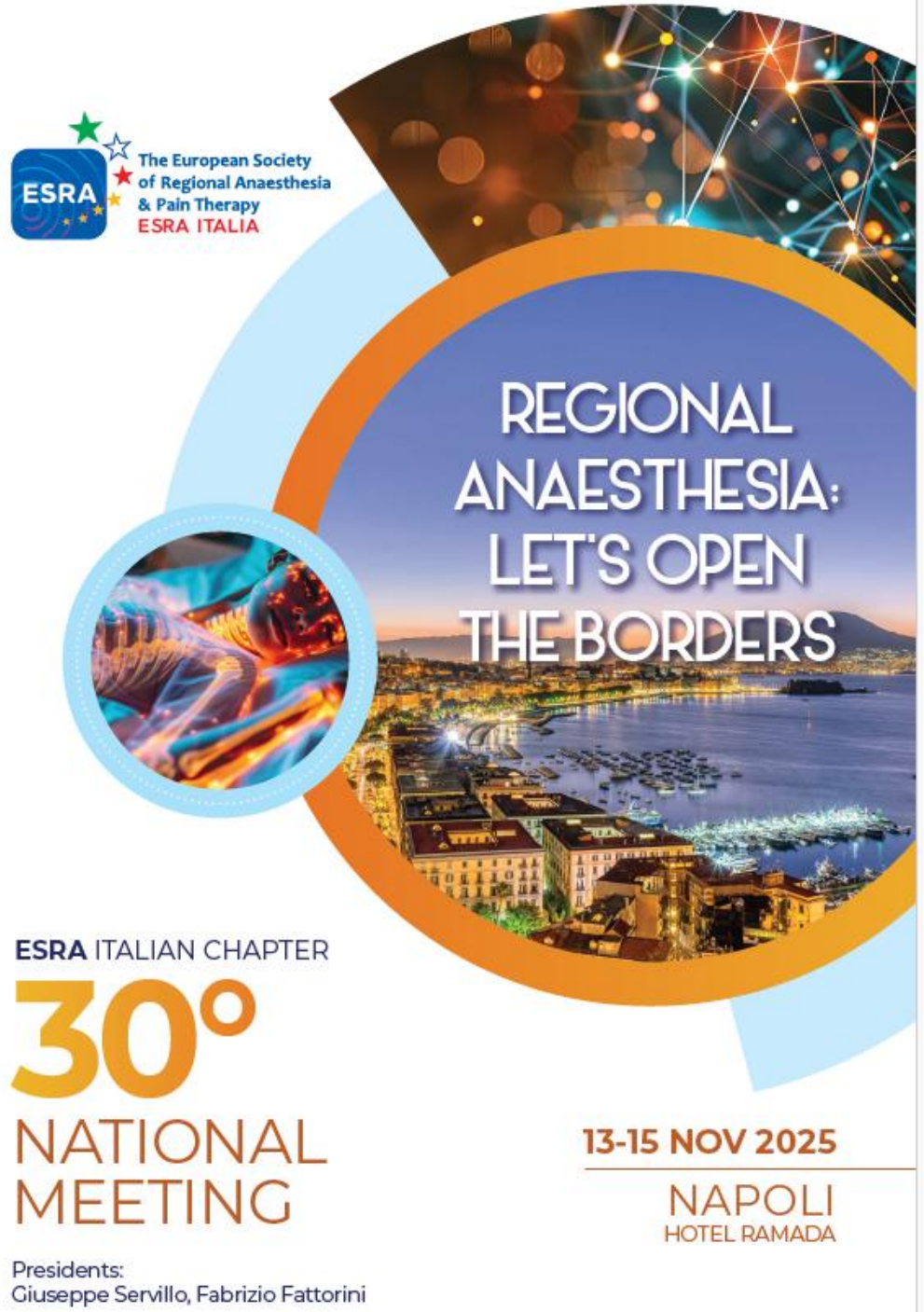
INTRACAVITARY ECG TECHNIQUE FOR TIP LOCATION DURING VENOUS ACCESS PLACEMENT

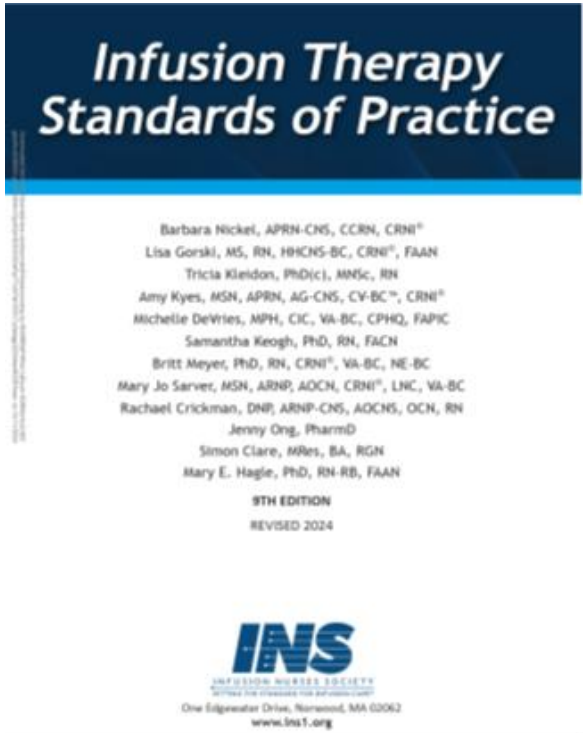
EMANUELE IACOBONE

OSPEDALE DI MACERATA

UO ANESTESIA E RIANIMAZIONE



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)



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

A GAVeCeLT consensus on the indication, insertion, and management of central venous access devices in the critically ill

JVA The Journal of Vascular Access 2024

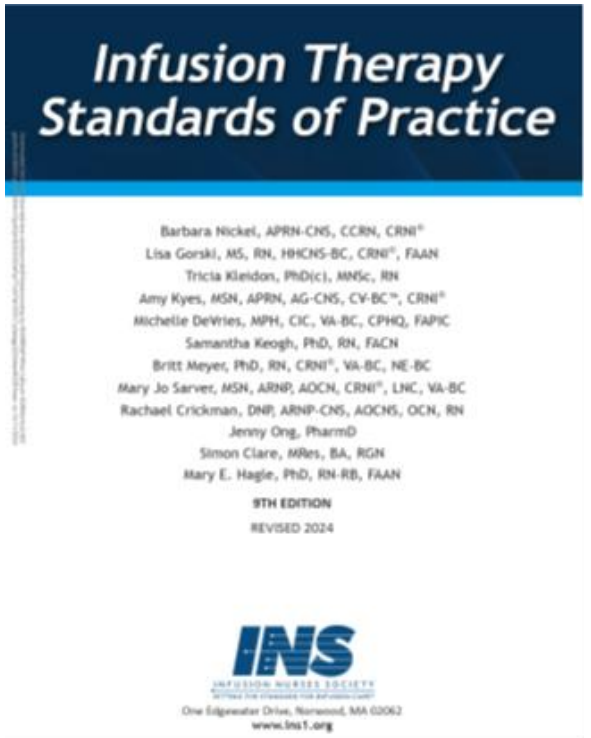
Evidence-Based Strategies and Recommendations for Preservation of Central Venous Access in Children

(*JPEN J Parenter Enteral Nutr.* 2019;00:1–24)

GAVeCeLT
Gli Accessi Venosi Centrali a Lungo Termine

RACCOMANDAZIONI GAVeCeLT 2024
PER LA INDICAZIONE, L'IMPIANTO E LA GESTIONE
DEI DISPOSITIVI PER ACCESSO VENOSO

a cura di Mauro Pittiruti e Giancarlo Scoppettuolo



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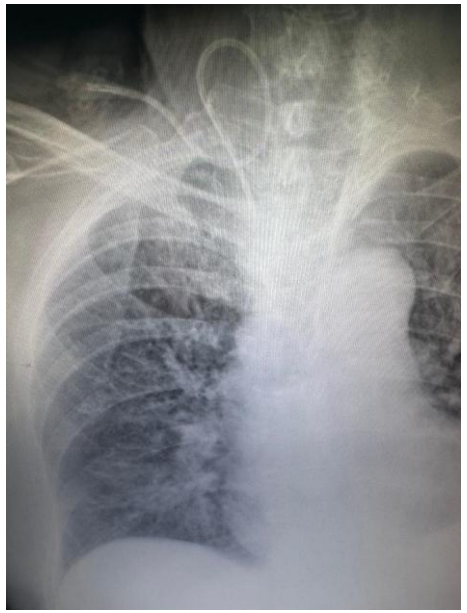
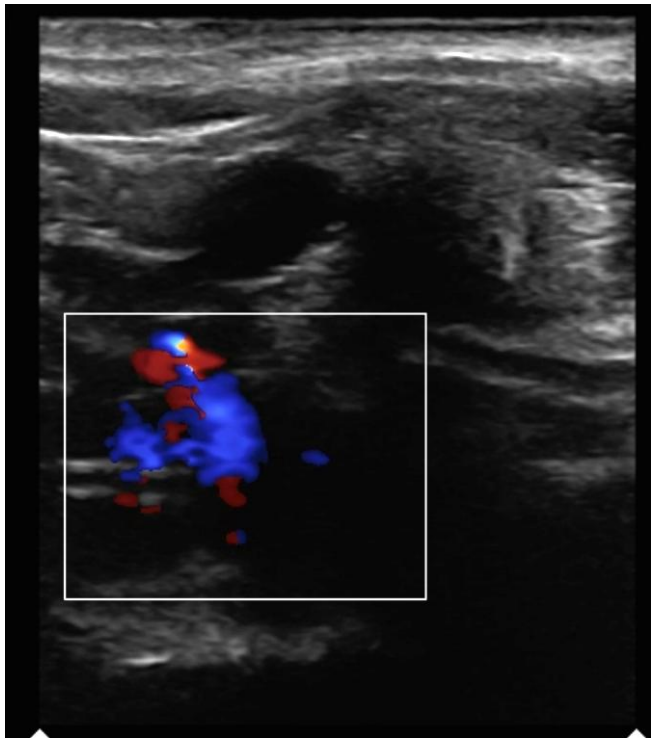
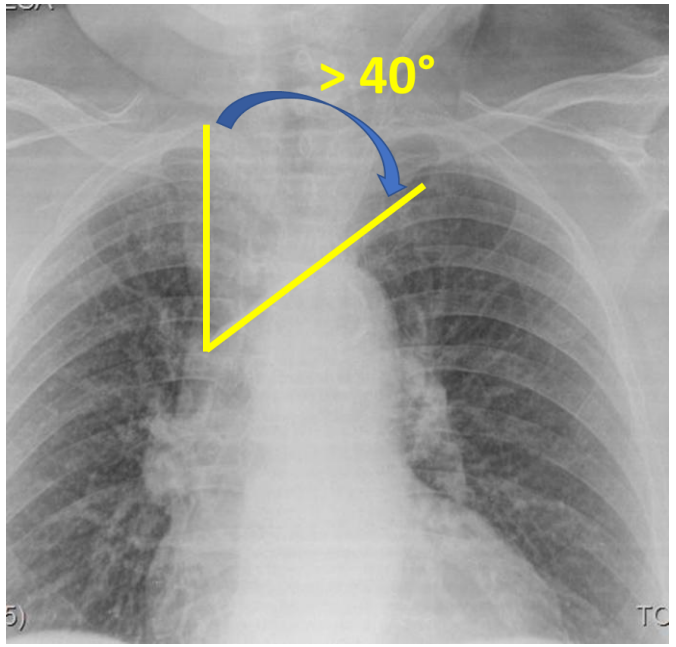
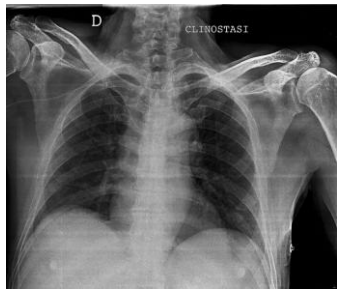
An Italian expert consensus on the choice of the method of tip location for central venous access devices

2025









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

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 elective 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).

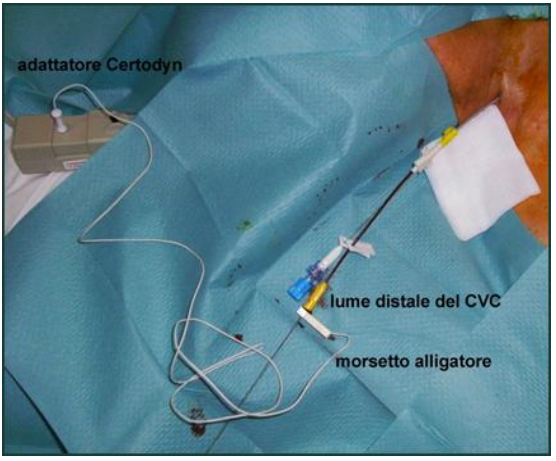
(100% agreement: 95.5% strongly agree, 4.5% agree)

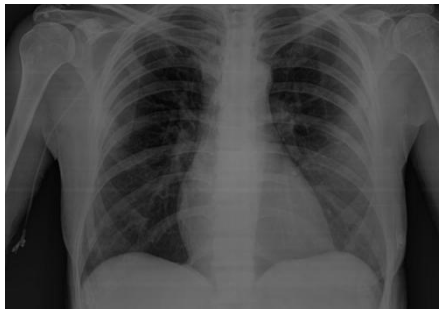
TIP LOCATION METHODS

DURING THE PROCEDURE	AFTER THE PROCEDURE
Intracavitary ECG	Chest x-ray
Fluoroscopy	Echocardiography (TTE, TEE)
Echocardiography (TTE, TEE)	CT, MR, angiography

- Intraprocedural techniques allow as to correct malposition during the procedure

- Post-procedural control of tip location is associated with the possible need for repositioning the tip. Which implies:
  - waste of time
  - waste of resources
  - potential harm to the patient



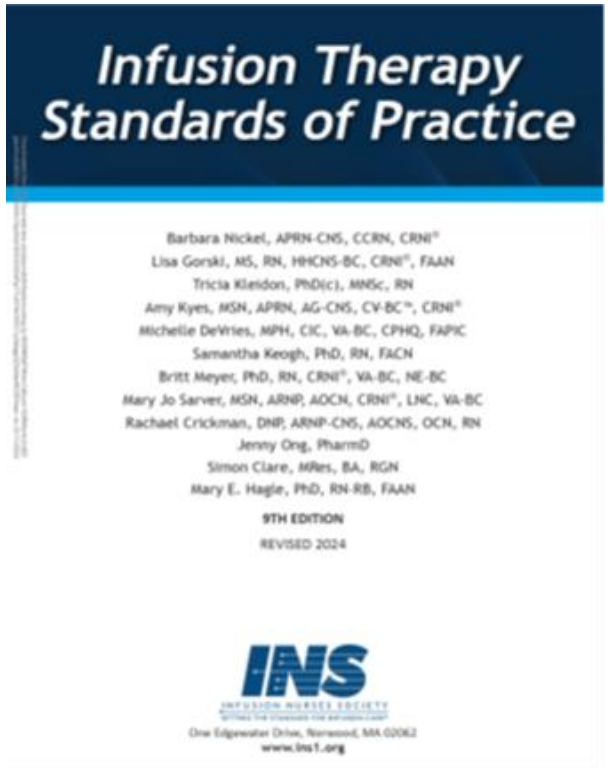


Question #3: In which cases is the IC-ECG method indicated?

Statement 3.1: The IC-ECG method is recommended as the intraprocedural method of first choice for the tip location of any CVAD whose tip is to be placed near the junction between superior vena cava and right atrium, or inside the right atrium (with the exception of ECC in the newborn).

(100% agreement: 90.9% strongly agree, 9.1% agree)

PROTOCOL ISAC 2	Verification of tip location during the procedure by **intracavitary ECG** and/or by echocardiography with bubble test (according to ECHOTIP protocol)
PROTOCOL ISP 2	Intra-procedural assessment of tip location—use **intracavitary ECG** and/or ultrasound (subcostal or apical view, using the "bubble test": see the ECHOTIP protocol)
PROTOCOL ISF	Verification of tip location during the procedure: if the tip has to be in right atrial, apply **intracavitary ECG** and/or echocardiography with bubble test (according to ECHOTIP protocol); if the tip has to be in inferior vena cava, use skin landmark or echocardiography with bubble test (according to ECHOTIP protocol). Consider X-ray abdomen after the procedure in particular cases
PROTOCOL ISP-Port	Check of tip location by **intracavitary ECG**, in the modified manner for patients with atrial fibrillation, if needed by echocardiography with bubble test (according to ECHOTIP protocol)
PROTOCO	Check of tip location by **intracavitary ECG**, in the modified manner for patients with



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IC-ECG

E. Use tip locating methods to identify CVAD tip location during the insertion procedure (ie, "real-time") for neonate, pediatric, and adult patients. Studies have demonstrated greater accuracy, more efficient initiation of infusion therapy, and reduced costs.[1,12] (IV)

   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.[1,12-30] (I)

The European Society of Regional Anaesthesia & Pain Therapy
ESRA ITALIA

ESRA ITALIAN CHAPTER | 30° NATIONAL MEETING
13-15 NOV 2025, NAPOLI

Intracavitary ECG versus X-ray guidance for central venous access device tip location: A cost-effectiveness analysis

2025

Fulvio Pinelli[1], Filippo Firenzuoli[2], Stefano Romagnoli[1,2], Marta Mazzella[3], Daniela Matarrese[4], Elvira Bianco[4], Valentina Gigli[5] and Gianluca Villa[1,2]

Table 1. Costs for PICC and port implantations.

	Port		PICC	
Costs	Fluoroscopy	IC-ECG	Chest X-rays	IC-ECG
Detailed costs				
Common costs (e.g. device, surgical materials, operating room, anesthesiologist's work time) (€)	309,10	309,10	278,74	278,74
Number of nurses required × nurse's hourly cost (€/h)	2 × 29,64 = 59,28	1 × 29,64	1 × 29,64	1 × 29,64
Angiography cost (€/h)	250,00			
Radiographer cost (€/h)	31,66			
Day hospital cost (€/day)	230,00			
Cost of transportation to the radiology department (€)			15,00	
Cost of disposable IC-ECG cable (€) (Vygocard™, Vygon, France)		10,92		10,92
Cost of IC-ECG monitor (Pilot™, Vygon, France) per procedure (€)		1,76		1,55
Cost per chest X-ray (CXR)	41,00		41,00	
Total costs				
Number of procedures/year (Ref. 2022)	753,00	753,00	969,00	969,00
Total cost per single procedure (€)	921,04	351,42	364,38	320,85
Total cost savings per single procedure by using IC-ECG versus radiology (€)		569,62		43,53
Percentage of procedures where IC-ECG is unfeasible		7%		7%
Number of patients requiring chest X-ray (CXR) as an alternative to unfeasible IC-ECG		52,71		67,83
Total cost of tip location when IC-ECG is unfeasible (€)		2.161,11		2.781,03
Primary malpositioning rate		5%	15%	
Total cost of re-implantation (€)		926,17	52.962,63	
Total cost for all procedures/year	693.543,12	267.706,54	406.046,85	313.684,88

IC-ECG: intracavitary ECG; CVAD: Central Vascular Access Device; PORT: Porth-A-Cath; PICC: Peripherally Inserted Central Catheter.

JVA The Journal of Vascular Access

Review

The Journal of Vascular Access
1–8

DOI: 10.1177/1129729820929835
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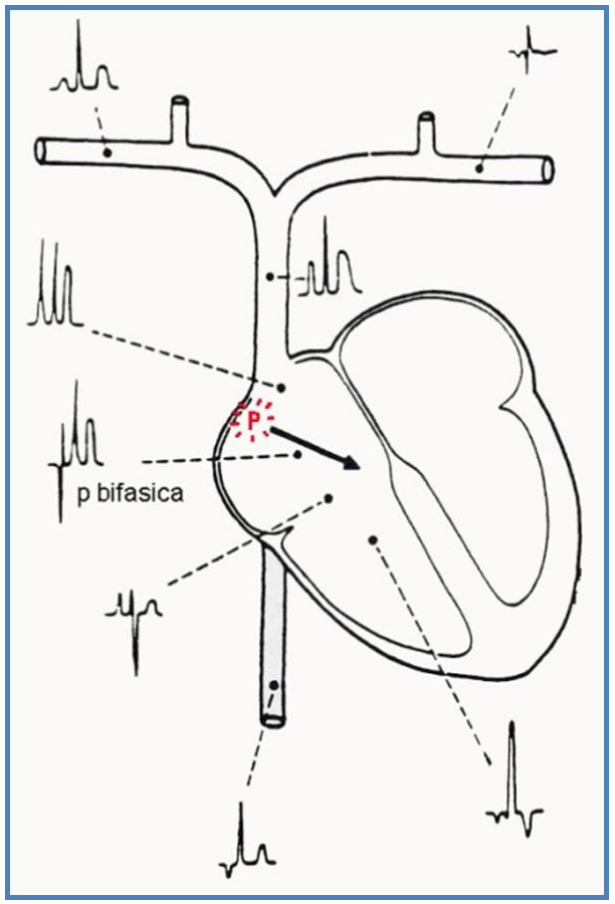
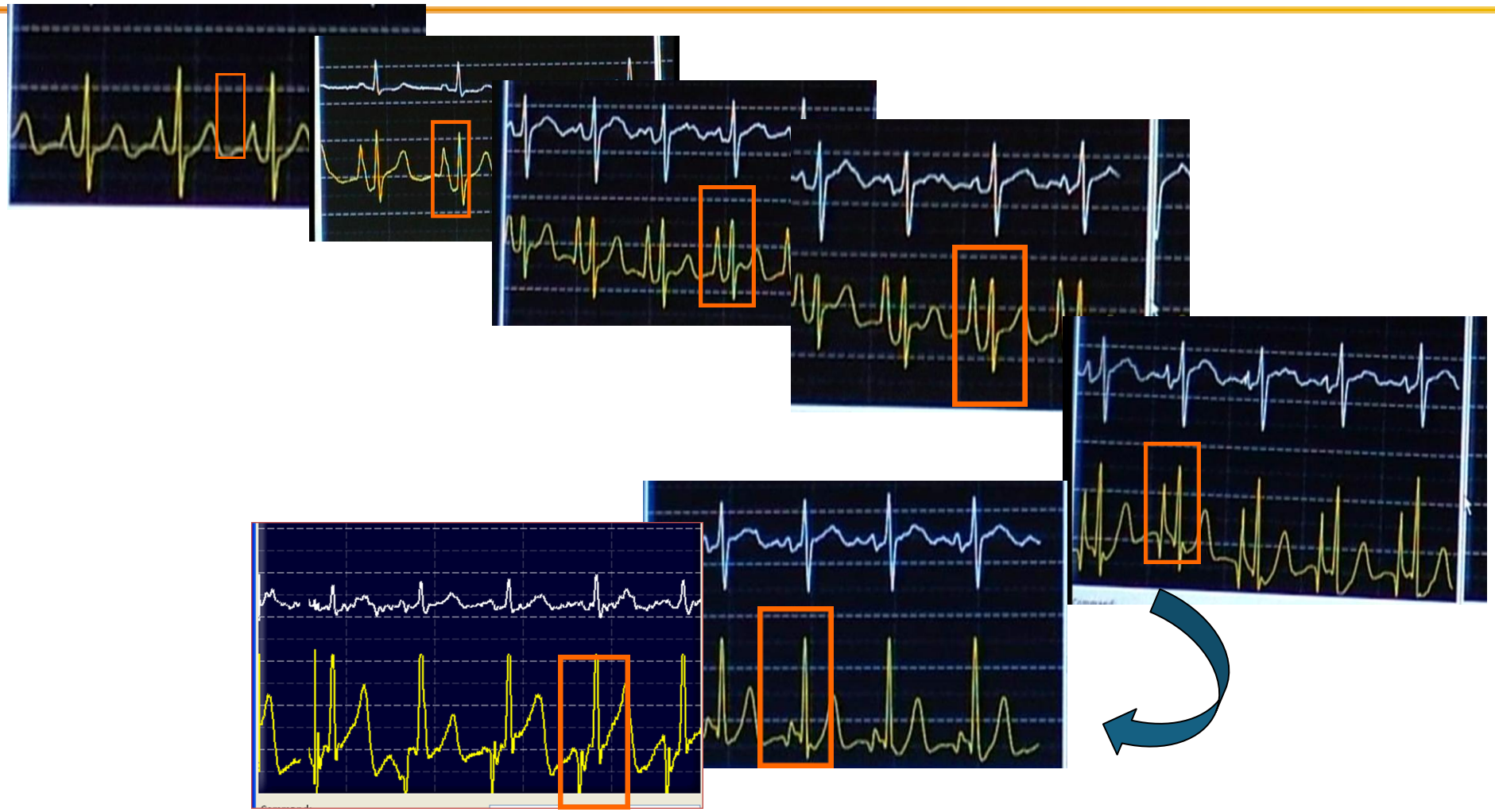
Intracavitary electrocardiography for tip location during central venous catheterization: A narrative review of 70 years of clinical studies

Mauro Pittiruti[1], Filippo Pelagatti[2] and Fulvio Pinelli[3]

catheters. Thanks to this intense publishing activity, many issues has been clarified: (a) the maximal height of the P wave represents faithfully CAJ (i.e. the crista terminalis); (b) the maximal height of the P wave is not related to the location of the sinus node, but to the site of transition between electrically inactive tissue (SVC) and electrically active tissue (RA); and (c) the best way to identify maximal P wave, avoiding false positives, is to look at the "typical" pattern of P wave changes when the catheter is pushed from the SVC into the atrium (rising P–peak–decreasing or biphasic P).



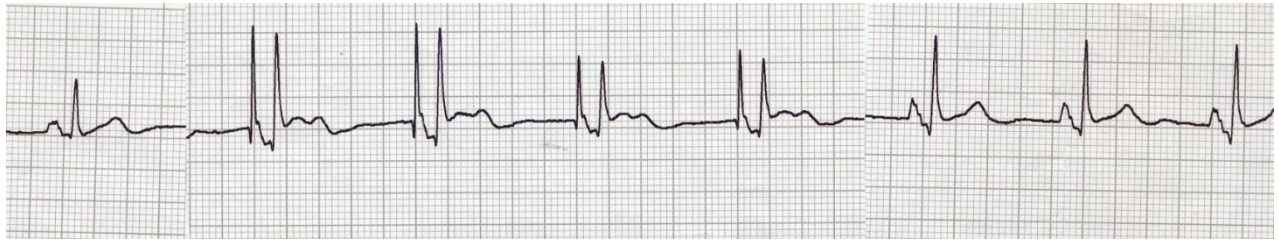


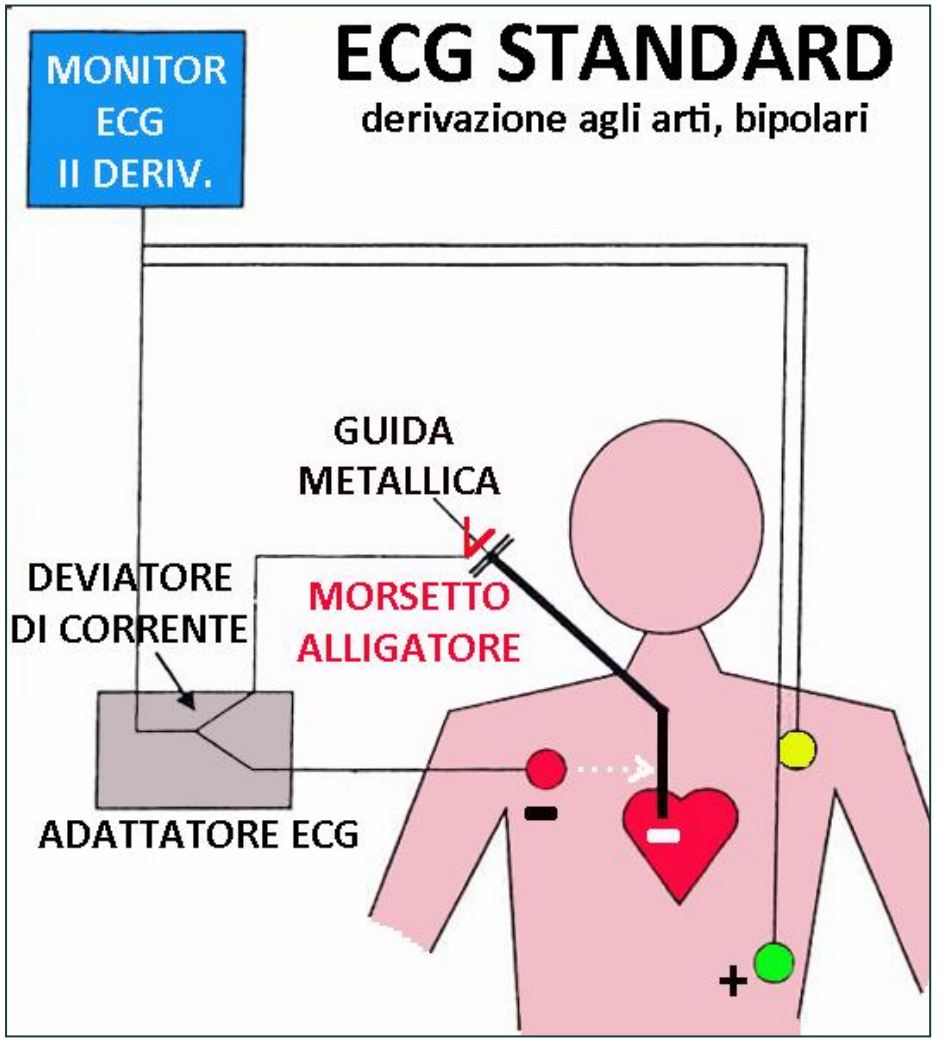
Martin JT et al. Neuroanesthetic adjiuncts for surgery in the sitting position. Intravascular electrocardiography. Anesth Analg 49: 793-805, 1970.

Thanks to Antonio La Greca

Intracavitary ECG

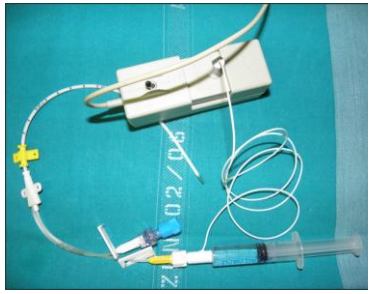
P basale **P max** **P rise**

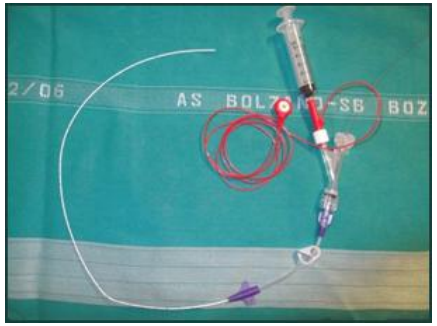




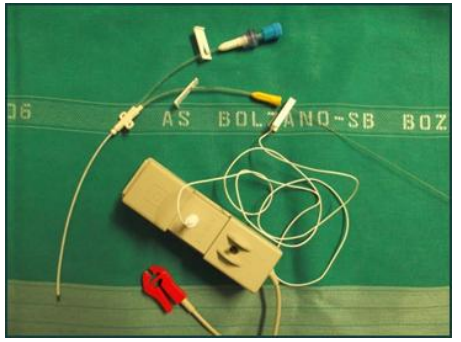
Thanks to Giuseppe Capozzoli

Column of saline technique





Guidewire technique



Martin JT et al. Neuroanesthetic adjiuncts for surgery in the sitting position. Intravascular electrocardiography. Anesth Analg 49: 793-805, 1970.

RESEARCH ARTICLE

Factors Influencing Intracavitary Electrocardiographic P-Wave Changes during Central Venous Catheter Placement

PLOS ONE | DOI:10.1371/journal.pone.0124846 April 27, 2015

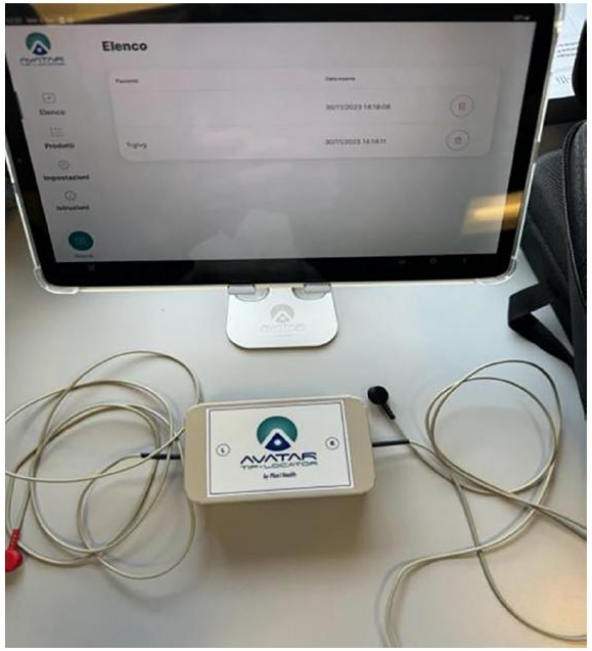
The correct reading of the P-wave variations can be influenced by many technical factors, such as:

- The position of the electrodes (which must be standardized)
- The choice of the most appropriate voltage on the monitor display (one should choose the amplitude that best magnifies the P-wave variations)
- The choice of monitoring mode
- The presence of other electro-medical devices in the proximity of the patient (it is advisable to turn off any device that is not essential)

A new wireless device for bedside assessment of tip location of central venous access devices using intracavitary ECG: A retrospective study

Fabrizio Brescia[1], Maria Giuseppina Annetta[2] and Mauro Pittiruti[3]

The Journal of Vascular Access
2025, Vol. 26(4) 1408–1412



Feasibility of the IC-ECG system

Number and percentage of cases with ECG trace clear and easy to interpret	906 cases (92.2%)
Number and percentage of cases with unidentified source of interference	45 cases (4.6%)
Number and percentage of cases with ECG tracing present on the display, but impossible to interpret due to severe disturbance or inability to identify p-wave in any form	32 cases (3.2%)

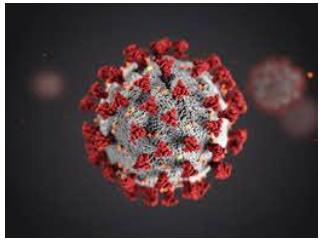
Pittiruti and Pinelli *Critical Care* (2020) 24:269
https://doi.org/10.1186/s13054-020-02997-1

Critical Care

COMMENTARY Open Access

Recommendations for the use of vascular access in the COVID-19 patients: an Italian perspective

Mauro Pittiruti[1*], Fulvio Pinelli[2] on behalf of the GAVeCeLT Working Group for Vascular Access in COVID-19



JVA The Journal of Vascular Access

Editorial

Vascular access in COVID-19 patients: Smart decisions for maximal safety

The Journal of Vascular Access
2020, Vol. 21(4) 408–410
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Giancarlo Scoppettuolo[1], Daniele Guerino Biasucci[2] and Mauro Pittiruti[3]

The combined use of wireless ultrasound probes and wireless IC-ECG systems such as the one we tested is specifically useful in COVID patients or in patients infected with multi-resistant germs, as these devices are easy to decontaminate (they can be quickly and completely cleaned with appropriate solutions/wipes immediately after the maneuver).

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Editorial

Choice and management of vascular access in the context of COVID-19 outbreak in Italy: Recommendations from clinical practice

The Journal of Vascular Access
1–6
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Davide Vailati[1], Giorgia Montrucchio[2], Vittorio Cerotto[3], Giuseppe Capozzoli[4], Fabio Gori[5], Flavia Petrini[6,7] and Luca Brazzi[2,8]; on behalf of the Italian Society of Anesthesia and Intensive Care (Società Italiana di Anestesia, Analgesia, Rianimazione e Terapia Intensiva, SIAARTI)

Contents lists available at ScienceDirect

Clinical Nutrition

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

osition of CVC tip	High osmolarity PN requires central venous access and should be delivered through a catheter whose tip is in the lower third of the superior vena cava, at the atrio-caval junction, or in the upper portion of the right atrium (Grade A). The position of the tip should preferably be checked during the procedure, especially when an infraclavicular approach to the subclavian vein has been used. Postoperative X-ray is mandatory (a) when the position of the tip has not been checked during the procedure, and/or (b) when the device has been placed using blind subclavian approach or other techniques which carry the risk of pleuropulmonary damage.	C, B	5

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

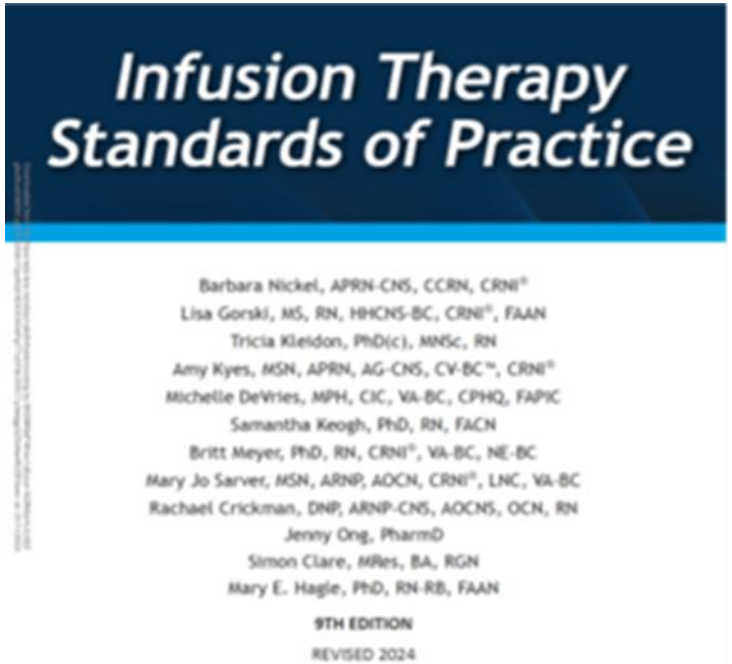
Annals of Internal Medicine SUPPLEMENT

The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results From a Multispecialty Panel Using the RAND/UCLA Appropriateness Method

Vineet Chopra, MD, MSc; Scott A. Flanders, MD; Sanjay Saint, MD, MPH; Scott C. Woller, MD; Naomi P. O'Grady, MD; Nasia Safdar, MD, PhD; Scott O. Trerotola, MD; Rajiv Saran, MD, PhD; Nancy Moureau, BSN, RN; Stephen Wiseman, PharmD; Mauro Pittiruti, MD; Elie A. Akl, MD, MPH, PhD; Agnes Y. Lee, MD, MSc; Anthony Courey, MD; Lakshmi Swaminathan, MD; Jack LeDonne, MD; Carol Becker, MHSA; Sarah L. Krein, PhD, RN; and Steven J. Bernstein, MD, MPH

existing PICC. Conversely, panelists rated routine radiographic verification of PICC tip position as inappropriate when PICCs were placed with electrocardiographic guidance, provided that proficiency with this technology had been demonstrated and adequate tracings (such as P-wave deflections) were observed.

a. Assess patient for known history of cardiac dysrhythmias and the presence of a P wave on ECG (if available) before planning to use ECG technology for tip confirmation. Contraindications to the use of ECG technology include patients with an abnormal ECG rhythm with an absence or alteration in the P wave (eg, presence of pacemakers, extreme tachycardia). Prospective observational studies have demonstrated safety and efficiency of using ECG to confirm catheter tip position in patients with atrial fibrillation.[20,29,31,32] (III)



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Conventional IC-ECG cannot be carried out when the p-wave is:

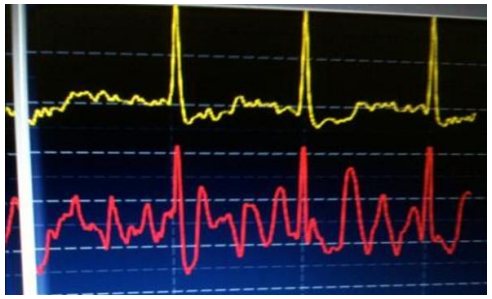
absent (atrial fibrillation);
abnormal (ectopic rhytms)
hidden (active pacemakers)

} Applicability

difficult to identify/evaluate (tachycardia, trembling patients, technical problems, malposition)

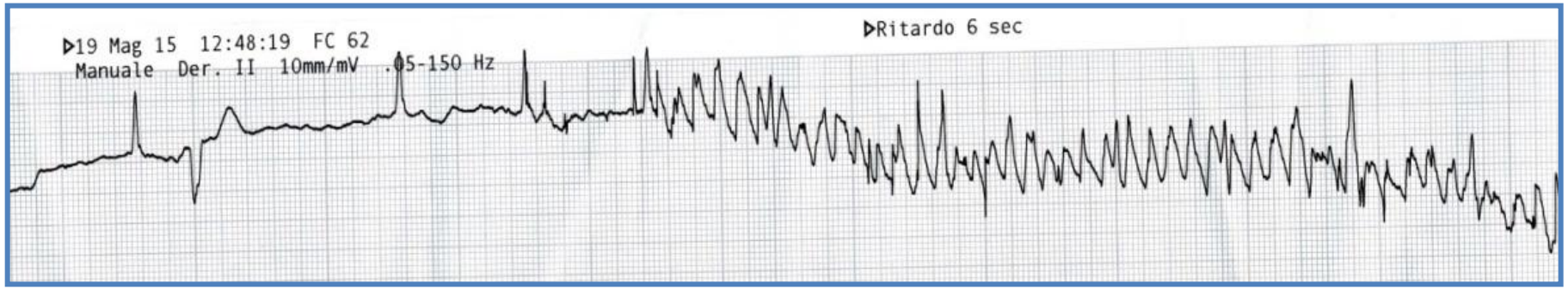
} Feasibilirty

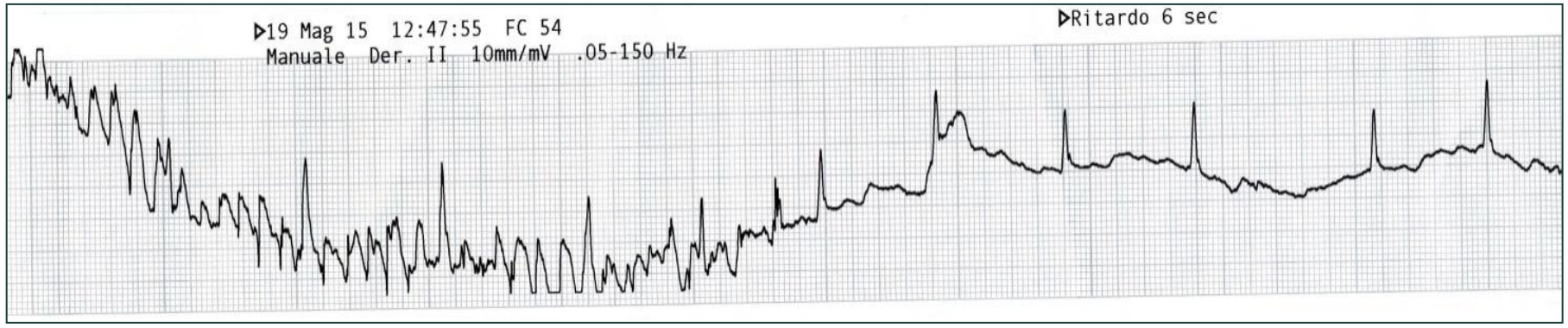
Applicability: 91-93%



Feasibility 98.5-99.3%

Atrial fibrillation





Schummer W. Modified ECG-guidance for optimal central venous catheter tip positioning. A transesophageal echocardiography controlled study Anaesthesist. 2005.

Original research article

JVA The Journal of Vascular Access

The Journal of Vascular Access
1–8

DOI: 10.1177/1129729818819422
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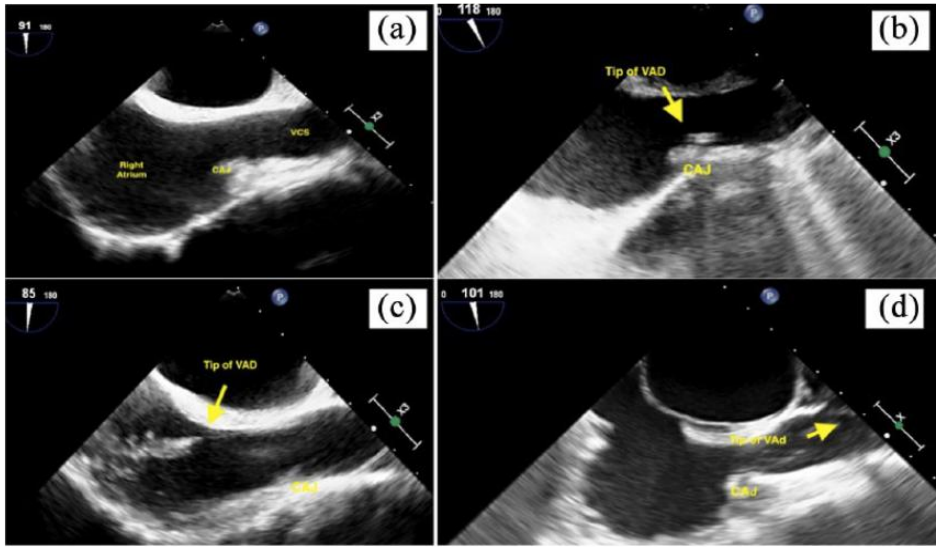
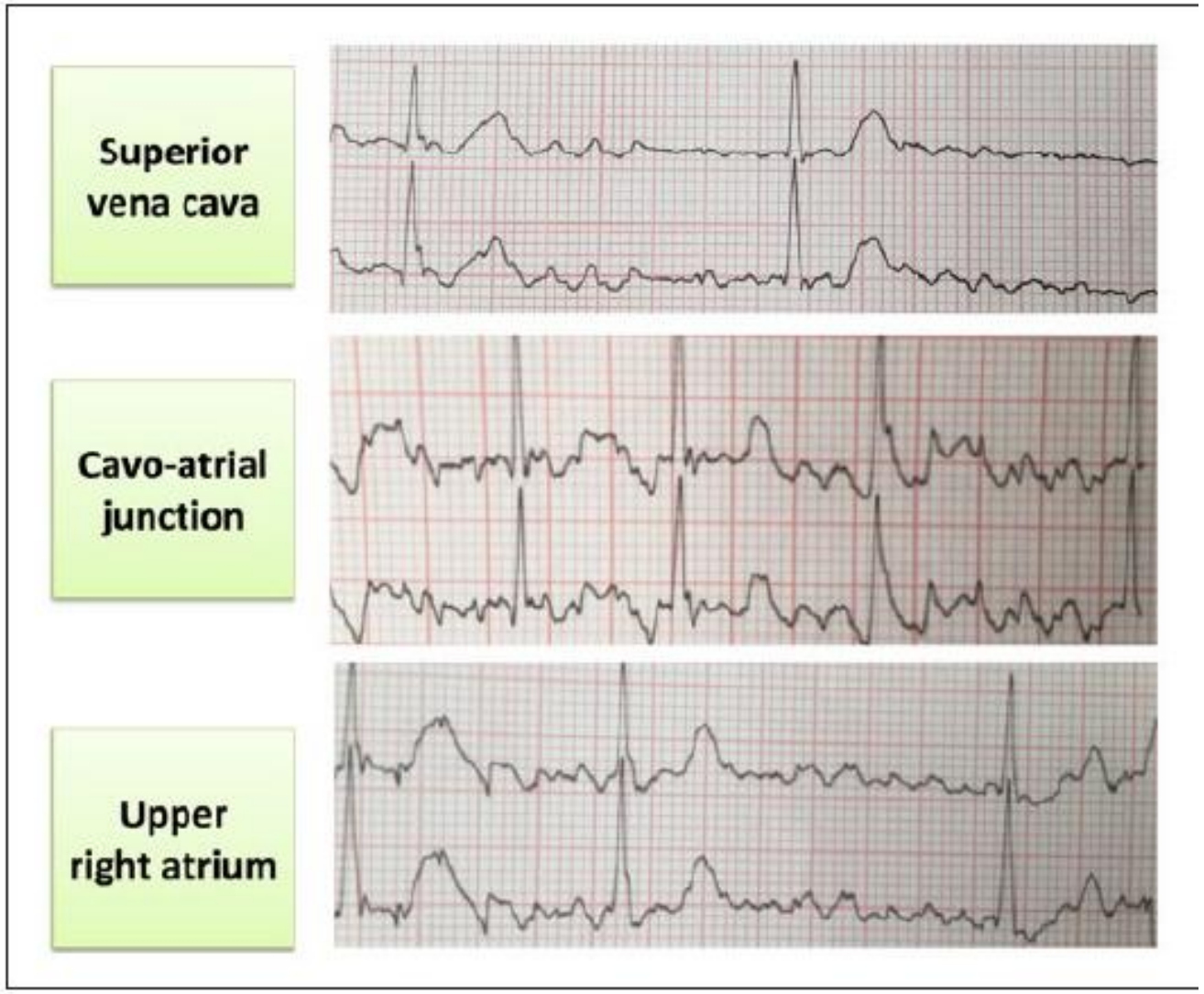
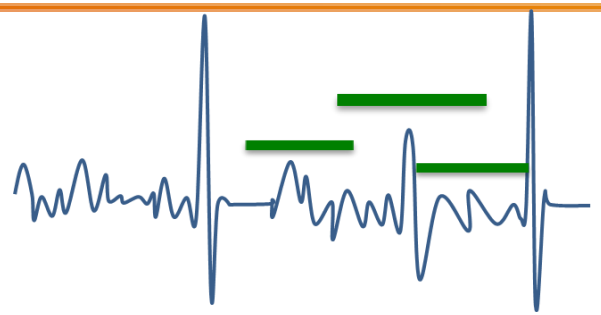
A modified intracavitary electrocardiographic method for detecting the location of the tip of central venous catheters in atrial fibrillation patients

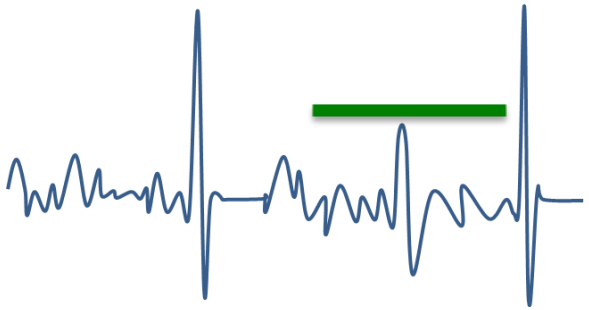
Maria Calabrese[1], Luca Montini[2], Gabriella Arlotta[1], Antonio La Greca[3], Daniele G Biasucci[2], Francesca Bevilacqua[1], Enrica Antoniucci[1], Andrea Scapigliati[1], Franco Cavaliere[1] and Mauro Pittiruti[3]







Method A



Method B

Method C

Question #6: In which cases is tip location by TTE with bubble test indicated?

Statement 6.1: Intraprocedural tip location by TTE is indicated as the first option in the following situations:

- **In the newborn, for the tip location of UVC, ECC, FICC;**
- **for the tip location of ultrasound-guided CICC in the newborn (in this case, both TTE and IC-ECG may be considered equally appropriate);**
- **in children and adults, for any FICC or FICC-port, if the tip is planned to be either in the right atrium or at the junction of the inferior cava and right atrium or in the subdiaphragmatic cava;**
- **in children and adults, for any CICC, PICC, chest-port, or PICC-port, when IC-ECG has limitations in its applicability and/or feasibility, or as a complement to the IC-ECG method in cases where interpretation is uncertain.**

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

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)**.

Original research article

JVA The Journal of Vascular Access

A feasible and safe standardized protocol for ultrasound and intracavitary electrocardiogram-based tip navigation and tip location during placement of peripherally inserted central catheters

The Journal of Vascular Access
2024, Vol. 25(3) 935–942

DOI: 10.1177/11297298221095039
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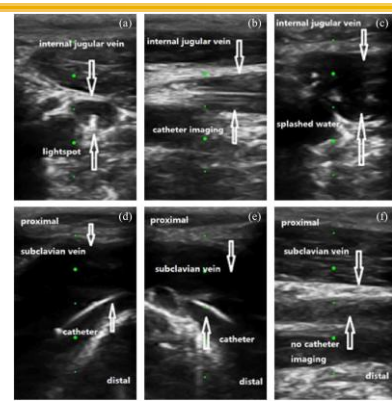


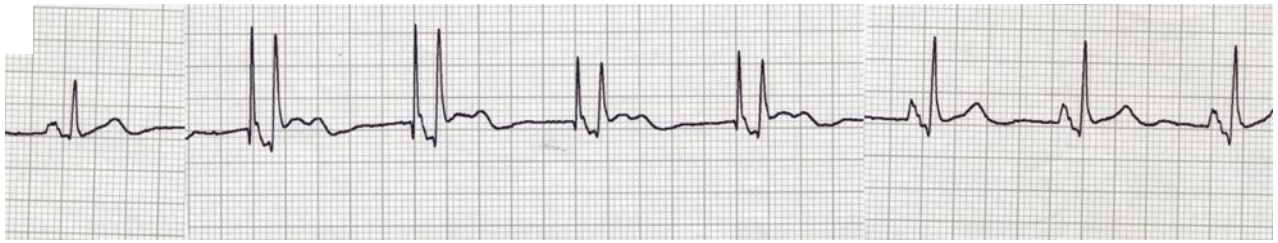
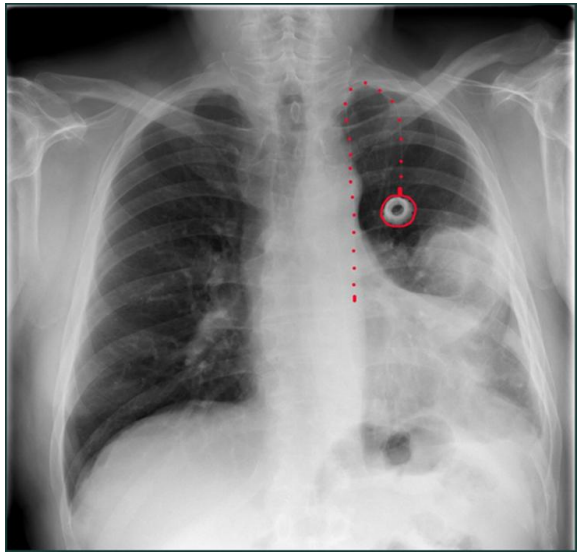


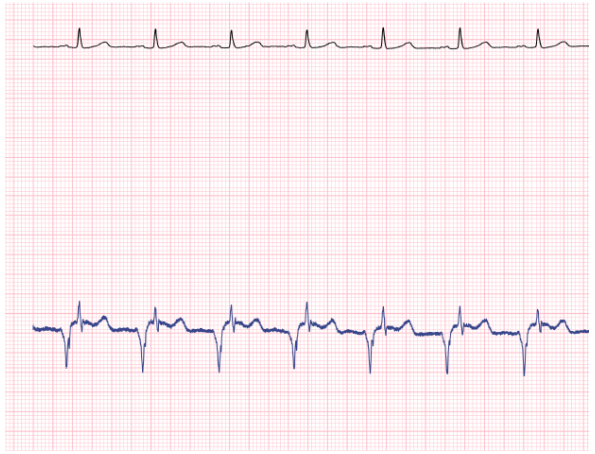
Table 3. Compared malposition of the tip location between two groups ($n = 3454$).

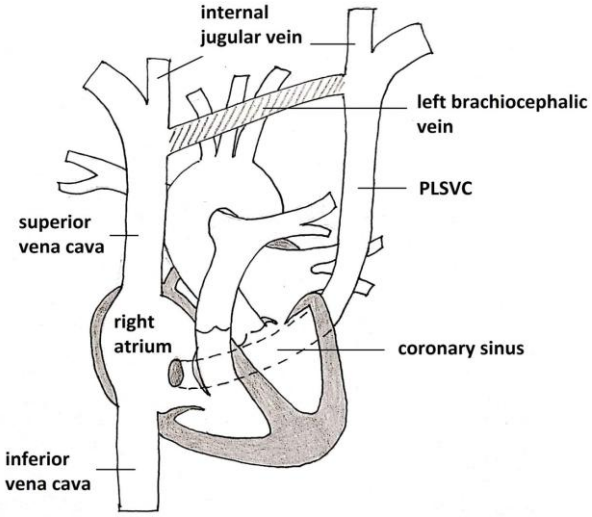
	ECG ($n = 1727$)	ECG + US ($n = 1727$)	Total ($n = 3454$)	p
Distance from tracheal carina (cm), *n* (%)				**<0.001**
<1.6	22 (1.3)	5 (0.3)	27 (0.8)	
1.6–4	1681 (97.3)	1720 (99.6)	3401 (98.5)	
>4	24 (1.4)	2 (0.1)	26 (0.8)	
Whether malposition or not, *n* (%)				**<0.001**
Y	46 (2.7)	7 (0.4)	53 (1.5)	
N	1681 (97.3)	1720 (99.6)	3401 (98.5)	

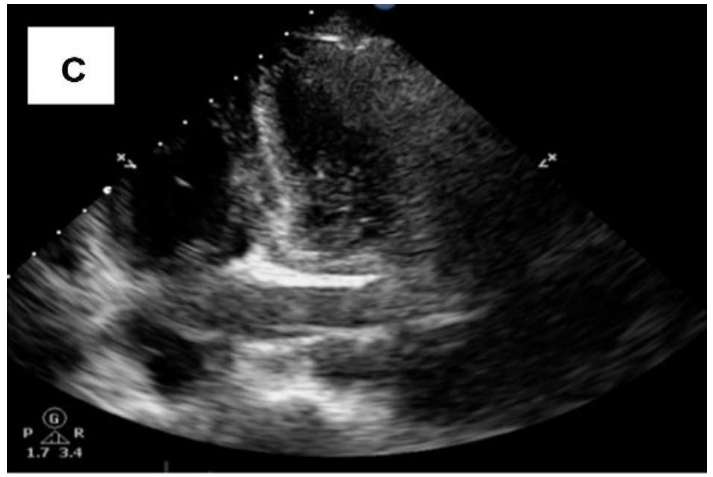
The combined use of intracavitary ECG and ultrasound based tip location may completely avoid the need for intraprocedural fluoroscopy and/or post-procedural chest X-ray in adult patients requiring central venous catheterization.....

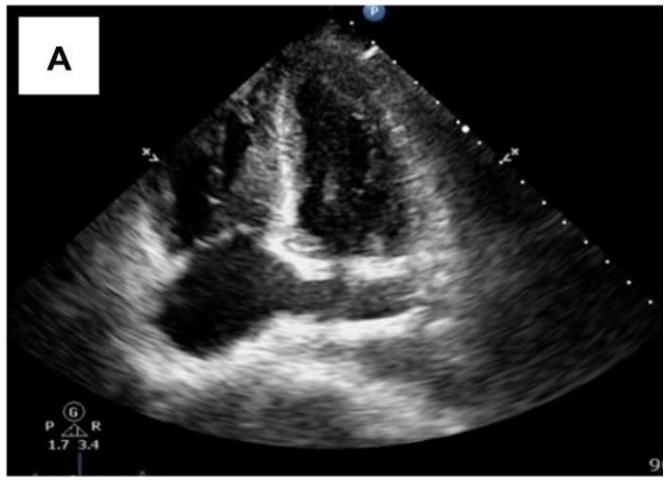
PERSISTENT LEFT SUPERIOR VENA CAVA











International Journal of Surgery Case Reports 12 (2015) 84–86

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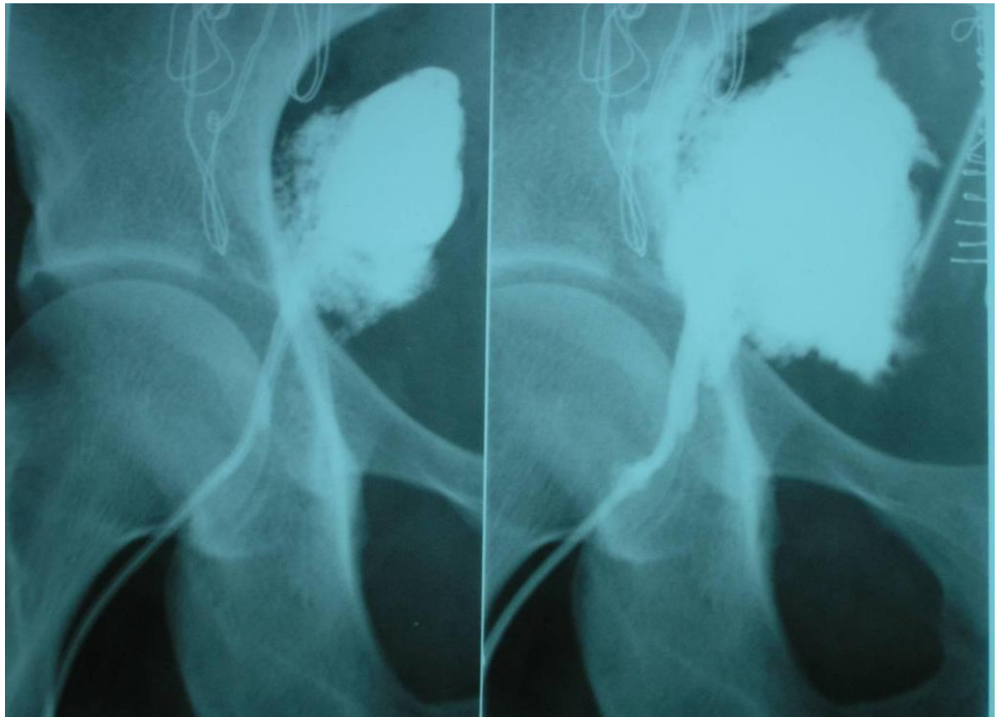
journal homepage: www.casereports.com

A case report of abdominal compartment syndrome caused by malposition of a femoral venous catheter

Georgios Pafitanis*, Koulas Spyridon, Evgenia Theodorakopoulou, Katrina Mason, Olga Ygropoulou, Ourania Mousafiri

Blizard Institute, 4 Newark Street, London E1 2AT, United Kingdom



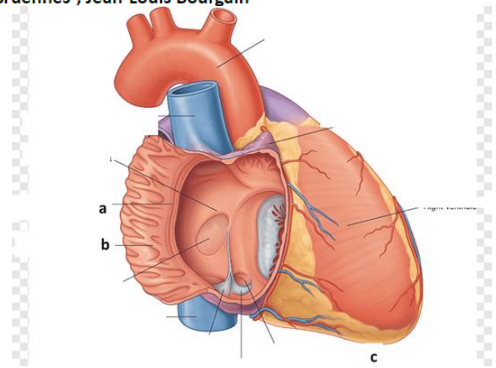
JVA
ISSN 1129-7298

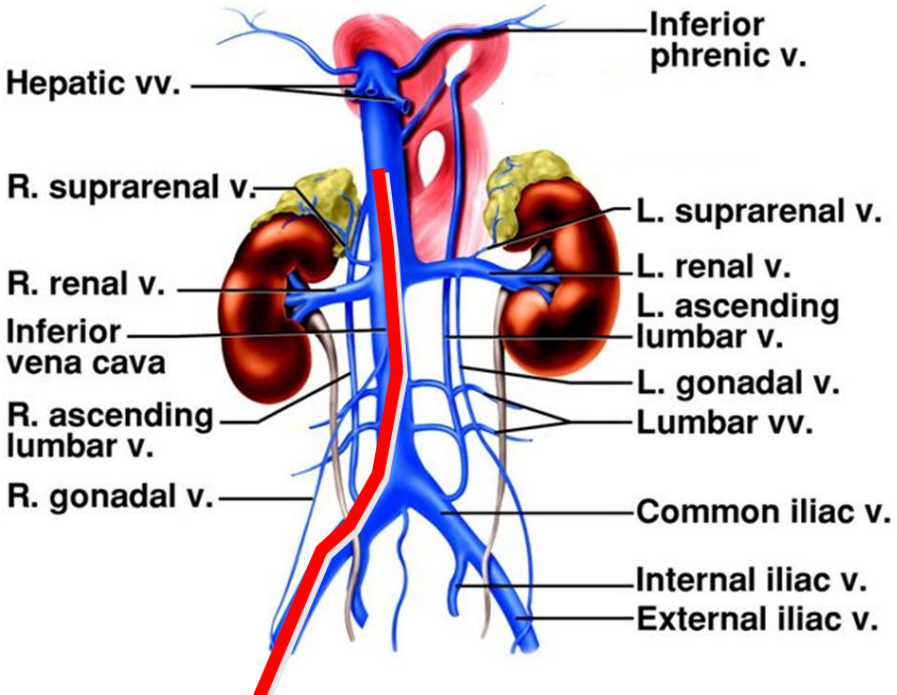
J Vasc Access 2015; 16 (4): 294-298
DOI: 10.5301/jva.5000386

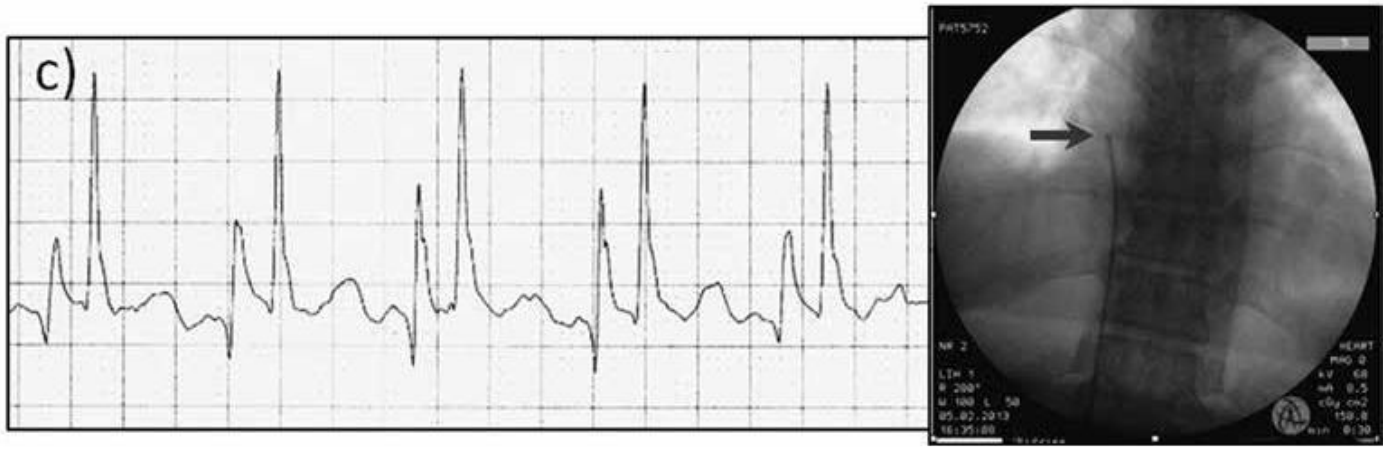
ORIGINAL ARTICLE

Peroperative electrocardiographic control of catheter tip position during implantation of femoral venous ports

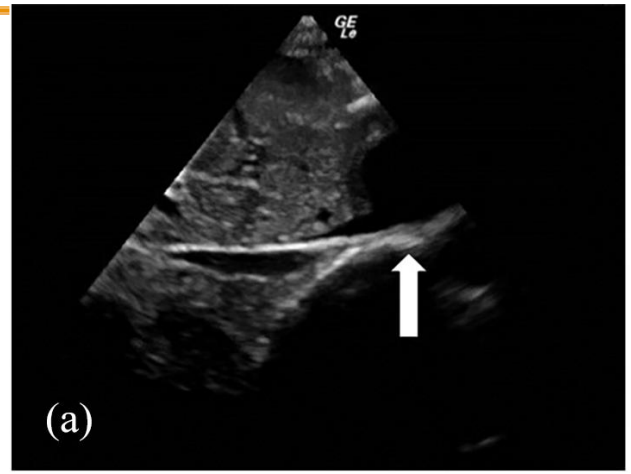
Pierre Gibault[1,2], Eric Desruennes[2], Jean-Louis Bourgain[2]

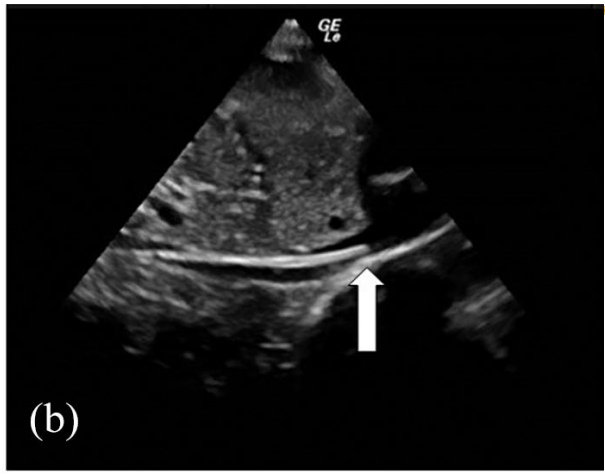






The application of intracavitary electrocardiogram for tip location of femoral vein catheters in chemotherapy patients with superior vena cava obstruction

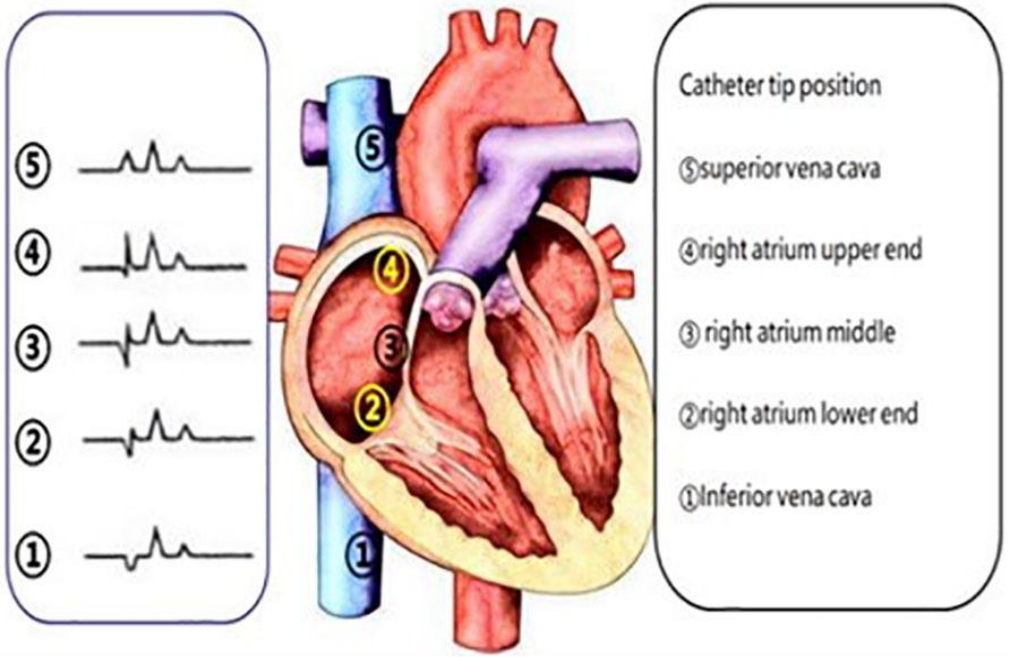




Use of intracavitary-ECG for tip location of femorally inserted central catheters

Mark D Weber, Adam S Himebauch and Thomas Conlon

JVA The Journal of Vascular Access



JVA The Journal of Vascular Access

The Journal of Vascular Access
1–6

DOI: 10.1177/11297298211015088
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Effects of indwelling centrally inserted central catheter on tip location of peripherally inserted central catheter with intracavitary electrocardiogram guidance: A retrospective case-control study

Table 2. Stability of the ECG waveform.

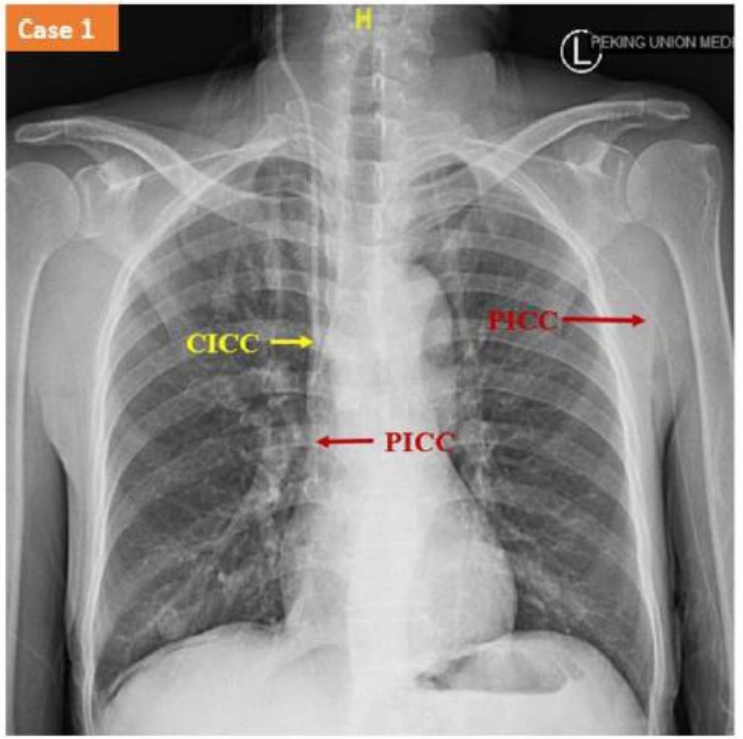
Group	Unstable waves (*N*, %)	Stable waves (*N*, %)	χ^2	*p* Value
Cases	3 (10.00)	27 (90.00)	0.22	0.64
Controls	2 (6.67)	28 (96.67)		

Table 3. Amplitude of the *P*-waves.

Amplitude (mV)	Cases	Controls	*t*	*p* Value
Baseline P-wave	0.14 ± 0.14	0.14 ± 0.11	0.06	0.96
Ideal P-wave	0.72 ± 0.47	0.64 ± 0.20	0.80	0.43

Table 4. Accuracy of the PICC tip location.

Group	PICC tip location (*N*, %)			Distance (cm)
	Accuracy	Shallow	Deep	
Cases	28 (93.33)	1 (3.33)	1 (3.33)	2.43 ± 1.51
Controls	29 (96.67)	1 (3.33)	0	2.47 ± 1.20
χ^2/t	1.40			−0.03
p Value	0.50			0.98



JVA
ISSN 1129-7298
J Vasc Access 2015; 16 (4): 285-288
DOI: 10.5301/jva.5000378
ORIGINAL ARTICLE

The intracavitary ECG method for insertion of a tunneled dialysis catheter without using fluoroscopy

Seong Cho, Yu-Ji Lee, Sung-Rok Kim

Division of Nephrology, Department of Internal Medicine, College of Medicine, The Sungkyunkwan University of Korea; Samsung Changwon Hospital, Changwon - Korea

The feasibility of this method was 94.4%

TABLE II - Tunneled catheter insertion characteristics

	N = 142
Risk of catheter placement failure, *N* (%)	0/142
Arterial puncture, *N* (%)	2/142
Hematoma, *N* (%)	2/142
Pneumo- or hemothorax, *N* (%)	0/142
Malfunction	3/142
P wave morphology at intracardiac EKG monitoring	
Zone 1: same as surface EKG P waves	8
Zone 2: P wave rising to maximal height	134
Zone 3: P wave decreasing with initial negative	0
Position of tip at the chest PA	
Zone 1: above carina	6
Zone 2: carina to 5 cm under the tracheal carina	136
Zone 3: below 5 cm under carina	0
Matching between intracardiac EKG and chest PA zone	134/136

JVA The Journal of Vascular Access

Review

A GAVeCeLT consensus on the indication, insertion, and management of central venous access devices in the critically ill

The Journal of Vascular Access
1–19

DOI: 10.1177/11297298241262932
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Question 11: Which should be the preferred methods for assessment of tip location?

Panel recommendation. The position of the tip of any central VAD must be assessed by intra-procedural, non-invasive methods such as intracavitary ECG or ultrasound-based tip location (preferably, according to the ECHOTIP protocol). *(Strong agreement: 26 agree, 0 uncertain, 0 disagree)*

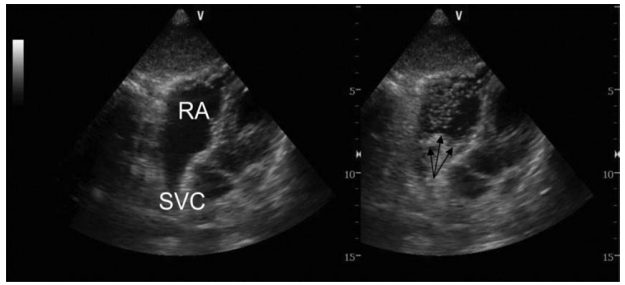
Question #1: In which cases is intraprocedural tip location of CVADs indicated?

Verification of correct central venous catheter placement in the emergency department: comparison between ultrasonography and chest radiography

Intern Emerg Med (2013) 8:173–180

Table 1 Reasons for hospitalization

Septic shock	99 (47 %)
Trauma	19 (9 %)
Lung disease	26 (12 %)
Heart disease	17 (8 %)
Abdominal disease	10 (5 %)
Acute renal failure and/or hydro-electrolytic disturbances	23 (11 %)
Inability to obtain peripheral access	5 (2 %)
Hypovolemic shock	9 (4 %)
Cardiopulmonary arrest	2 (1 %)



Question #2: In which cases is post-procedural tip location of CVADs indicated?

Statement 2.1: Post-procedural tip location is indicated:

a. **When intraprocedural tip location was impossible due to clinical emergency.**
b. **In rare but possible cases in which the main intraprocedural tip location methods (IC-ECG and TTE) were both found to be inapplicable or infeasible or associated with uncertain results.**
c. **In case of a CVAD placed in another hospital, or not used for a long time, or with history of previous tip migration (secondary tip malposition).**
d. **In case of device malfunction (e.g. persistent withdrawal occlusion).**
e. **In the case of dislocation of the extracutaneous tract of the device (unless the dislocation is obviously incompatible with a central position of the tip).**

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

Question #2: In which cases is post-procedural tip location of CVADs indicated?

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

The Journal of Vascular Access
1–5

DOI: 10.1177/11297298211023275
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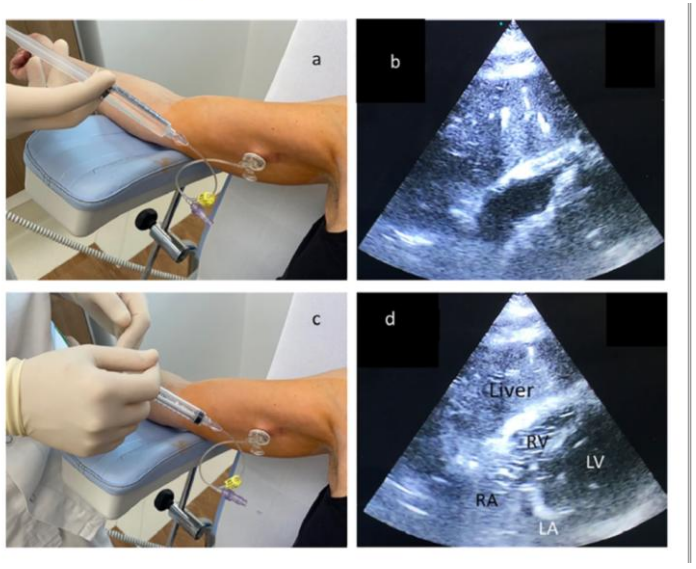
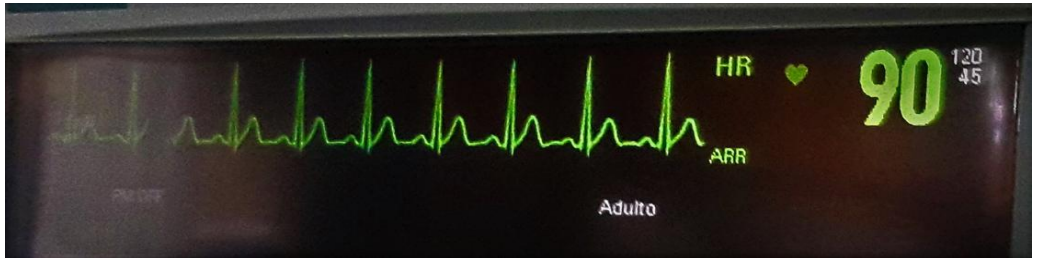
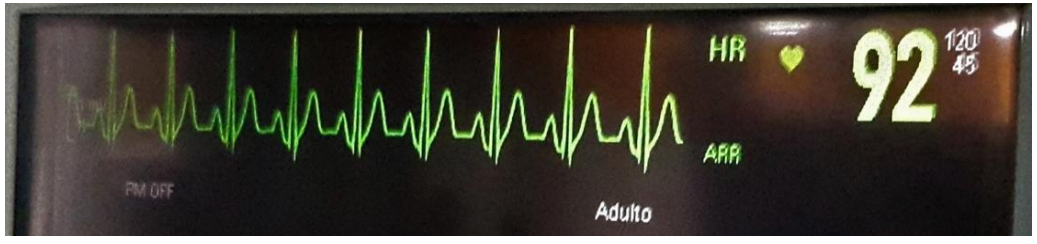
Sonia D'Arrigo[1], Maria Giuseppina Annetta[1] and Mauro Pittiruti[2]



- Pregnant woman with severe chronic constipation as "*slow transit*".
- PN
- PICC 4 Fr,





The intracavitary ECG method for positioning the tip of central venous access devices in pediatric patients: results of an Italian multicenter study

Francesca Rossetti[1], Mauro Pittiruti[2], Massimo Lamperti[3], Ugo Graziano[4], Davide Celentano[5], Giuseppe Capozzoli[6]

J Vasc Access 2014;

TABLE VI - MISMATCH BETWEEN IC-ECG AND X-RAY

	OB	BM	SN	MF	GR	
Mismatch Gr. A N=157	-	-	3	1	2	6 (3.8%)
Mismatch Gr. B N=119	-	-	1	2	3	6 (5%)
Mismatch Gr. C N=31	1	-	-	-	-	1 (3.2%)

The IC-ECG method is safe and accurate in the pediatric patient as much as in adults. Its applicability and feasibility are more than 99%. The concordance with the radiological methods is high (95.8%) and even higher (98.8%) when using a dedicated ECG monitor. If com-

The intracavitary ECG method for tip location of ultrasound-guided centrally inserted central catheter in neonates

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

The Journal of Vascular Access
2023, Vol. 24(5) 1134–1139

DOI: 10.1177/11297298211068302
journals.sagepub.com/home/jva
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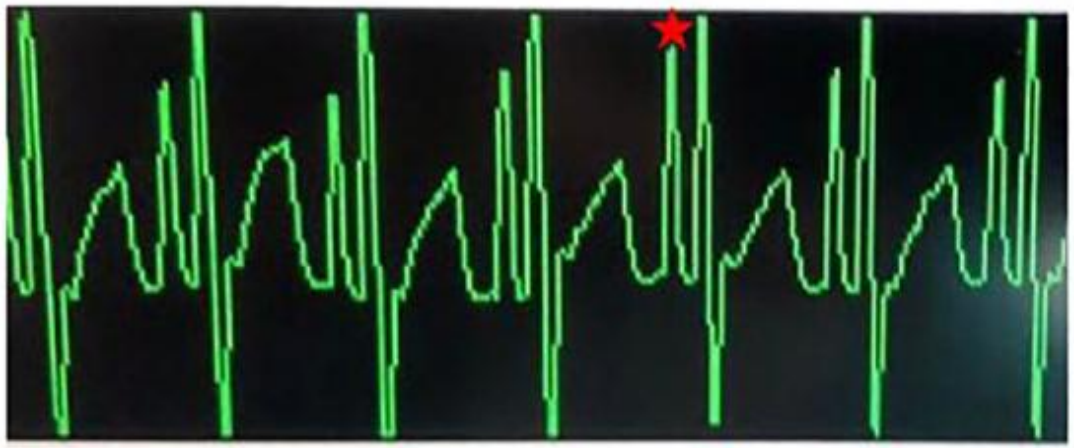

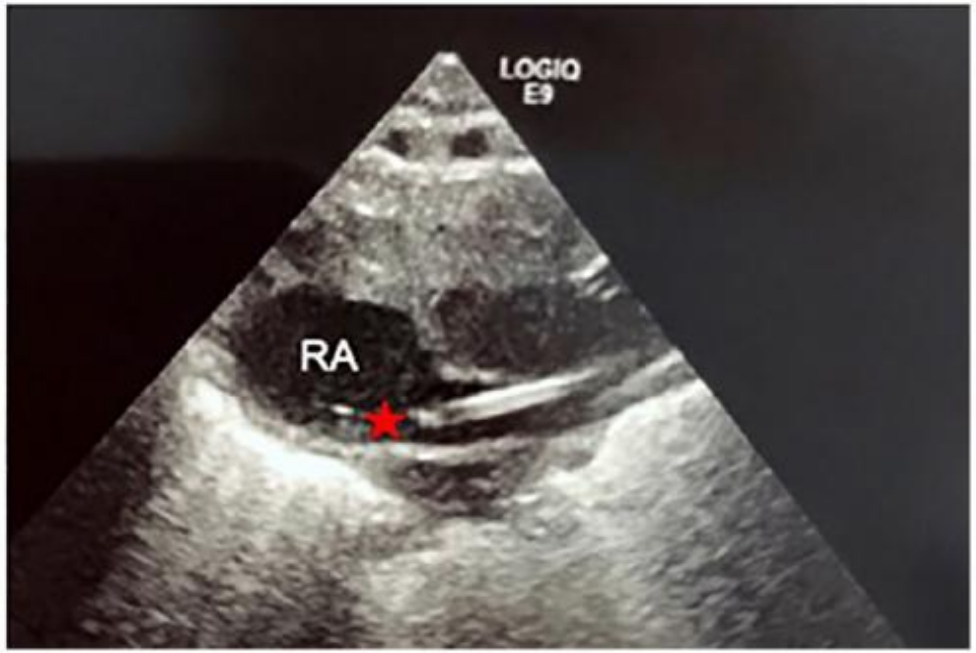

TEAM ACCESSI

Vascolari

MACERATA

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