultrasound-based tip navigation and tip location during placement of central venous access devices in pediatric patients

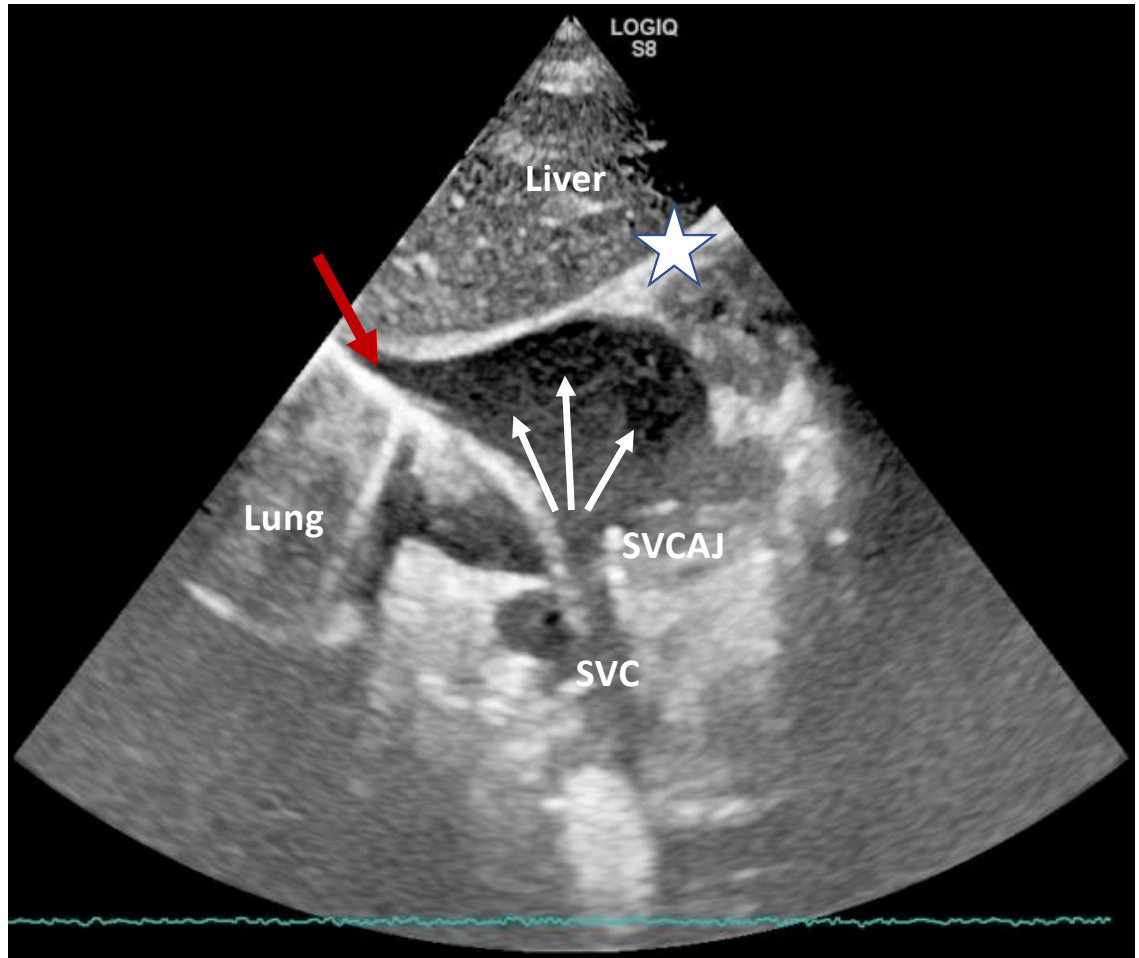
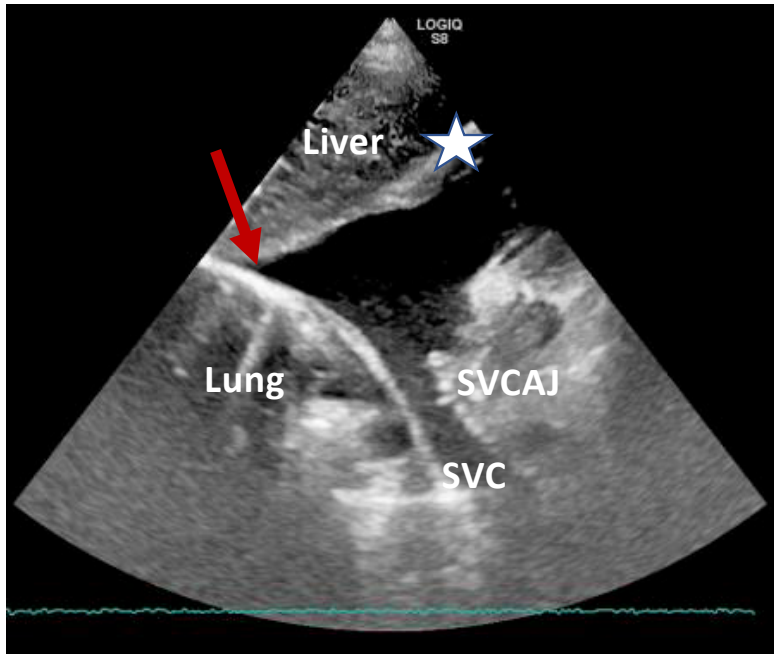
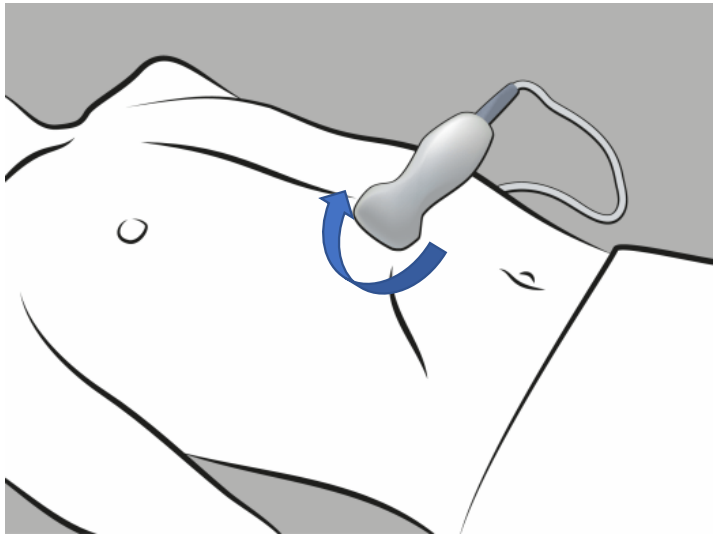
JVA

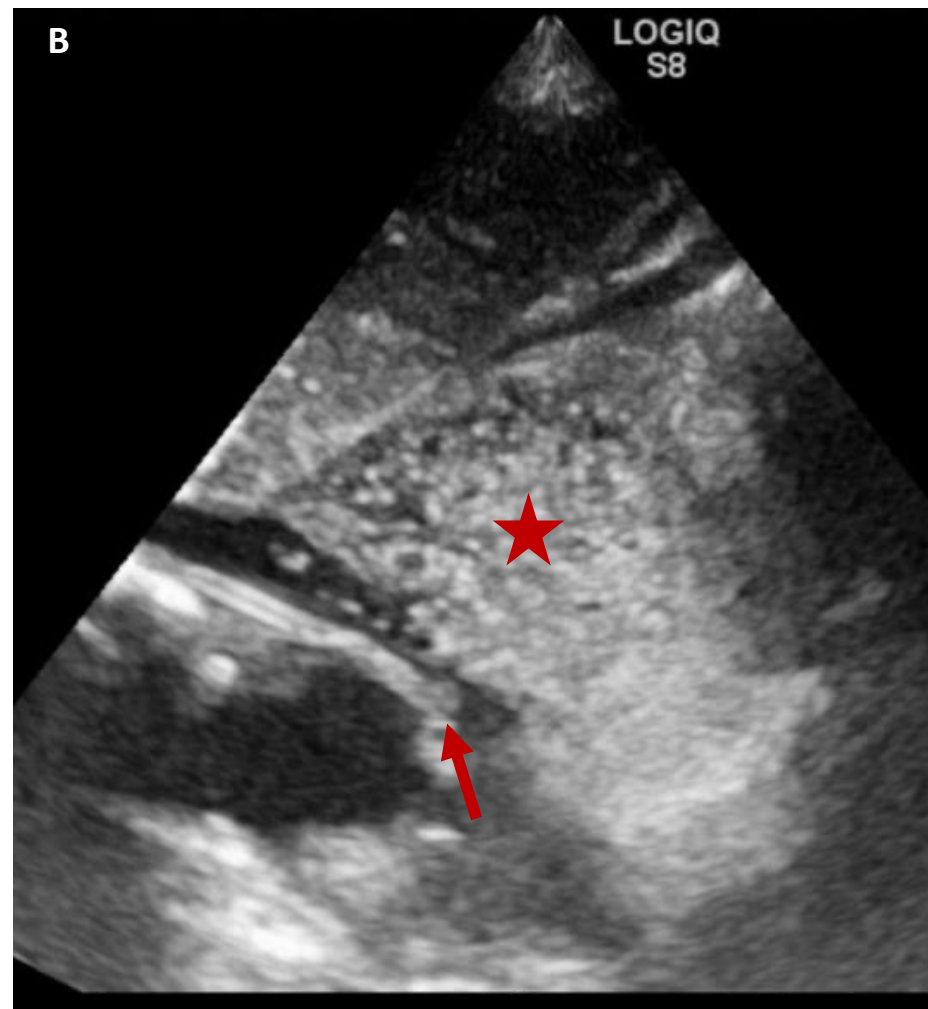
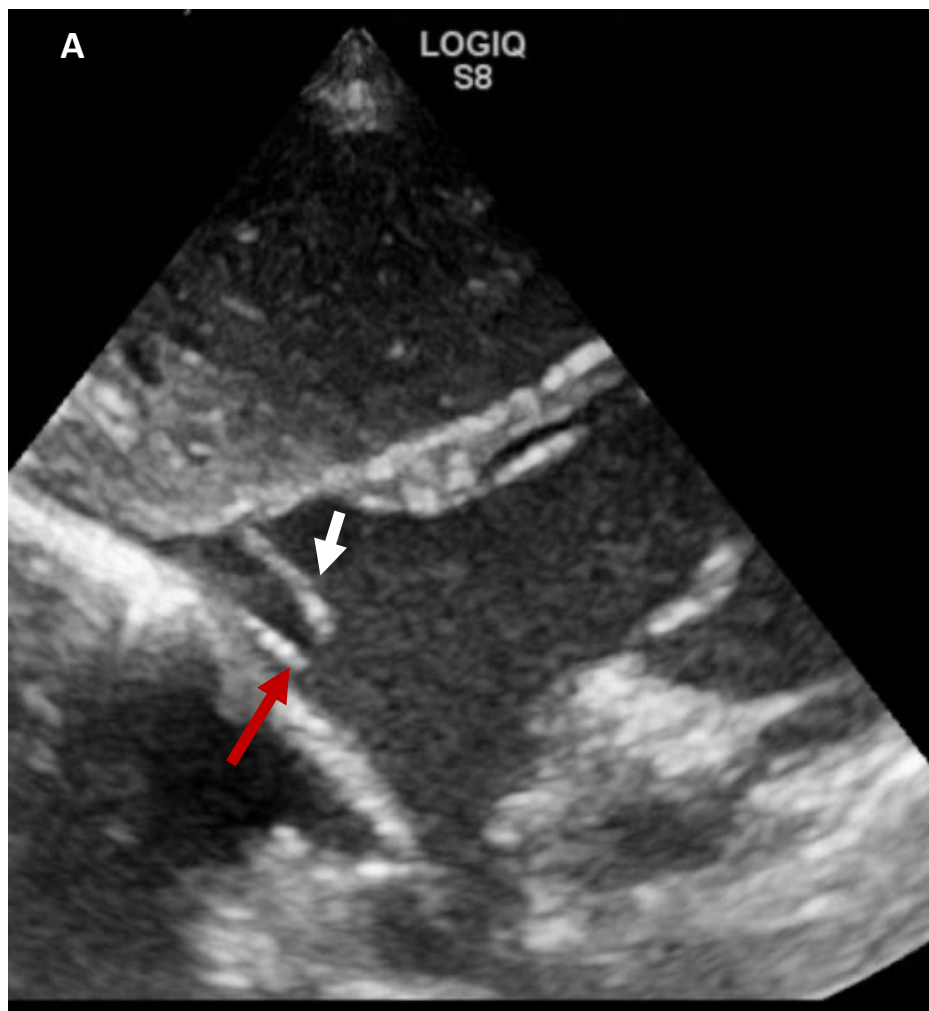
The Journal of
Vascular Access

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

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







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

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

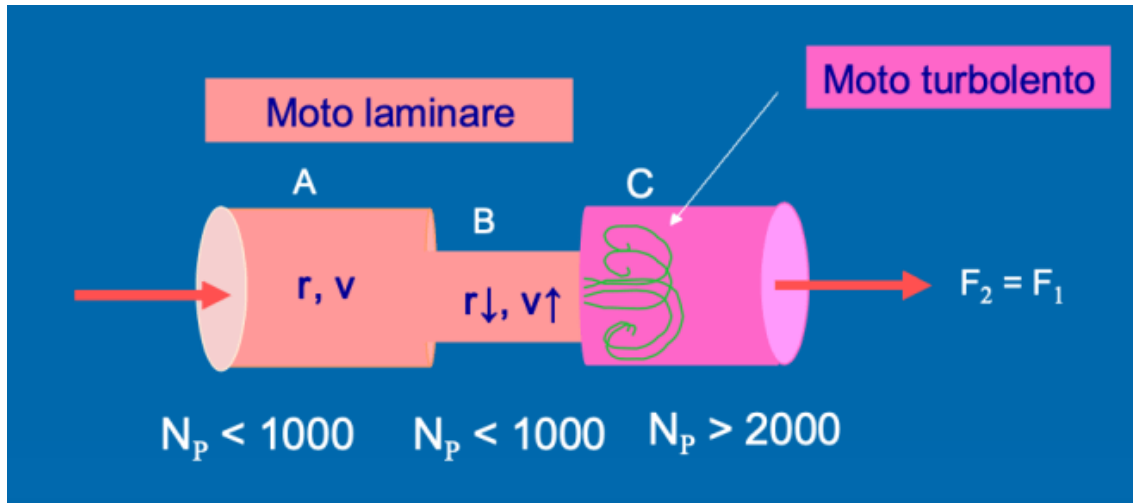
- **Applicability 96% (96 out of 100 cases)**

- 4 cases, both the subcostal window and the apical window were not satisfactory, due to burns and/or presence of open surgical wounds
- In these cases, tip location was assessed by IC-ECG only.

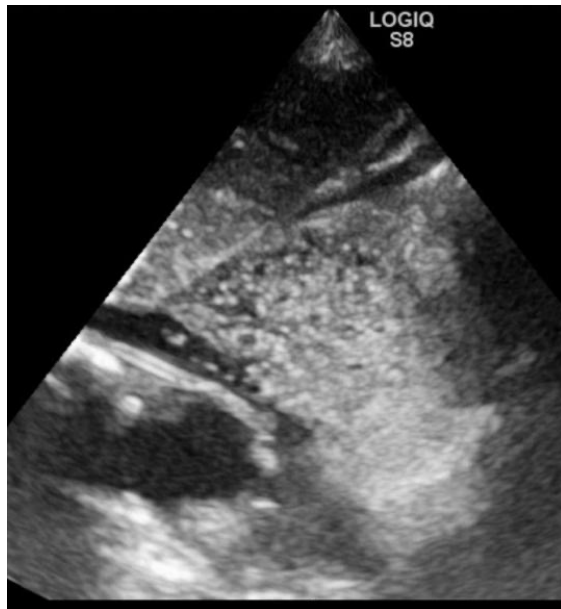
- **Feasibility 100% (96 out of 96 cases)**

- In all 96 patients micro-bubbles appeared in the right atrium immediately (within 1s), confirming the proper location of the tip at the CAJ

- **First study ever testing applicability and feasibility of the ECHOTIP-Ped Protocol**



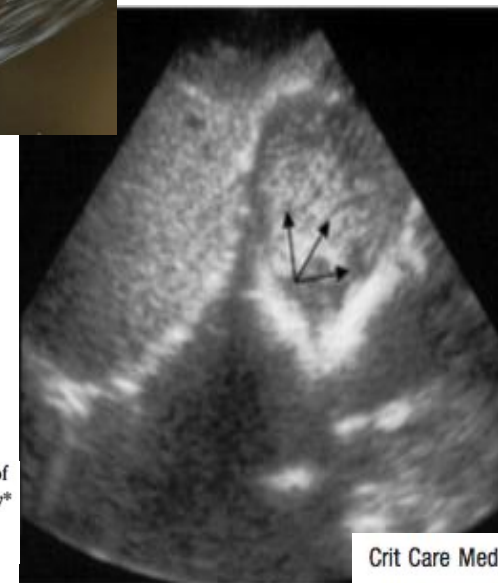
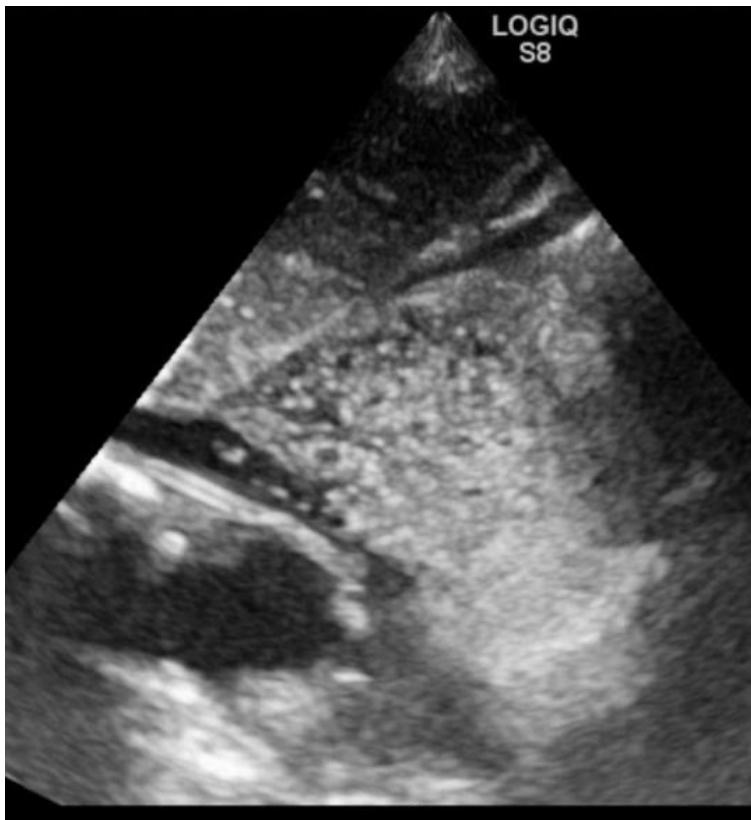
Bubble Test



Bubble Test

--

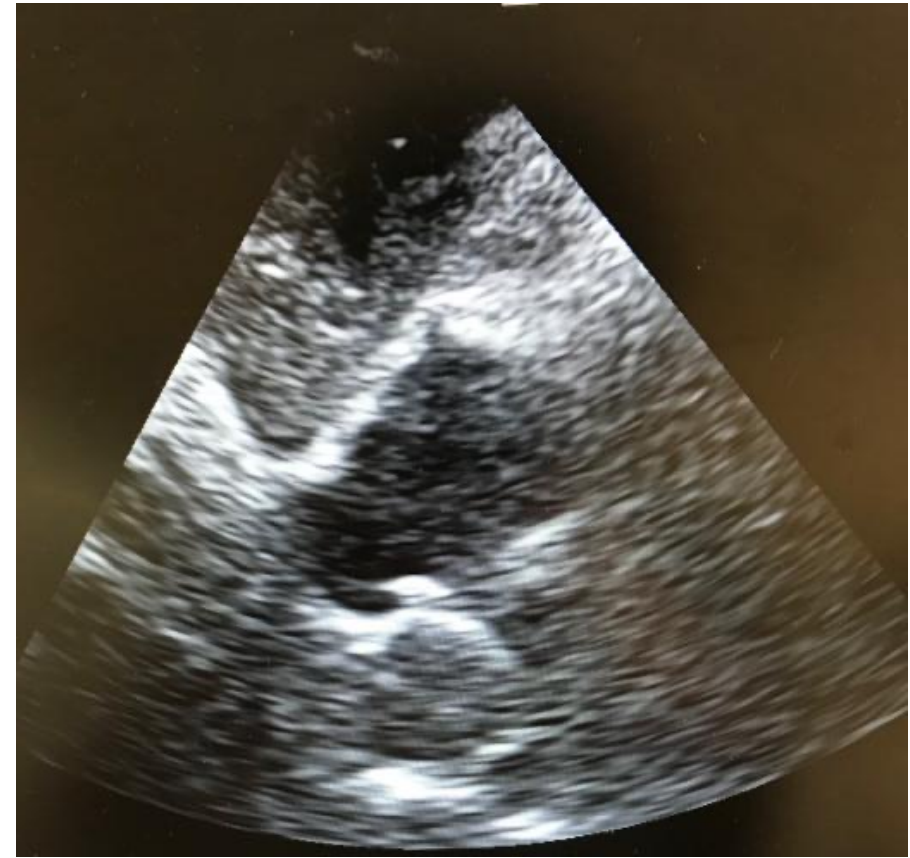
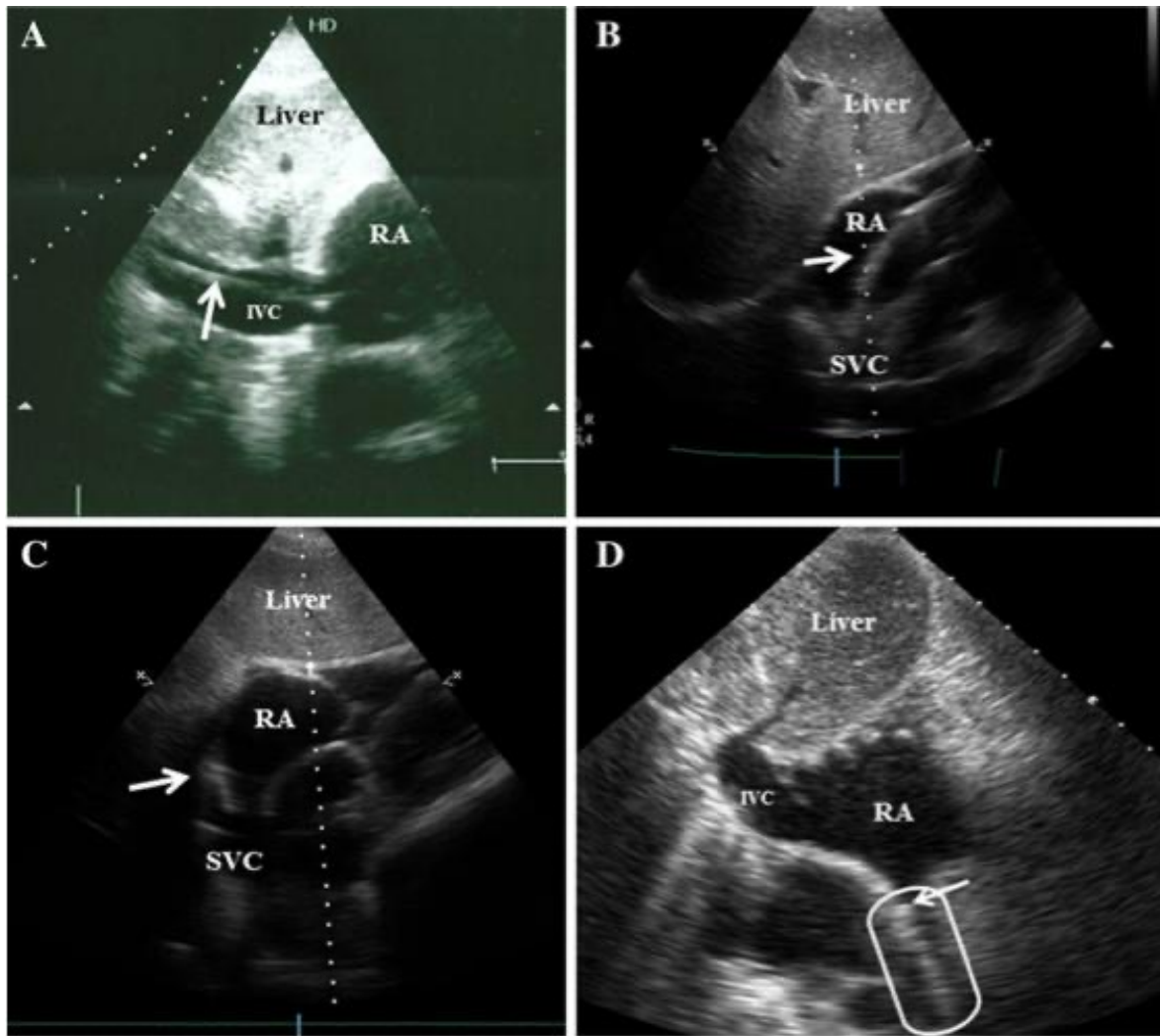
Subcostal Bicaval



Ultrasound localization of central vein catheter and detection of postprocedural pneumothorax: An alternative to chest radiography*

Antonella Vezzani, MD; Claudia Brusasco, MD; Salvatore Palermo, MD; Claudio Launo, MD; Mario Mergoni, MD; Francesco Corradi, MD, PhD

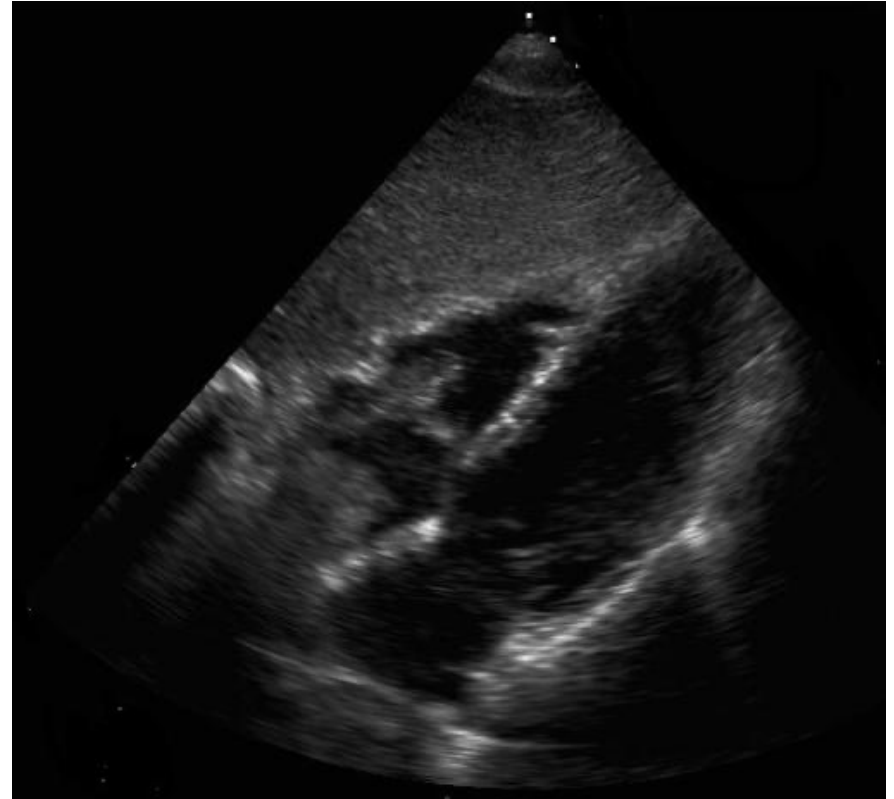
Crit Care Med 2010 Vol. 38, No. 2



Bedel et al. Intensive Care Med (2013) 39:1932–1937

Bubble Test

Apical 4 Ch



Subcostal 4 Ch

BUBBLE TEST...

Ultrasound localization of central vein catheter and detection of postprocedural pneumothorax: An alternative to chest radiography*

Antonella Vezzani, MD; Claudia Brusasco, MD; Salvatore Palermo, MD; Claudio Launo, MD;
Mario Mergoni, MD; Francesco Corradi, MD, PhD

Crit Care Med 2010; 38:533–538

Characteristics	Interpretation
No bubbles	Negative test: an aberrant or too distal tip position must be considered.
Few bubbles or appearance time > 2 secs	Test to be repeated: if confirmed, possible misplacement (probably in the SV or IJV).
Numerous bubbles indistinguishable separately turbulent flow coming from atrium within 2 secs	Negative test; intra-atrial positioning.
Numerous bubbles indistinguishable separately linear flow coming from superior vena cava within 2 secs	Positive test: CVC tip correctly placed in the SVC.

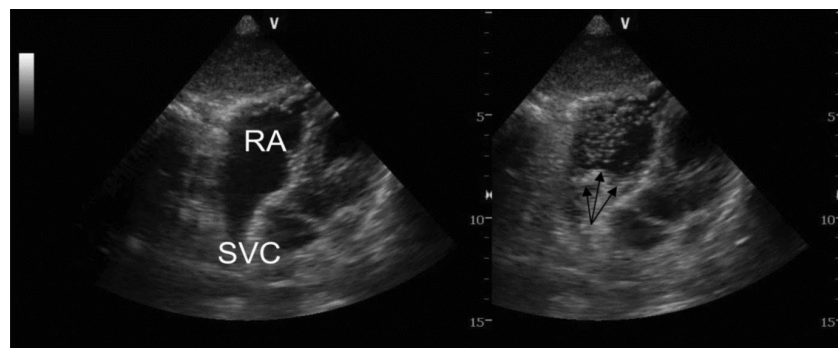
ORIGINAL RESEARCH CONTRIBUTION

Central Vascular Catheter Placement Evaluation Using Saline Flush and Bedside Echocardiography

Anthony J. Weekes, MD, David A. Johnson, MD, Stephen M. Keller, MD, Bradley Efunne, MD,
Christopher Carey, MD, Nigel L. Rozario, MS, and H. James Norton, PHD

The mean ($\pm$ SD) times of onset of turbulence for CVC tips in proximal and distal SVC zones were 1.12 ($\pm$ 0.33) and 1.10 ($\pm$ 0.30) seconds, respectively.

2014



2015

Confirmation of correct central venous catheter position in the preoperative setting by echocardiographic “bubble-test”

M. MEGGIOLARO¹, A. SCATTO¹, A. ZORZI², E. ROMAN-POGNUZ¹
A. LAURO³, C. PASSARELLA¹, G. BONACCORSO¹

sis, a cut off value of 500 ms had the highest diagnostic accuracy with a sensitivity of 100% (95% C.I. lower limit=60%) and a specificity of 99% (95% C.I. lower limit=84%) for CVC malposition. The inter-observer agreement on a cut

Transthoracic echocardiography as bedside technique to verify tip location of central venous catheters in patients with atrial arrhythmia

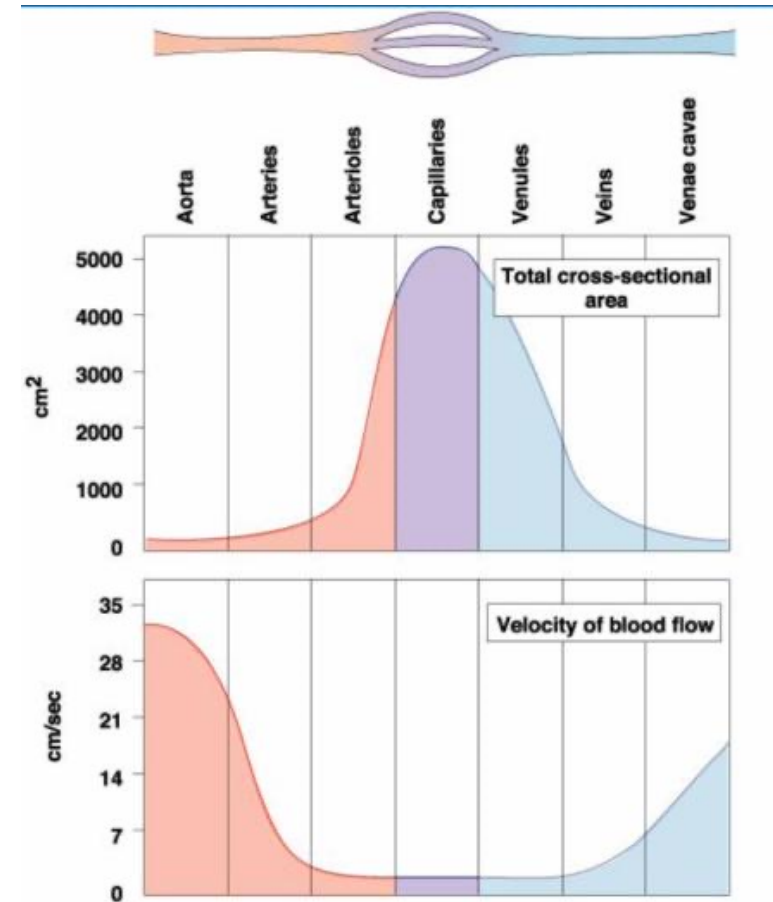
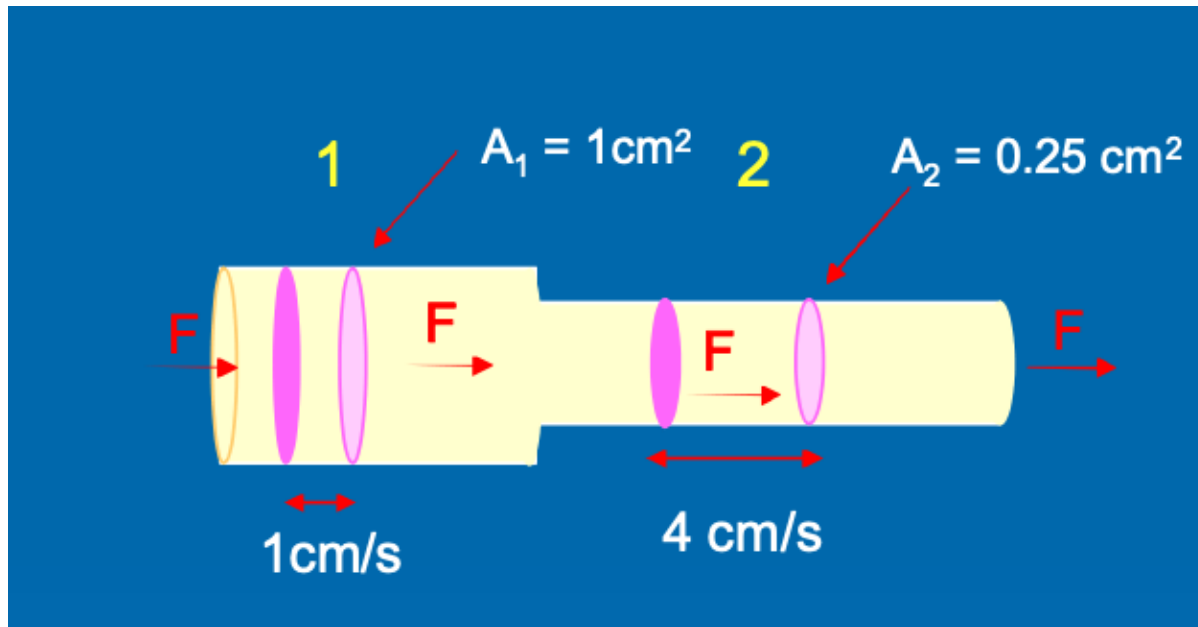
Emanuele Iacobone¹ , Daniele Elisei¹, Diego Gattari¹, Luigi Carbone¹ and Giuseppe Capozzoli²

When the tip was well positioned, the mean ($\pm$ SD) time for onset of the bubble effect was 0.89 ± 0.33 s in patients with CICC and 1.1 ± 0.20 s in those with PICC; this time difference was not statistically significant ($p > 0.05$).

Conclusion

In conclusion, TTE with bubble test is feasible, safe, and accurate in verifying bedside correct tip location at the CAJ in patients with atrial arrhythmia. When the tip is in the correct position, the appearance of bubbles in the right atrium is immediate, and the time from the injection is much fewer than 2 s. Tip location by TTE can also be applied in PICC, but further studies may be needed to confirm its use in this type of catheter.

Blood is a NON-COMPRESSIBLE & NON-NEWTONIAN fluid



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

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

The Journal of Vascular Access
1-5
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11297298221132415
journals.sagepub.com/home/jva


- ***The most accurate study
assessing bubble test in
pediatrics compared to IC-
ECG as reference standard!***

- *5 to 10 ml of “shaken” normal saline
was rapidly injected through the
catheter*
 - *5mL in children <10kg*
 - *10mL in children ≥10kg*
- *In 96 out of 96 patients micro-
bubbles appeared in the right
atrium immediately - **within 1s** -
confirming the proper location of
the tip at the CAJ*
- *A longer delay (**>1 s**) was considered
as suggestive of an inappropriate
position of the tip*



Acquiring and maintaining point-of-care ultrasound (POCUS) competence for anesthesiologists

L'acquisition et le maintien des compétences en échographie au chevet (POCUS) pour les anesthésiologistes

T. Jared McCormick, MD · Elizabeth Clarke Miller, MD · Robert Chen, MD · Viren N. Naik, MD, MEd, MBA

How to Train?

Examination	Views
Basic critical care echocardiography	Parasternal long axis
	Parasternal short axis
	Apical four-chamber view
	Sub-xiphoid four-chamber view
	Inferior vena cava-long axis
Lung and pleura	Anterior chest wall
	Anterolateral chest wall
	Posterosuperior chest wall
	Posteroinferior chest wall
Abdominal free fluid	Right upper quadrant view
	Left upper quadrant view
	Suprapubic view
Guidance for vascular access	Short axis of vessel and surrounding structures
	Long axis of vessel with guidewire <i>in situ</i>

Point-of-Care Ultrasound in General Practice: A Systematic Review

Camilla Aakjær Andersen, MD¹

Sinead Holden, PhD^{1,2,3}

Jonathan Vela, MD⁴

Michael Skovdal Rathleff, PhD⁵

Martin Bach Jensen, MD, PhD¹

¹Center for General Practice at Aalborg University, Aalborg, Denmark

²Center for Neuroplasticity and Pain (CNAP), Aalborg East, Denmark

³Center for Sensory-Motor Interaction (SMI), Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Aalborg, Denmark

⁴Department of Rheumatology, Aalborg University Hospital, Aalborg North, Denmark



ABSTRACT

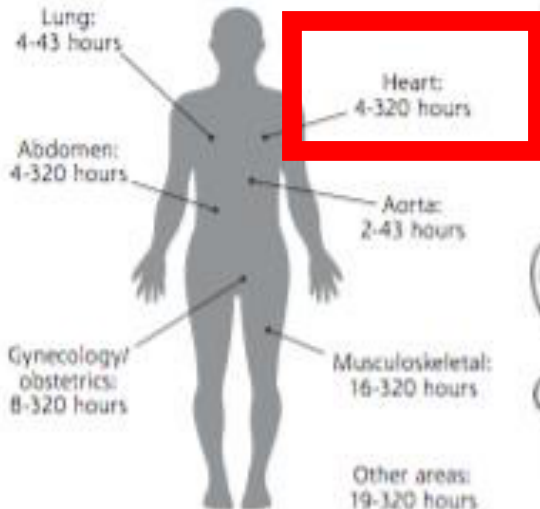
PURPOSE Ultrasound examinations are currently being implemented in general practice. This study aimed to systematically review the literature on the training in and use of point-of-care ultrasound (POCUS) by general practitioners.

METHODS We followed the Cochrane guidelines for conduct and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting. We searched the databases MEDLINE (via PubMed), EMBASE, CINAHL, Web of Science, and Cochrane Central Register of Controlled Trials using the key words *ultrasonography* and *general practice* in combination and using thesaurus terms. Two reviewers independently screened articles for inclusion, extracted data, and assessed the quality of included studies using an established checklist.

RESULTS We included in our review a total of 51 full-text articles. POCUS was applied for a variety of purposes, with the majority of scans focused on abdominal and obstetric indications. The length of training programs varied from 2 to 320 hours. Competence in some types of focused ultrasound scans could be attained with only few hours of training. Focused POCUS scans were reported to have a higher diagnostic accuracy and be associated with less harm than more comprehensive scans or screening scans. The included studies were of a low quality, however, mainly because of issues with design and reporting.

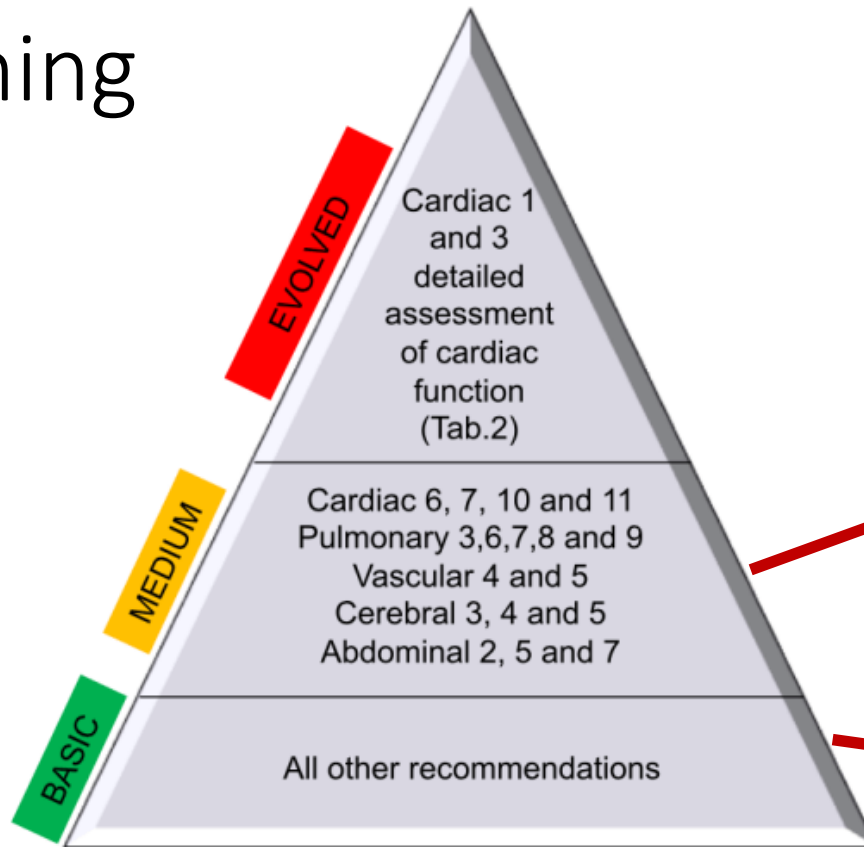
CONCLUSIONS POCUS has the potential to be an important tool for the general practitioner and may possibly reduce health care costs. Future research should aim to assess the quality of ultrasound scans in broader groups of general practitioners, further explore how these clinicians should be trained, and evaluate the clinical course of patients who undergo scanning by general practitioners.

Figure 3. Training in ultrasound examinations by anatomic area.

Training Time	Elements of Training	References
 Lung: 4-43 hours Abdomen: 4-320 hours Gynecology/obstetrics: 8-320 hours Heart: 4-320 hours Aorta: 2-43 hours Musculoskeletal: 16-320 hours Other areas: 19-320 hours	Heart Elements of training: lectures: 5 studies; hands-on: 6 studies; e-learning: 2 studies; case review: 2 studies; supervised scans: 2 studies; training in hospital: 2 studies Lung Elements of training: lectures: 2 studies; hands-on: 2 studies; e-learning: 1 study; case review: 1 study; supervised scans: 1 study; training in hospital: 1 study Aorta Elements of training: lectures: 7 studies; hands-on: 6 studies; e-learning: 3 studies; case review: 3 studies; supervised scans: 6 studies; training in hospital: 3 studies Abdomen Elements of training: lectures: 6 studies; hands-on: 6 studies; e-learning: 1 study; case review: 2 studies; supervised scans: 4 studies; training in hospital: 4 studies Gynecology/obstetrics Elements of training: lectures: 9 studies; hands-on: 9 studies; e-learning: 2 studies; case review: 3 studies; supervised scans: 7 studies; training in hospital: 8 studies Musculoskeletal Elements of training: lectures: 1 study; hands-on: 2 studies; e-learning: 1 study; case review: 1 study; training in hospital: 1 study Other areas Elements of training: e-learning: 1 study; case review: 2 studies; supervised scans: 1 study; training in hospital: 1 study	20-22, 27, 32, 39, 52, 58, 65, 67 22, 30, 32 17, 19, 20, 22, 32, 37, 51, 57, 59, 62, 63, 65 20, 25, 26, 31-33, 37, 51, 57, 62, 63, 65 20, 23, 24, 35, 36, 40, 45, 46, 49-51, 55-57, 60-62, 64 20, 24, 62 22, 24, 62

Note: Icons made by Freepik from www.flaticon.com.

ESPNIC Guidelines Training



Singh et al. *Critical Care* (2020) 24:65
<https://doi.org/10.1186/s13054-020-2787-9>

Critical Care

RESEARCH

Open Access

International evidence-based guidelines on Point of Care Ultrasound (POCUS) for critically ill neonates and children issued by the POCUS Working Group of the European Society of Paediatric and Neonatal Intensive Care (ESPNIC)



Posizionamento PICC
Tip location ecografica
Diagnosi PNX
Incannulamento arterie

Puntura ecoguidata vasi venosi
cervico-toracici e vena femorale

Singh et al. *Critical Care* (2020) 24:65
<https://doi.org/10.1186/s13054-020-2787-9>

Critical Care

Training & assessment methods

- **Observe 5** ultrasound guided procedures
- **Perform 5** ultrasound scans on patients
- Logbook that documents every procedure
- **5 supervised** ultrasound guided procedures of each type
- For each ultrasound guided vascular access procedure the practitioner should be signed off as competent for that procedure by an expert trainer using a **global rating scale** before they perform the procedure unsupervised.
- To be eligible for completion of competency-based training in both adult and pediatric US guided vascular access the practitioner should have performed **30 US guided vascular access procedures of any type in a 12 months period**

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

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

ECHOTIP... what's next?

- Large multicenter trials aimed at
 - Confirming diagnostic accuracy of each ultrasound view
 - Clarifying role and optimal cut-off time of the '**bubble test**' by assessing positive and negative predictive value for both extra- and intra-cardiac malposition
- Assessing inter- and intra- rater variability of each ultrasound view associated or not to the 'bubble test'
- **Consensus on the appropriate training** on ultrasound based tip-location

Thanks a lot

