The European Society
of Regional Anaesthesia
& Pain Therapy
ESRA ITALIA

ESRA ITALIAN CHAPTER

30° NATIONAL MEETING

13-15 NOV 2025

NAPOLI
HOTEL RAMADA

Presidents:
Giuseppe Servillo, Fabrizio Fattorini

MZ EVENTS

The ECHOTIP protocol: use of ultrasound for tip navigation and tip location during central venous access placement

Fabrizio Brescia

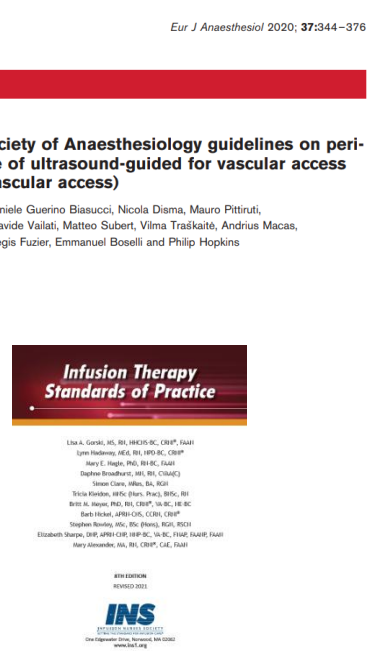
SOC Anestesia e Rianimazione

Vascular Access Team

CRO AVIANO
IRCCS CRO
Istituto di ricovero e cura a carattere scientifico "Centro di Riferimento Oncologico" di Aviano

REGIONE AUTONOMA FRIULI VENEZIA GIULIA

Global Use of Ultrasound


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

Infusion Therapy Standards of Practice

8TH EDITION
REVISED 2021

INS

Preprocedural US assessment

US Venipuncture

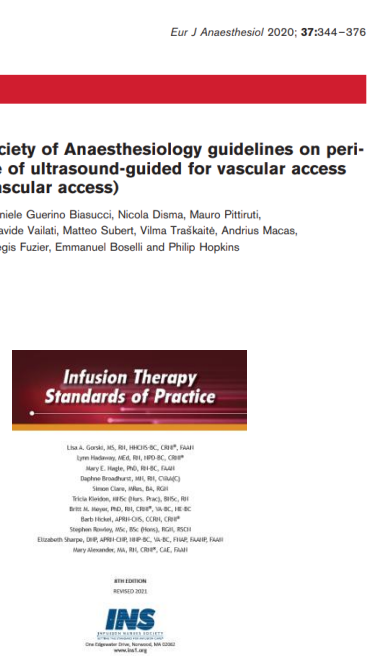
Immediate diagnosis of venipuncture complications

US Tip navigation - correct direction of the catheter

US Tip location - position of the catheter tip

Diagnosis and monitoring of late non-infectious complications

Global Use of Ultrasound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Editorial

JVA The Journal of Vascular Access

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

The Journal of Vascular Access
2023, Vol. 24(4) 535–544

DOI: 10.1177/1129729821044325
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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]

2021

Editorial

JVA The Journal of Vascular Access

Ultrasound-based tip navigation and tip location during placement of central venous access devices in adult patients: The ECHOTIP protocol revisited

The Journal of Vascular Access
1–7

DOI: 10.1177/11297298251347084
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Maria Giuseppina Annetta[1], Stefano Elli[2], Antonio Gidaro[3], Davide Giustivi[4], Emanuele Iacobone[5] and Mauro Pittiruti[6]

2025

US Tip navigation

Editorial

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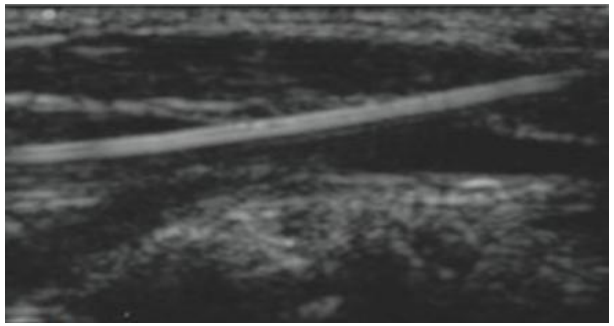
2021

1. Tip navigation: ultrasound-based visualization of the guidewire and/or of the catheter to verify the correct direction into the superior vena cava (SVC) or inferior vena cava (IVC).



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US Tip navigation

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)	Visualization of the deep vessels of the lower limb according to RaFeVA
	3–8 MHz convex probe (common iliac vein and IVC)	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

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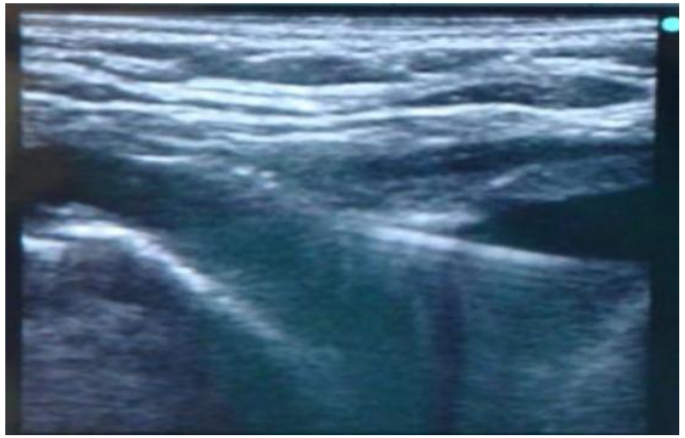
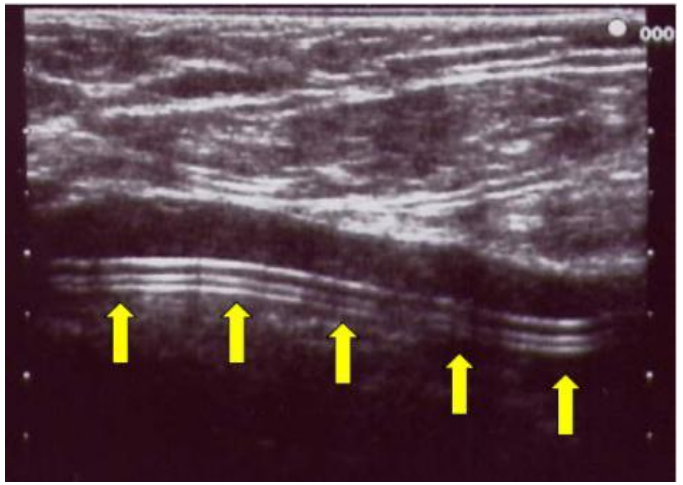
US Tip navigation

guidewire visualization



catheter visualization



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The Journal of Vascular Access
1–10
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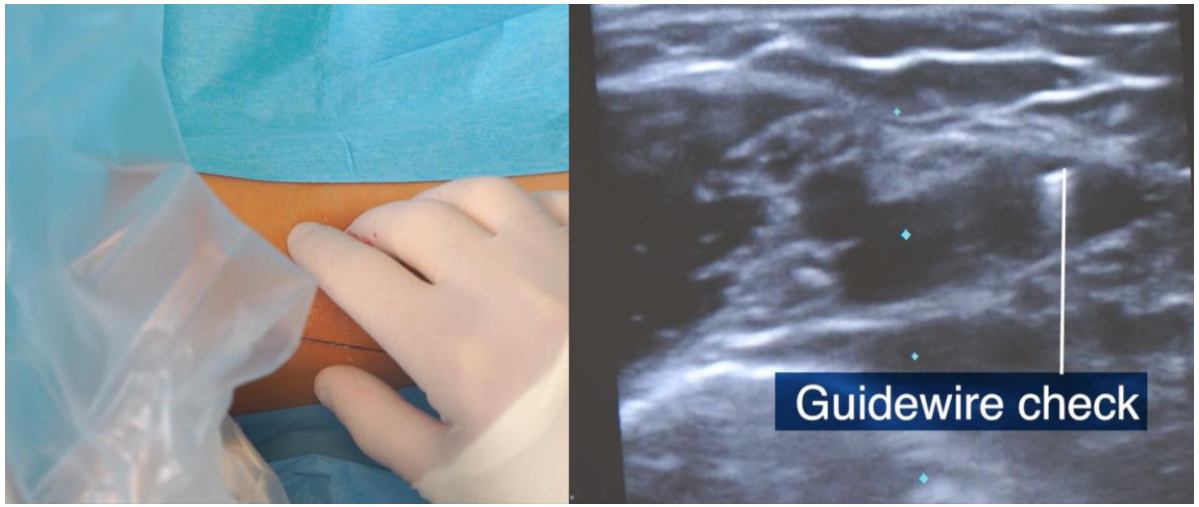
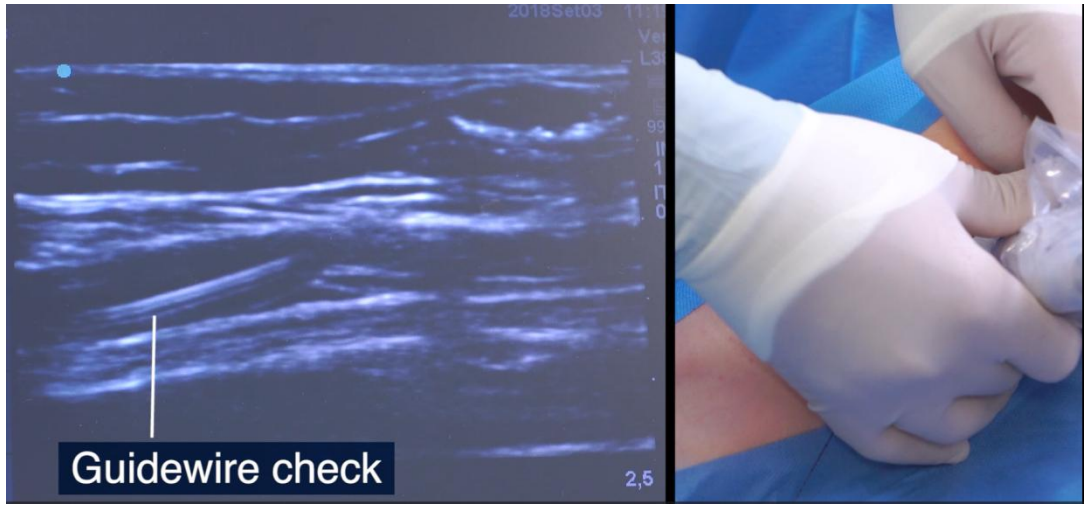
US Tip navigation guidewire visualization

Short axis



Long axis



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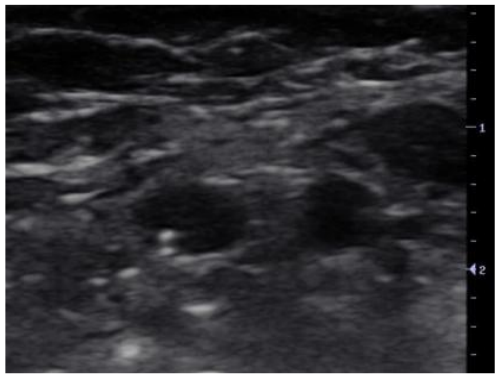
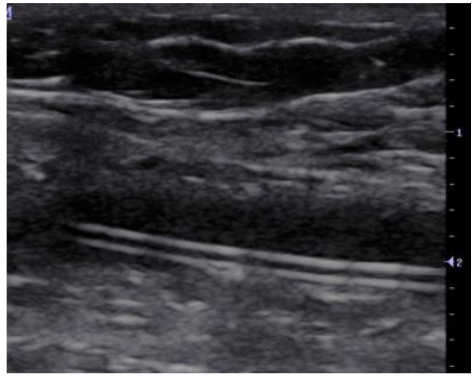
US Tip navigation Visualization of the catheter in the vein

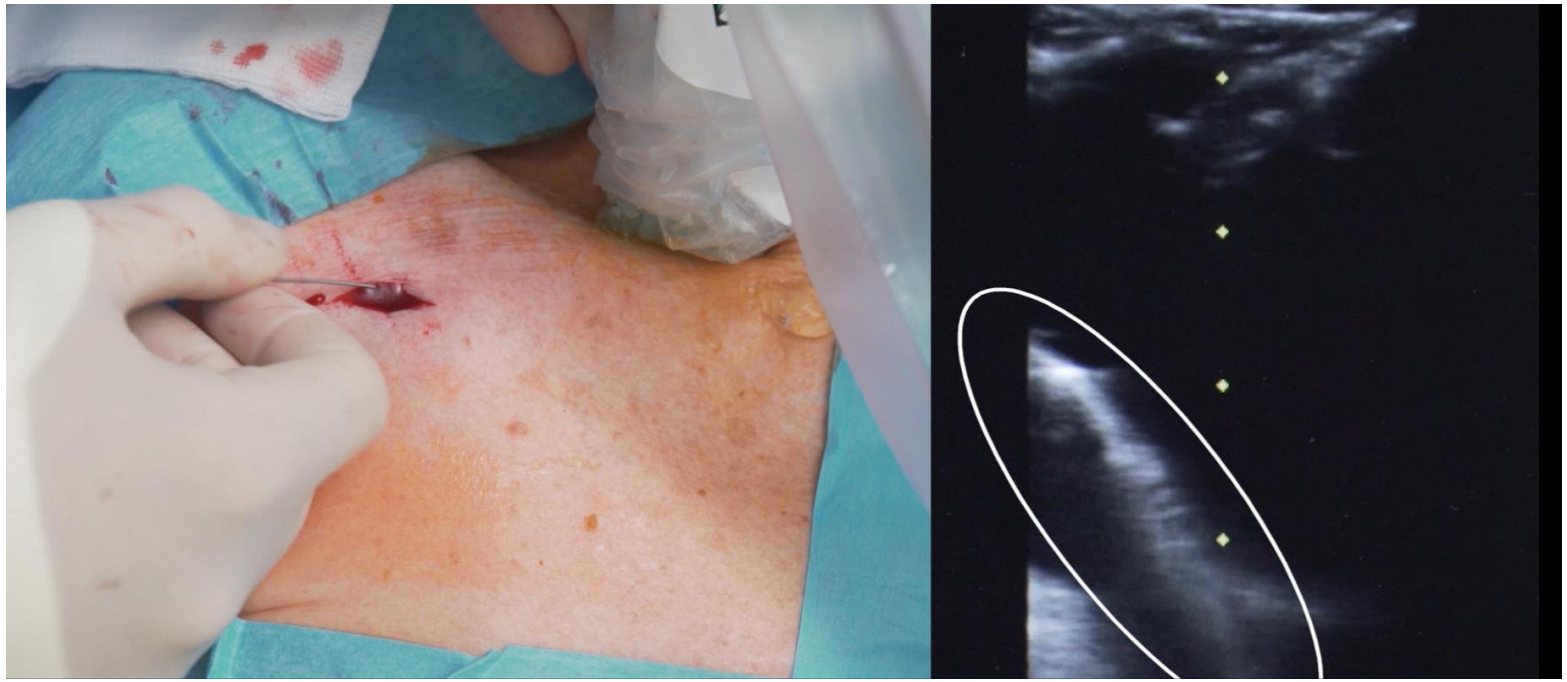
Short axis



Long axis



Visualization of the guidewire toward the brachio-cephalic vein and SVC



US Tip navigation

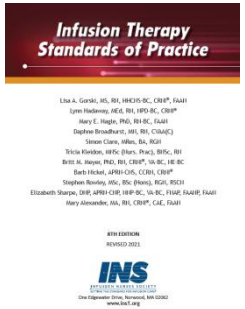
Overall feasibility 96% - Specificity 100% (no false positives)

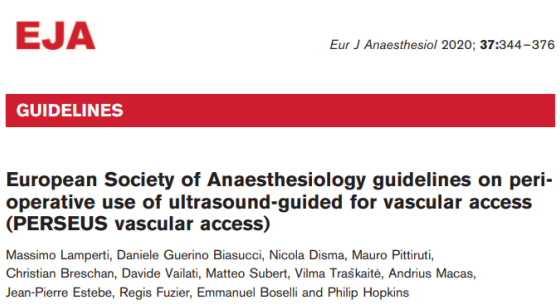
LIMITS

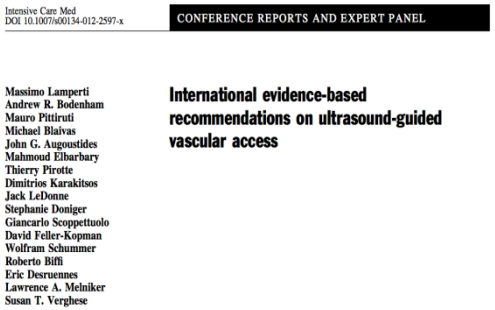
- While the guidewire can be easily visualized in SVC, the catheter is not easily identified, unless it still has the guidewire inside
- Some case of false negative has been described

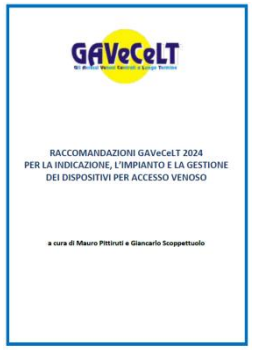
Tip location

23.3 The CVAD tip location with the greatest safety profile in adults and children is the cavoatrial junction (CAJ).



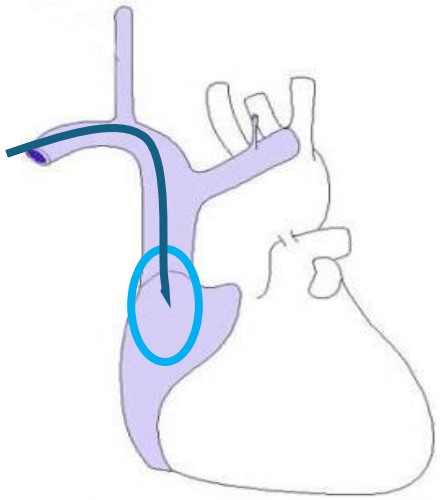


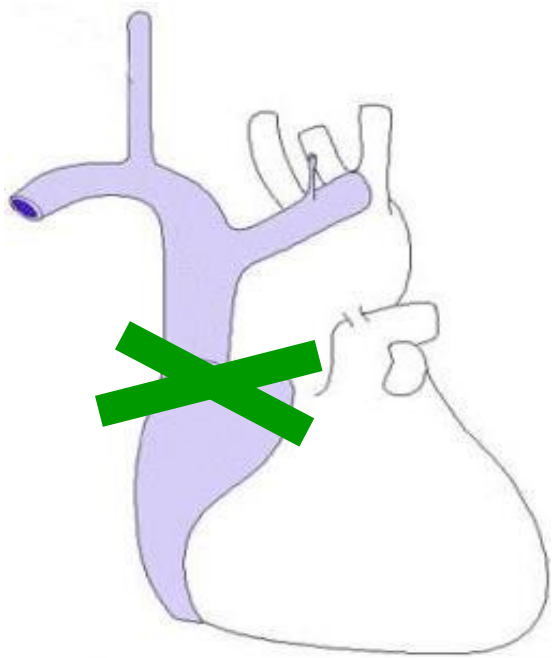




Intraprocedural verification of the correct location of the tip of the catheter

1/3 distal of the SVC
cavo-atrial junction
1/3 prox right atrium
IVC





TUTTI GLI ALTRI

Cateteri venosi PERIFERICI

Compresi cateteri negli intenti "centrali"
ma con la punta posizionata non correttamente

Se usati come "centrali"

Rischio di trombosi

Rischio di malfunzionamento

COSA POSSIAMO INFONDERE DOVE

	Via PERIFERICA	Via CENTRALE
Nutrizione parenterale	Osmolarità < 850 mOsm/l (SINPE) Osmolarità < 800 mOsm/l (ASPEN)	**Qualunque osmolarità**
Chemioterapia infusionale	Evitare TASSATIVAMENTE i vescicanti Evitare PREFERIBILMENTE tutti i CHT	**Qualunque farmaco**
Terapie varie (farmaci in bolo o infusione rapida, soluzioni cristalloidi, etc.)	pH compreso tra 5 e 9 Osmolarità < 600 mOsm/l (INS) Osmolarità < 500 mOsm/l (AVA)	**Qualunque pH**

Flusso	∅ (mm)	Flow (ml/min)
Digital / Metacarpal veins	2-5	10 – 30
Cephalic or Basilic vein	6	40
Basilic vein (upper arm)	8 -10	95
Axillary vein	16	333
Subclavian vein	19	800
Innominate (or brachio-cephalic) vein	19	800
Superior vena cava	30	2000

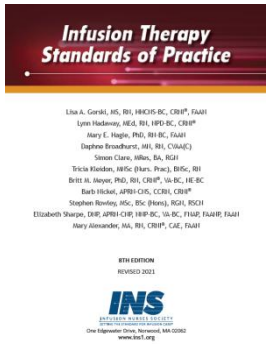
It should be noted that for **optimum flow rates**, it may be necessary to position the tip of the catheter ***at the junction*** of the right atrium and superior vena cava (SVC; ***Vesely, 2003***) to **avoid irritation/thrombus formation when the catheter tip abuts on to the vein wall** (***Fletcher & Bodenham, 2000***).

TECHNICAL REPORT INTERNATIONAL JOURNAL OF LABORATORY HEMATOLOGY

Int. Jnl. Lab. Hem. 2007, **29**, 261–278

Guidelines on the insertion and management of central venous access devices in adults

L. BISHOP*, L. DOUGHERTY†, A. BODENHAM‡, J. MANSI*, P. CROWE§, C. KIBBLER¶, M. SHANNON**, J. TRELEAVEN†



Malfunzionamento

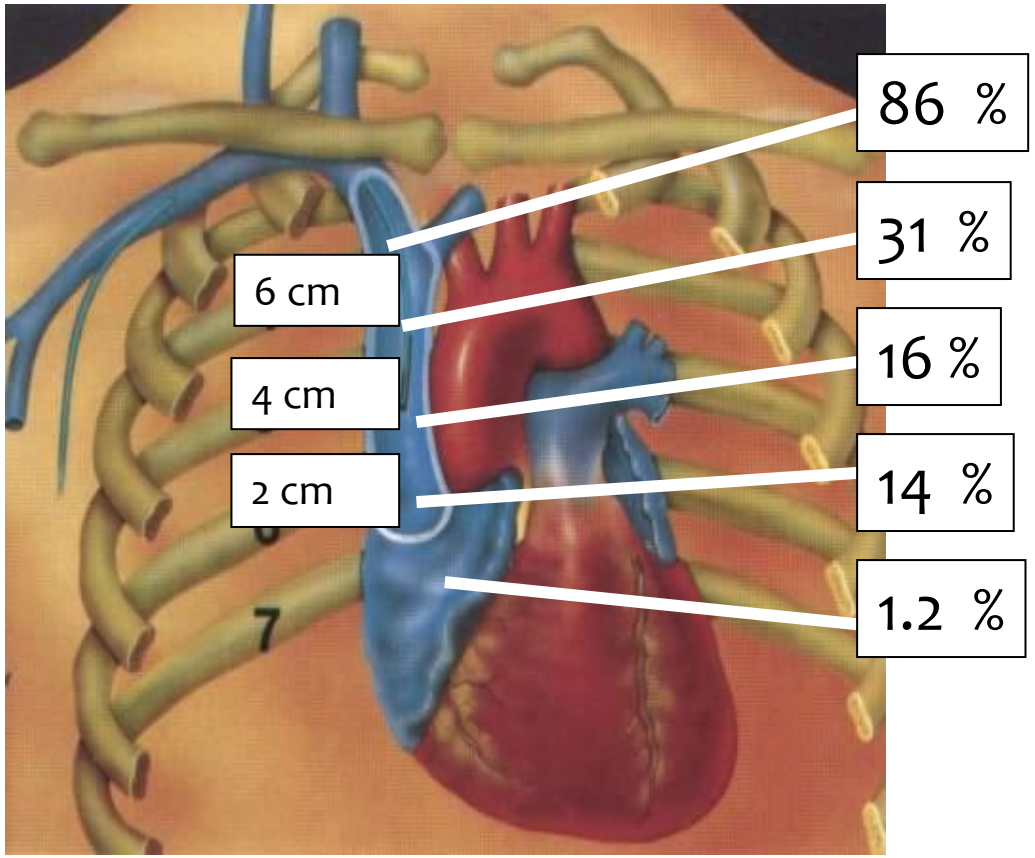
C. Avoid placing tip of the CVAD outside the SVC or IVC (eg, innominate, brachiocephalic, subclavian, external, or common iliac veins), as this is associated with higher rates of complications. In rare circumstances including anatomical or pathophysiological changes, these less-than-ideal tip positions might be clinically indicated.[5,6,11,15-21] (III)

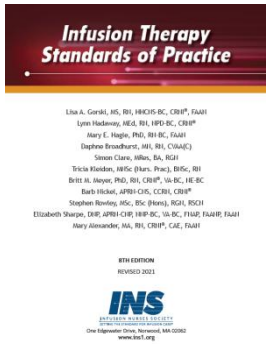
D. Avoid intracardiac tip location in neonates and infants less than 1 year of age as this tip location has been associated with vessel erosion and cardiac tamponade. This complication has been described in the literature with particular reference to the use of small-gauge catheters typically less than 3 French (Fr).[2,12,22-37] (II)

Am J Surg. 1999;178:38–41.

Silicone Venous Access Devices Positioned with Their Tips High in the Superior Vena Cava Are More Likely to Malfunction

Judy Petersen, RN, MN, AOCN, Joseph H. Delaney, MD, Mark T. Brakstad, MD, Ronald K. Rowbotham, MS, Charles M. Bagley, Jr., MD, *Seattle, Washington*





Trombosi

Support Care Cancer (2005) 13:325–331
DOI 10.1007/s00520-004-0723-1

ORIGINAL ARTICLE

Jo Caers
Christel Fontaine
Vincent Vinh-Hung
Johan De Mey
Gerrit Ponnet

Catheter tip position as a risk factor for thrombosis associated with the use of subcutaneous infusion ports

C. Avoid placing tip of the CVAD outside the SVC or IVC (eg, innominate, brachiocephalic, subclavian, external, or common iliac veins), as this is associated with higher rates of complications. In rare circumstances including anatomical or pathophysiological changes, these less-than-ideal tip positions might be clinically indicated.[5,6,11,15-21] (III)

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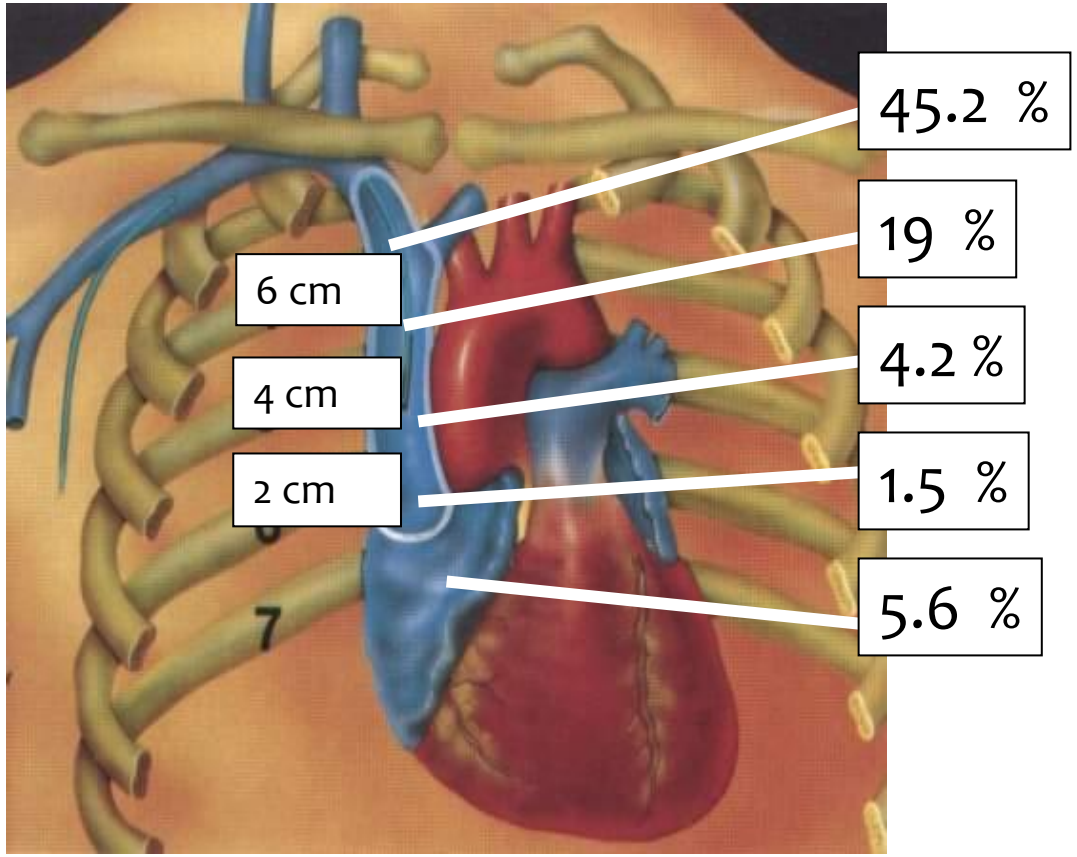

Rx torace ~~post~~ procedurale

Frequenza dei malposizionamenti primari (con verifica della posizione della punta postprocedurale): 2-30%

Verifica della posizione della punta postprocedurale = possibile necessità di riposizionamento

- Tempo
- Costi
- Danno per il paziente

JVA The Journal of Vascular Access

Editorial

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

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With this purpose in mind, the Italian Group of Long-Term Venous Access Devices (GAVeCeLT) and the Italian Vascular Access Society (IVAS) have decided to develop a joint consensus document that may assist the clinicians in the choice of the safest, most accurate, and most cost-effective method of tip location in different categories of patients requiring a CVAD.

Tip location

IVAS
ITALIAN VASCULAR ACCESS SOCIETY

GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine

Editorial

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Question #1: In which cases is intraprocedural tip location of CVADs indicated?

Background. According to the most recent guidelines,[1–3,16,20] assessment of tip location should be performed during any maneuver of central venous catheterization. The two most popular intra-procedural methods, IC-ECG and TTE, are simple and rapid enough

Tip location

to be performed in most cases—even when the central access is placed in emergency[21]—since they require just an ECG monitor with a sterile cable (IC-ECG) or a sectorial or convex ultrasound probe (TTE). Though, in conditions of extreme emergency (i.e. during resuscitation maneuvers) tip location may be impossible or difficult to perform. In such conditions, the assessment of the location of the tip of a centrally inserted central catheter (CICC) in adults or children or of an umbilical venous catheter (UVC) in neonates should be postponed. If the CVAD has been inserted in extreme urgency, without the proper strategies of infection prevention (hand hygiene, appropriate skin antisepsis, maximal barrier precautions), the post-procedural tip location may be even omitted, since the device must be removed within 24–48 h, as recommended by current guidelines.[2,3]

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Question #1: In which cases is intraprocedural tip location of CVADs indicated?

Tip location

Panel recommendation

Statement 1.1: Intraprocedural verification of tip position is always indicated: it should be performed during insertion/implantation of any CVAD, whether in neonate, child, or adult, whether in election or emergency, with the possible exception of CVADs inserted under conditions of extreme clinical emergency (e.g. UVC placement during neonatal resuscitation or CICC placement in children/adults in cardiorespiratory arrest).

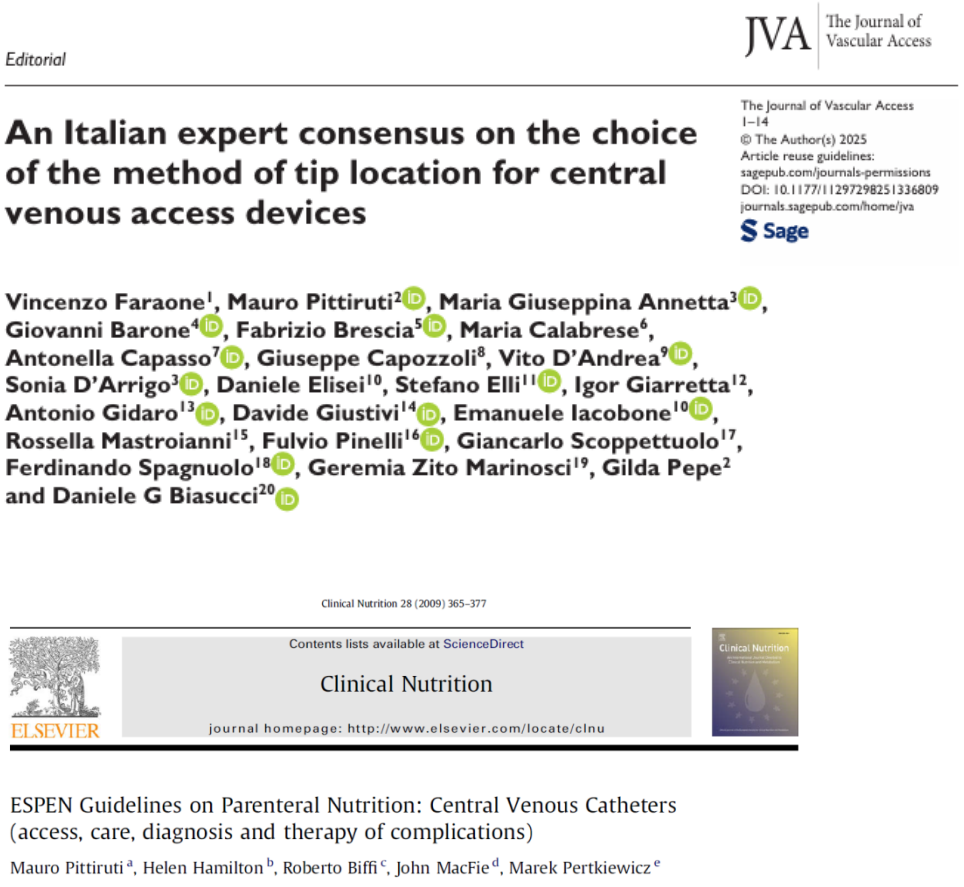
(100% agreement: 95.5% strongly agree, 4.5% agree)

Special considerations

- If insertion has occurred under conditions of extreme clinical emergency, it is best to (a) perform a post-procedural tip location as soon as allowed by the patient's condition (see below) or (b) remove the device.
- Urgent placement of a 20- to 25-cm femoral catheter in an adult patient does not necessarily involve tip location, since such a device is unlikely to reach the inferior cava and it cannot be classified as "central."

Tip location

Use methods for identifying CVAD tip location during the insertion procedure (ie, "real-time") due to greater accuracy, more rapid initiation of infusion therapy, and reduced costs.[38-47] (III)



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Vincenzo Faraone[1], Mauro Pittiruti[2], Maria Giuseppina Annetta[3], Giovanni Barone[4], Fabrizio Brescia[5], Maria Calabrese[6], Antonella Capasso[7], Giuseppe Capozzoli[8], Vito D'Andrea[9], Sonia D'Arrigo[3], Daniele Elisei[10], Stefano Elli[11], Igor Giarretta[12], Antonio Gidaro[13], Davide Giustivi[14], Emanuele Iacobone[10], Rossella Mastroianni[15], Fulvio Pinelli[16], Giancarlo Scoppettuolo[17], Ferdinando Spagnuolo[18], Geremia Zito Marinosci[19], Gilda Pepe[2] and Daniele G Biasucci[20]

Clinical Nutrition 28 (2009) 365–377

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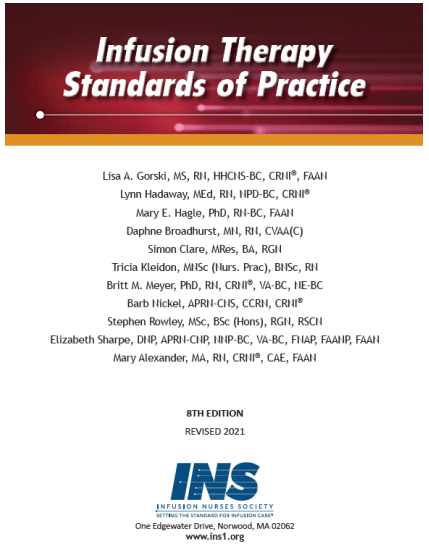
journal homepage: http://www.elsevier.com/locate/clnu

ELSEVIER

ESPEN Guidelines on Parenteral Nutrition: Central Venous Catheters (access, care, diagnosis and therapy of complications)

Mauro Pittiruti[a], Helen Hamilton[b], Roberto Biffi[c], John MacFie[d], Marek Pertkiewicz[e]



Infusion Therapy Standards of Practice

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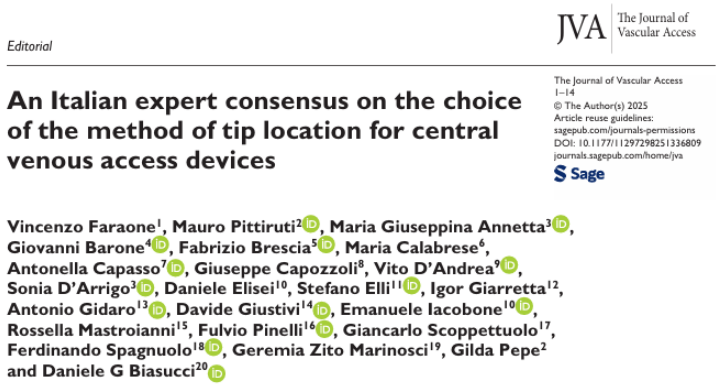

Editorial

JVA The Journal of Vascular Access

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

The Journal of Vascular Access
1–14

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Vincenzo Faraone[1], Mauro Pittiruti[2], Maria Giuseppina Annetta[3], Giovanni Barone[4], Fabrizio Brescia[5], Maria Calabrese[6], Antonella Capasso[7], Giuseppe Capozzoli[8], Vito D'Andrea[9], Sonia D'Arrigo[3], Daniele Elisei[10], Stefano Elli[11], Igor Giarretta[12], Antonio Gidaro[13], Davide Giustivi[14], Emanuele Iacobone[10], Rossella Mastroianni[15], Fulvio Pinelli[16], Giancarlo Scoppettuolo[17], Ferdinando Spagnuolo[18], Geremia Zito Marinosci[19], Gilda Pepe[2] and Daniele G Biasucci[20]

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Tip location

- Fluoroscopy
- Intracavitary electrocardiography
- Trans-thoracic echocardiography
- Trans-esophageal echocardiography

Tip location

Fluoroscopy

fluoroscopy is a very old method of tip location with no clinical advantage and many disadvantages[1–4,14,15]: it is inaccurate (since it is based on radiological landmarks), expensive (since it requires expensive equipment and dedicated environment), and unsafe (since it implies x-ray exposure of both the patient and the clinician); though, it is still adopted by some centers for insertion of CVADs such as chest-port and dialysis catheters.

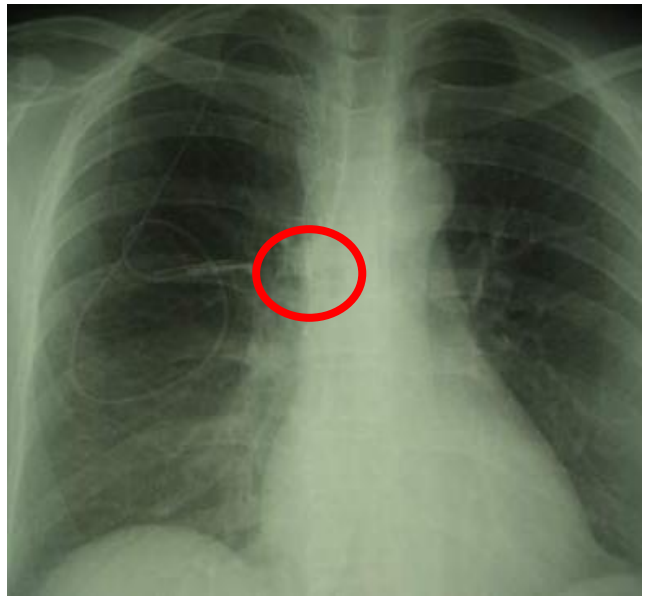
Right atrium?

Azygos vein

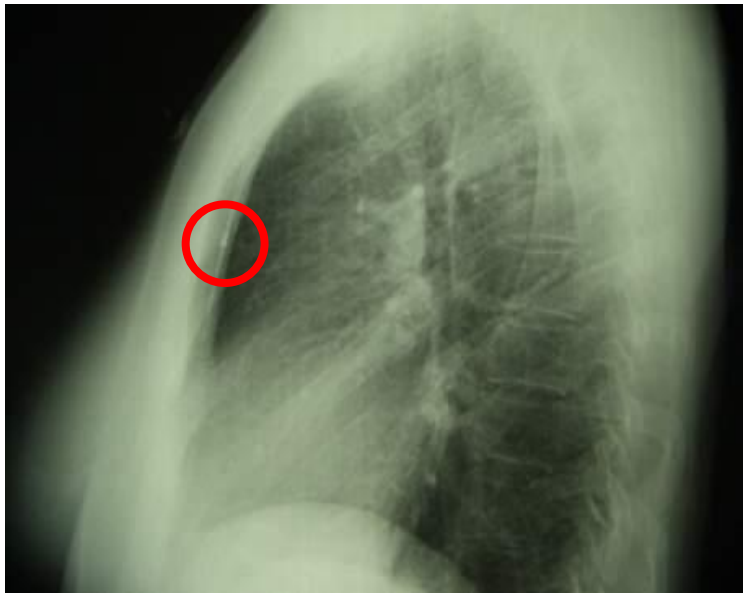
Tip location

Fluoroscopy

Accuracy of radiological landmarks



Superior Vena cava ?



Internal mammary vein

Tip location

Fluoroscopy

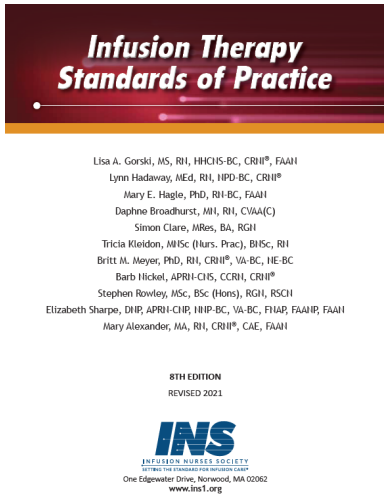
Accuracy of radiological landmarks

Tip location

Intracavitary ECG

E. Use methods for identifying CVAD tip location during the insertion procedure (ie, "real-time") due to greater accuracy, more rapid initiation of infusion therapy, and reduced costs.[38-47] (III)

1. Use electrocardiogram (ECG) methods with either a metal guidewire or a column of normal saline inside the catheter lumen and observe the ECG tracing to place the CVAD tip at the CAJ. Follow manufacturers' directions for use with other ECG-based technology using a changing light pattern to detect tip location.[1,2,4,11,23,24,26,27,43,44,48-61] (II)



Review

JVA The Journal of Vascular Access

Intracavitary electrocardiography for tip location during central venous catheterization: A narrative review of 70 years of clinical studies

The Journal of Vascular Access
1–8

DOI: 10.1177/1129729820929835
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Mauro Pittiruti[1], Filippo Pelagatti[2] and Fulvio Pinelli[3]

Hellerstein HK, Pritchard WH and Lewis RL. Recording of intracavity potentials through a single lumen, saline filled cardiac catheter.
Proc Soc Exp Biol Med ***1949****; 71(1):58–60.*

Original research article

JVA The Journal of Vascular Access

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2020, Vol. 21(6) 861–867

DOI: 10.1177/1129729820905200
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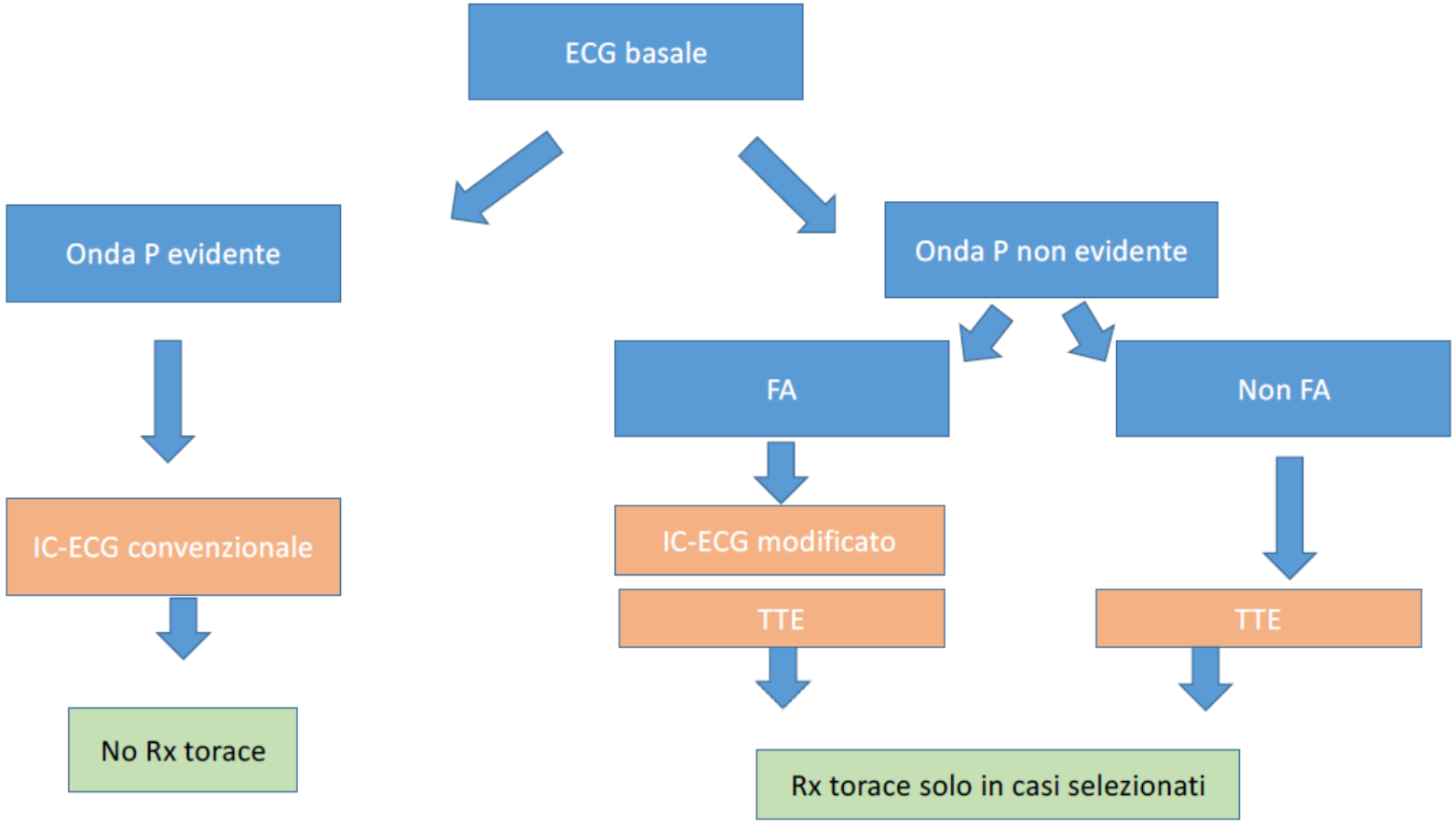
Transthoracic echocardiography as bedside technique to verify tip location of central venous catheters in patients with atrial arrhythmia

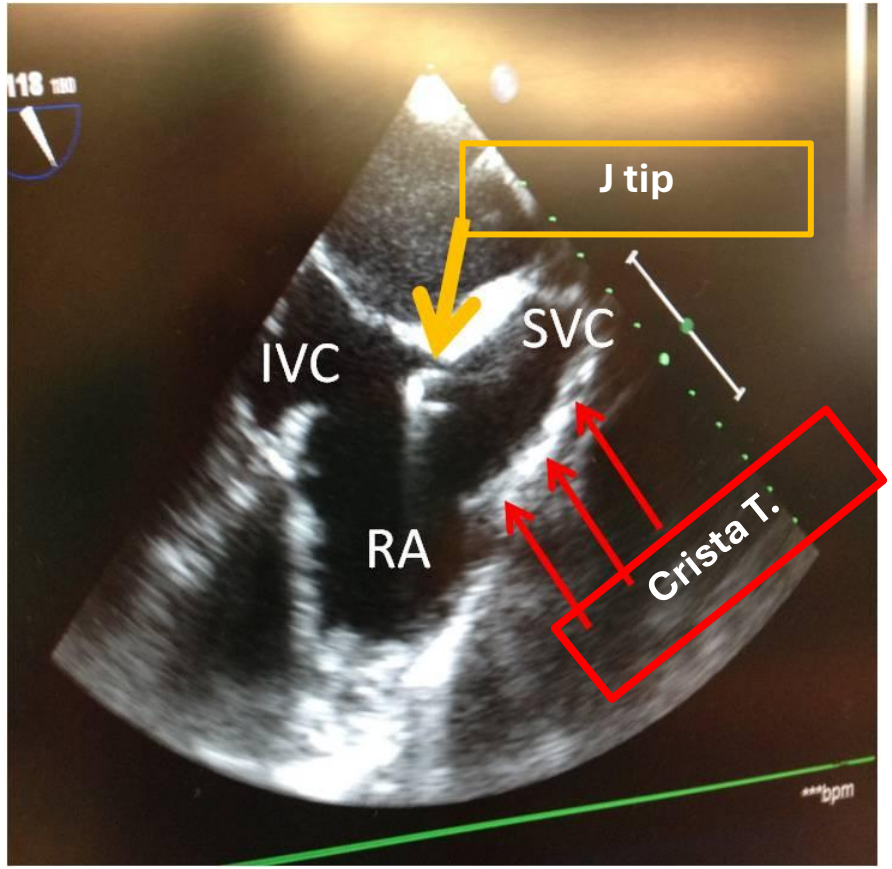
Emanuele Iacobone[1], Daniele Elisei[1], Diego Gattari[1], Luigi Carbone[1] and Giuseppe Capozzoli[2]

Difficult identification of the P wave…



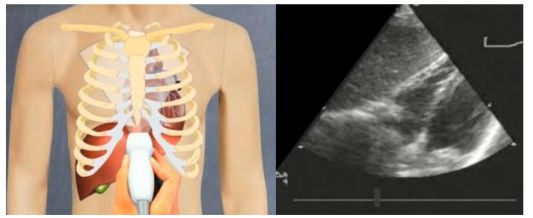
Trans-esophageal echocardiography

- The most accurate method for tip location
- Invasive
- Logistically impossible in the majority of patients
- Feasible for CICCs before/during cardiac surgery
- Not feasible for PICCs
- It requires a hard training for operators

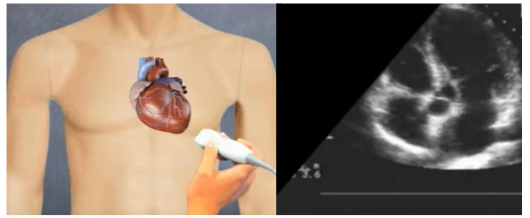


Trans-thoracic echocardiography

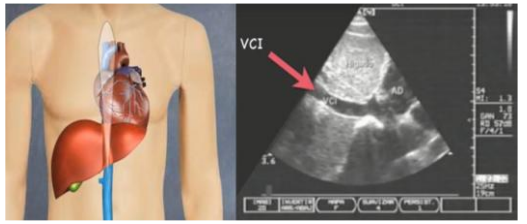
- Direct visualization of the catheter tip is difficult in adult patients
- Direct visualization of the catheter tip is usually only possible if located in the right atrium
- "Bubble test"
- Better visualization in pediatric/neonatal settings



Subcostal 4-chamber view



Apical 4-chamber view



Subcostal bicaval view

Trans-thoracic echocardiography

Editorial

JVA The Journal of Vascular Access

Ultrasound-based tip navigation and tip location during placement of central venous access devices in adult patients: The ECHOTIP protocol revisited

The Journal of Vascular Access
1–7

DOI: 10.1177/11297298251347084
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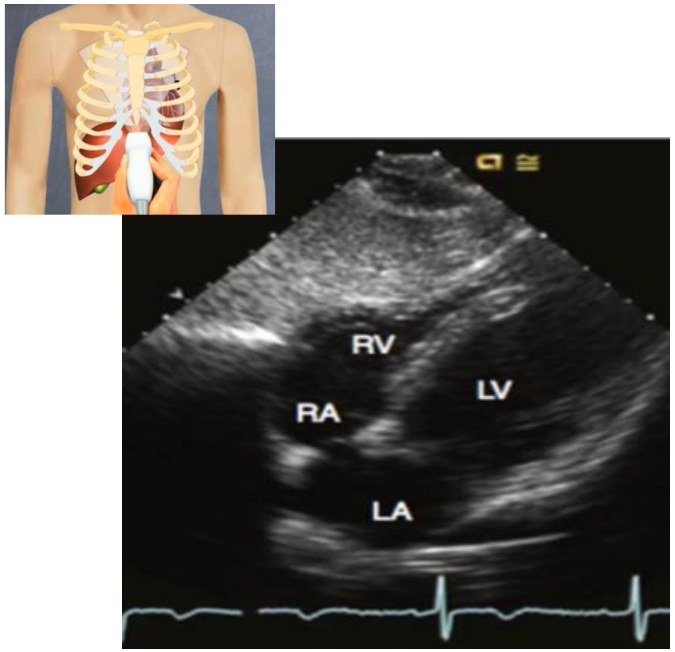
Maria Giuseppina Annetta[1], Stefano Elli[2], Antonio Gidaro[3], Davide Giustivi[4], Emanuele Iacobone[5] and Mauro Pittiruti[6]

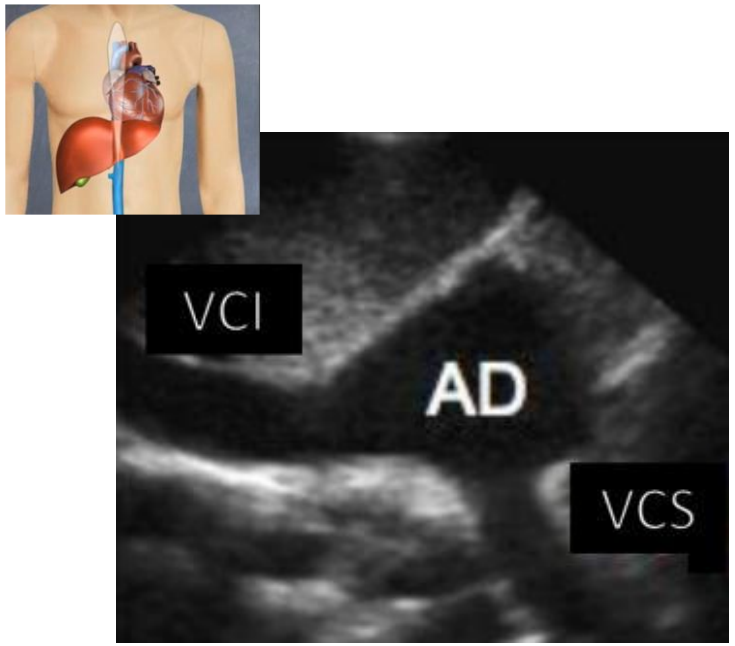
- Feasible in any clinical setting
- Non-invasive
- Difficult in some patients
- Safe for both operator and patient
- Less easy to learn than the IC-ECG: training required
- Less accurate in adults than the IC-ECG: need to standardize the technique and define the method

Trans-thoracic echocardiography

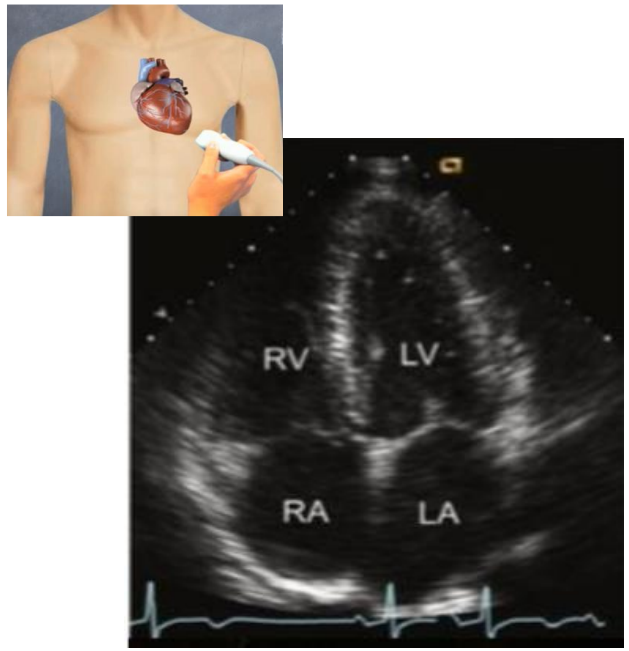
Direct visualization of the catheter tip is usually possible only if located in the right atrium



I scelta
Subcostal 4-chamber view



Subcostal bicaval view



II scelta
Apical 4-chamber view

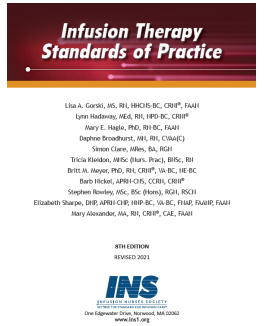
Trans-thoracic echocardiography

Table 4 Recommendations on ultrasound vascular access in adults and cost-effectiveness

Ultrasound vascular access in adults				
Domain code	Suggested definition	Level of evidence	Degree of consensus	Strength of recommendation
D4.SD2.S1	Ultrasound guidance should be routinely used for short-term central venous access in adults	A	Very good	Strong
D4.SD2.S2	Ultrasound guidance should be routinely used for long-term central venous access in adults	A	Very good	Strong
D4.SD2.S3	PICCs should be routinely inserted at mid arm level by ultrasound guidance using micro introducer technique	A	Very good	Strong
D4.SD2.S4	Use of ultrasound guidance should be taken into consideration for any kind of peripheral intravenous line when difficult access is anticipated	B	Very good	Strong
D4.SD2.S5	Ultrasound-guided arterial catheterization improves first-pass success and should be used routinely in adults	A	Very good	Strong
D4.SD2.S6	Ultrasound can accurately detect pneumothorax and should be routinely performed after central venous catheter cannulation when the pleura could have been damaged	B	Very good	Strong
D4.SD2.S7	CEUS (contrast-enhanced ultrasound) is a valid method for detecting a central venous catheter tip in the right atrium	B	Very good	Strong
Cost-effectiveness of the use of ultrasound for vascular cannulation				
D5.S1–3	Ultrasound-guided vascular access has to be used because it results in clinical benefits and reduced overall costs of care makes it cost-effective	A	Very good	Strong

Bubble test

a. The addition of agitated saline to enhance trans-thoracic echocardiography has been shown to be effective in detecting catheter tip position in the lower third of the SVC, as well as detecting catheter malposition through delayed opacification and reduced echogenicity.[66-68] (IV)



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International evidence-based recommendations on ultrasound-guided vascular access

Trans-thoracic echocardiography

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

DYNAMIC EMERGENCY MEDICINE

Rapid Confirmation of Central Venous Catheter Placement Using an Ultrasonographic "Bubble Test"

Confirmation of endovenous placement of central catheter using the ultrasonographic "bubble test"

Ajit S. Baviskar, Khalid I. Khatib,[1] Sanjeev Bhoi,[2] Sagar C. Galwankar,[3] and Harshad C. Dongare

Agitated Saline Bubble–Enhanced Transthoracic Echocardiography: A Novel Method to Visualize the Position of Central Venous Catheter

Ming Wen, MD; Konrad Stock, MD; Uwe Heemann, MD; Mario Aussieker, MD; Claudius Küchle, MD

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]

[1]Division of Anaesthesiology and Intensive Care, University Hospital of Padua, Padua, Italy; [2]Division of Cardiology, Deparment of Cardiac, Thoracic and Vascular Sciences, University of Padua, Padua, Italy; [3]Division of Radiology, University Hospital of Padua, Padua, Italy

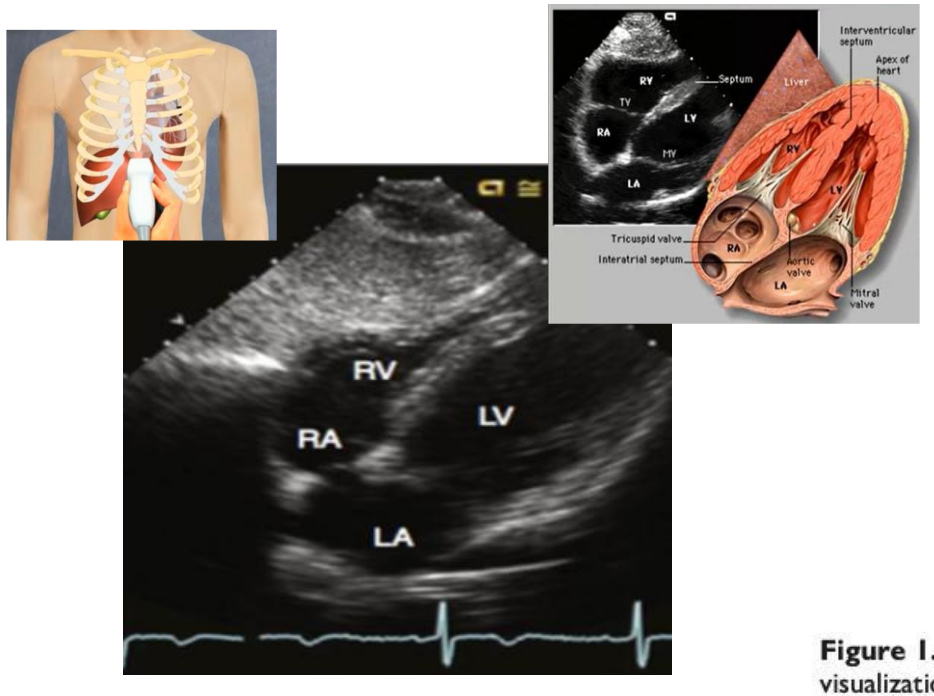
Trans-thoracic echocardiography

Bubble test

The immediate appareance of the bubbles in the right atrium will confirm the proximity of the tip

If the bubbles do not appear or appear with a significant delay, the tip is not in SVC

Trans-thoracic echocardiography



Bubble test

Subcostal 4-chamber view

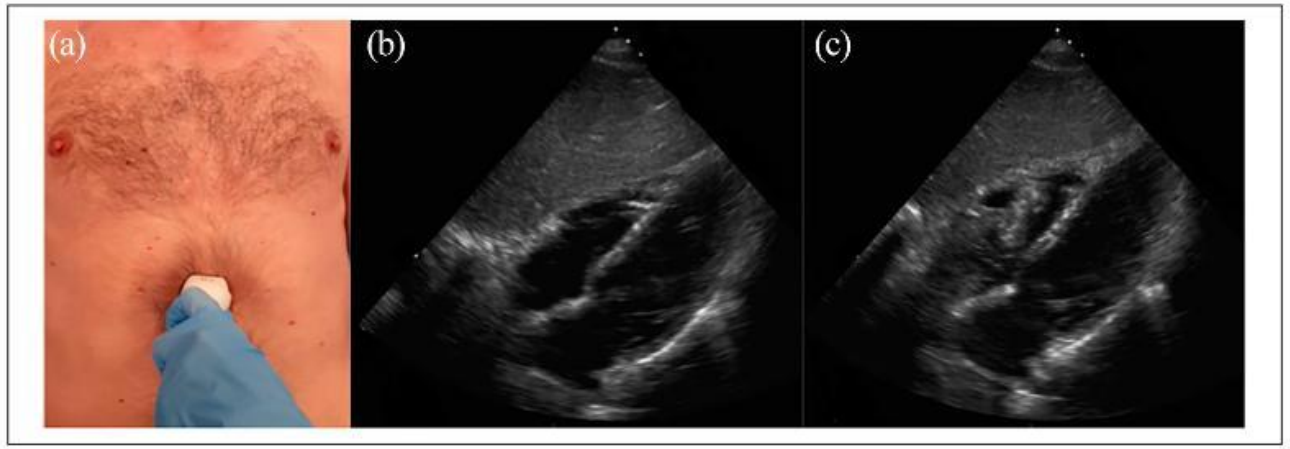
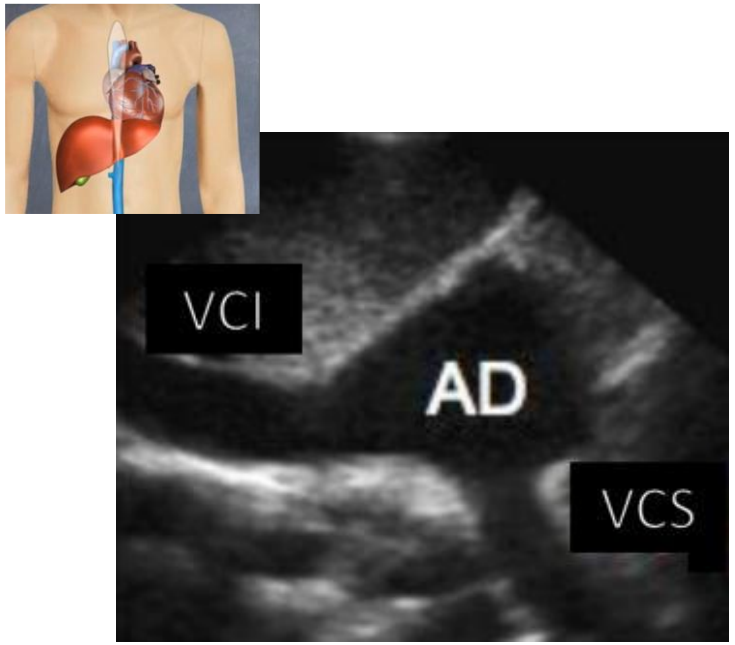


Figure 1. Subcostal (longitudinal) four-chamber view: placement of the probe (a), visualization of the heart chambers (b), and visualization of the microbubbles in the right atrium (c).

Trans-thoracic echocardiography



Bubble test

Subcostal bicaval view

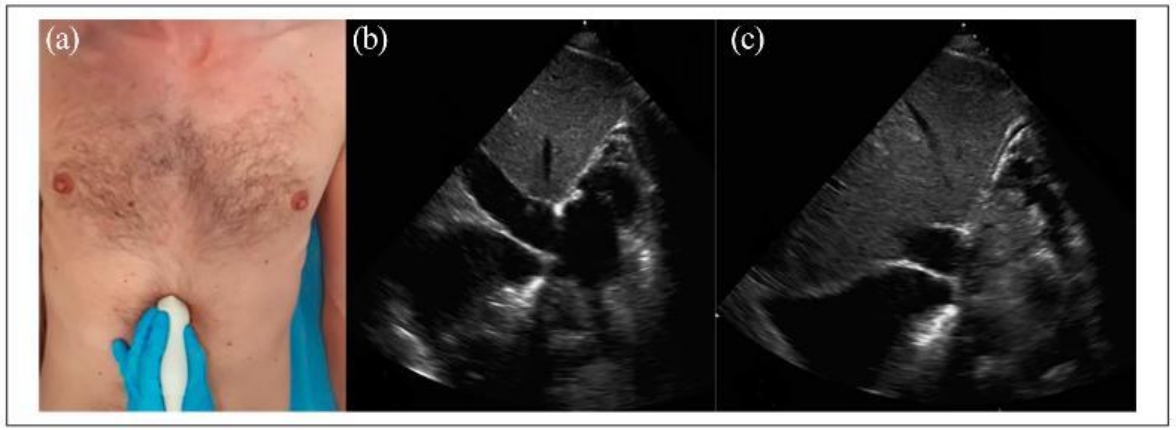
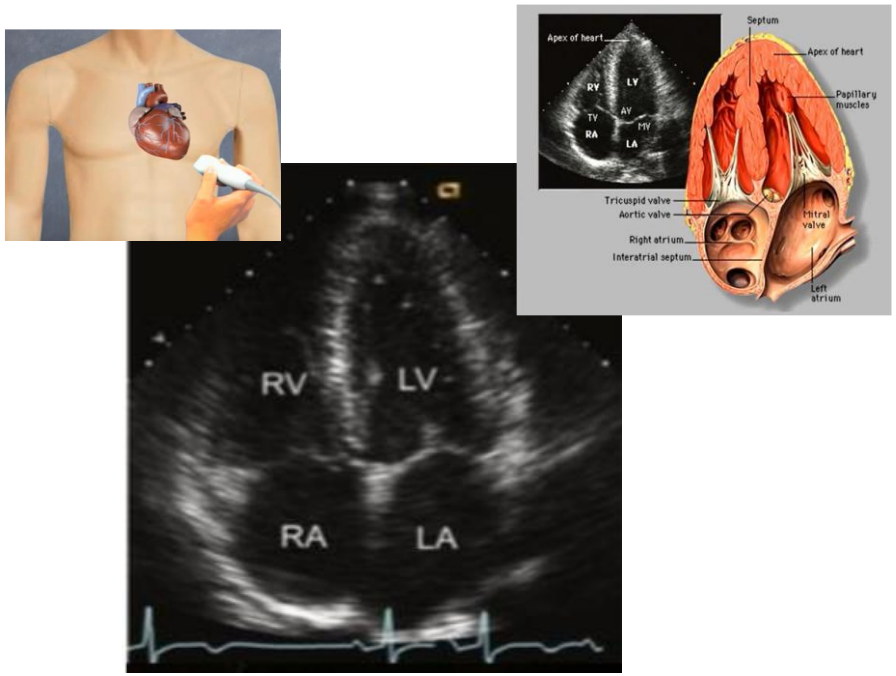


Figure 2. Subcostal (oblique) bi-caval view: placement of the probe (a), visualization of the superior vena cava, inferior vena cava, and right atrium (b), and visualization of the microbubbles in the right atrium (c).

Trans-thoracic echocardiography



Bubble test

Apical 4-chamber view

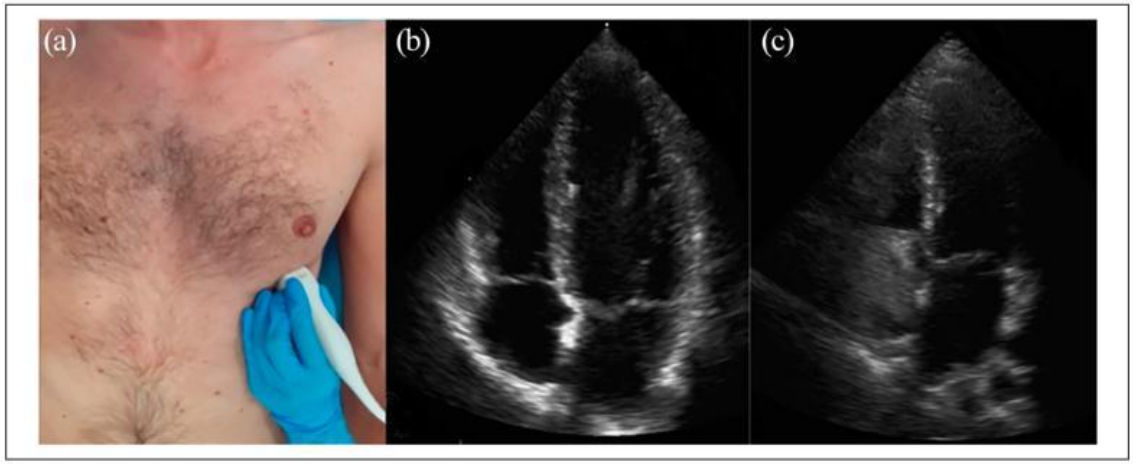
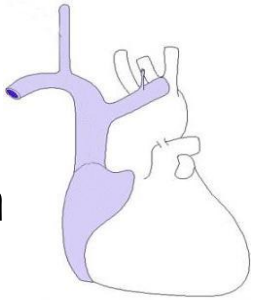


Figure 3. Transthoracic apical four-chamber view: placement of the probe (a), visualization of the heart chambers (b), and visualization of the microbubbles in the right atrium (c).

Trans-thoracic echocardiography

Bubble test

Qualitative data more reliable than quantitative data



- LAMINAR and IMMEDIATE FLOW in the right atrium: tip at the cavo-atrial junction or lower segment SVC
- IMMEDIATE and TURBULENT FLOW in the right atrium: intra-atrial tip
- LAMINAR FLOW with APPRECIABLE BUT NOT MEASURABLE LATENCY: catheter in the correct direction but the tip is probably distant from the cavo-atrial junction
- FLOW with APPRECIABLE LATENCY >2 sec: the catheter is poorly positioned
- TURBULENT FLOW FROM BELOW: catheter tip in IVC

Editorial

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2023, Vol. 24(4) 535–544

DOI: 10.1177/11297298211044325
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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]

US Tip location

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 (<2s) 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

ULTRASOUND FOR TIP NAVIGATION AND TIP LOCATION

ECHOTIP protocol

JVA The Journal of Vascular Access

Editorial

The Journal of Vascular Access
1–10

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

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

Protocol	Probe	Windows
Tip navigation	Linear "hockey stick" probe, 10–14 MHz	Acoustic windows of RaCeVA
Tip location	Small sectorial probe, 7–8 MHz	Bi-caval view; four-chamber apical view; long axis view of SVC

ULTRASOUND FOR TIP NAVIGATION AND TIP LOCATION

ECHOTIP protocol

Editorial

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

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1–9

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

Protocol	Probe	Windows
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)

ULTRASOUND FOR TIP NAVIGATION AND TIP LOCATION

ECHOTIP protocol

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Editorial

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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]

	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

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Editorial

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Ultrasound-based tip navigation and tip location during placement of central venous access devices in adult patients: The ECHOTIP protocol revisited

Maria Giuseppina Annetta[1], Stefano Elli[2], Antonio Gidaro[3], Davide Giustivi[4], Emanuele Iacobone[5] and Mauro Pittiruti[6]

ECHOTIP protocol for FICCs

Tip navigation	7–12 MHz linear probe (femoral and external iliac veins) 3–8 MHz convex probe (inferior vena cava)	Visualization of wire/catheter inside the veins of the lower limb according to the RaFeVA protocol. Visualization of wire/catheter inside the subdiaphragmatic tract of the inferior vena cava, using the transhepatic view.
Tip location	2–6 MHz sectorial probe or 3–8 MHz convex probe	Tip in inferior vena cava: immediate visualization (<500 ms) of the bubbles in the subdiaphragmatic tract of the inferior vena cava (using the transhepatic view). Tip in right atrium: immediate visualization (<500 ms) of the bubbles in the right atrium (using the subcostal views). Alternative option: immediate visualization of micro-embolic signals by pulsed wave doppler.

ECHOTIP protocol - 2

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Editorial

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Ultrasound-based tip navigation and tip location during placement of central venous access devices in adult patients: The ECHOTIP protocol revisited

Maria Giuseppina Annetta[1], Stefano Elli[2], Antonio Gidaro[3], Davide Giustivi[4], Emanuele Iacobone[5] and Mauro Pittiruti[6]

1) The appropriate interpretation of the "bubble test" when used for estimating the distance between catheter tip and right atrium, with special regard to the delay time of appearance of the micro-bubbles

In conclusion, these recent findings suggest that the 1–2 s cut-off previously proposed in the literature[24,25,31] and adopted by the 2021 ECHOTIP protocol[8] is excessively long and thus inappropriate for the indirect estimation of tip location. The cut-off most likely to be accurate is 500 ms, as originally suggested by Meggiolaro et al.,[29] since such delay is associated with a very high probability of the presence of the tip at less than 1 cm from the point where the bubbles appear. Although 500 ms seem to be a suitable and efficient cut-off, this duration is notably very brief and hard to measure (e.g. a blink of an eye lasts approximately the same time).[32] For the practical purposes, this new version of the ECHOTIP protocol—as regards tip location of PICCs and CICCs—recommends to consider that the tip is at the cavo-atrial junction when the micro-bubbles appear in the right atrium "immediately" (i.e. within 500 ms) after the start of saline injection, independently from the catheter type or length.

ECHOTIP protocol - 2

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2) The application of the pulsed-wave doppler as an alternative option for visualizing the appearance of the flow in the right atrium during the “bubble test”

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Original research article

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

Antonio Gidaro[1], Francesco Casella[1], Chiara Cogliati[1], Antonio La Greca[2], Francesca Lugli[1], Chiara Trione[1], Maria Calloni[1], Chiara Melchionda[1], Federica Samartin[1], Emanuele Salvi[1] and Elisa Ceriani[1]

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1–7
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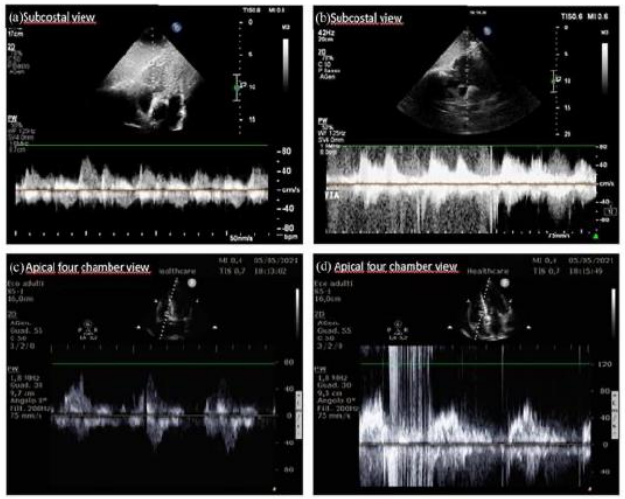
Advantages:
Visual signal of MES (microembolic signals)
Production of a typical sound due to the alternation of PW wave
It is synchronous with cardiac flow and heart rate

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



ECHOTIP protocol - 2

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Ultrasound-based tip navigation and tip location during placement of central venous access devices in adult patients: The ECHOTIP protocol revisited

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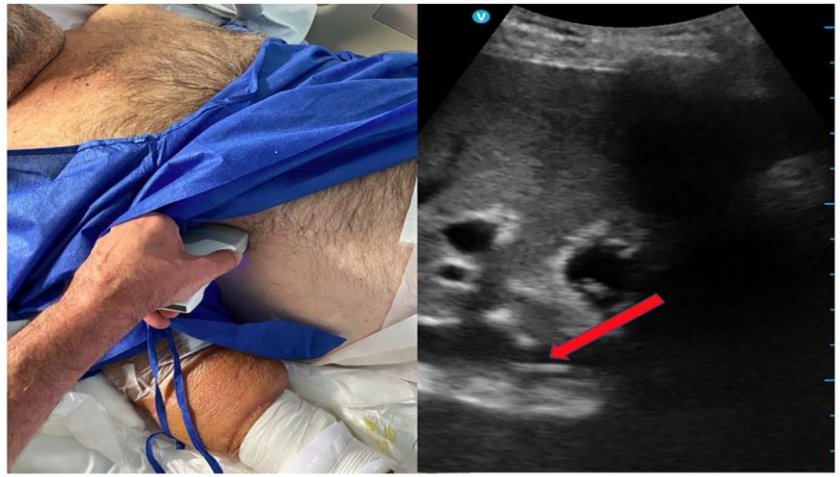
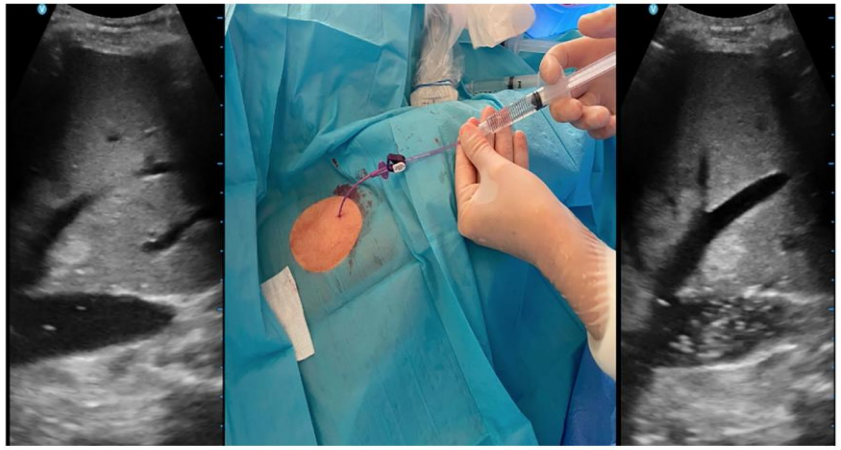
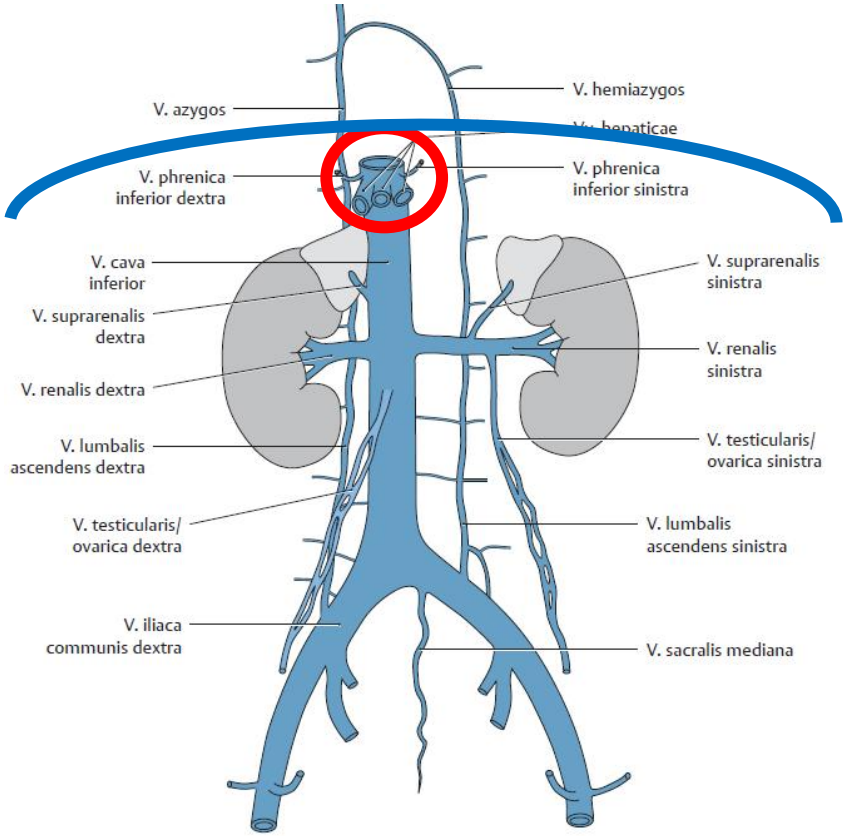
Maria Giuseppina Annetta[1], Stefano Elli[2], Antonio Gidaro[3], Davide Giustivi[4], Emanuele Iacobone[5] and Mauro Pittiruti[6]

3) The adoption of the trans-hepatic acoustic window for the visualization of the catheter in the subdiaphragmatic tract of the inferior vena cava.







Techniques in vascular access

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Applicability and feasibility of intraprocedural tip location of femorally inserted central catheters by transhepatic ultrasound visualization of the inferior vena cava in adult patients

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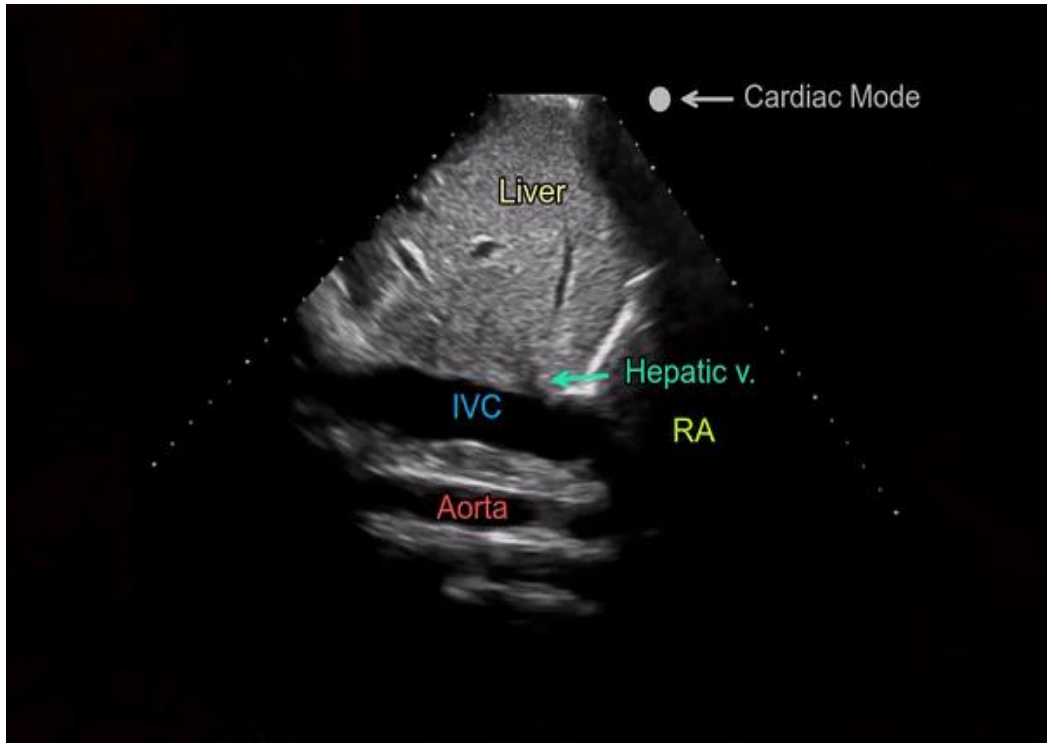
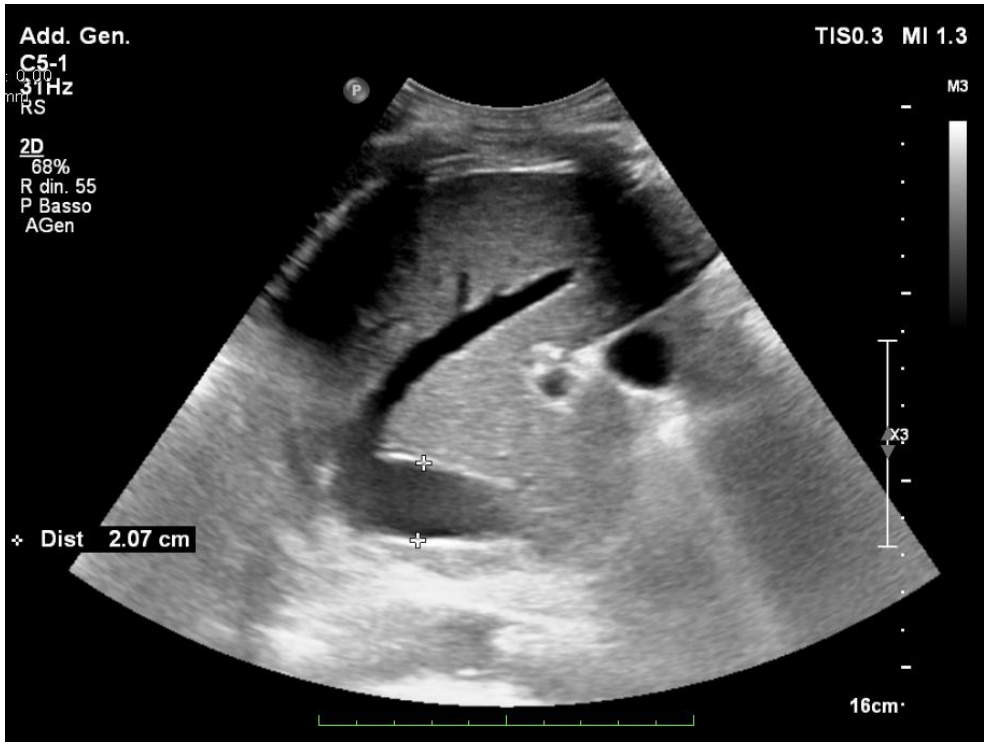
Maria Giuseppina Annetta[1], Bruno Marche[1], Igor Giarretta[2] and Mauro Pittiruti[1]

Which part of the inferior vena cava can be seen with a transhepatic approach?

Right atrium, subdiaphragmatic portion of the IVC for approximately 3-4 cm up to the superior pole of the right kidney

Transhepatic US visualization of the IVC





Techniques in vascular access

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Ultrasound based tip location of femorally inserted central catheters into the inferior vena cava: A comparison between the transhepatic and the subcostal view

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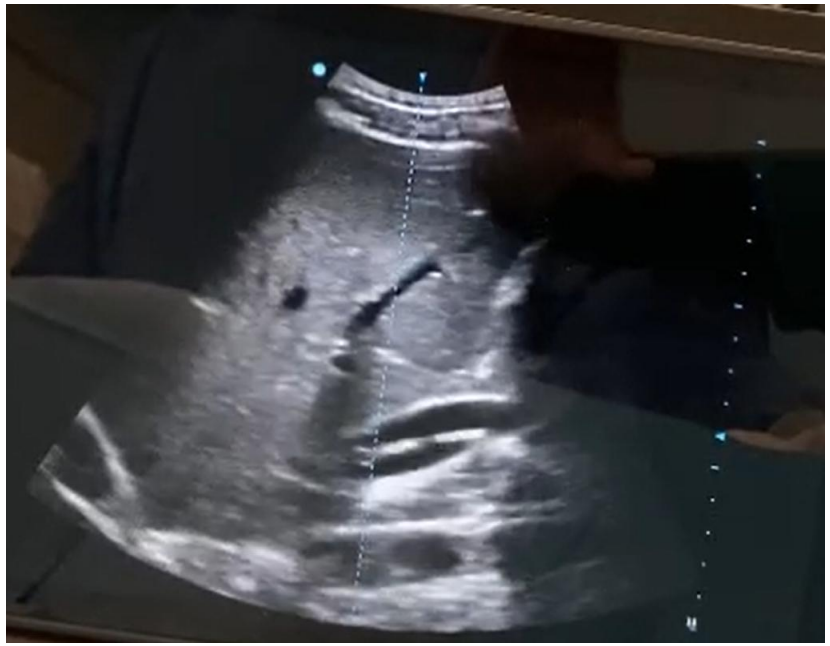
Maria Giuseppina Annetta[1], Bruno Marche[2], Giovanna Mercurio[1] and Mauro Pittiruti[3]



Abstract

Background: Intraprocedural catheter tip location is currently recommended. Intracavitary EGC and ultrasound are the preferred methods of tip location for catheters with their tip in the superior vena cava or in the right atrium. Though, the best method of intraprocedural tip location for catheters with their tip in the inferior vena cava is still uncertain. One possibility is to visualize the subdiaphragmatic inferior vena cava by ultrasound, using either the transhepatic or the subxiphoid view.

Methods: In this prospective study, we compared two different ultrasound windows for the visualization of the inferior vena cava (transhepatic vs subxiphoid) for the purpose of localizing the catheter tip during the insertion of femorally inserted central catheters.

Results: We studied 249 consecutive insertions of central catheters via the superficial femoral vein. Intraprocedural location of the catheter tip was performed by ultrasound, using both transhepatic and subxiphoid view. Visualization of the inferior vena cava was possible only in 81 cases (32.5%) with the subxiphoid view, but it was always possible in all 249 cases with the transhepatic view. The catheter tip was localized in 15 patients out of 81 with the subxiphoid view (18.5%); the transhepatic view allowed the visualization of the tip in all 249 patients.

Conclusions: The applicability of the subxiphoid window has several limitations, both in terms of visualization of the inferior vena cava and localization of the catheter tip. The transhepatic view should be the preferred method for intraprocedural ultrasound localization of the catheter tip in the inferior vena cava.

Editorial

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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]

US Tip location

Table 1. The ECHOTIP-2 protocol.

ECHOTIP protocol for CICCs		
Tip navigation	7–12 MHz linear probe	Visualization of wire/catheter inside the veins according to the RaCeVA protocol.
Tip location	2–6 MHz sectorial probe or 3–8 MHz convex probe	Immediate visualization (<500 ms) of the bubbles in right atrium, preferably using the subcostal views (apical view is regarded as second choice). Alternative option: immediate visualization of micro-embolic signals by pulsed wave doppler (using the same views).
ECHOTIP protocol for PICCs		
Tip navigation	7–12 MHz linear probe	Visualization of wire/catheter inside the veins according to the RaPeVA and RaCeVA protocols.
Tip location	2–6 MHz sectorial probe or 3–8 MHz convex probe	Immediate visualization (<500 ms) of the bubbles in right atrium, preferably using the subcostal views (apical view is regarded as second choice). Alternative option: immediate visualization of micro-embolic signals by pulsed wave doppler (using the same views).
ECHOTIP protocol for FICCs		
Tip navigation	7–12 MHz linear probe (femoral and external iliac veins) 3–8 MHz convex probe (inferior vena cava)	Visualization of wire/catheter inside the veins of the lower limb according to the RaFeVA protocol. Visualization of wire/catheter inside the subdiaphragmatic tract of the inferior vena cava, using the transhepatic view.
Tip location	2–6 MHz sectorial probe or 3–8 MHz convex probe	Tip in inferior vena cava: immediate visualization (<500 ms) of the bubbles in the subdiaphragmatic tract of the inferior vena cava (using the transhepatic view). Tip in right atrium: immediate visualization (<500 ms) of the bubbles in the right atrium (using the subcostal views). Alternative option: immediate visualization of micro-embolic signals by pulsed wave doppler.

ULTRASOUND FOR TIP NAVIGATION AND TIP LOCATION

Tecnologia wireless

- Extreme portability of the system
- Multiple transducers
- Connect to specific applications

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