ABBANDONARE LA RADIOLOGIA: NUOVI PROTOCOLLI PER LA TIP LOCATION DEI CICC IN TERAPIA INTENSIVA

EMANUELE IACOBONE

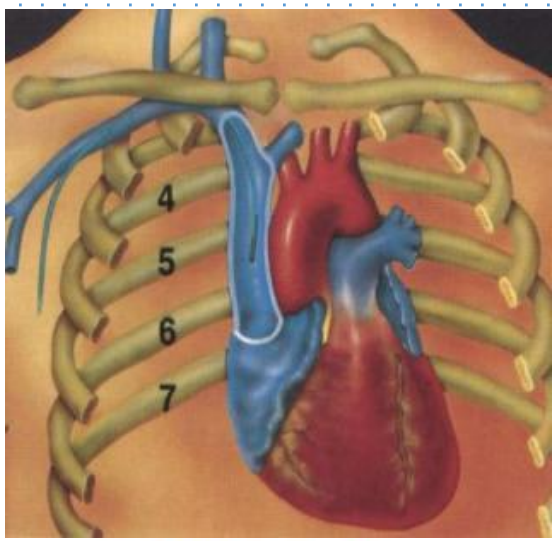
OSPEDALE DI MACERATA

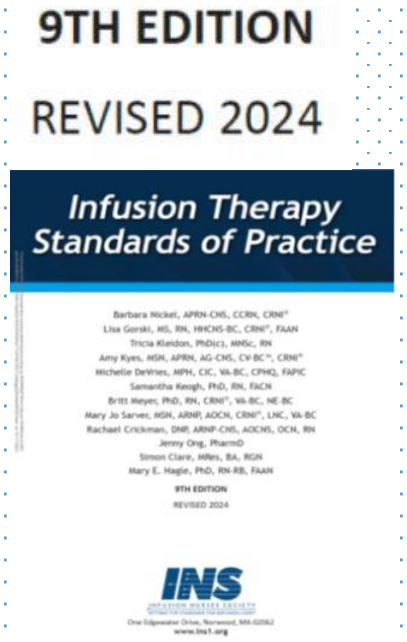
UO ANESTESIA E RIANIMAZIONE

9-10-11 dicembre | *december 9th-10th-11th*

GAVeCeLT 2024 BOLOGNA

B. Position the tip of a CVAD in the lower third of the superior vena cava (SVC) or upper third of the right atrium (RA) at or near the CAJ for adults and children.
   1. For upper body insertion sites, respiratory variation, arm movement, and changes in body position will cause the CVAD tip to move in a caudal or cephaloid direction. Tip location deeper in the right atrium near the tricuspid valve or in the right ventricle is associated with cardiac arrhythmias (refer to Standard 51, *Central Vascular Access Device Malposition*). Tip location proximal to the SVC is associated with increased risk of thrombosis (refer to Standard 51, *Central Vascular Access Device Malposition;* Standard 50, *Catheter-Associated Thrombosis).*
   2. For lower body insertion sites, position the CVAD tip in the inferior vena cava (IVC) above the level of the diaphragm.[4-6] (IV)
   3. For hemodialysis CVADs, position the CVAD tip at the mid-right atrium to avoid vessel and right atrial trauma or complications.[7] (IV)

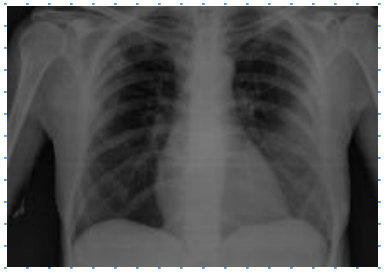




TIP NAVIGATION	
Fluoroscopia	• Meno accurate dell'ecoscopia • Costosa • Non sicura (X-ray) • Logisticamente difficile – per "bedside" CVADs (PICC and CICC)
Metodi Elettromagnetici	• Poco accurati • Costosi • Disponibili solo per alcuni cateteri
Metodi Ecografici	• Facili • Costo-efficacia • Sicuri • Accurati

TECNICHE DI TIP LOCATION

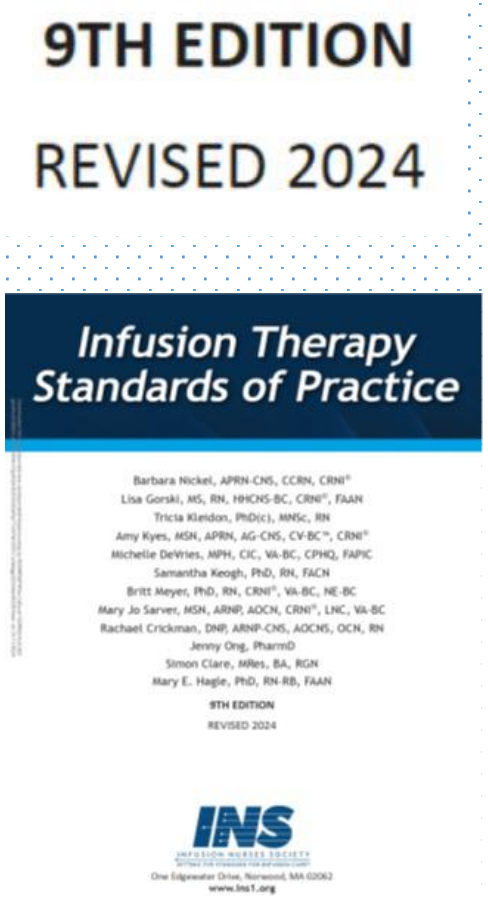
INTRAPROCEDURALI	POSTPROCEDURALI
ECG intracavitario Fluoroscopia Ecocardiografia transtoracica - transesofagea	Radiografia del torace Ecocardiografia transtoracica - transesofagea TC, RM, angiografia…..



G. Verify the CVAD tip position with ECG, ultrasound, or assessing the postprocedure chest radiograph prior to initiating infusion therapy. (Committee Consensus)

5. Postprocedure radiograph imaging is not necessary if alternative catheter tip location technology confirms appropriate tip placement.1,12-30,42,43 (I)
a. Most evidence is specific to peripherally inserted central catheter (PICC), and further research is needed to confirm applicability to other CVADs.

I. Document the time of insertion and CVAD tip location by including a copy of the ECG tracing, chest radiograph note, or other appropriate report in the patient's health record (refer to Standard 10, Documentation in the Health Record).



PROTOCOLLO ISAC 2	Verifica intra-procedurale della posizione centrale della punta (tip location) **mediante ECG intracavitario** e/o mediante **ecocardioscopia con bubble test** (secondo il protocollo ECHOTIP)
PROTOCOLLO ISP 2	Controllo della posizione centrale della punta (tip location) **mediante il metodo dell'ECG intracavitario**, nella variante modificata nel caso di pazienti in fibrillazione atriale, eventualmente corroborato dalla tip location mediante **ecocardiografia transtoracica con 'bubble test'** (secondo il protocollo ECHOTIP)
PROTOCOLLO ISF	Verifica intra-procedurale della posizione centrale della punta (tip location): se la punta è prevista in atrio destro, utilizzare **il metodo dell'ECG intracavitario e/o la ecocardioscopia con bubble test** (secondo il protocollo ECHOTIP); se la punta deve stare in vena cava inferiore, usare una stima della lunghezza mediante reperi cutanei **con ecocardioscopia intraprocedurale con bubble test** (secondo il protocollo ECHOTIP), ma prendere in considerazione **una lastra dell'addome** post-procedurale in casi selezionati
PROTOCOLLO ISP-Port	Controllo della posizione centrale della punta (tip location) **mediante il metodo dell'ECG intracavitario** - nella variante modificata nel caso di pazienti in fibrillazione atriale – eventualmente corroborato da tip location **mediante ecocardiografia transtoracica con bubble test** (secondo il protocollo ECHOTIP).
Protocollo ISALT-3	Controllo intra-procedurale della posizione della punta (tip location) **mediante ECG intracavitario** (metodo convenzionale oppure metodo modificato, in caso di fibrillazione atriale) e/o **ecocardioscopia con bubble test** (secondo il protocollo ECHOTIP).

Intensive Care Med (2012) 38:1105–1117
DOI 10.1007/s00134-012-2597-x

CONFERENCE REPORTS AND EXPERT PANEL

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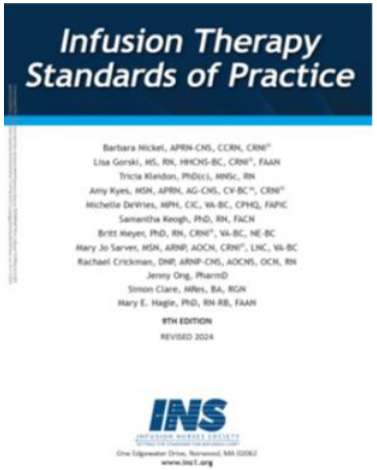
International evidence-based recommendations on ultrasound-guided vascular access

2012

WoCoVA-GAVeCeLT Consensus, Intensive Care Medicine 2012

9TH EDITION

REVISED 2024



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

2020

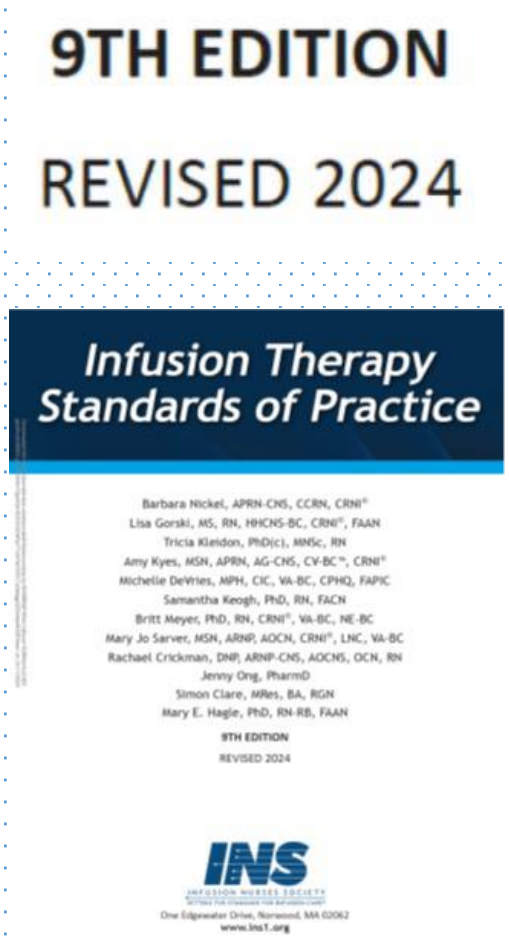
When an intracardiac electrocardiogram is not applicable, we recommend using real-time ultrasound to detect and prevent central venous catheter malposition, as it has been shown to be well tolerated, feasible, quickly performed and interpreted at bedside, and more accurate and faster than a chest radiograph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

2. Consider the use of ultrasound for CVAD tip location.

The clinical applicability of this is currently limited by the small sample sizes used to demonstrate its efficacy as a reliable and safe method to replace chest radiographs in all ages, and its usefulness is limited by the knowledge, skill, and experience of the operator.6,33-38 (III)

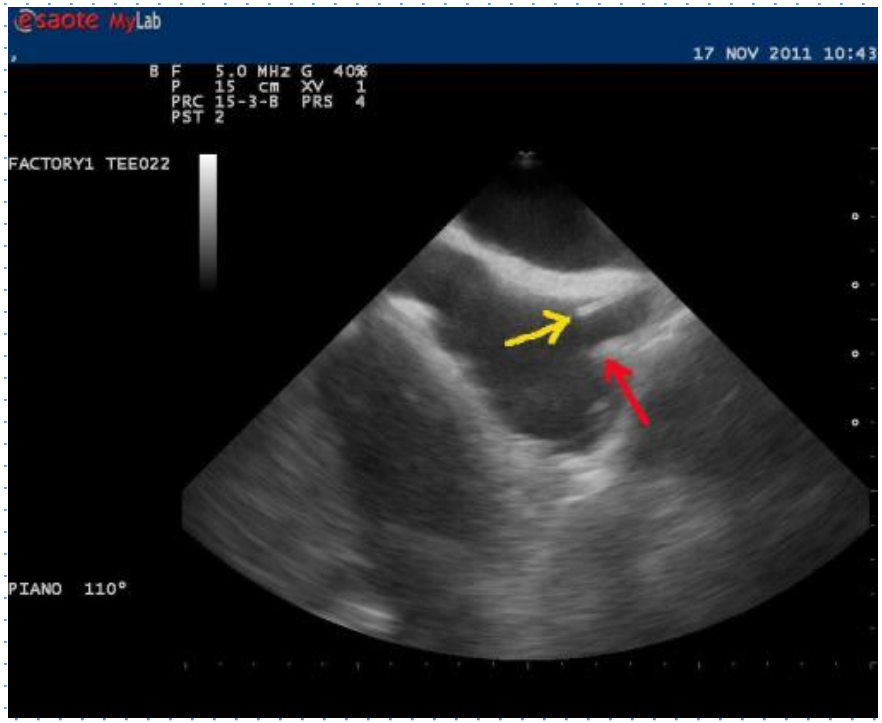
a. The addition of agitated saline to enhance transthoracic echocardiography has been shown to be effective in detecting catheter tip position in the lower third of the SVC, as well as detecting catheter malposition through delayed opacification and reduced echogenicity.6,39 (IV)

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



CRITICAL CARE

Transoesophageal echocardiographic evaluation of central venous catheter positioning using Peres' formula or a radiological landmark-based approach: a prospective randomized single-centre study†



- Gold standard per la tip location
- Invasivo
- Impossibile per la maggior parte dei pazienti
- Fattibile per i CICCs prima o durante cardiochirurgia
- Non è fattibile nei PICCs
- É necessario un training importante per gli operatori

British Journal of Anaesthesia, 118 (2): 215–22 (2017)

REVIEW Open Access

Bedside ultrasound to detect central venous catheter misplacement and associated iatrogenic complications: a systematic review and meta-analysis

2018

Table 2 Outcomes regarding feasibility, prevalence, accuracy parameters, and time to measurement of included studies

Study	Feasibility	Prevalence of pneumothorax (%)	Prevalence of malposition (%)	Specificity (95% CI)[1]	Sensitivity (95% CI)[2]	Mean time for US (min) (±SD)[4] [IQR]	Mean time for CXR performance (min) (±SD)[4] [IQR]	Mean time for CXR interpretation (min) (±SD)[4] [IQR]
All studies (2548)	96.8%	1.1%	6.8%	98.4 (97.8–99.5)	68.2 (54.4–79.4)	2.83 (95% CI: 2.77–2.89)	34.7 (95% CI: 32.6–36.7)	46.3 (95% CI: 44.4–48.2)
Supraclavicular ultrasound (76)	94.6%	–	0%	100 (94.4–100)[3]	–			
TTE and CEUS (1195)	97.7%	1.4%	6.8%	98.9 (96.1–99.7)	68.7 (61.7–96.4)			
Vascular ultrasound and TTE (729)	98.1%	0.8%	3.4%	99.0 (96.5–99.7)	96.1 (79.7–99.4)			
Vascular ultrasound, TTE and CEUS (548)	93.3%	1.4%	12.3%	98.6 (96.1–99.5)	56.2 (32.8–77.1)			

2022

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

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

JVA The Journal of Vascular Access

The aim:

- To review the evidence available in the literature about ultrasound-based tip navigation and tip location
- Novel standardized protocol for ultrasound-based tip navigation and tip location
- The best method for ultrasound visualization of the guidewire and/or catheter and/or tip

Table 1. (a) ECHOTIP protocol for CICCs.

	Probe	Technique
Tip navigation	7–12 MHz linear probe	Visualization of the cannulated vessel (wire/catheter inside the vein) Visualization of the deep vessels of neck and chest according to RaCeVA
Tip location	2–6 MHz sectorial probe As alternative option: 3–8 MHz convex probe	Immediate visualization (<1 s) of bubbles in RA after flushing First option: subcostal views (four-chamber or bi-caval) Second option: four-chamber apical view

(b) ECHOTIP protocol for PICCs.

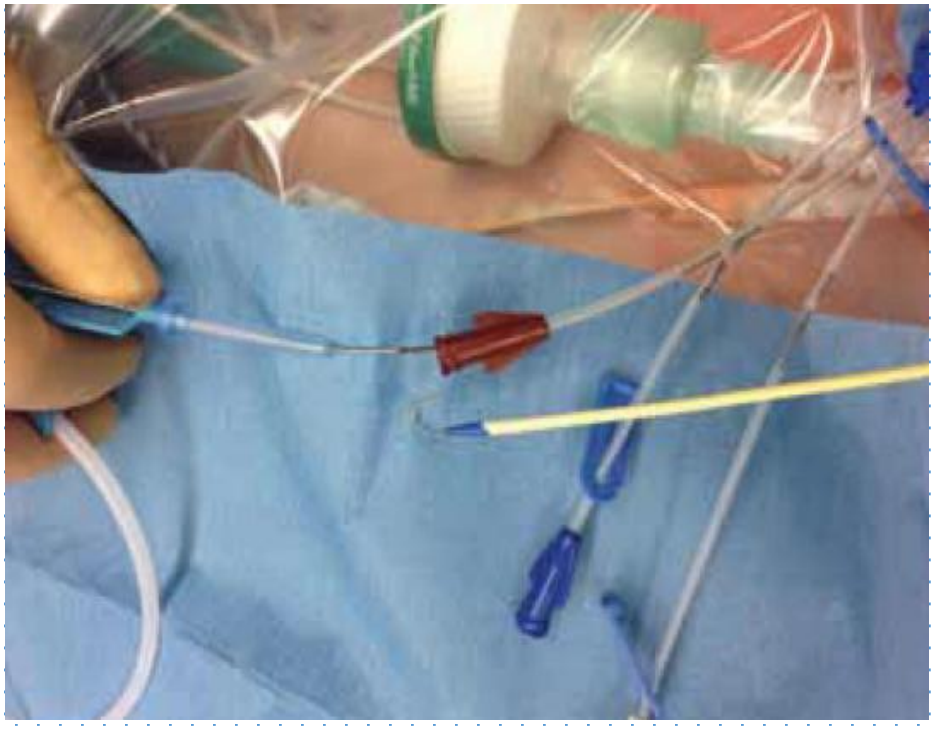
	Probe	Technique
Tip navigation	7–12 MHz linear probe	Visualization of the deep veins of the arm and of the infra/supraclavicular area according to RaPeVA and RaCeVA
Tip location	2–6 MHz sectorial probe As alternative option: 3–8 MHz convex probe	Immediate visualization (<2 s) of bubbles in RA after flushing First option: subcostal views (four-chamber or bi-caval) Second option: four-chamber apical view

(c) ECHOTIP protocol for FICCs.

	Probe	Technique
Tip navigation	7–12 MHz linear probe (femoral vein and external iliac vein) 3–8 MHz convex probe (common iliac vein and IVC)	Visualization of the deep vessels of the lower limb according to RaFeVA Visualization of IVC in short and long axis views
Tip location	2–6 MHz sectorial probe As alternative option: 3–8 MHz convex probe	Visualization of bubbles after flushing Tip in IVC: immediate visualization of bubbles in IVC Tip in RA or at the junction RA/IVC: immediate visualization of bubbles in RA

controllo della guida metallica nella vena anonima - vena cava superiore

controllo del catetere nella vena anonima – vena cava superiore



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

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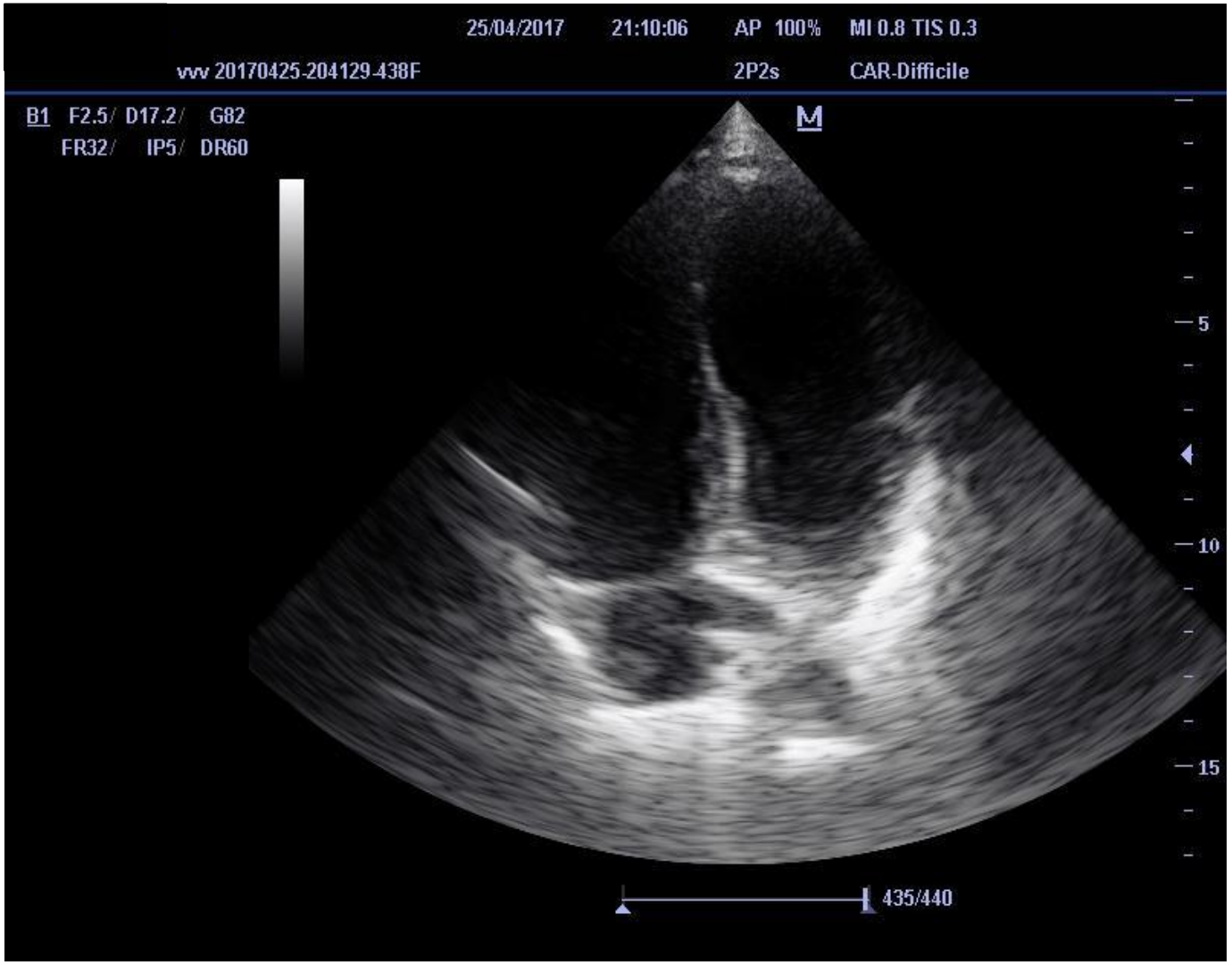
2P2s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15
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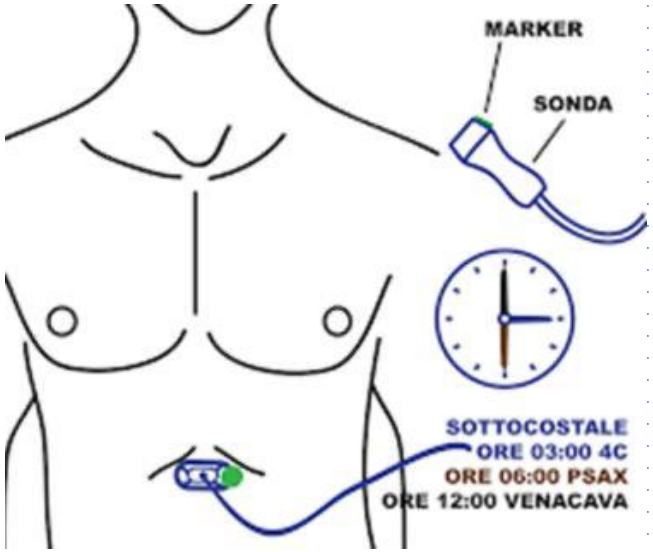
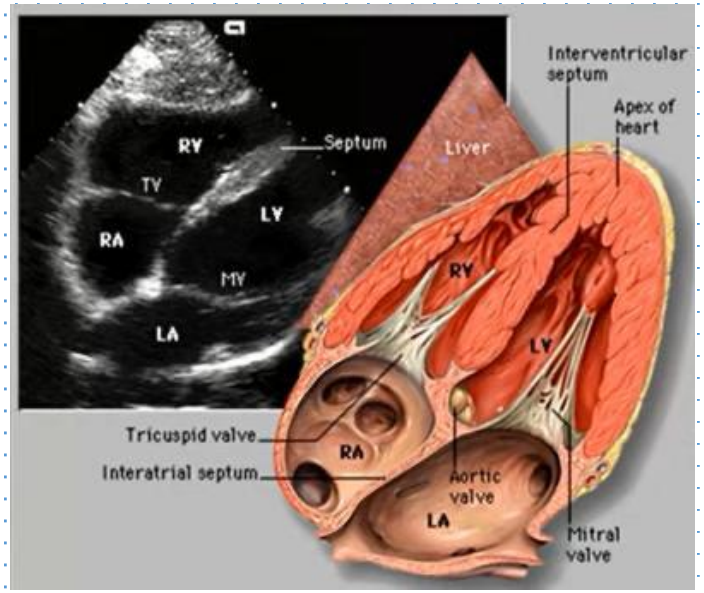
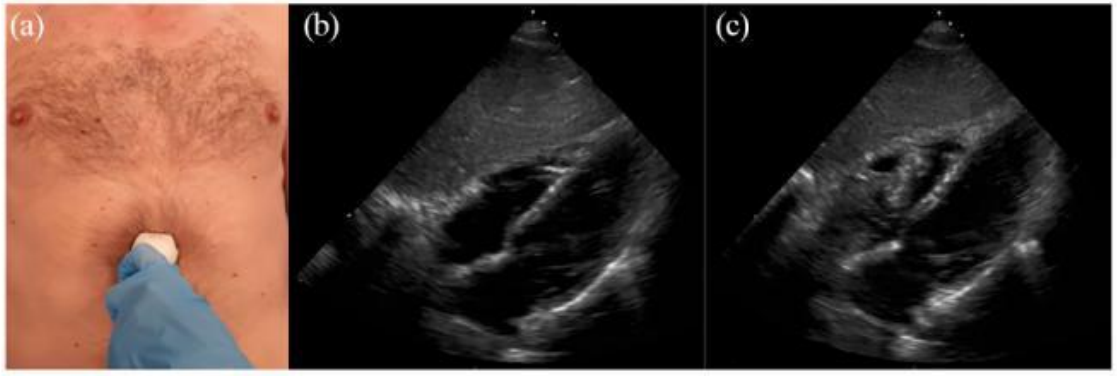
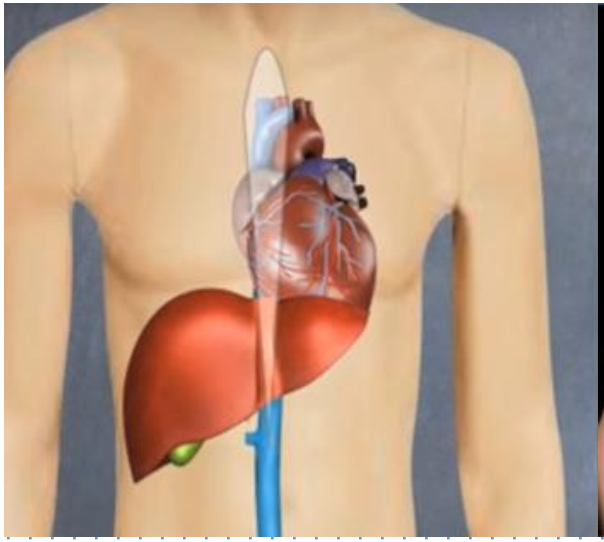
Sottocostale longitudinale 4 camere

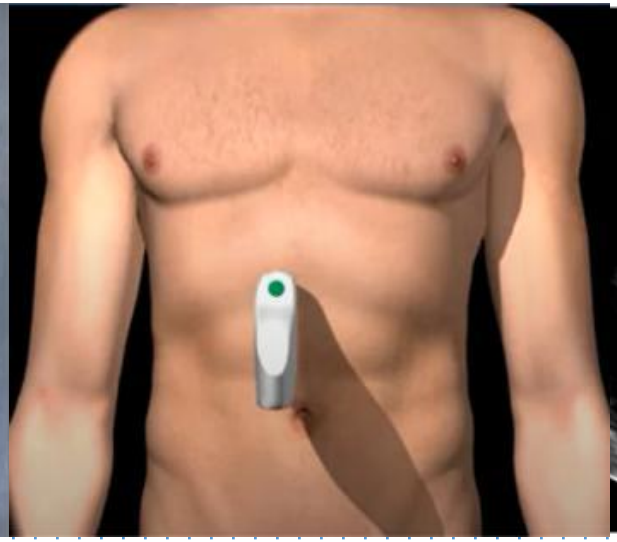


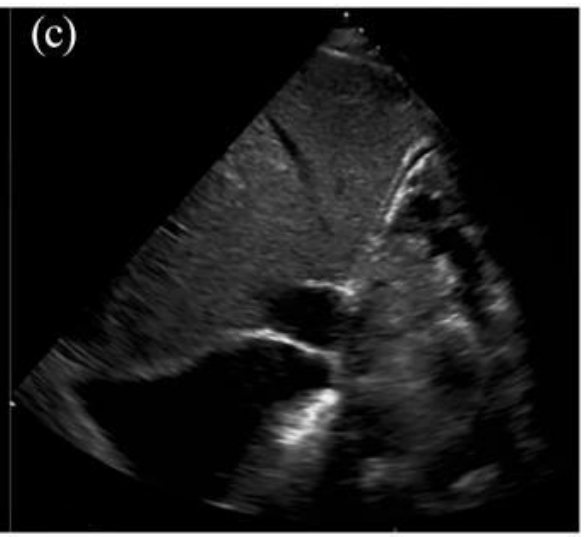




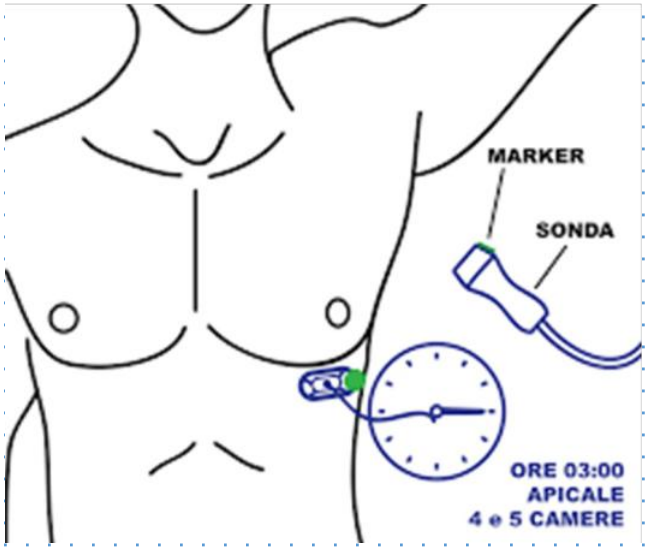
Sottocostale obliqua (Bicavale)

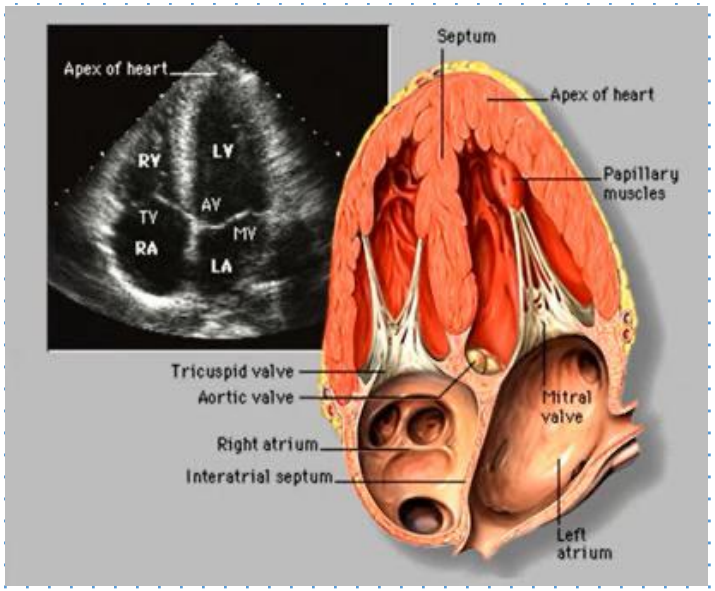




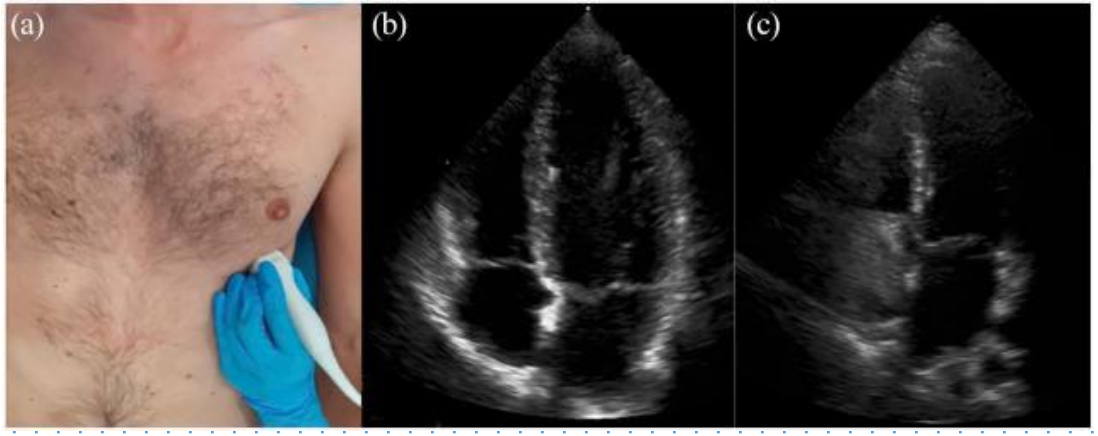


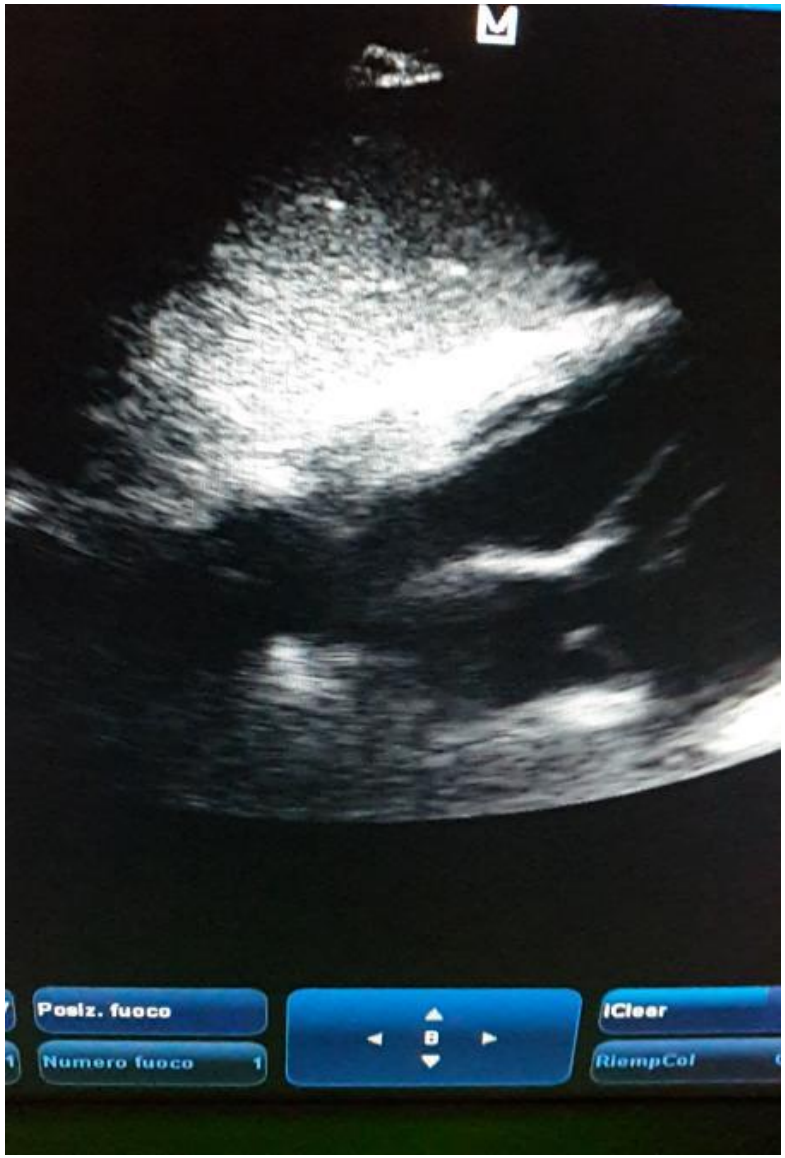
Apicale quattro camere





4°-6° spazio intercostale lungo l'emiclaveare o ascellare anteriore

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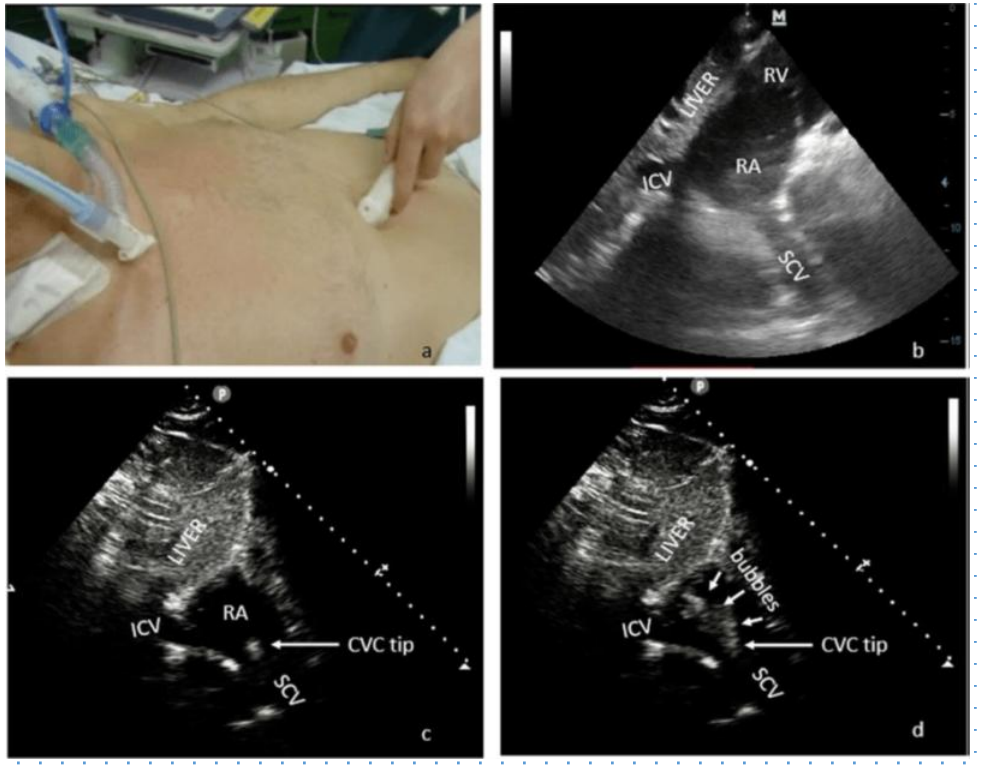
a
RV
LIVER
ICV
RA
SCV
b
LIVER
ICV
RA
CVC tip
SCV
c
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bubbles
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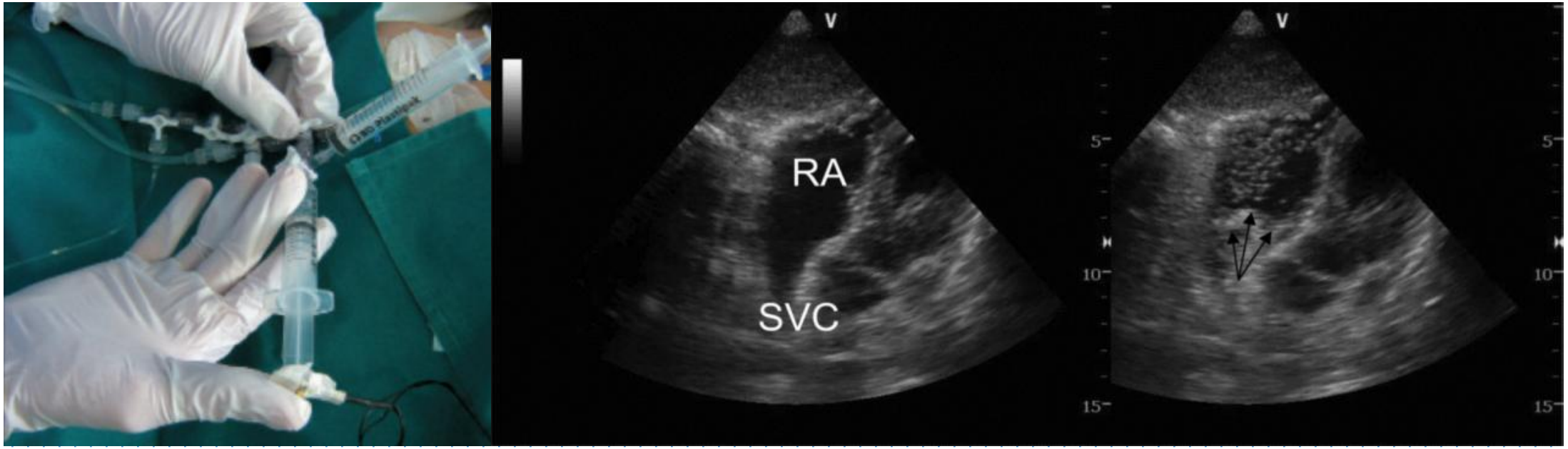
d

«BUBBLE TEST»



The rapid infusion of normal saline or of a 9:1 mixture of saline + air creates microbubbles inside the vasculature: such microbubbles act as contrast medium, and their appearance in the RA facilitates the visualization of the tip.

Dove tutto ha avuto inizio.....

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

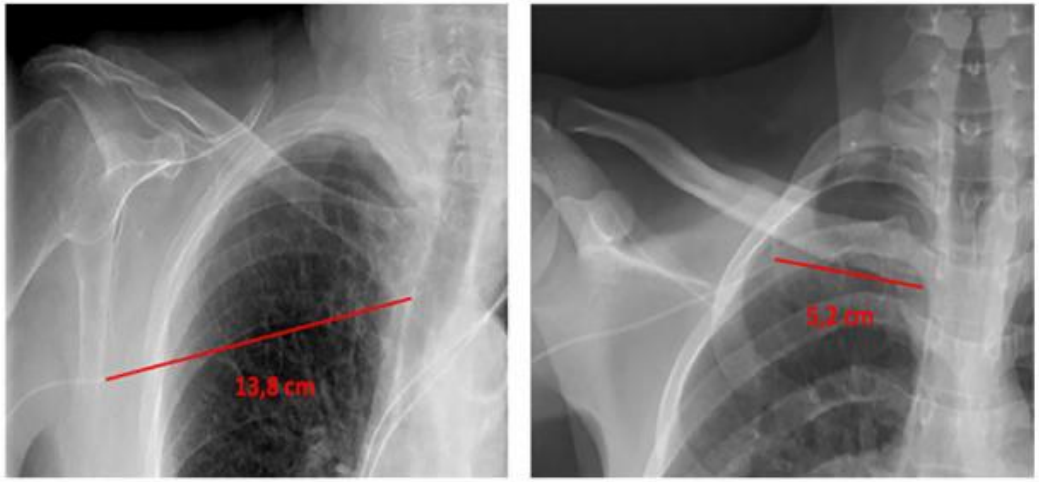
Characteristics	Interpretation
No bubbles	Negative test: an aberrant or too distal tip position must be considered.
Few bubbles or appearance time >2 secs	Test to be repeated: if confirmed, possible misplacement (probably in the SV or IJV).
Numerous bubbles indistinguishable separately turbulent flow 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.

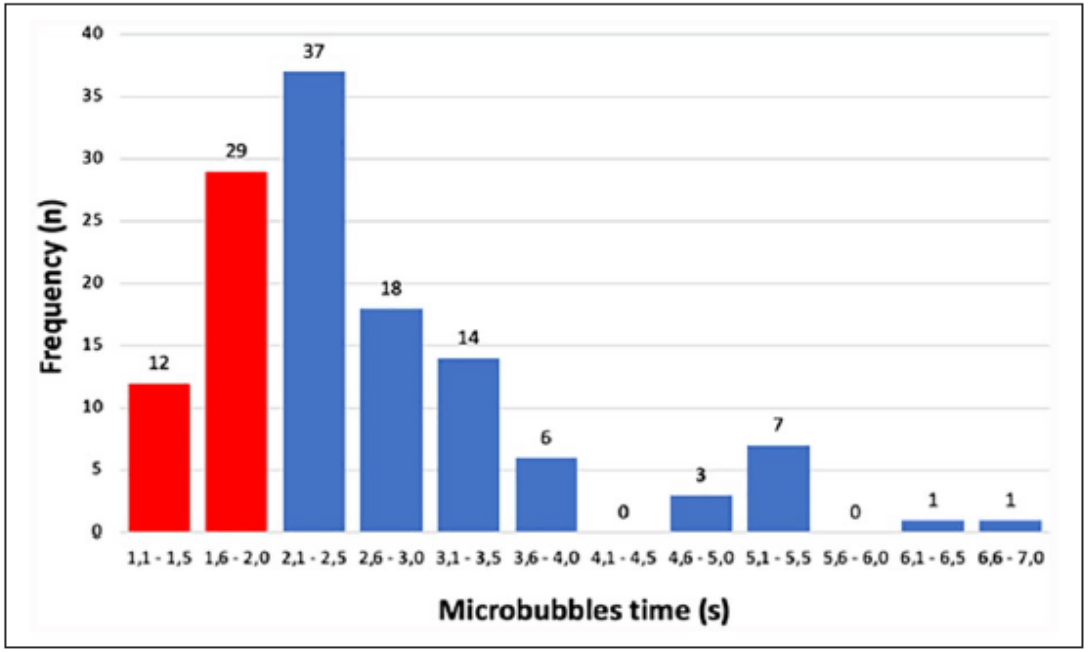
Crit Care Med 2010; 38:533–538

JVA The Journal of Vascular Access

Contrast enhanced ultrasound as a new tool to estimate the performance of midline catheters in the single patient

2021





Two seconds, originally proposed by Vezzani, is too long

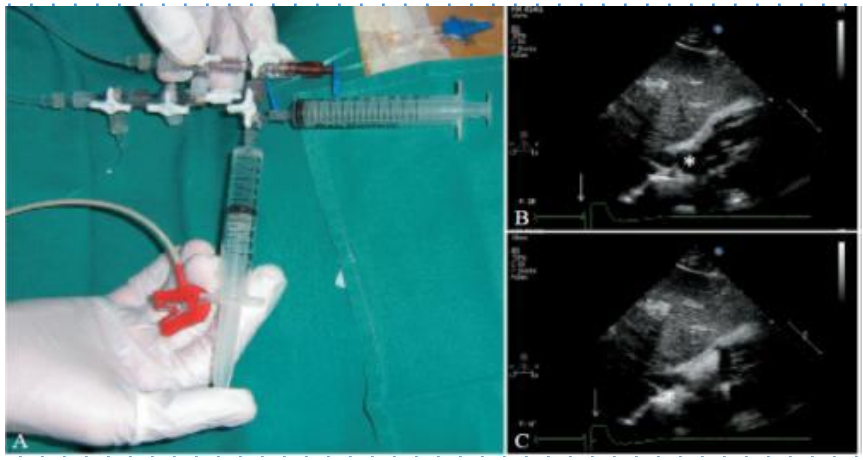
Academic Emergency Medicine
Official Journal of the Society for Academic Emergency Medicine

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 Efune, MD, Christopher Carey, MD, Nigel L. Rozario, MS, and H. James Norton, PHD

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



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

Emanuele Iacobone[1], Daniele Elisei[1], Diego Gattari[1], Luigi Carbone[1] and Giuseppe Capozzoli[2]

When the tip was well positioned, the mean (±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 ($p > 0.05$).

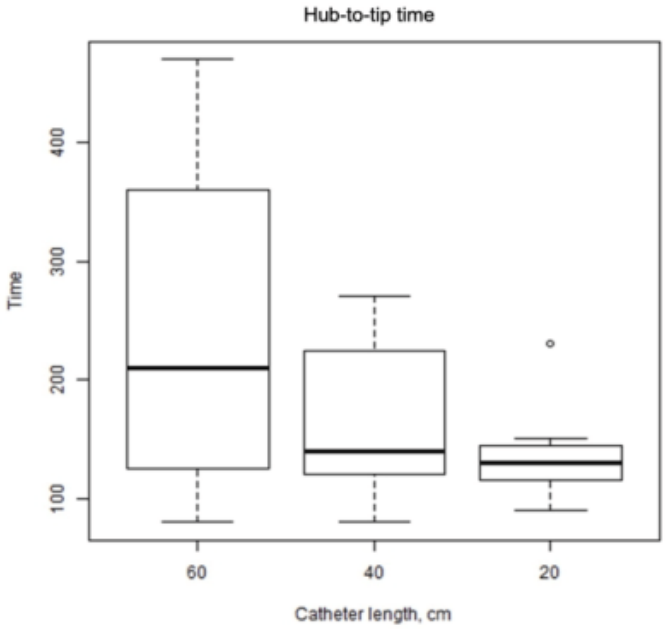
Confirmation of correct central venous catheter position in the preoperative setting by echocardiographic "bubble-test"

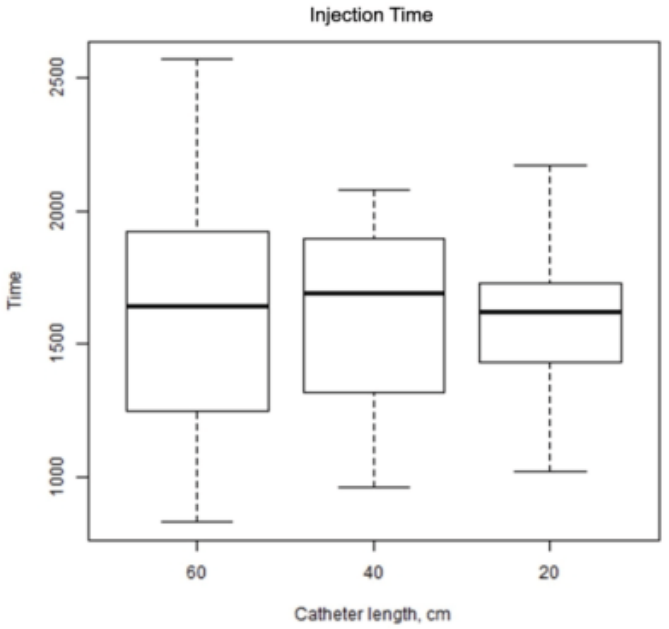
M. MEGGIOLARO [1], A. SCATTO [1], A. ZORZI [2], E. ROMAN-POGNUZ [1]
A. LAURO [3], C. PASSARELLA [1], G. BONACCORSO [1]

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 mal-position. The inter-observer agreement on a cut

JVA | The Journal of Vascular Access

2023





Techniques in vascular access

JVA | The Journal of Vascular Access

An ultrasound-based technique in the management of totally implantable venous access devices with persistent withdrawal occlusion

Sonia D'Arrigo[1], Maria Giuseppina Annetta[1] and Mauro Pittiruti[2]

The Journal of Vascular Access
1–5

DOI: 10.1177/11297298211023275
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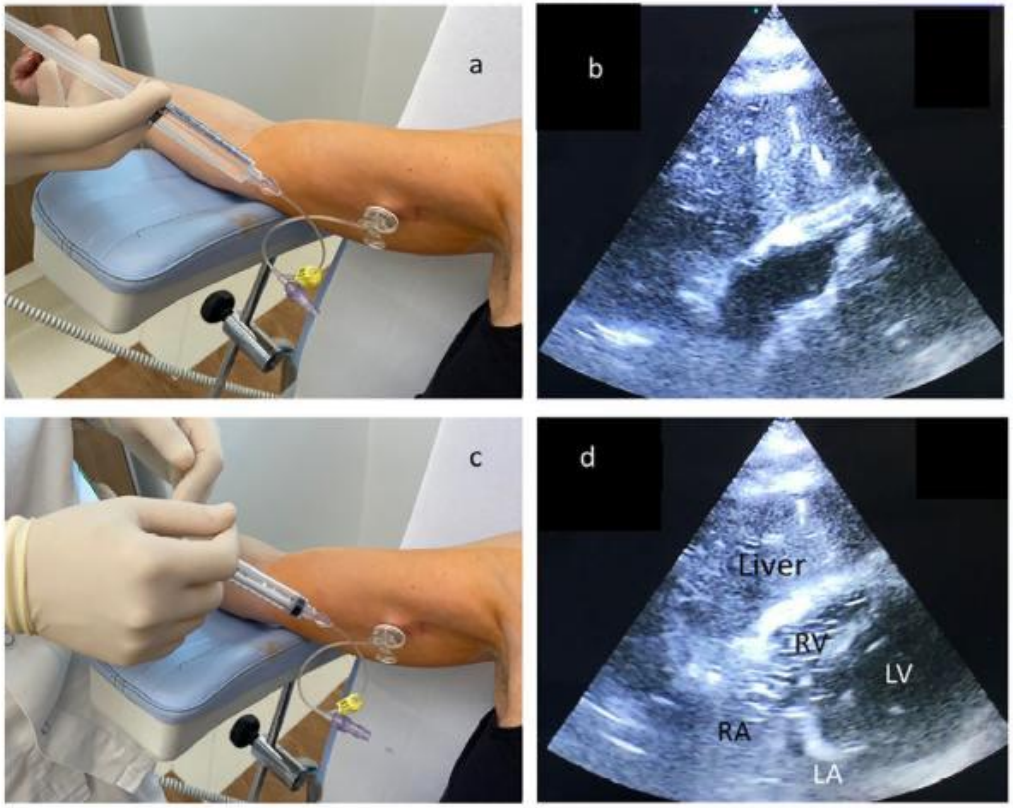

Original research article

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Pulsed-wave Doppler for ultrasound-based tip location using bubble test: A pilot study

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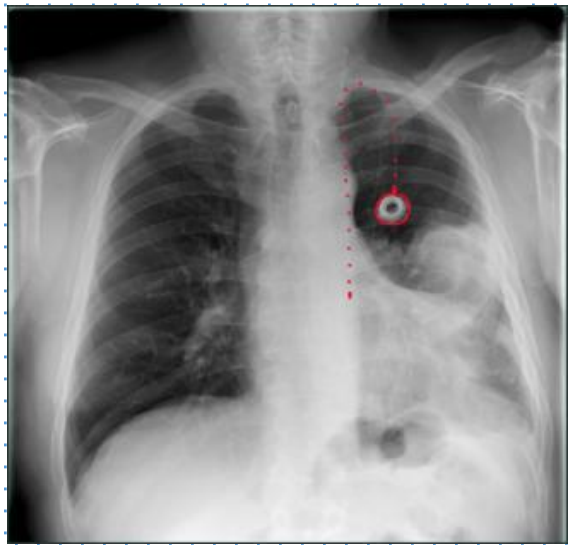
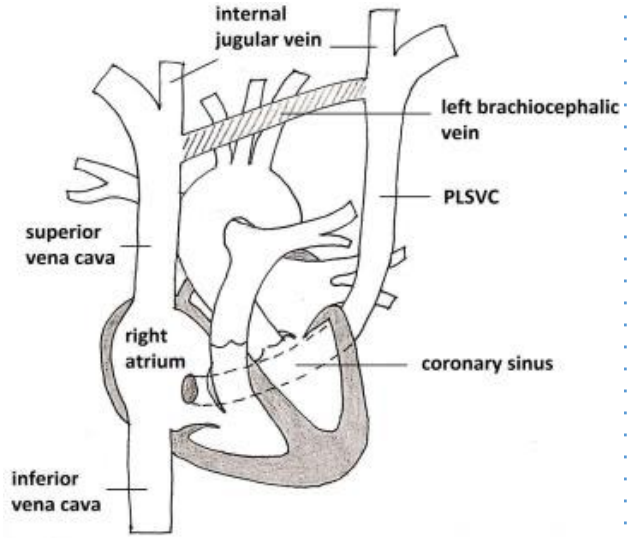
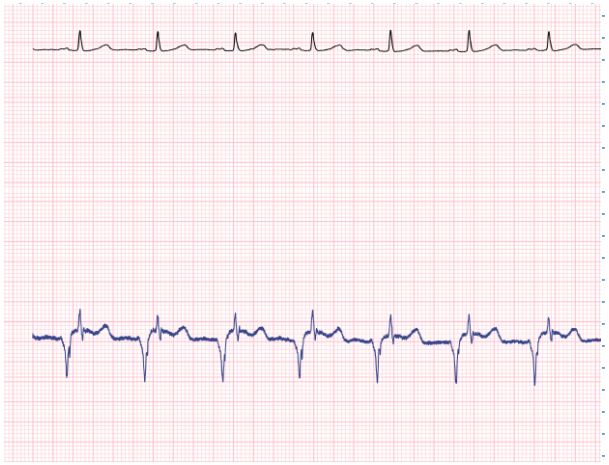
Advantages:
Visual signal of MES (microembolic signals)
Production of a typical sound due to the alternation of PW wave
It is synchronous with cardiac flow and heart rate

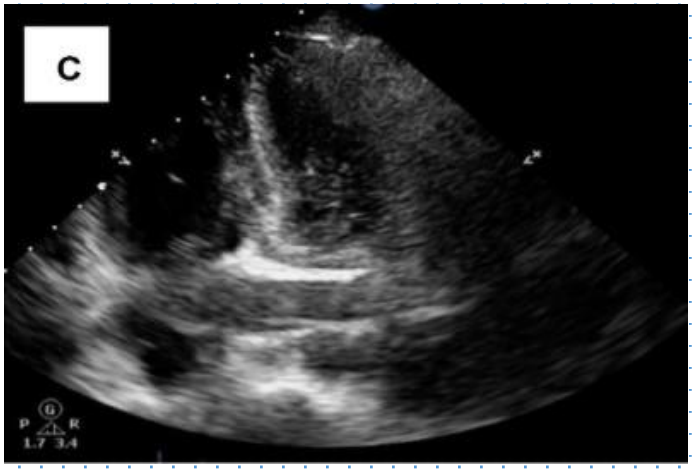
Limitations:
Single center
Small sample size (n=9)

PERSISTENT LEFT SUPERIOR VENA CAVA









Are routine chest radiographs still indicated after central line insertion? A scoping review

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Barriers identified	Percentage (95% CI)
Policy or protocol requiring radiography after line placement	17% (11.5%–21.8%)
Political forces in hospital would opposite this as I would be in minority performing the US protocol	16% (11.2%–21.4%)
I do not feel adequately comfortable with my US skills to make this call	14% (9.2%–19.4%)
Medicolegal concerns	13% (7.8%–18%)
Inertia: I don't think of it or it is just hard to change behavior and break habits	11% (5.8%–16.0%)
I lack sufficient ultrasound confidence to make this call	10% (4.8%–15.0%)
It is more convenient to get a chest radiography	7% (2.4%–12.6%)
I was not aware, or I did not appreciate that this was an option	4% (0%–9.2%)
Ultrasound is not as sensitive as chest radiography in evaluation of position or pneumothorax	2% (0%–6.8%)
No barriers, I currently use ultrasound and not chest radiography for confirmation	0% (0%–5.5%)
Lack of infrastructure to save images and report.	Unavailable
Adequate communication/documentation of good placement and exclusion of PTX	Unavailable

In this field a lot has been done, but there is still a lot that we can do……