GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine

2022
ROMA
5-6-7 Dicembre / December 5th-6th-7th

NUOVE TECNICHE DI TIP LOCATION BASATE SULL'ECOCARDIOSCOPIA

EMANUELE IACOBONE

ASUR MARCHE

OSPEDALE DI MACERATA

UO ANESTESIA E RIANIMAZIONE

asur marche
azienda sanitaria unica regionale

2021

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]

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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.

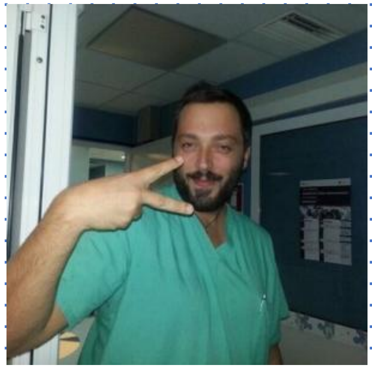
	Probe	Technique
Tip navigation	7–12 MHz linear probe	Visualization of the deep veins of the arm and of the infra/supraclavicular area according to RaPeVA and RaCeVA
Tip location	2–6 MHz sectorial probe As alternative option: 3–8 MHz convex probe	Immediate visualization (<2 s) of bubbles in RA after flushing 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








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



PROTOCOLLO SIC	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

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

Ultrasound vascular access in adults		
Domain code	Suggested definition	Level of evidence
D4.SD2.S1	Ultrasound guidance should be routinely used for short-term central venous access in adults	A
D4.SD2.S2	Ultrasound guidance should be routinely used for long-term central venous access in adults	A
D4.SD2.S3	PICCs should be routinely inserted at mid arm level by ultrasound guidance using micro introducer technique	A
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
D4.SD2.S5	Ultrasound-guided arterial catheterization improves first-pass success and should be used routinely in adults	A
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
D4.SD2.S7	CEUS (contrast-enhanced ultrasound) is a valid method for detecting a central venous catheter tip in the right atrium	B
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

SIAARTI
PRO VITA CONTRA DOLOREM SEMPER

Buone pratiche cliniche SIAARTI

LE BUONE PRATICHE PER GLI ACCESSI VASCOLARI

Autori

Cerotto V, Vailati D, Montrucchio G, Capozzoli G, Brazzi L, Gori F

Controllo della punta	Riferimento	Limiti
RX Torace - Fluoroscopia	Tratto di vena compreso tra la carena e i due corpi vertebrali al di sotto della carena stessa	Ingrandimento atriale Varianti congenite atipiche
ECG Intracavitario	Ottenimento dell'onda P massimale	Fibrillazioni, flutter, tachicardia atriale parossistica
ECOCARDIO Transtoracico	Finestra sottocostale: visualizzazione della punta (possibile anche utilizzo di contrasto ecografico-CEUS)	Disponibilità e scarsa finestra ecografica (caratteristiche cliniche del paziente)
ECOCARDIO Transesofageo	Visualizzazione diretta della punta	Disponibilità, curva di apprendimento, invasività

2020

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

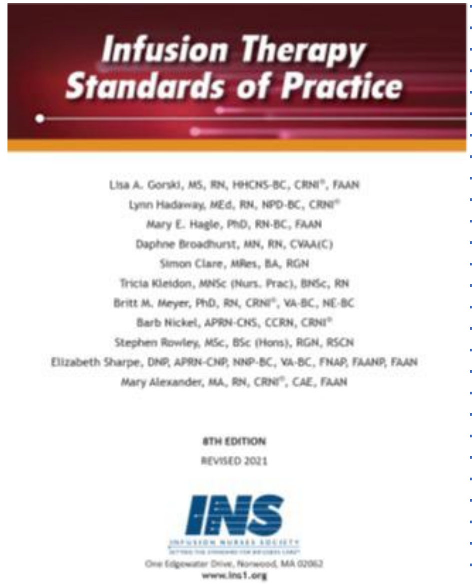
When an intracavity electrocardiogram is not applicable, we recommend using real-time ultrasound to detect and prevent central venous catheter malposition, as it has been shown to be well tolerated, feasible, quickly performed and interpreted at the bedside, and it is more accurate and faster than chest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

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)

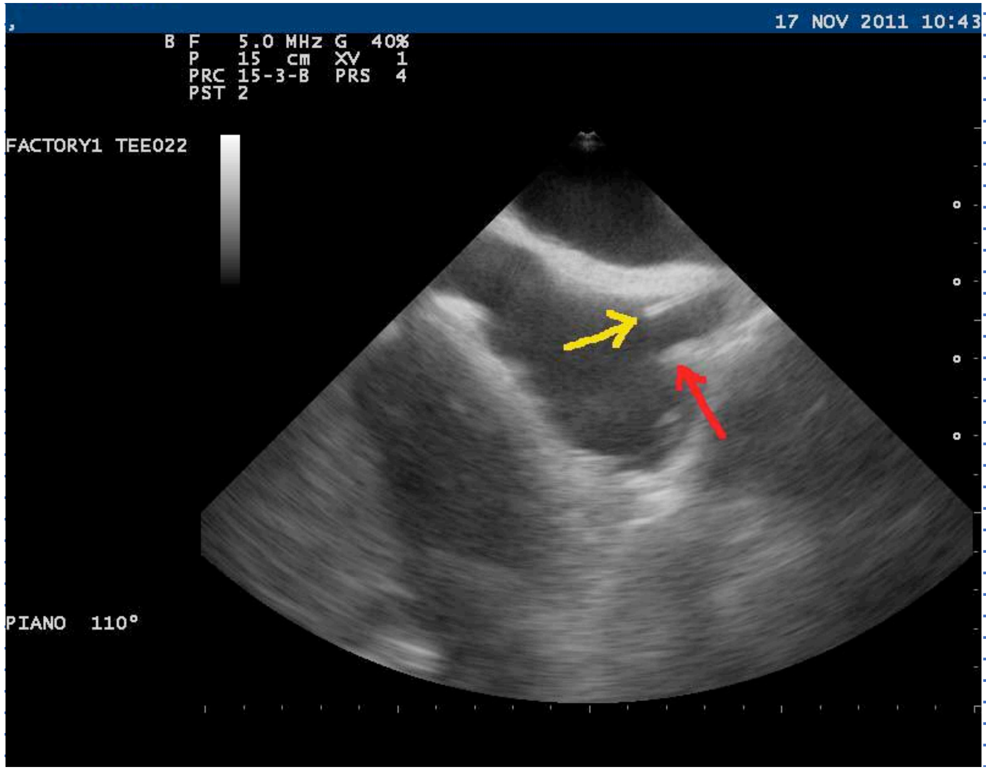
1. Use electrocardiogram (ECG) methods with either a metal guidewire or a column of normal saline inside the catheter lumen and observe the ECG tracing to place the CVAD tip at the CAJ. Follow manufacturers' directions for use with other ECG-based technology using a changing light pattern to detect tip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

3. Consider the use of ultrasound for CVAD tip location. The clinical applicability of this is currently limited by the small sample sizes used to demonstrate its efficacy as a reliable and safe method to replace chest radiographs in all ages, and its usefulness is limited by the knowledge, skill, and experience of the operator.[36,43,44,46,63-65] (III)

2021

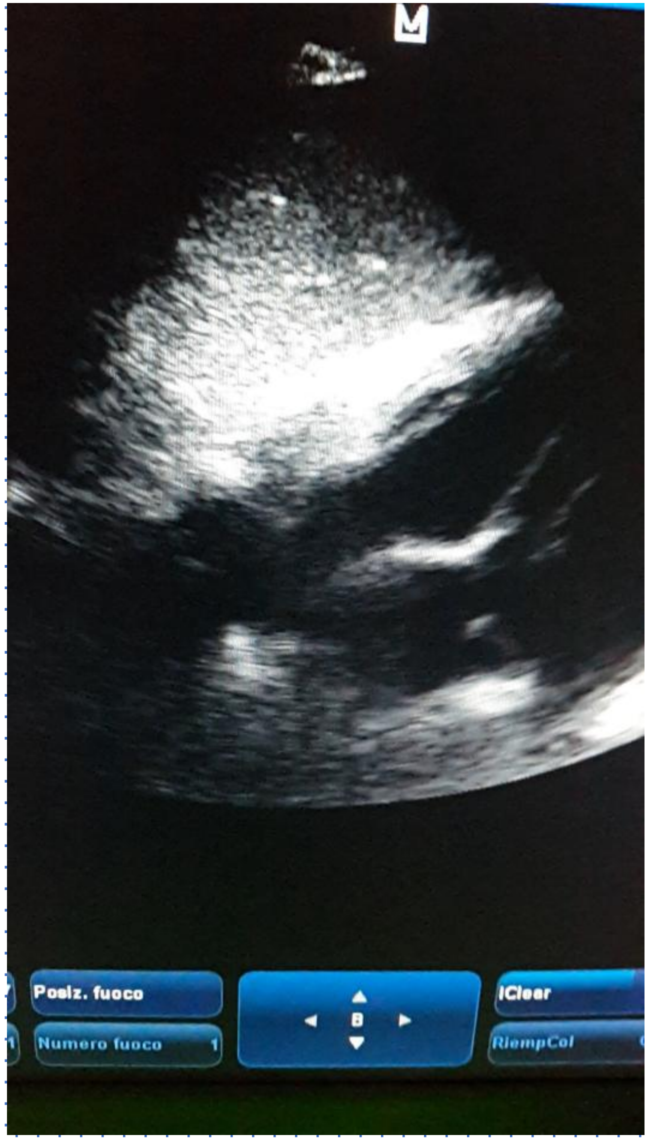


Transoesophageal echocardiographic evaluation of central venous catheter positioning using Peres' formula or a radiological landmark-based approach: a prospective randomized single-centre study†



- 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)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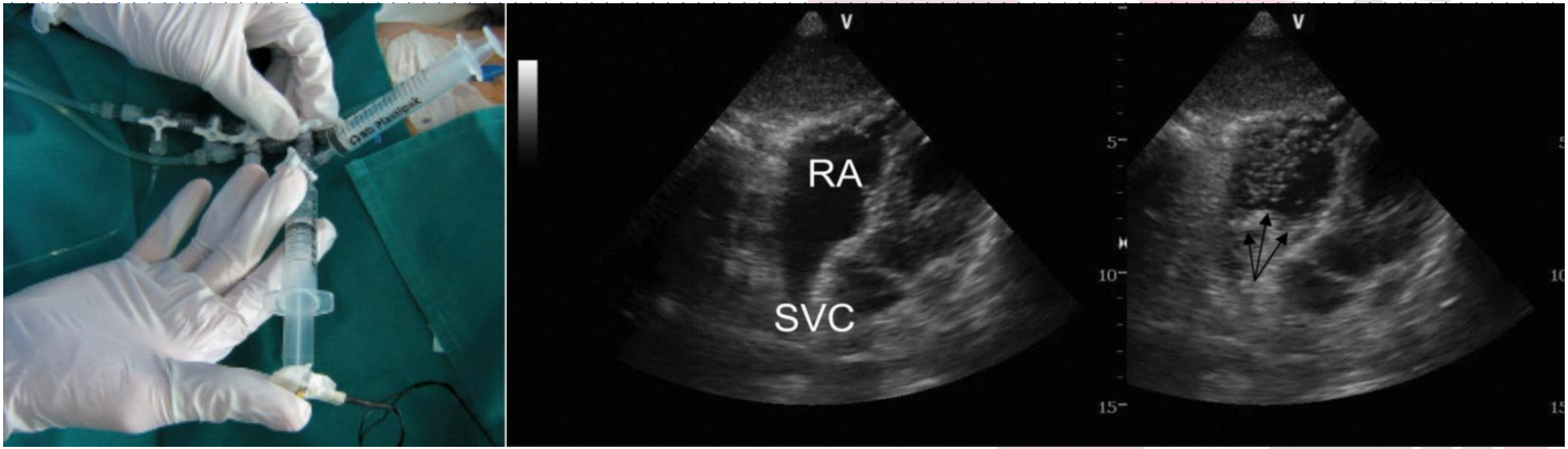
ASSOCIATION FOR ACADEMIC SURGERY

Bedside Ultrasound can Safely Eliminate the Need for Chest Radiographs after Central Venous Catheter Placement: CVC Sono in the Surgical ICU (SICU)[1]

diagnostic modalities [21–24]. On the other hand, because of difficulty in visualizing the superior vena cava, especially the lower part of SVC at the cavoatrial junction, transthoracic echocardiography (TTE) has not been well described compared with transesophageal echocardiography (TEE), a more accurate modality to localize the tip of central venous catheters [25, 26].

Journal of Surgical Research 163, 155–161 (2010)

«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.

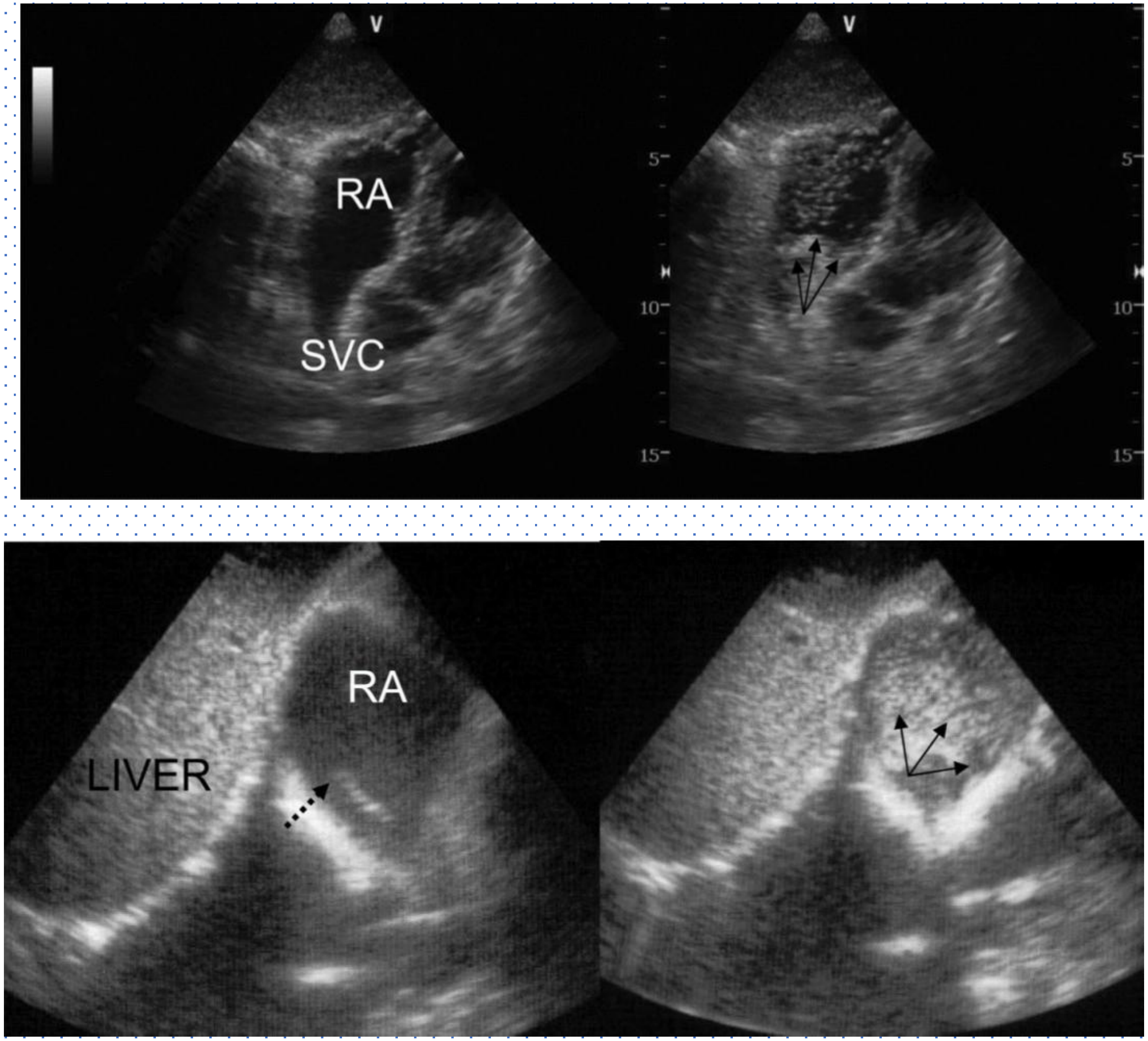
Dove tutto ha avuto inizio……….

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.

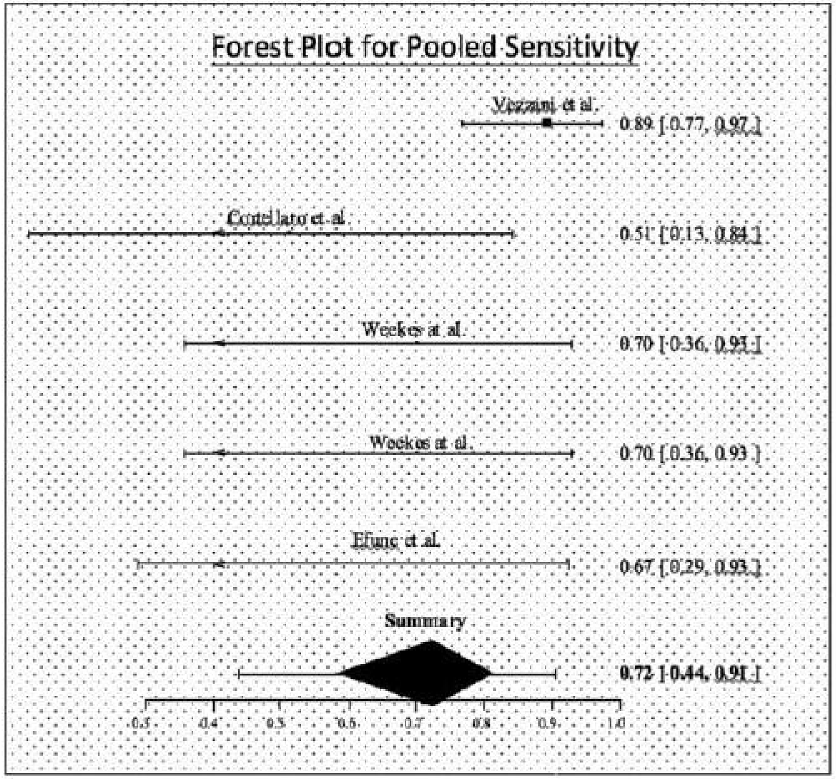
Crit Care Med 2010; 38:533–538

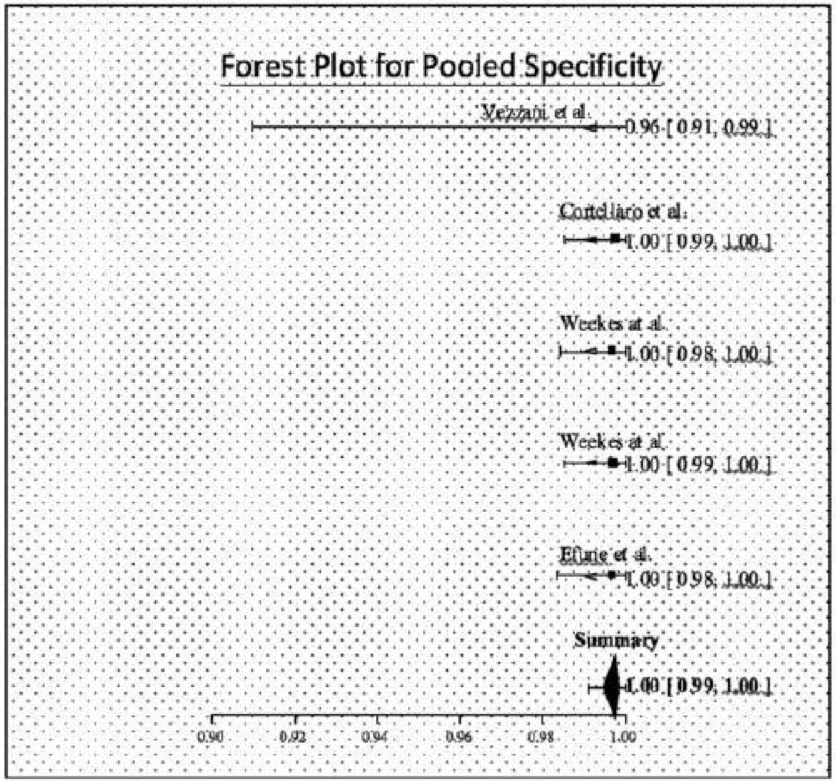

RA
SVC
5
10
15
RA
LIVER

Use of Contrast-Enhanced Ultrasound for Confirmation of Central Venous Catheter Placement

Systematic Review and Meta-analysis

J Ultrasound Med 2017; 36:2503–2510





Diagnostic Accuracy of Central Venous Catheter Confirmation by Bedside Ultrasound Versus Chest Radiography in Critically Ill Patients: A Systematic Review and Meta-Analysis

2017

Diagn... neter
Confir... s Chest
Radio... ematic
Revie...

2017

Reference	Feasibility (%)[a]	Incidence of Central Venous Catheter Malposition	Sensitivity (95% CI)[b]	Specificity (95% CI)[b]	Incidence of Pneumothorax	Chest Radiograph time (Minutes), Mean (SD)	Ultrasound time (Minutes), Mean (SD)
Vezzani et al (30)	89.2	0.28	0.93 (0.76–0.99)	0.96 (0.88–0.99)	0.04	83.0 (79.0)[c]	10.0 (5.0)
Maury et al (16)	98.8	0.11	1.00 (0.66–1.00)	1.00 (0.95–1.00)	0.01	80.3(66.7)[d]	6.8 (3.5)
Zanobetti et al (31)	100	0.55	0.92 (0.85–0.96)	0.89 (0.81–0.95)	0.02	65.0 (74.0)[e]	5.0 (3.0)
Cortellaro et al (32)	100	0.085	0.33 (0.04–0.78)	0.98 (0.92–1.00)	–	288.0 (216.0)[e]	4.0 (1.0)
Matsushima and Frankel (33)	71	0.17	0.50 (0.19–0.81)	0.98 (0.89–1.00)	0.00	75.3 (–)[f]	10.8
Bedel et al (34)	96	0.06	0.83 (0.36–1.00)	1.00 (0.96–1.00)	0.00	103.0 (81.0)[f]	1.76 (1.3)
Baviskar et al (35)	100	0.00	–	–	–	–	0.75
Duran-Gehring et al (36)	92	0.065	0.33 (0.01–0.91)	1.00 (0.92–1.00)	0.04	299.0 (–)[e]	5.0
Weekes et al (37)	96.6	0.03	0.75 (0.19–0.99)	1.00 (0.97–1.00)	–	–	–
Wen et al (38)	100	0.01	1.00 (0.16–1.00)	1.00 (0.98–1.00)	–	28.3 (25.7)[c]	3.2 (1.1)
Syed et al (39)	100	0.50	1.00 (0.16–1.00)	1.00 (0.16–1.00)	–	–	–
Madhulika et al (40)	100	0.24	1.00 (0.86–1.00)	1.00 (0.95–1.00)	0.00	–	–
Gekle et al (41)	100	0.00	–	–	–	30.0 (–)[f]	8.9
Weekes et al (42)	97.4	0.03	0.75 (0.19–0.99)	1.00 (0.98–1.00)	0.00	20.0 (30.0)[c] median (IQR)	1.1 (0.7) median (IQR)
Meggiolaro et al (43)	100	0.45	0.53 (0.38–0.68)	0.95 (0.86–0.99)	0.00	67.0 (42.0–84.0)[e] median (IQR)	10.0 (7.0–20.0) median (IQR)

Reference	Design[a]	CVC, *n*	CVC Site	Primary Outcome Measure	Secondary Outcome Measure	Operator Experience[b]	Ultrasound Technique
Vezzani et al (30)	Prospective	111	IJ/SC	Malposition, pneumothorax	Time to confirmation	Experienced	Vascular and cardiac views, agitated saline used
Maury et al (16)	Prospective	81	IJ/SC	Malposition, pneumothorax	Time to confirmation	Inexperienced	Vascular and cardiac views, nonagitated saline used
Zanobetti et al (31)	Prospective	210	IJ/SC	Malposition, pneumothorax	Time to confirmation	Both experienced and inexperienced	Vascular and cardiac views, nonagitated saline used
Cortellaro et al (32)	Prospective	71	IJ/SC	Malposition	Time to confirmation	Both experienced and inexperienced	Cardiac views, agitated saline used
Matsushima and Frankel (33)	Prospective	69	IJ/SC/ peripherally inserted central catheter	Malposition, pneumothorax	Time to confirmation	Inexperienced	Vascular and cardiac views, nonagitated saline used
Bedel et al (34)	Prospective	98	IJ/SC	Malposition	Pneumothorax, time to confirmation	Experienced	Cardiac views, nonagitated saline used
Baviskar et al (35)	Prospective	25	IJ/SC/axillary	Time to verification	Malposition	Experienced	Cardiac views, agitated saline used
Duran-Gehring et al (36)	Prospective	25	IJ/SC	Time to verification	Malposition, pneumothorax	Inexperienced	Cardiac views, agitated saline used
Weekes et al (37)	Prospective	148	IJ/SC/femoral	Malposition	–	Both experienced and inexperienced	Cardiac views, agitated saline used
Wen et al (38)	Retrospective	202	IJ	Malposition	Time to confirmation	Both experienced and inexperienced	Cardiac views, agitated saline used
Syed et al (39)[c]	Prospective	4	–	Malposition	–	–	Cardiac views, agitated saline used
Madhulika et al (40)[c]	Prospective	100	IJ	Malposition, pneumothorax	–	–	Cardiac views, nonagitated saline used
Gekle et al (41)	Prospective	81	IJ/SC	Malposition, pneumothorax	Time to confirmation	Experienced	Cardiac views, agitated saline used
Weekes et al (42)	Prospective	156	IJ/SC	Malposition, pneumothorax	Time to confirmation	Experienced	Cardiac views, nonagitated saline used
Meggiolaro et al (43)	Prospective	105	IJ/SC	Malposition, pneumothorax	Time to confirmation and time to bubble test	Experienced	Vascular and cardiac views, agitated saline used

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)			

Real-time ultrasound-guided placement of peripherally inserted central venous catheter without fluoroscopy

2018

Table 3. Tip malposition found by ultrasonography and X-ray.

Total number of tip malpositions found by ultrasonography	78
Strayed into ipsilateral internal jugular vein	74
Coiled in subclavian vein	4
Detection rate of tip malposition with ultrasonography	82.1% (78/95)
Total number of tip malpositions after X-ray	17
Coiled in subclavian vein	7
Strayed into internal jugular vein	6
Inserted too distal (in right atrium)	2
Strayed into contralateral subclavian vein	2
Success rate (%) of ultrasound-guided tip navigation	98.2% (937/954).
Success rate (%) of ultrasound-guided tip location	98.0% (935/954).
Adjustment rate (%) after X-ray	1.8% (17/952)
Final success rate (%) of PICC placement	99.8% (952/954)

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

Table 1. (a) ECHOTIP protocol for CICCs.

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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
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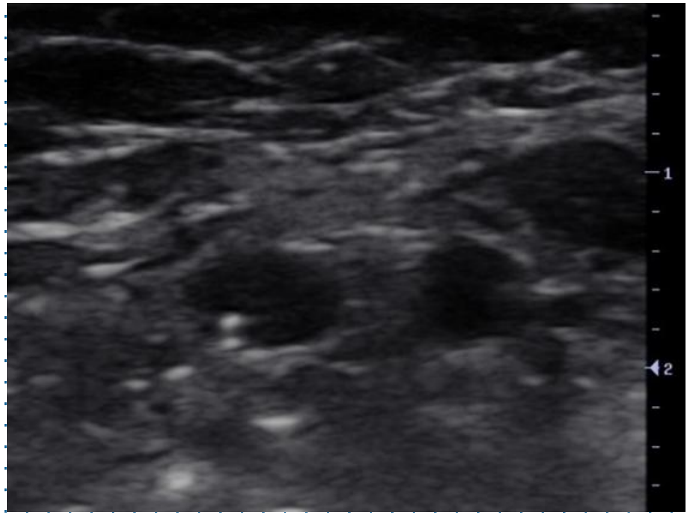
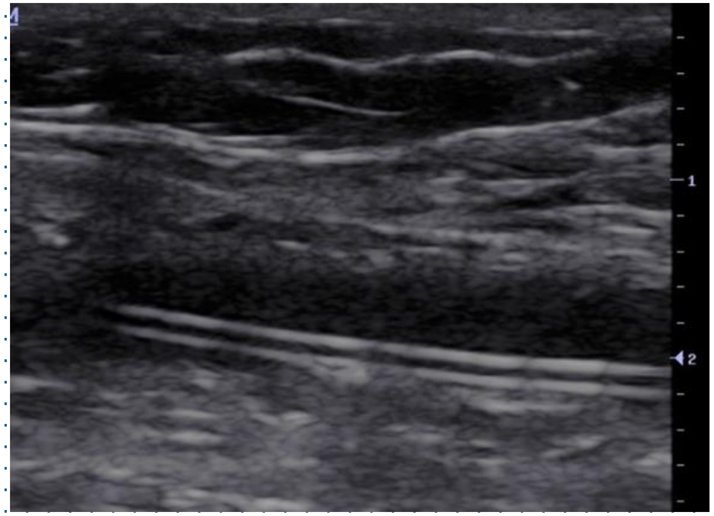
VISIONE DEL CATETERE

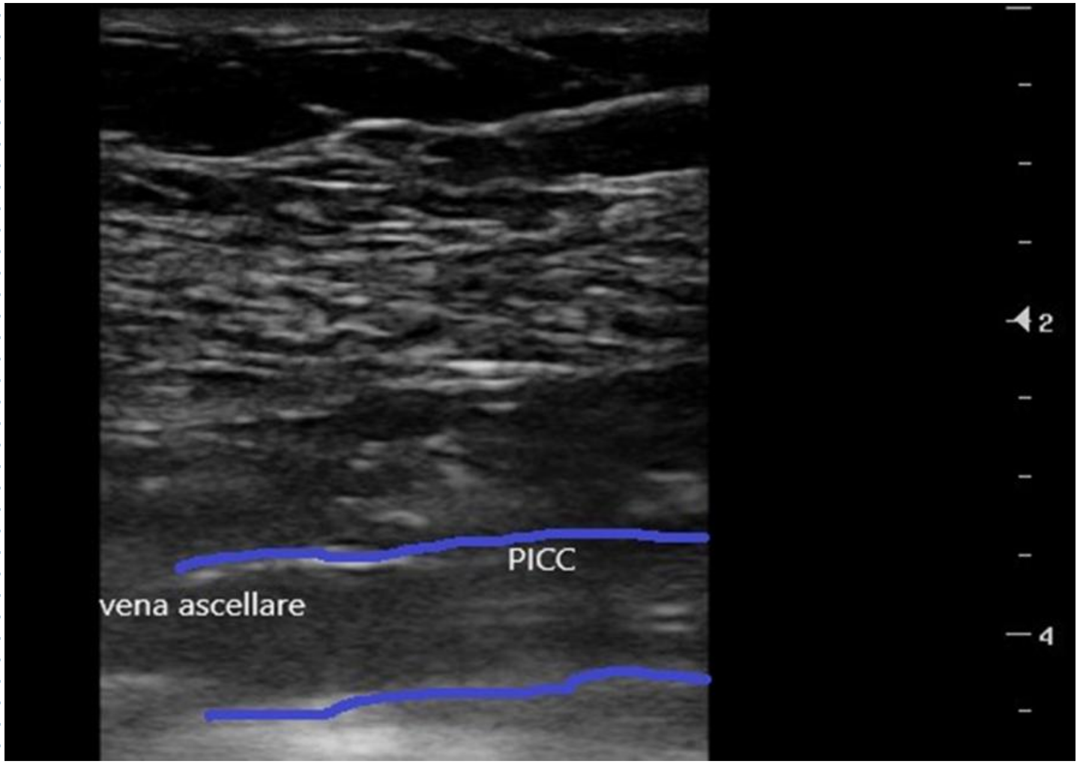


short axis view

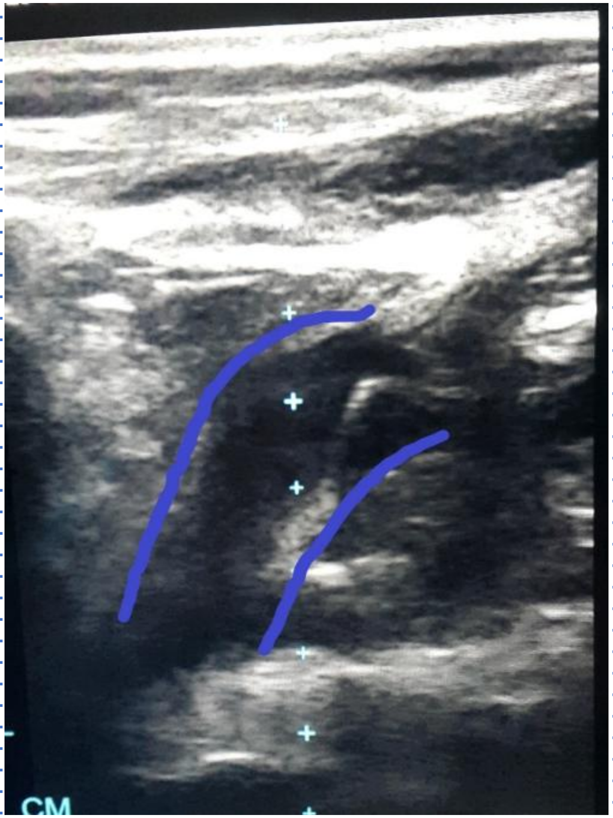


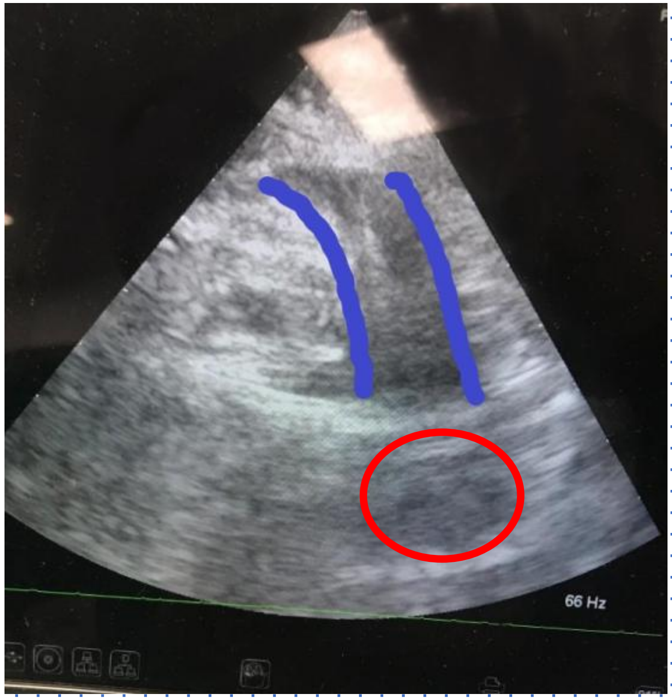
long axis view

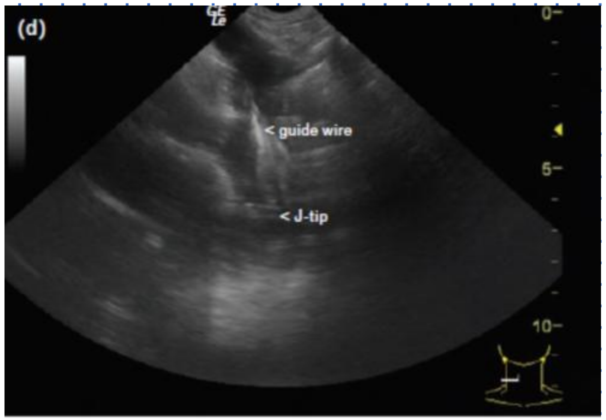
VISUALIZATION OF THE CATHETER IN THE VEINS OF THE ARM UP TO AXILLARY VEIN



Controllo del catetere nella vena anonima-vena cava superiore

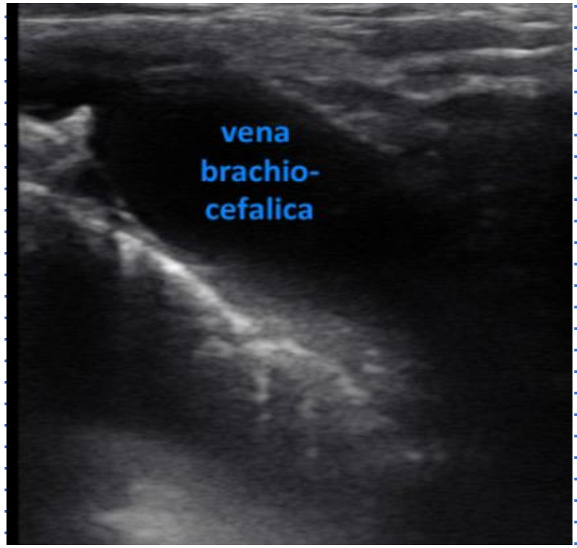


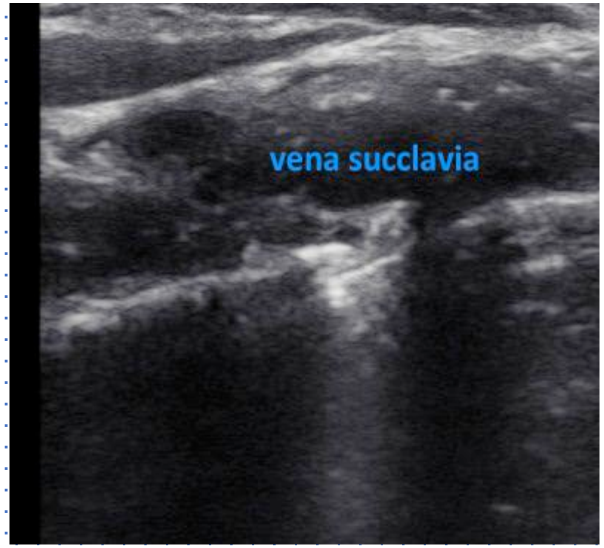




Ultrasound confirmation of central venous catheter position via a right supraclavicular fossa view using a microconvex probe

Assenza del catetere nelle vene omo-controlaterali





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

GAVeCeLT

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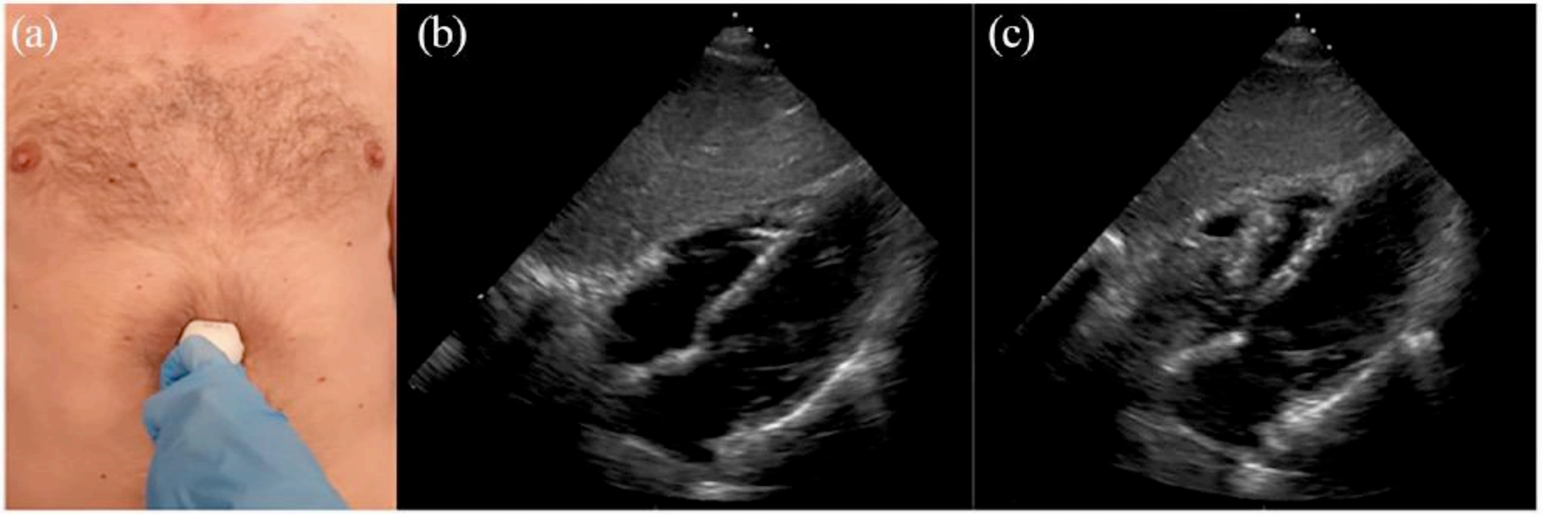
	Probe	Technique
Tip navigation	7–12 MHz linear probe	Visualization of the deep veins of the arm and of the infra/supraclavicular area according to RaPeVA and RaCeVA
Tip location	2–6 MHz sectorial probe As alternative option: 3–8 MHz convex probe	Immediate visualization (<2 s) of bubbles in RA after flushing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

(c) ECHOTIP protocol for FICCs.

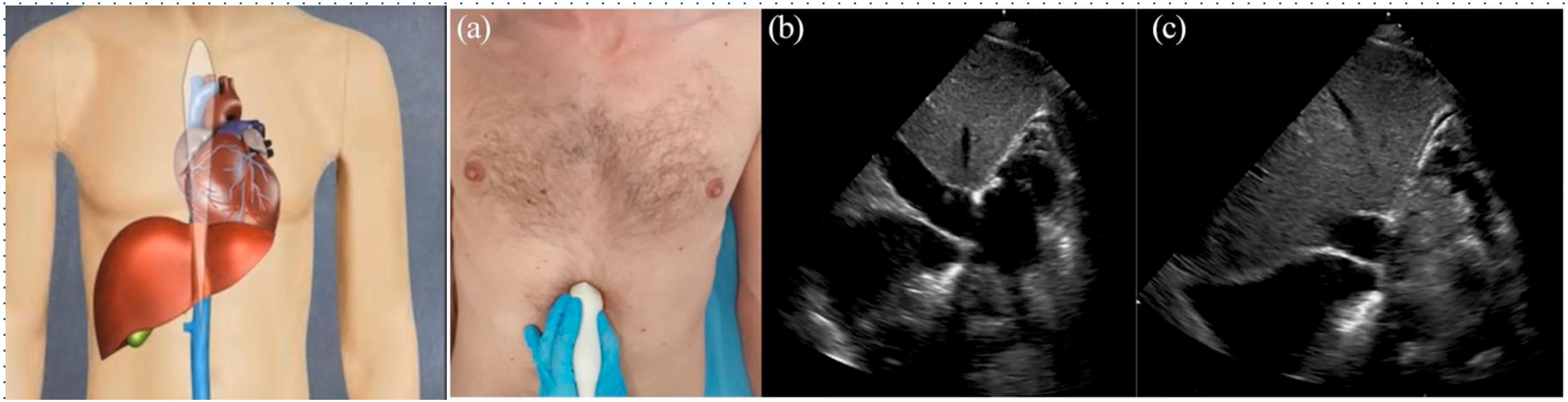
	Probe	Technique
Tip navigation	7–12 MHz linear probe (femoral vein and external iliac vein) 3–8 MHz convex probe (common iliac vein and IVC)	Visualization of the deep vessels of the lower limb according to RaFeVA Visualization of IVC in short and long axis views
Tip location	2–6 MHz sectorial probe As 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

TRANSTHORACIC ECHOCARDIOGRAPHY: ACOUSTIC VIEWS



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).

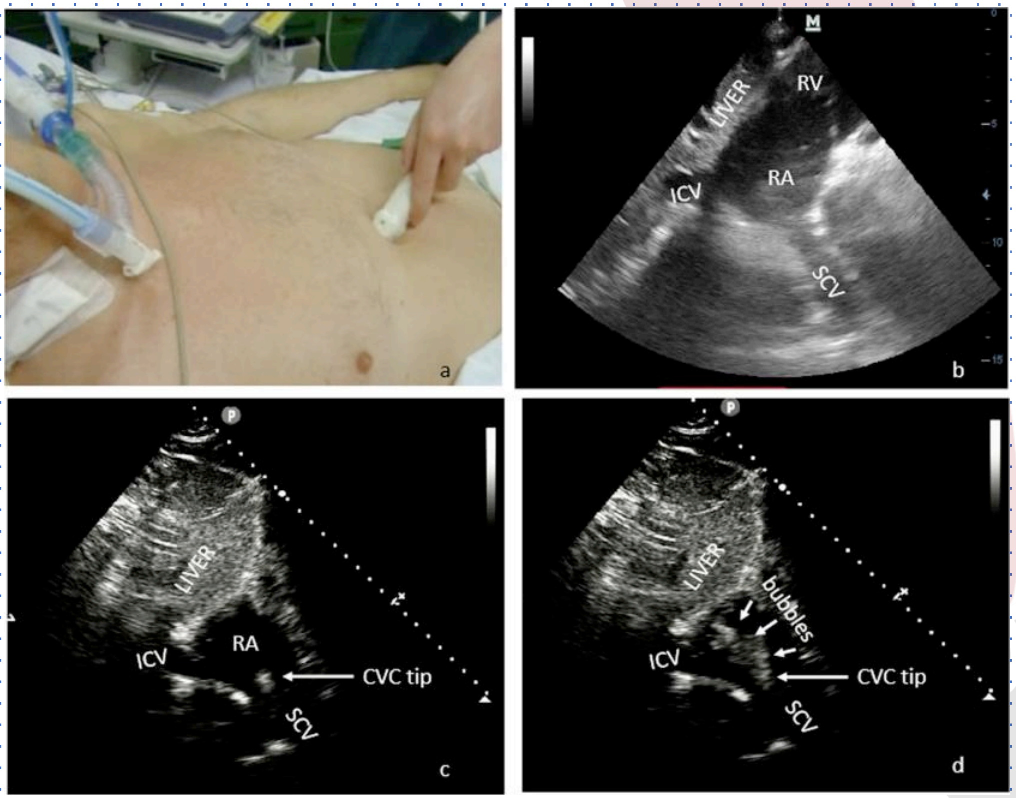
TRANSTHORACIC ECHOCARDIOGRAPHY: ACOUSTIC VIEWS



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).

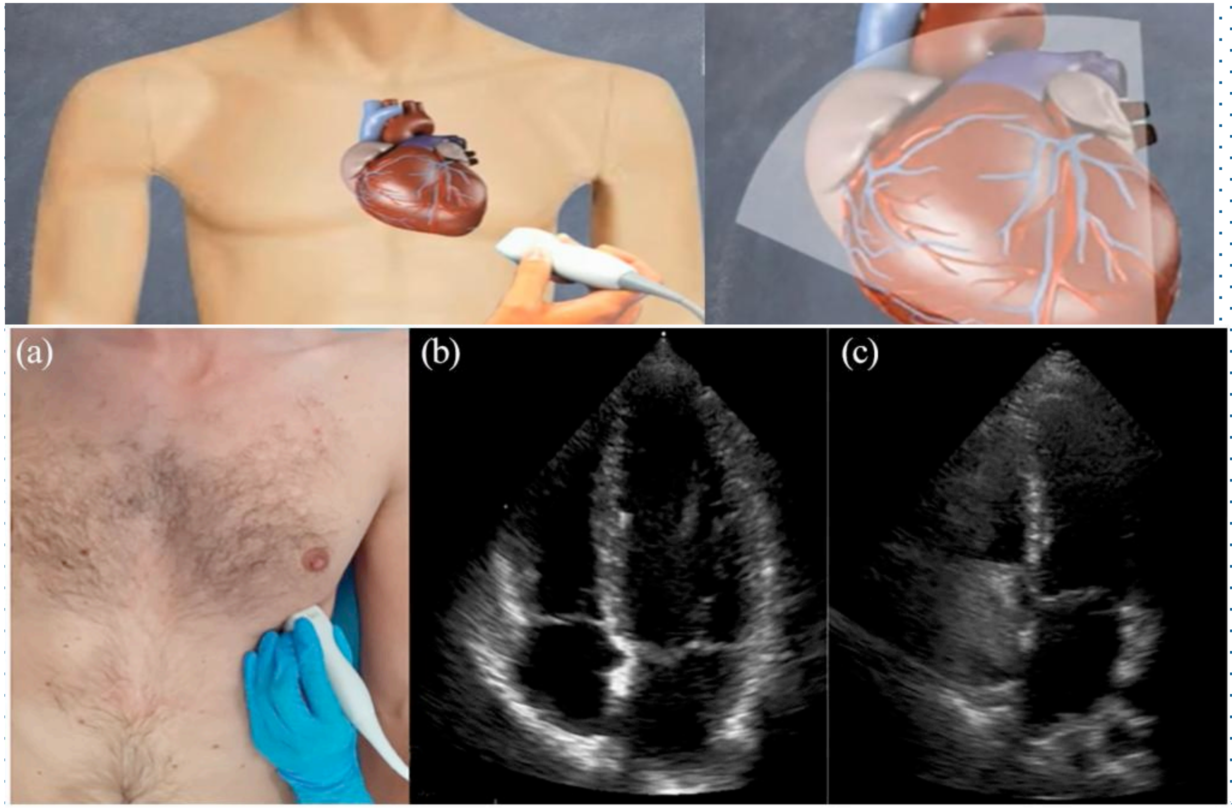
Ultrasound localization of central vein catheter tip by contrast-enhanced transthoracic ultrasonography: a comparison study with trans-esophageal echocardiography

2022



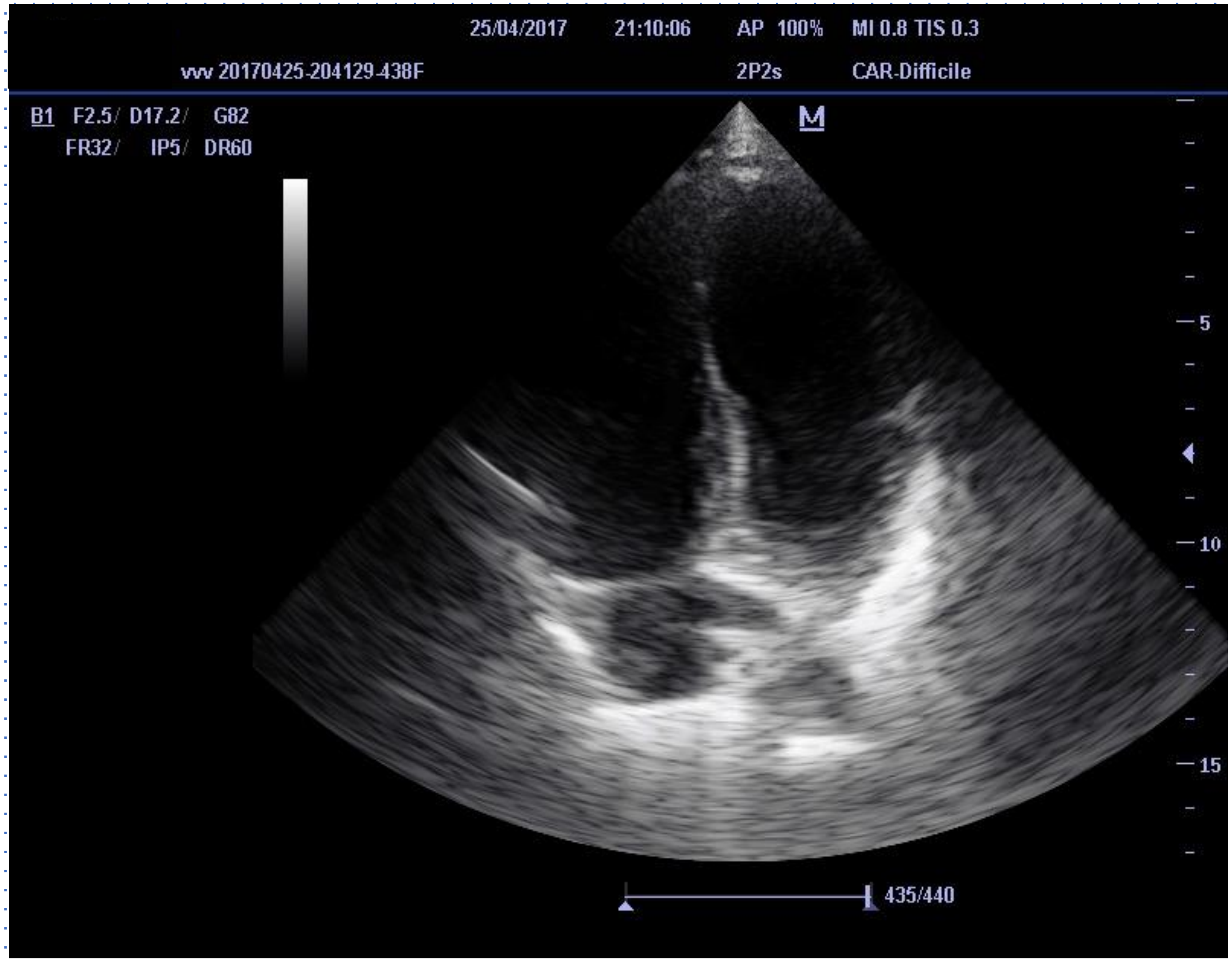
Corradi *et al. Critical Care* *(2022) 26:113*

TRANSTHORACIC ECHOCARDIOGRAPHY: ACOUSTIC VIEWS



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).


2P2s


25/04/2017
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B1 F2.5/ D17.2/ G82
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435/440

The utility of transthoracic echocardiography to confirm central line placement: An observational study

Table 2 Success of transthoracic echocardiographic identification of the right atrium (RA), injected microbubbles, and guidewire by skill level of sonographer and overall

	Adequate RA view			Identified microbubbles			Identified guidewire		
	n/n	% (95% CI)	*P* value*	*n/n*	% (95% CI)	*P* value*	*n/n*	% (95% CI)	*P* value*
Expert *vs* Novice									
Expert	62/65	95 (87 to 99)		61/65	94 (85 to 98)		62/65	95 (87 to 99)	
Novice	32/35	91 (77 to 98)		30/35	86 (70 to 95)		29/35	83 (66 to 93)	
P value†	0.42			0.27			0.06		
Overall	94/100	94 (87 to 98)	< 0.0001	91/100	91 (84 to 96)	< 0.01	91/100	91 (84 to 96)	< 0.01

Can J Anesth/J Can Anesth (2014) 61:340–346

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American Journal of Emergency Medicine

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Brief Report

Contrast enhanced ultrasound vs chest X-ray to determine correct central venous catheter position

2014

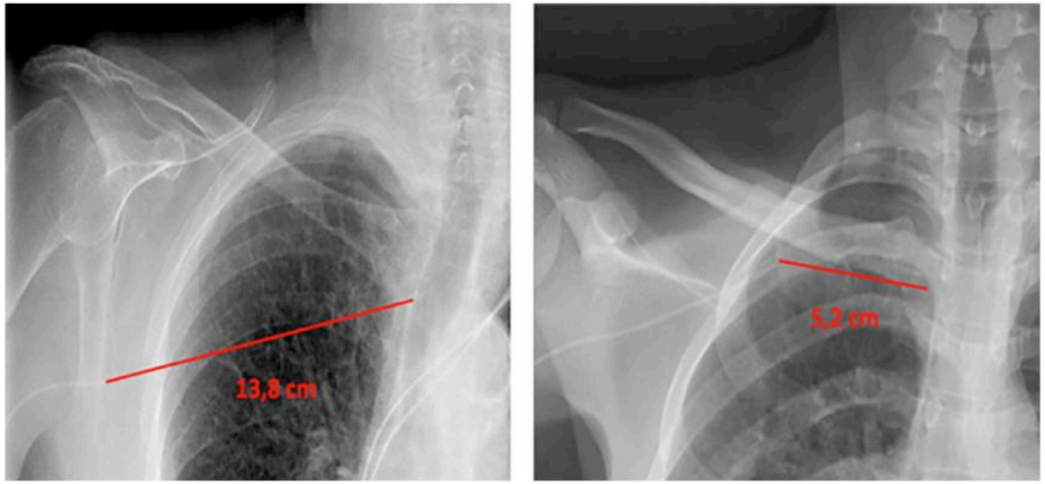
Table 4
Characteristics of patients not recognized by CEUS

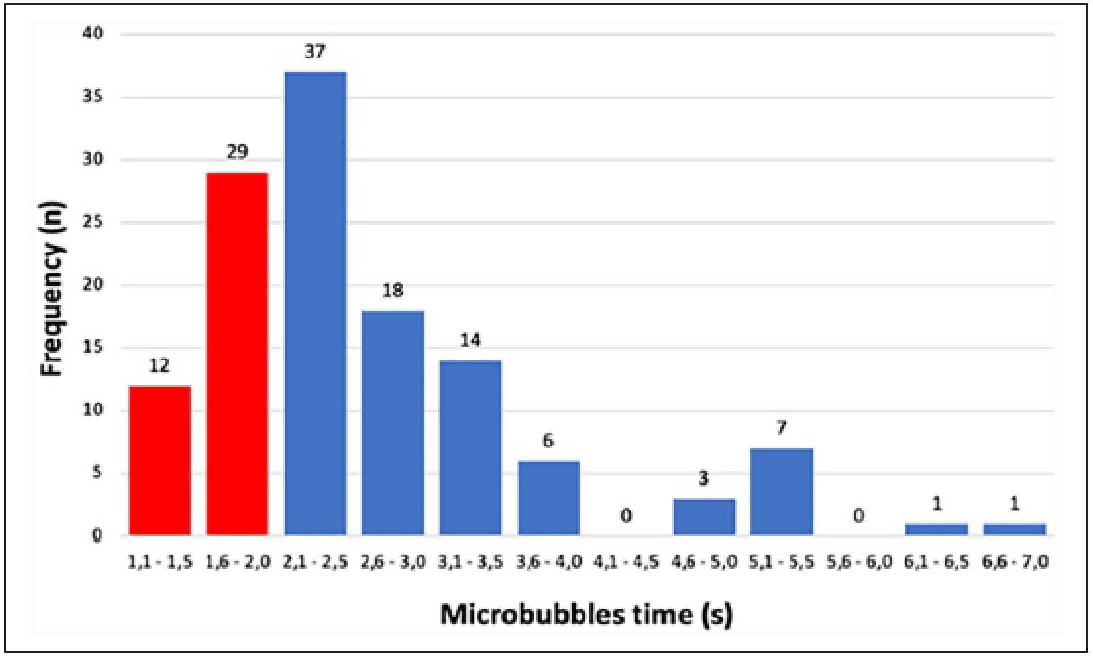
Patients	Clinical presentation	BMI	Line access site	CEUS results	CEUS time of visualization	interpretation	CXR results
1	Hematemesis in cirrhosis	22	Right IJV	laminar flow	<2 s	Correct tip placement	Right subclavian vein
2	Hemoperitoneum in cirrhosis	31	Left IJV	laminar flow	<2 s	Correct tip placement	Right brachiocephalic vein
3	Urosepsis	23	Left IJV	laminar flow	<2 s	Correct tip placement	Left brachiocephalic vein
4	Pneumonia	24	Right IJV	laminar flow	<2 s	Correct tip placement	Right atrium

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

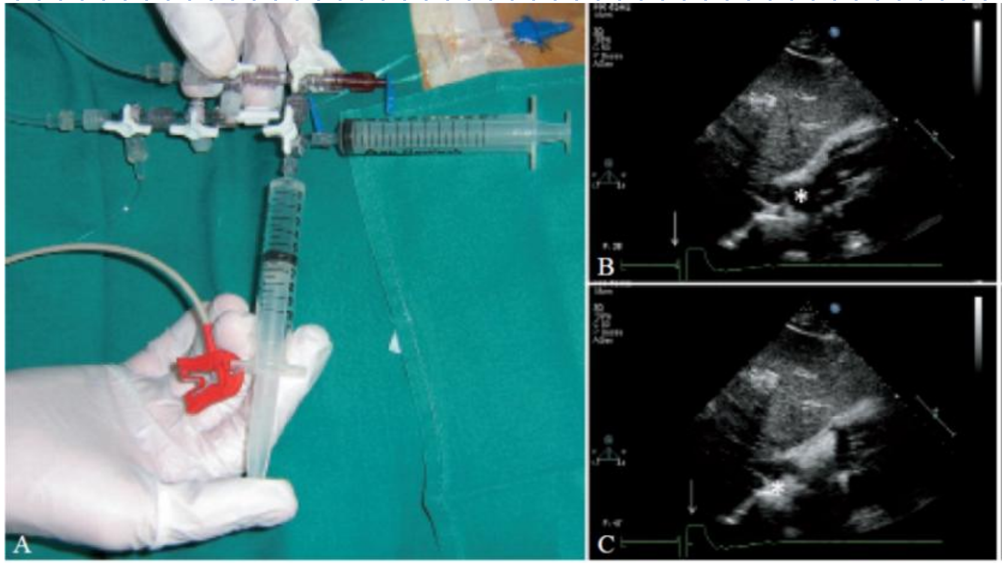
Academic Emergency Medicine
Official Journal of the Society for Academic Emergency Medicine

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.



2014

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

2015

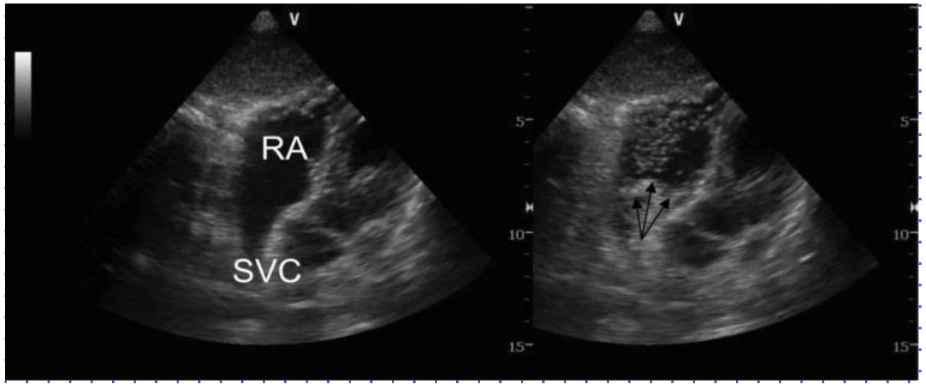
The mean time of appearance of the bubbles is one second or even less

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

2021

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 ($p > 0.05$).



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.

JVA The Journal of Vascular Access

The Journal of Vascular Access
1–5

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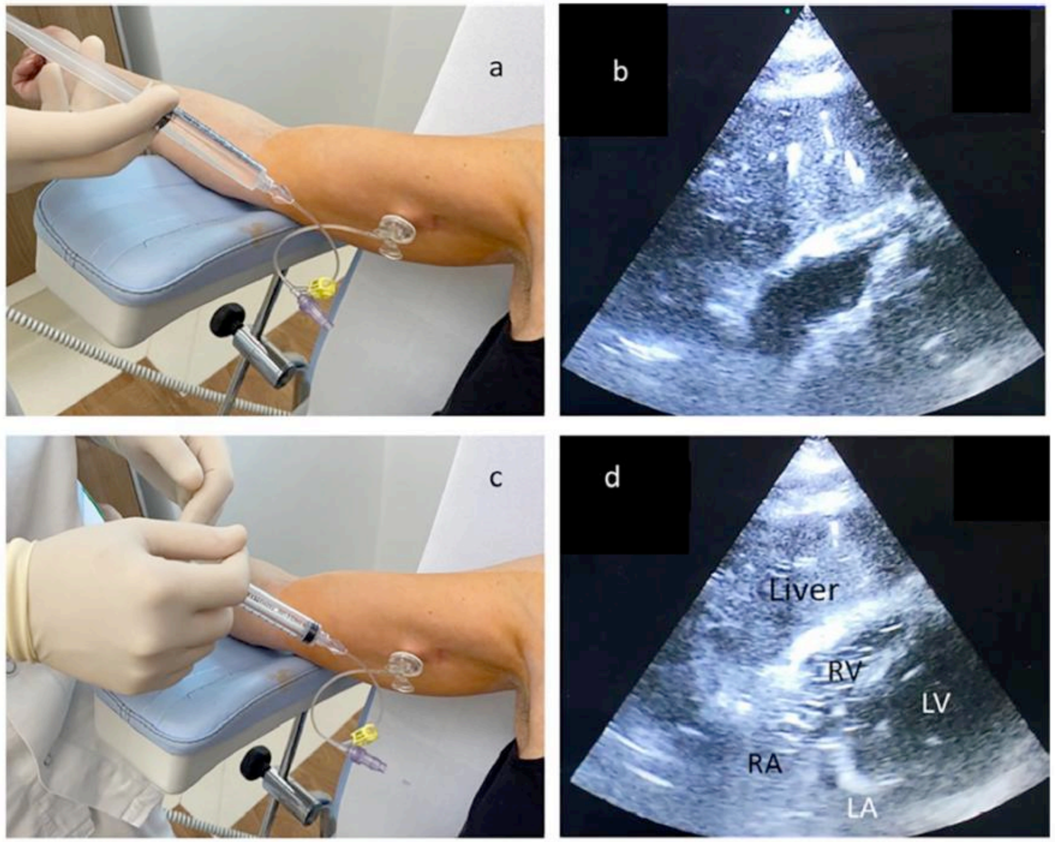
SAGE

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]



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

The combined use of intracavitary ECG and ultrasound based tip location may completely avoid the need for intraprocedural fluoroscopy and/or post-procedural chest X-ray in adult patients requiring central venous catheterization..........




There is still a lot that we can do…