



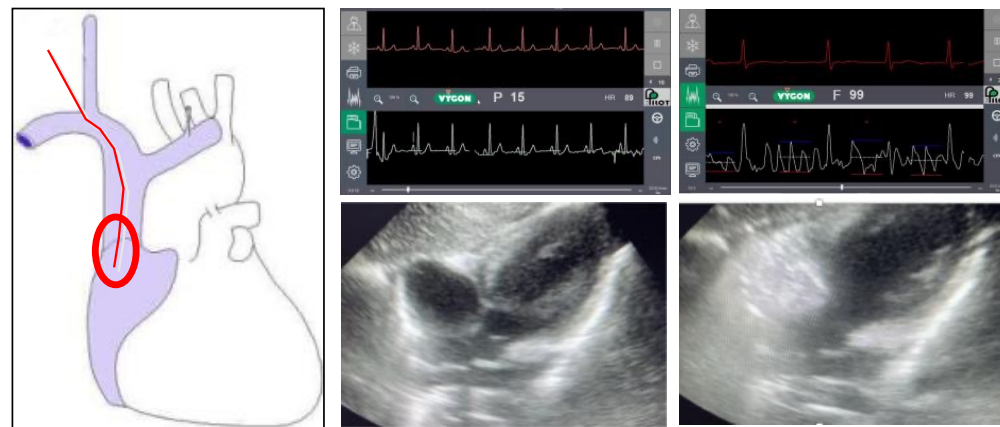
III Convegno Nazionale sui PICC-port

XVI PICC Day

Convegno Nazionale Annuale sui PICC

Corsi precongressuali
teorico-pratici

ROMA 2023
11-12 Dicembre



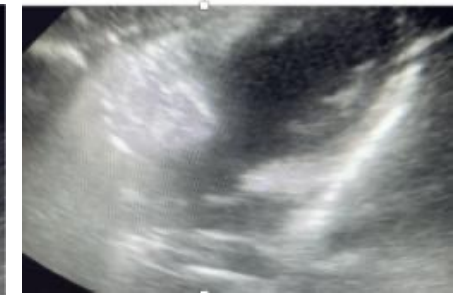
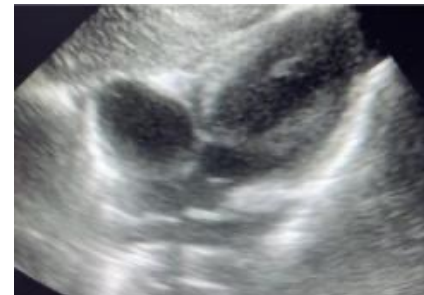
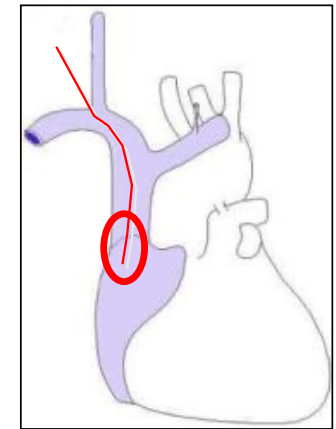
Tip Location e Tip Navigation dei PICC Integrazione ECHOTIP + ECG intracavitario



Antonio La Greca
Fondazione Policlinico Universitario A. Gemelli IRCCS Roma
Università Cattolica del sacro Cuore

Tip location + navigation: why a clue for integration of techniques

- IC-ECG as a standard for tip location
- Ultrasound as a strong tool for navigation + «location»
- Understanding the limits of both methods
- Advantages of «advanced» techniques
 - «Modified» IC-ECG
 - Bubble/Flush tests
- Advantages of methods integration (EchoTip/IC-ECG)



Infusion Therapy Standards of Practice

8TH EDITION

REVISED 2021



INFUSION NURSES SOCIETY
SETTING THE STANDARD FOR INFUSION CARE®

IC-ECG: the standard of care for tip location

- 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)

H. Implement strategies to deal with crises such as pandemics by reducing health care facility risk (eg, limit visitors, cancel elective procedures), isolating symptomatic patients, and protecting clinicians (eg, barriers at triage; limit number of staff caring for patient; ensure availability of PPE where most needed, eg, N95 respirators in the presence of aerosol-generating procedures; and adoption of technology, eg, wireless probes, electrocardiogram [ECG] technology to minimize the need for radiological confirmation of device tip location).

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 manufacturer instructions.
5. Avoid fluoroscopy except where CVAD placement is difficult or has failed at the bedside, as it requires exposure to ionizing radiation.^{4,53,62,70} (IV)

IC-ECG: the standard of care for tip location

Infusion Therapy Standards of Practice

Lisa A. Gorski, MS, RN, HHCNS-BC, CRNI®
Lynn Hadaway, MEd, RN, NPD-BC
Mary E. Haglo, PhD, RN-BC
Daphne Broadhurst, PhD, RN-BC
Simon Clark, PhD, RN-BC
Tricia Kleidon, PhD, RN-BC, BNSC
Britt M. M... PhD, VA-AP
Elizabeth... PhD, BS
...ANP, FAAN

19. TRANSMISSION-BASED PRECAUTIONS

23. CENTRAL VASCULAR ACCESS DEVICE TIP LOCATION

INS
INFUSION NURSES SOCIETY
SETTING THE STANDARD FOR INFUSION CARE

70
Nautiflus

Standard status of the technique

1. Standard precautions for electrical safety and signal optimization
2. A standard monitor
3. A universal cable (column of saline technique)
4. Entire pattern of P-wave variations to be visualized



1. Electrical safety



1. Electrical safety + Signal optimization

- Remove all plugged-in devices
 - Shift to battery
 - Monitor setting / quality
-

2. Standard monitor



Infusion Therapy Standards of Practice

8TH EDITION

REVISED 2021

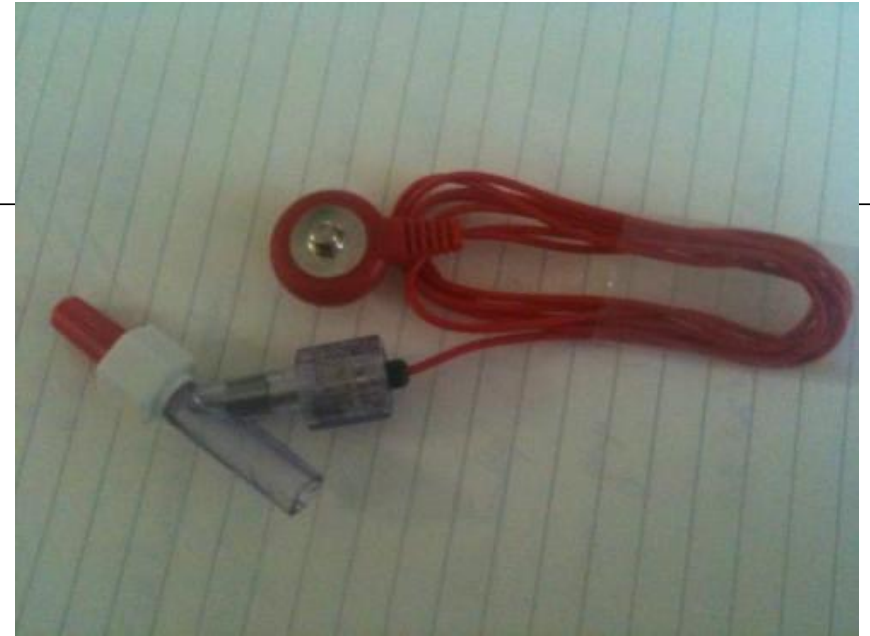


INFUSION NURSES SOCIETY
SETTING THE STANDARD FOR INFUSION CARE®

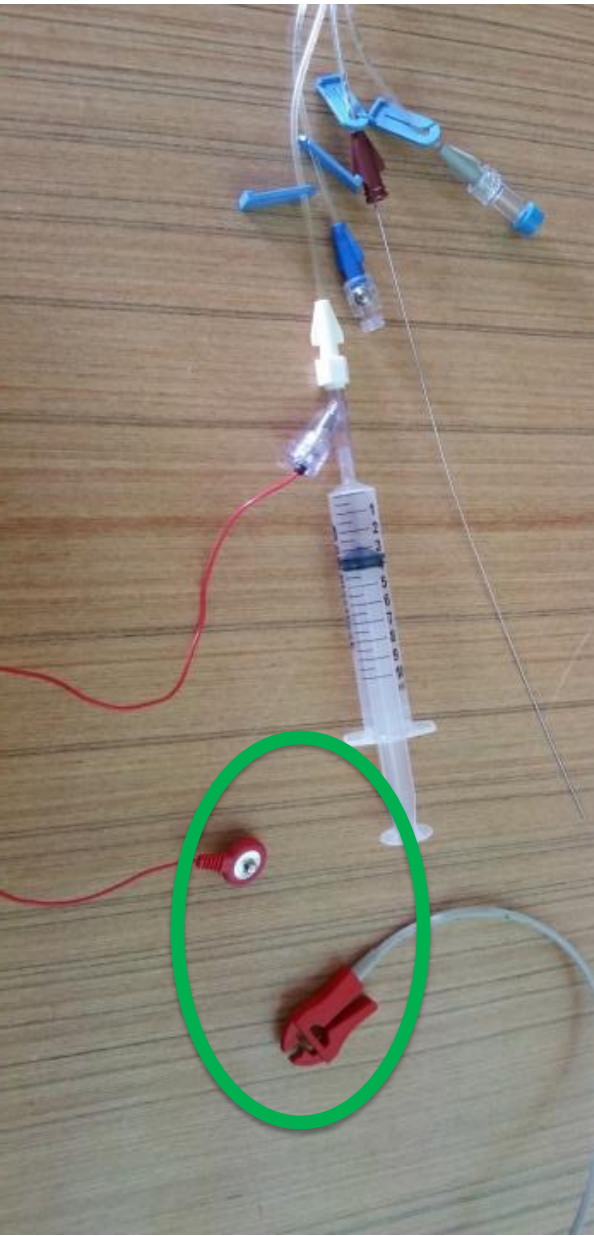
3. A universal cable

- 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)

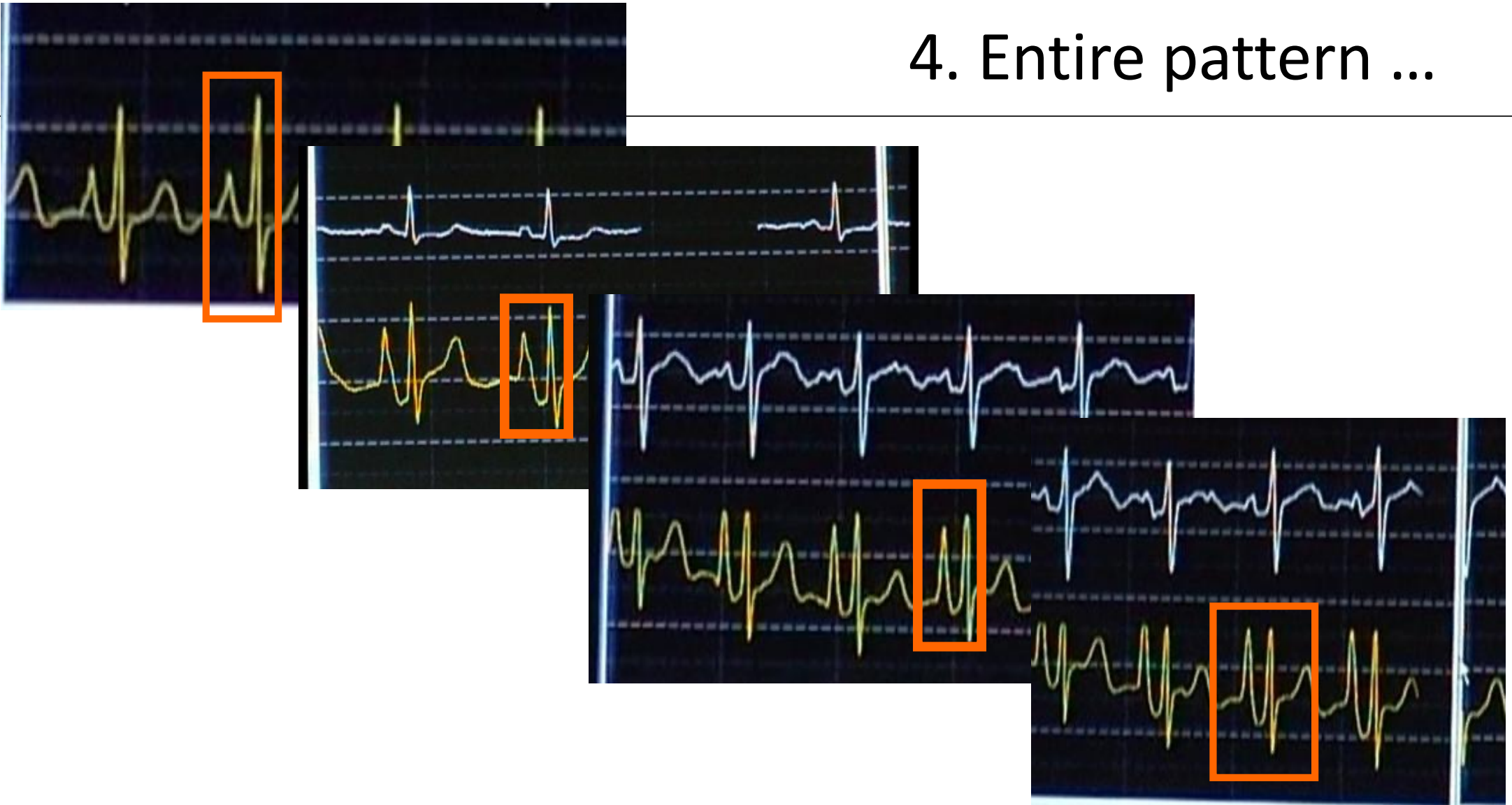
3. A universal cable



Column of saline technique

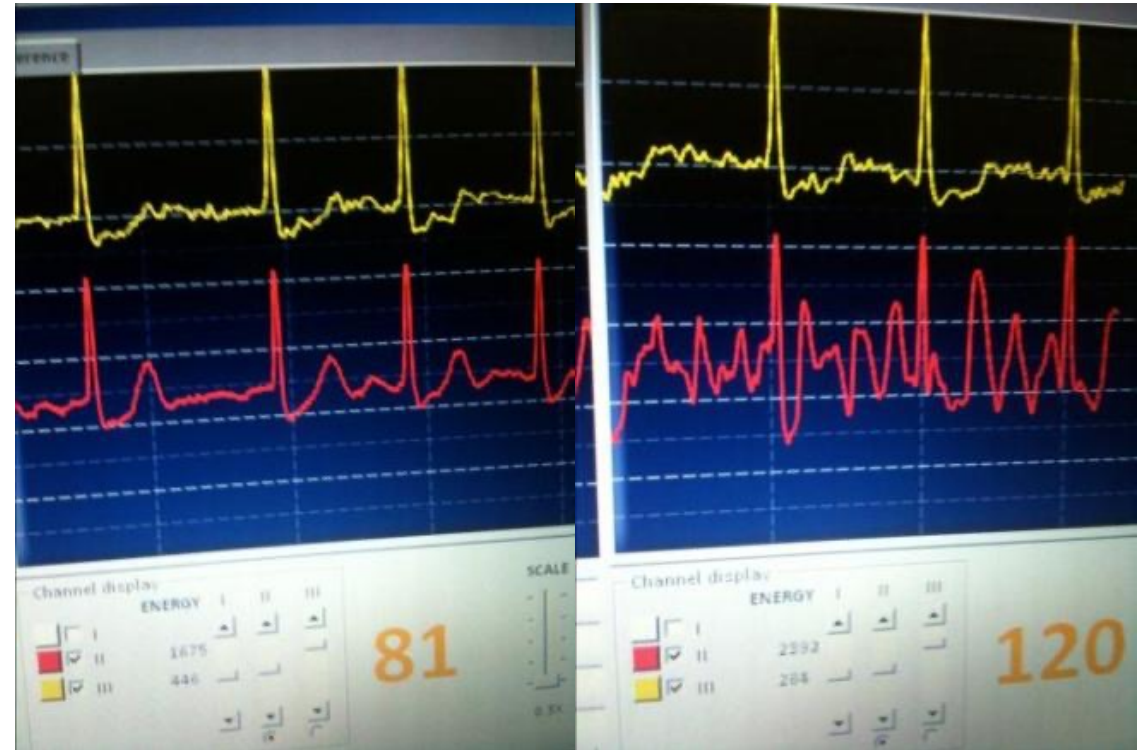
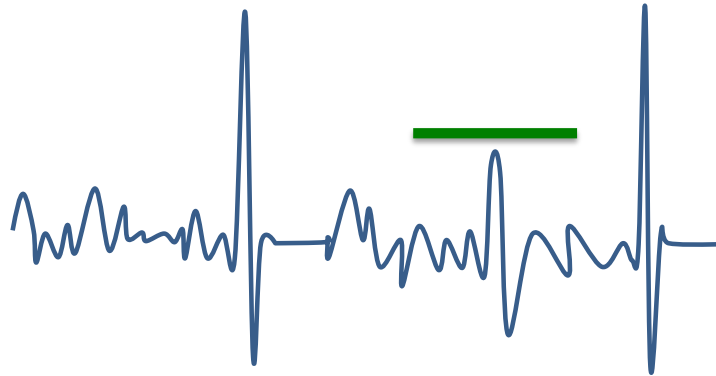


4. Entire pattern ...



Modified ECG for atrial fibrillation

- Highest f wave in a T-Q segment
- Repeat in at least 10 T-Q segments
- Sum and obtain the mean value



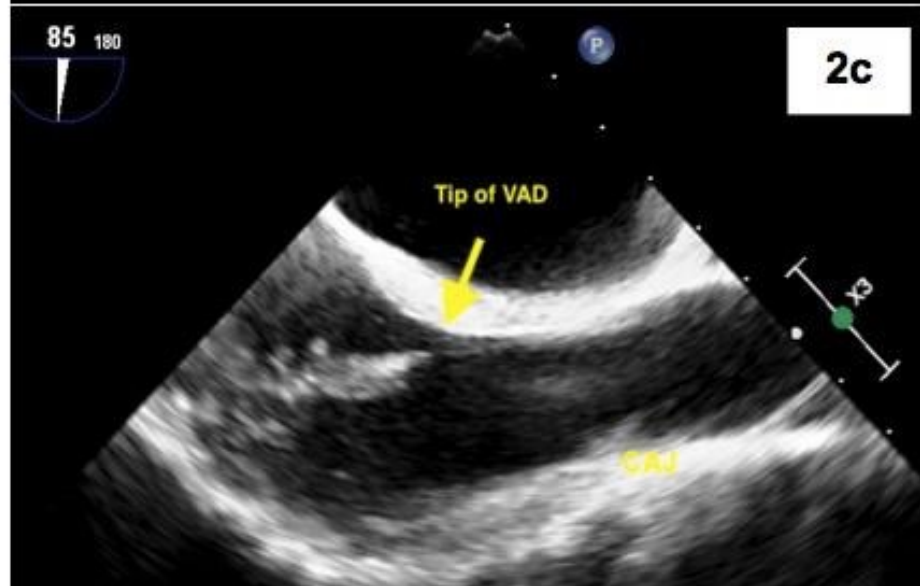
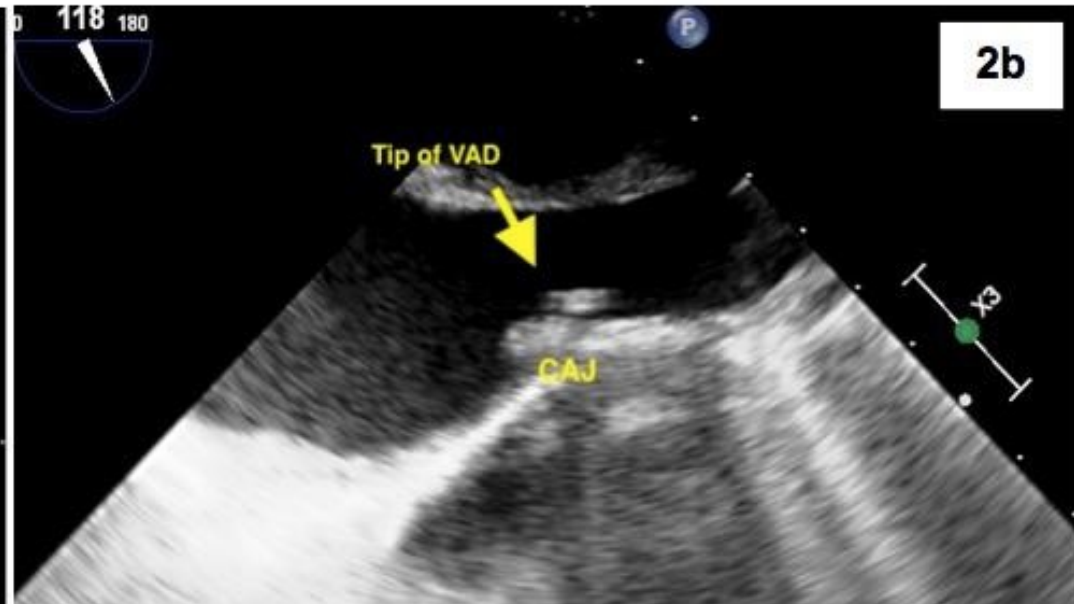
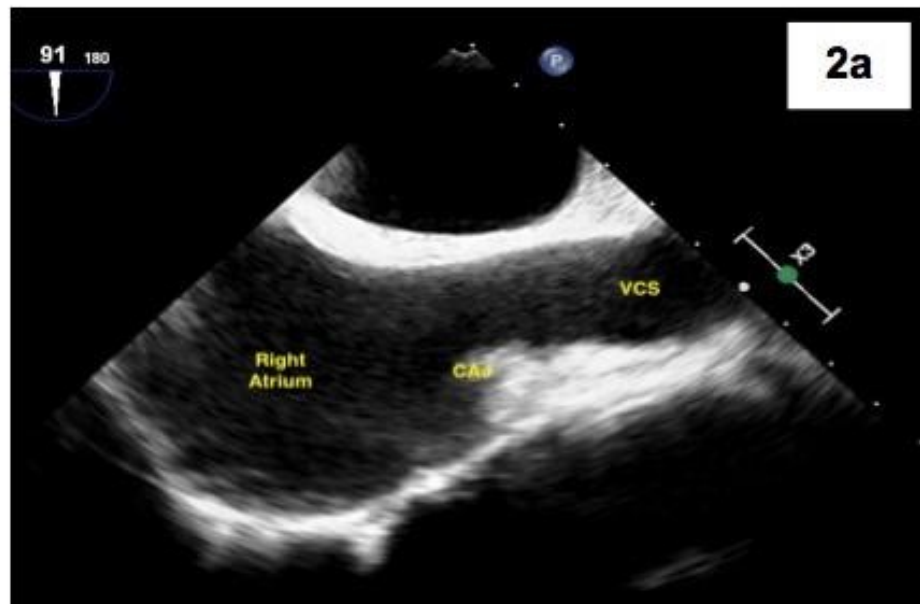
Original research article

JVA | The Journal of
Vascular Access

**A modified intracavitary
electrocardiographic method
for detecting the location of the
tip of central venous catheters in
atrial fibrillation patients**

The Journal of Vascular Access
148
© The Author(s) 2018
Article reuse guidelines:
sagepub.com/journalsPermissions
DOI: 10.1177/129729818819422
jva.sagepub.com/home/jva
SAGE

Maria Calabrese¹, Luca Montini², Gabriella Arlotta¹,
Antonio La Greca³, Daniele G Biasucci², Francesca Bevilacqua¹,
Enrica Antonucci¹, Andrea Scapigliati¹, Franco Cavaliere¹
and Mauro Pittiruti²



With the tip placed at the CAJ, the mean value of the *f* waves was significantly higher than in the other two positions.

ANOVA
p <.001
for all

Pairwise
p <.05
for each

Methods to measure the F-wave	Anatomical site	Mean ± SD (number of observations)	Pairwise comparison*
Method A	SVC	1,9 ± 0,89 (385)	SVC <i>vs</i> CAJ
	CAJ	3,33 ± 1,47 (590)	CAJ <i>vs</i> RA; CAJ <i>vs</i> SVC
	RA	2,08 ± 0,75 (376)	RA <i>vs</i> CAJ
Method B	SVC	2,11 ± 1,32 (180)	SVC <i>vs</i> CAJ
	CAJ	4,52 ± 1,87 (180)	CAJ <i>vs</i> RA; CAJ <i>vs</i> SVC
	RA	2,03 ± 0,9 (180)	RA <i>vs</i> CAJ
Method C	SVC	2,34 ± 1,39 (180)	SVC <i>vs</i> CAJ
	CAJ	5,07 ± 2,07 (180)	CAJ <i>vs</i> RA; CAJ <i>vs</i> SVC
	RA	2,32 ± 0,93 (180)	RA <i>vs</i> CAJ

Legend. SVC =superior vena cava; RA =right atrium; CAJ = cavo-atrial junction; SD =standard deviation; mm =millimeter.

* ANOVA was significantly different for all (p<0.001); each pairwise comparison was individually significant (p<.05) at post-hoc analysis (Scheffé test for all pairwise comparisons).

Infusion Therapy Standards of Practice

8TH EDITION

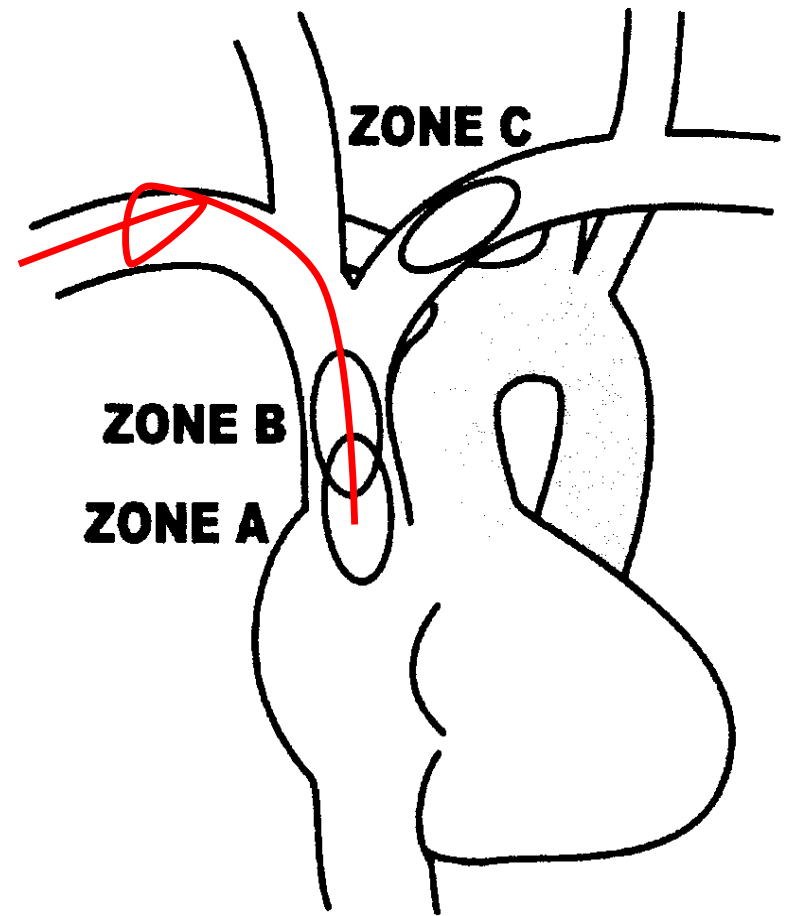
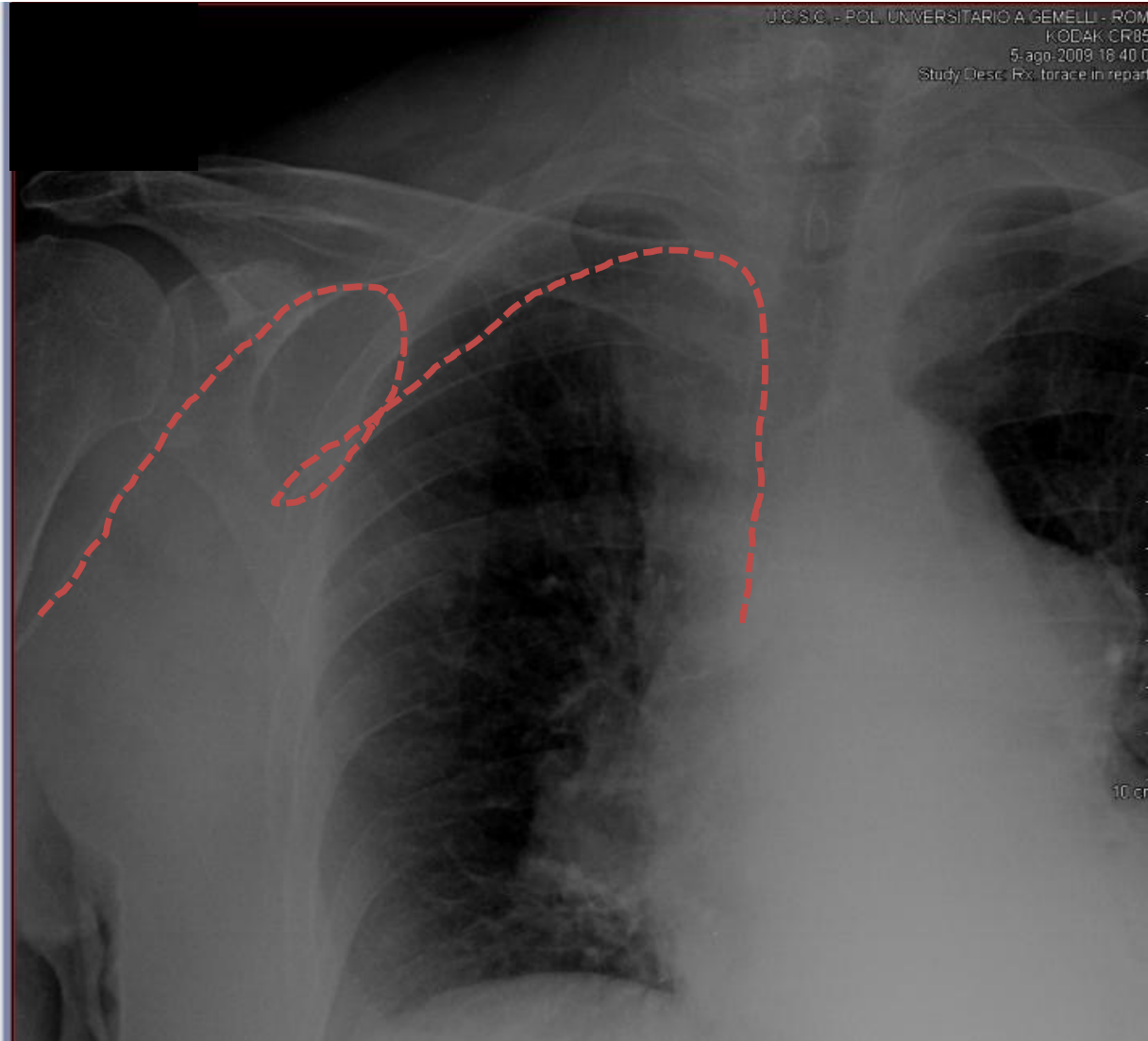
REVISED 2021



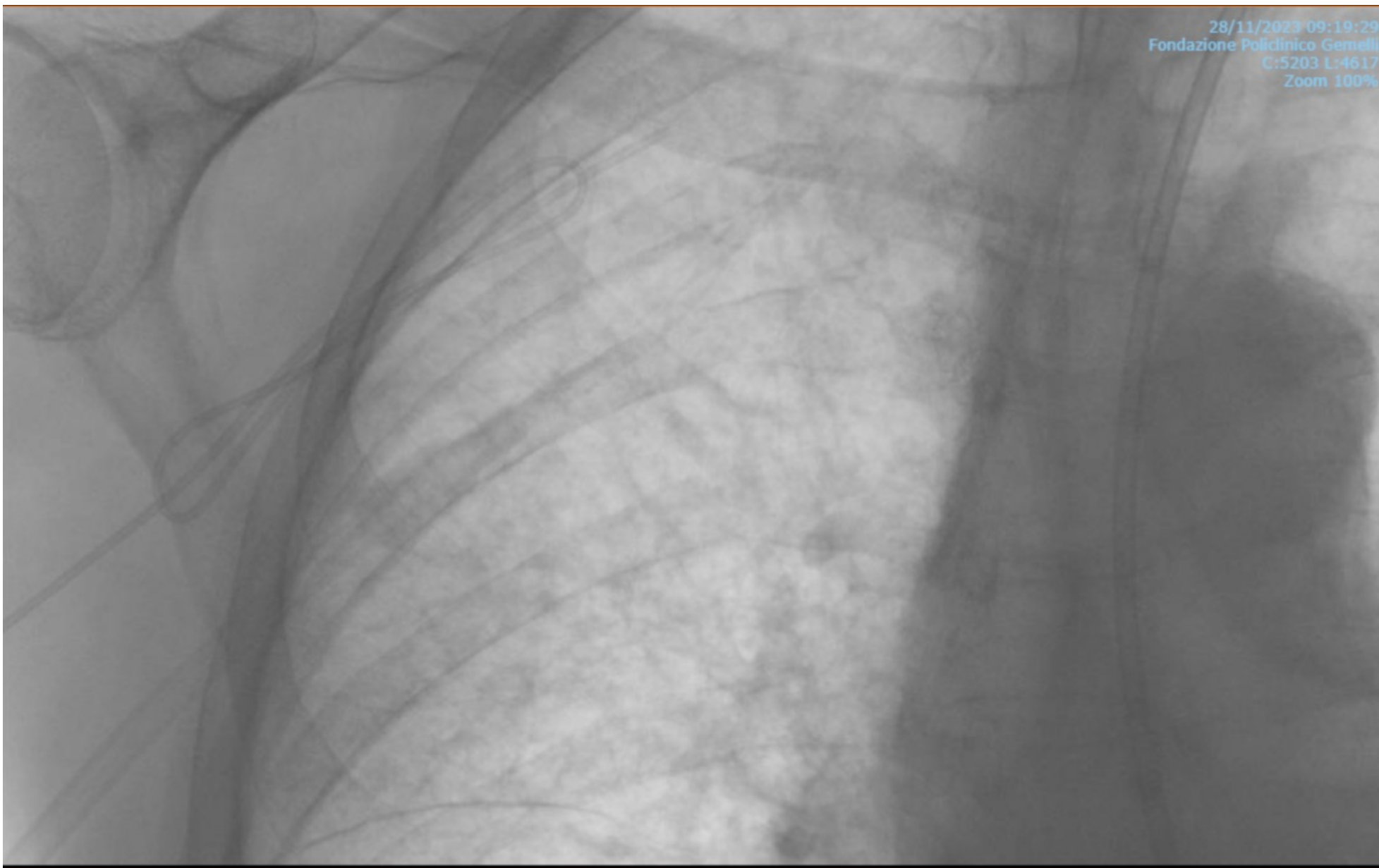
INFUSION NURSES SOCIETY
SETTING THE STANDARD FOR INFUSION CARE®

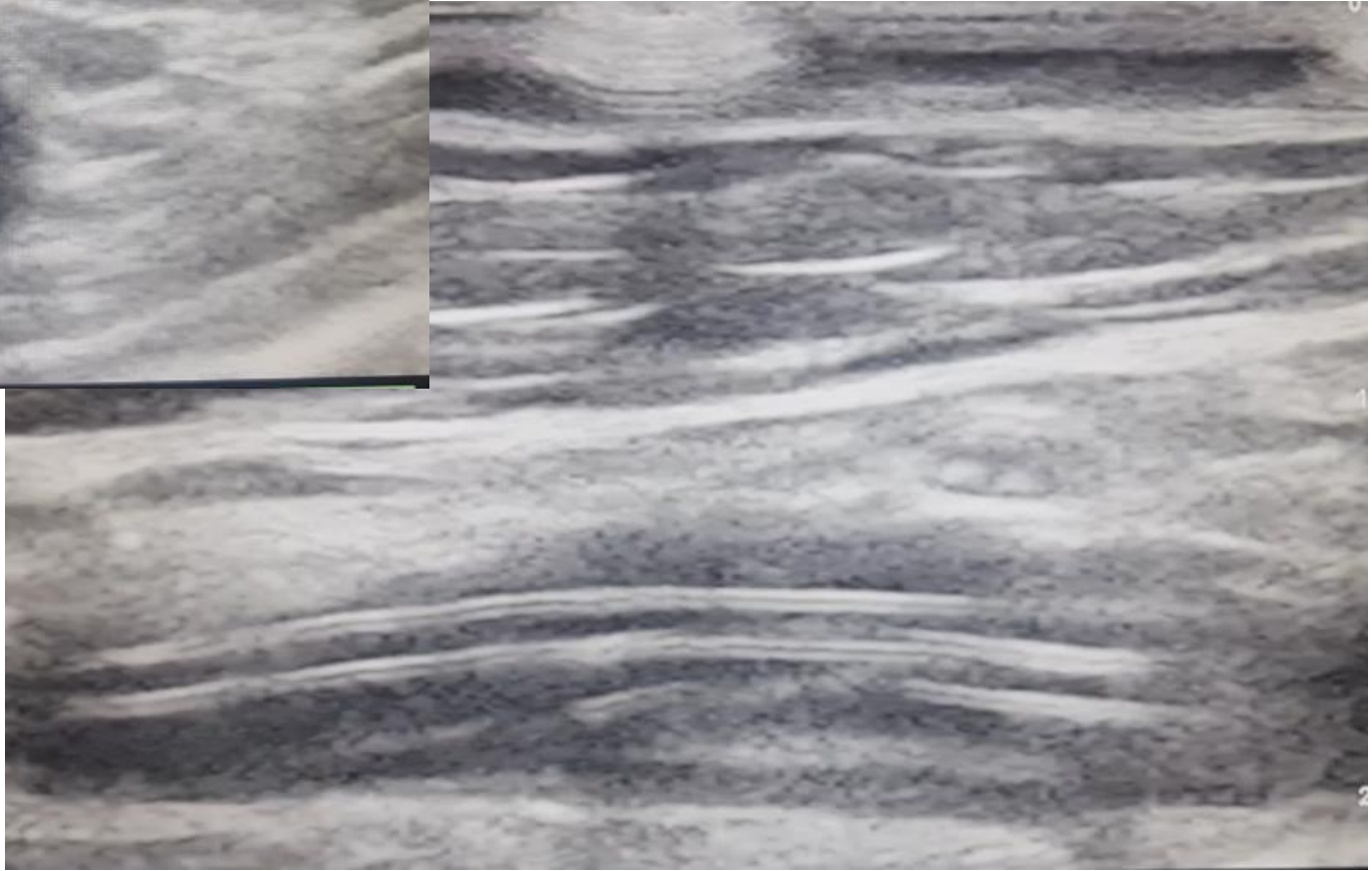
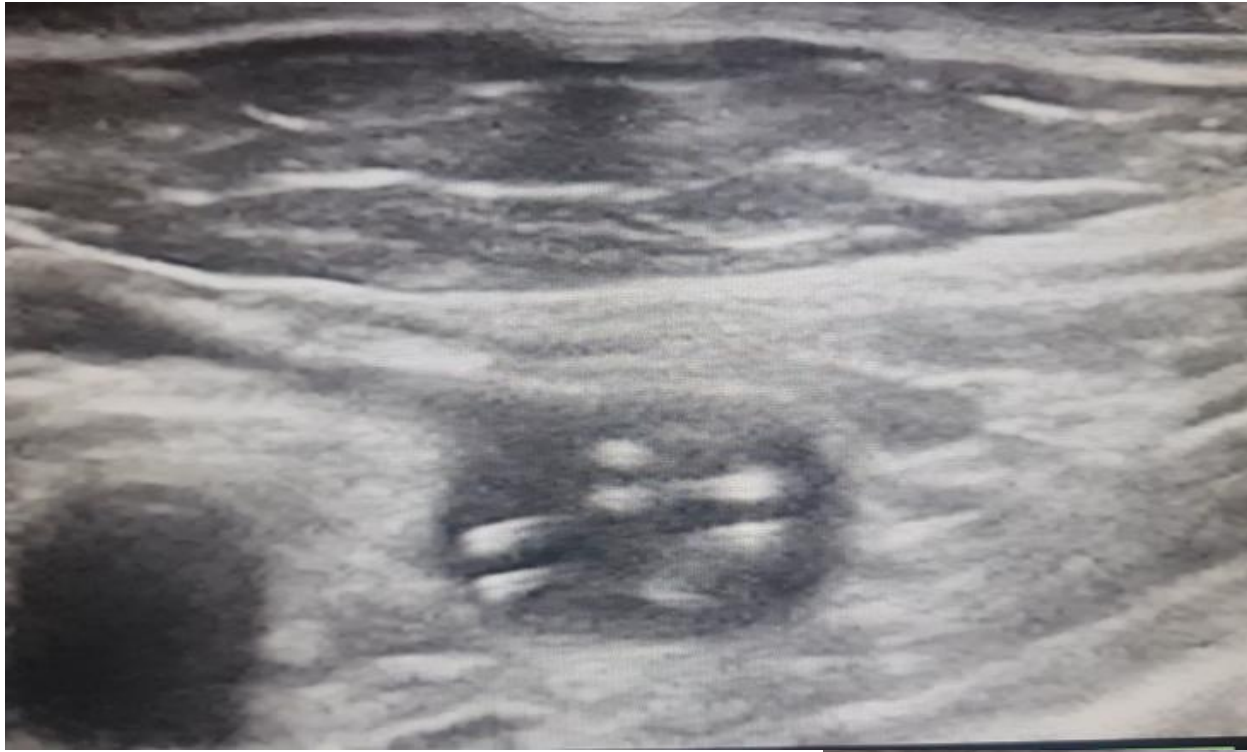
- E. Use methods for identifying CVAD tip location during the insertion procedure (ie, “real-time”) due to greater accuracy, more rapid initiation of infusion therapy, and reduced costs.³⁸⁻⁴⁷ (III)
1. Use electrocardiogram (ECG) methods with either a metal guidewire or a column of normal saline inside 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)
 2. 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 placement. 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). Recent prospective observational studies have demonstrated safety and efficiency of using ECG to confirm catheter tip position in patients with atrial fibrillation.^{51,62} (IV)

DO WE NEED NAVIGATION?

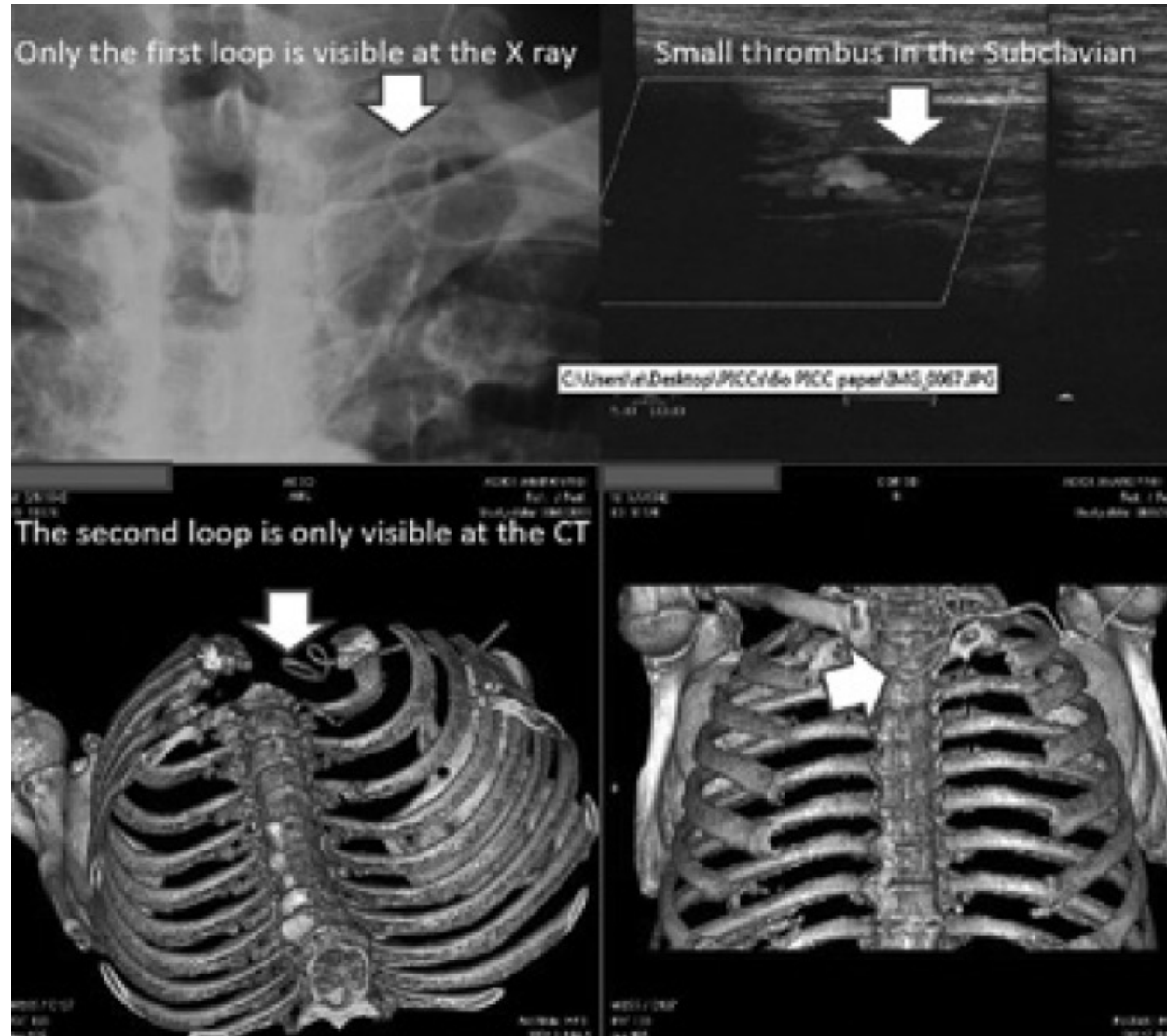


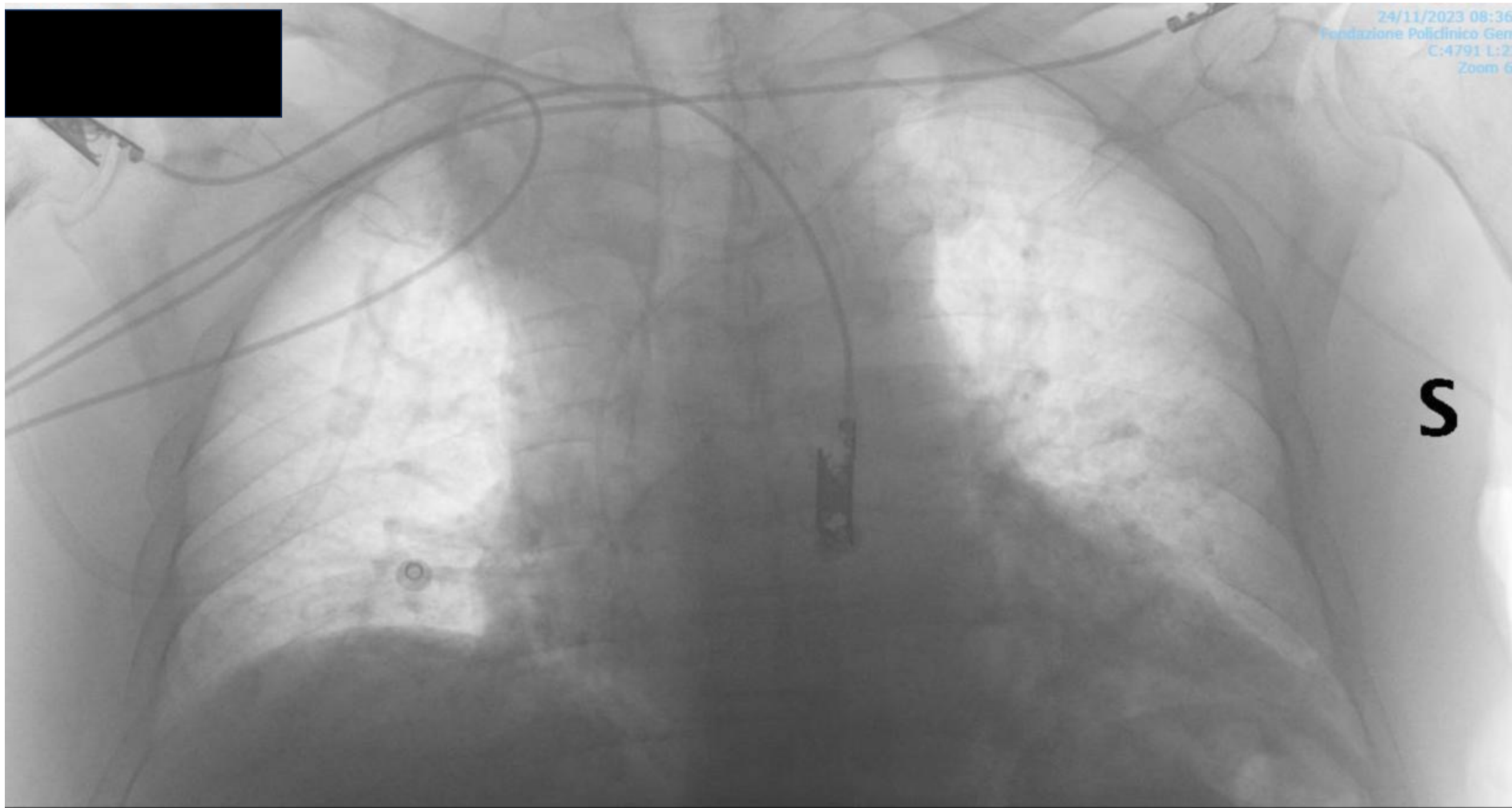
28/11/2023 09:19:29
Fondazione Policlinico Gemelli
C:5203 L:4617
Zoom 100%

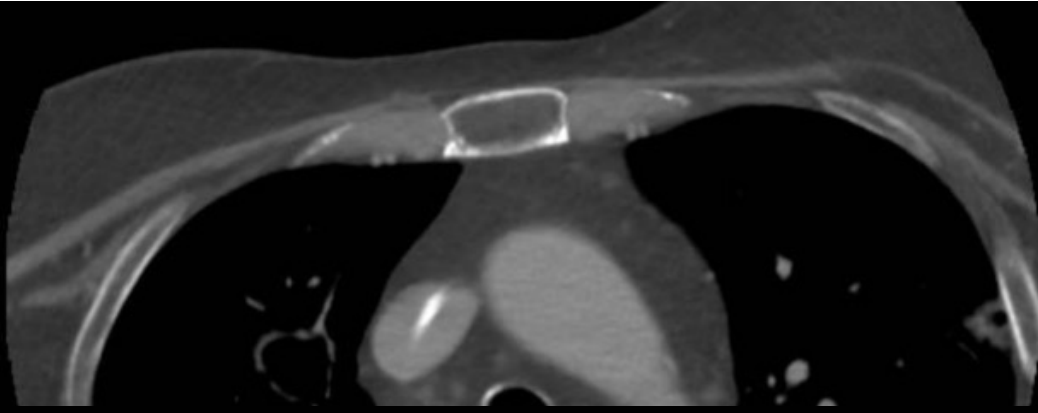




Do we need navigation systems in the vascular access practice? A case of peripherally inserted central catheter malposition

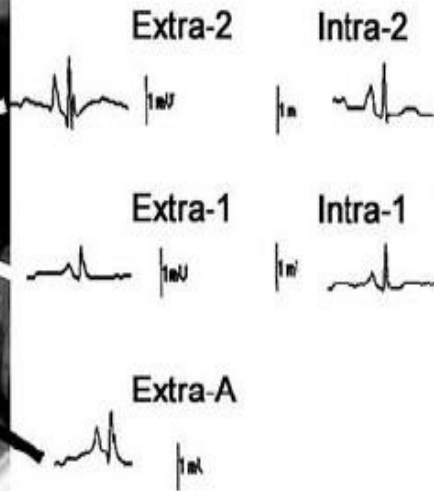








EKG-Ableitung analoger Positionen



**An “atrial” P wave
does not exclude an
extravascular tip
position ...**

**... nor a “near-
atrial” tributary
vessel tip
position !!!**

“Extravasal position of central venous catheters despite unsuspecting ECG-guidance”
Schummer W, AINS 2005

IC-ECG

Incomplete mapping

1a. Axillary

1b. Brachiocephalic

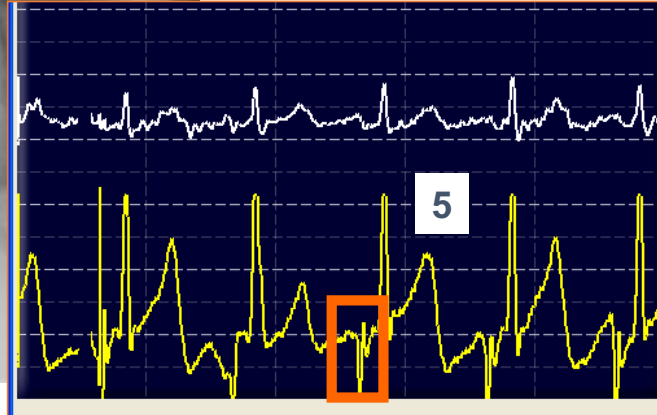
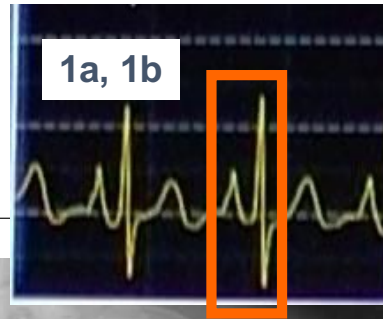
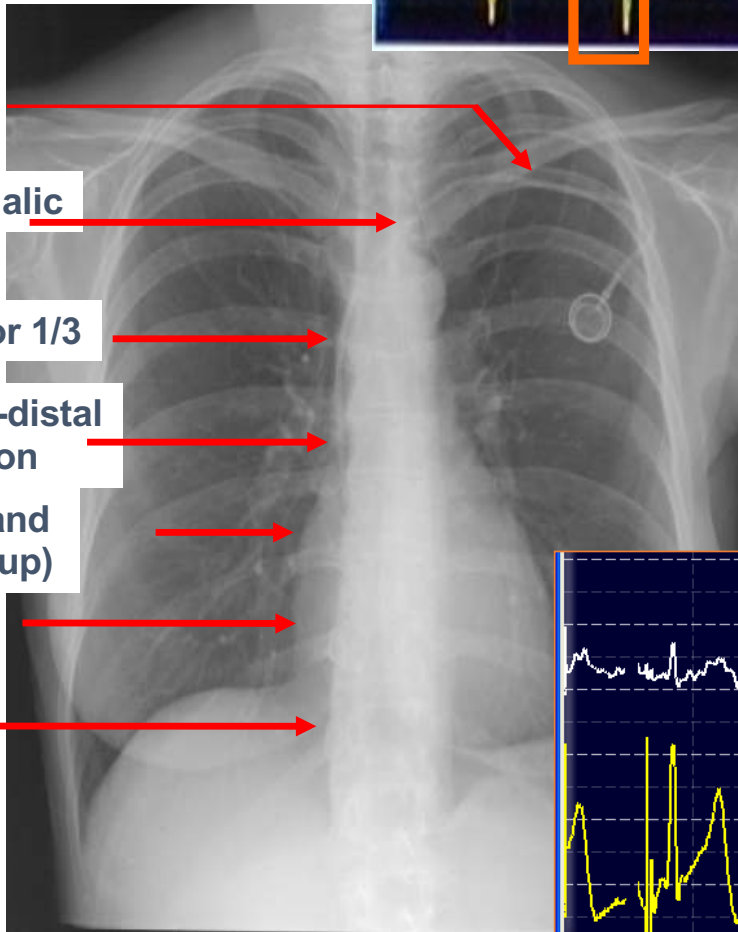
1c. SVC, superior 1/3

2. SVC, medium-distal 1/3 and junction

3. RA (junction and superior 1/3 sup)

4. Deep atrium

5. IVC



IC-ECG

Incomplete mapping

1a. Axillary

1b. Brachiocephalic

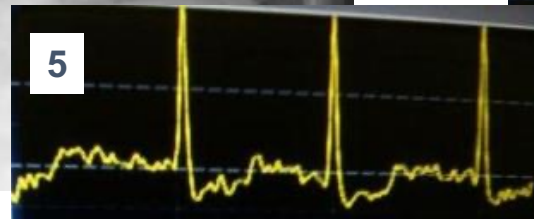
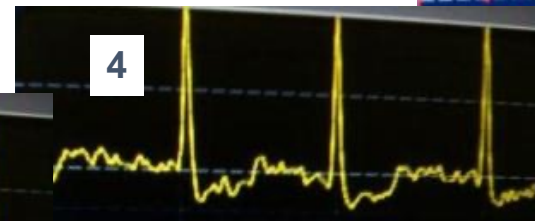
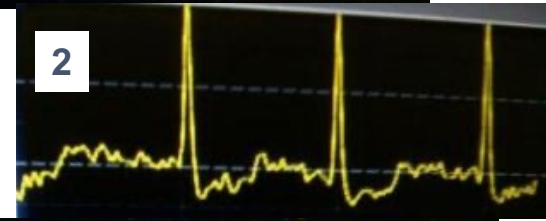
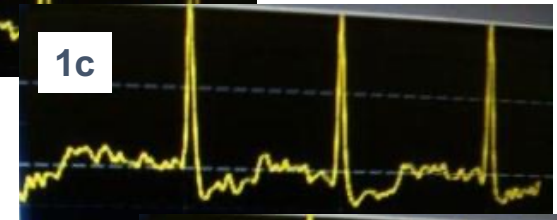
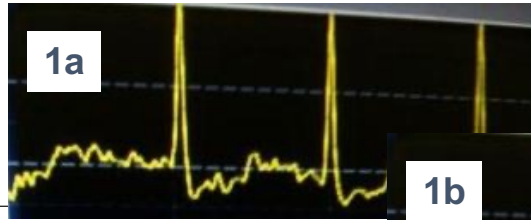
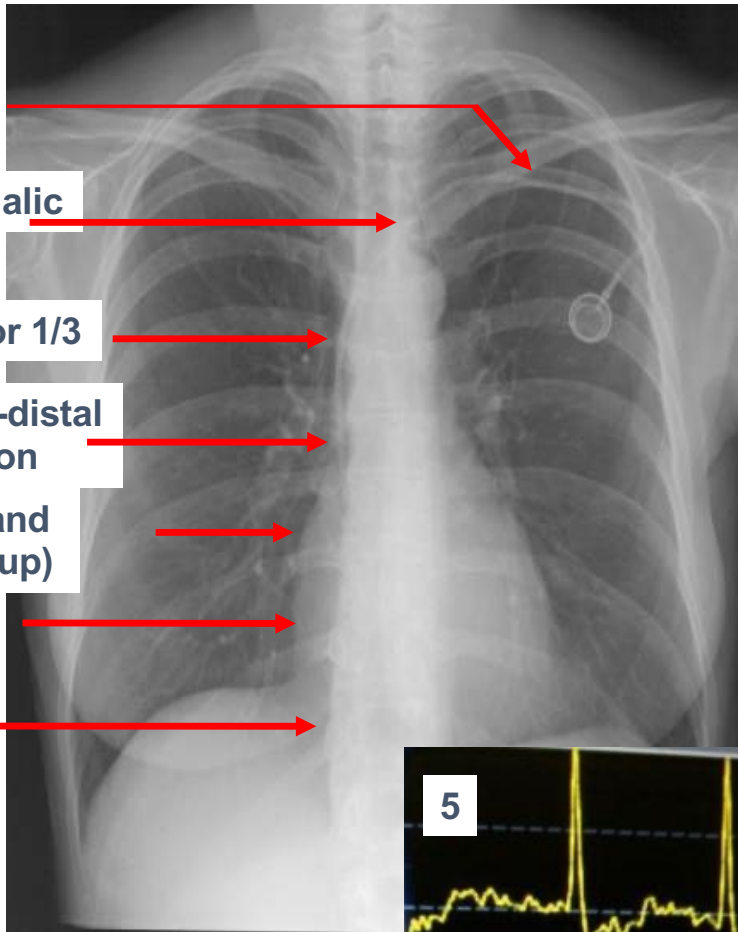
1c. SVC, superior 1/3

2. SVC, medium-distal
1/3 and junction

3. RA (junction and
superior 1/3 sup)

4. Deep atrium

5. IVC



Tip navigation: useful in all CVCs insertions

Used during the procedure to help the operator in directing the guide wire and/or the catheter in the right direction.

They do not replace 'tip location' methods

Still, they are particularly useful to reduce the risk of primary malpositions:

- when difficulties of catheter advancement are **anticipated** or **experienced during line insertion**
- when intra-procedural 'tip location' methods are not applicable or not feasible or of difficult interpretation

**US-based tip location and navigation:
GUIDELINES**

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		

**WoCoVA-GAVeCeLT Consensus
Intensive Care Medicine 2012**

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

CONFERENCE REPORTS AND EXPERT PANEL

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

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

2012

European Society of Anaesthesiology guidelines on peri-operative use of ultrasound-guided for vascular access (PERSEUS vascular access)**2020**

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).

US-based tip location and navigation:

STANDARD STATUS OF THE TECHNIQUE

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

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

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).
2. Tip location by direct visualization of the final position of the tip of the catheter, usually at the junction between right atrium and SVC or between right atrium (RA) and IVC.
3. Tip location by indirect visualization of the final position of the tip of the catheter, using the so-called “bubble test” (visualization of micro-bubbles inside the vasculature after injection of saline or saline/air mixture into the catheter).

Table 1. (a) ECHOTIP protocol for CICC.

	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

ECHOTIP - PICC NAVIGATION according to RaPeVA

4

The Journal of Vascular Access 00(0)

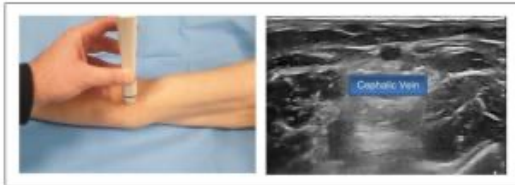


Figure 1. Step 1: Visualization of the cephalic vein at the antecubital fossa.



Figure 2. Step 2: Identification of the artery and brachial veins and visualization of the confluence between the antecubital vein and basilic vein.

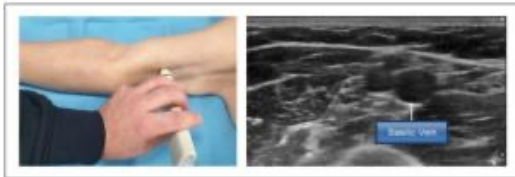


Figure 3. Step 3: Identification of the basilic vein along the bicipital-humeral groove, sliding the probe upwards.



Figure 4. Step 4: Examination of the nerve-vascular bundle of the arm.

Editorial

The SIP protocol update: Eight strategies, incorporating Rapid Peripheral Vein Assessment (RaPeVA), to minimize complications associated with peripherally inserted central catheter insertion

Fabrizio Brescia¹, Mauro Pittiruti², Timothy R Spencer³ and Robert B Dawson⁴

JVA The Journal of Vascular Access

The Journal of Vascular Access
© The Author(s) 2022

ARTICLE IN PRESS
ARTICLE IN PRESS
ARTICLE IN PRESS
ARTICLE IN PRESS
ARTICLE IN PRESS
ARTICLE IN PRESS
ARTICLE IN PRESS
ARTICLE IN PRESS

SAGE

Brescia et al.

5

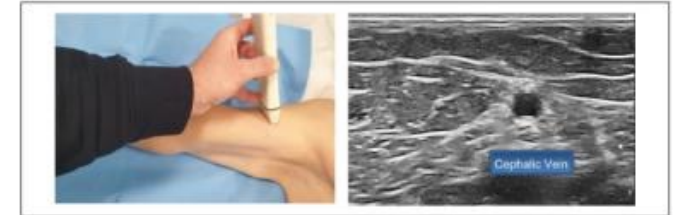


Figure 5. Step 5: Visualization of the cephalic vein, moving laterally over the biceps muscle.



Figure 6. Step 6: Rapid examination of the axillary vein in the infraclavicular area.

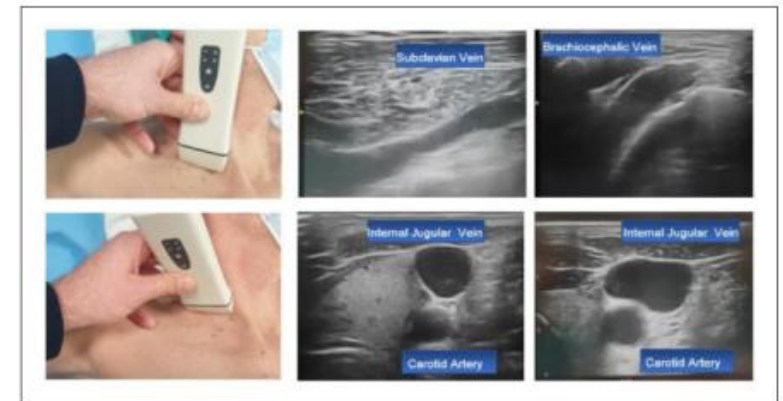


Figure 7. Step 7: Visualization of the subclavian, brachiocephalic, and internal jugular vein in the supraclavicular area.

ECHOTIP - CICC e PICC - tip location (1)

Tip location: per l'adulto, manovra di supporto / rescue al metodo di scelta (ECG endocavitario), anche in urgenza:

- a) supporto: nei pazienti per i quali si prevede non applicabilità del metodo (pace-maker attivi sull'atrio) o difficile fattibilità (aritmie atriali, scarsa collaborazione/tremore)
- b) rescue: pazienti senza fattori predittivi di non applicabilità/fattibilità ma per i quali l'ECG non dà il risultato atteso o è di dubbia interpretazione

ECHOTIP - CICC e PICC - tip location (2)

1. Sonda:

- Prima scelta: settoriale cardiologica
- Seconda scelta: convex

2. Finestra acustica:

usare le seguenti 2 proiezioni:

- prima scelta: sottocostale epigastrica 4 camere
 - ad integrazione (facoltativa) della precedente: sottocostale epigastrica bi-cavale
- seconda scelta: apicale 4 camere (in caso di inadeguatezza della sottocostale)

ECHOTIP - CICC e PICC - tip location (3)

Tip location: il target, a differenza del neonato e del bambino, NON E' la visualizzazione diretta del catetere nelle camere cardiache, ma la **localizzazione indiretta** della punta mediante visualizzazione degli effetti del flush/bubble test:

3. Procedura: Una volta posizionata la punta del catetere nella supposta regione target (giunzione tra VCS e atrio di destra) eseguire un flush rapido di soluzione fisiologica da 5-10 ml (lume distale se catetere multilume)

- Flusso laminare immediato in atrio destro: punta in prossimità della giunzione atrio-cavale
- Flusso turbolento immediato in atrio destro: punta intra-atriale
- Flusso laminare con latenza percepibile: catetere in direzione corretta ma probabilmente con punta «alta»
- Flusso laminare con latenza > 2 secondi: catetere malposizionato

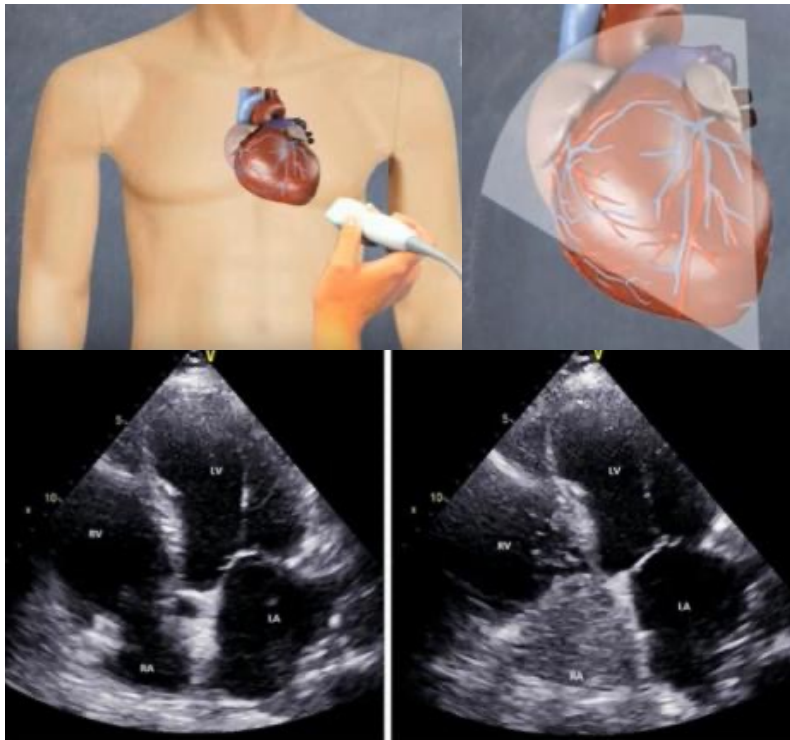
ECHOTIP - CICC e PICC - tip location (4)

Preparazione del mezzo di contrasto ecografico:

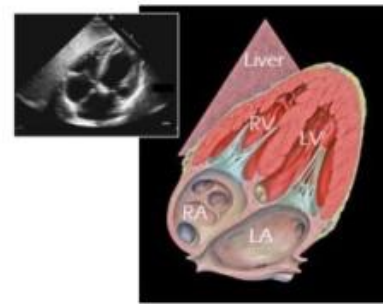
- Materiale: soluzione fisiologica standard
- Modalità di preparazione:
 - Primo livello: aspirazione semplice (***FLUSH TEST***)
 - Secondo livello (in caso di insoddisfacente risultato con il primo livello): miscelazione (shaking) di 9 ml di SF con 1 ml di aria (tecnica del rubinetto a 3 vie) (***BUBBLE TEST***)

**US-based tip location and navigation:
LIMITATIONS**

Acoustic windows: rescue strategies

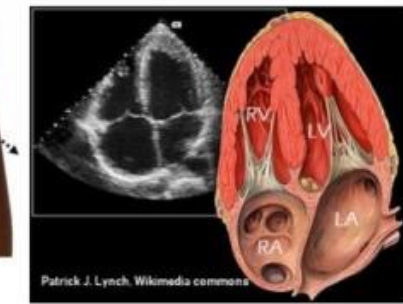
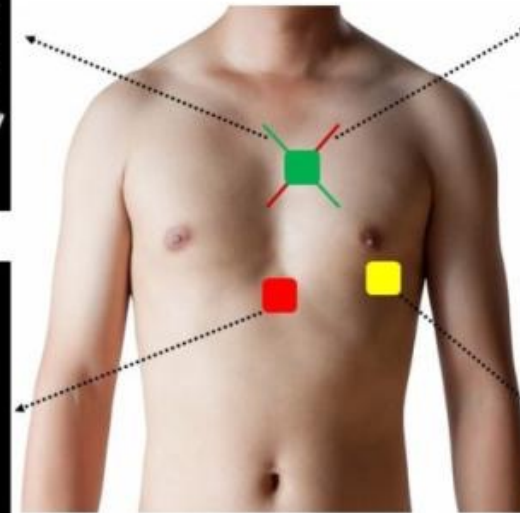


Apical 4 Chambers



Subxiphoid 4-chamber

THE BASIC VIEWS OF FoCUS

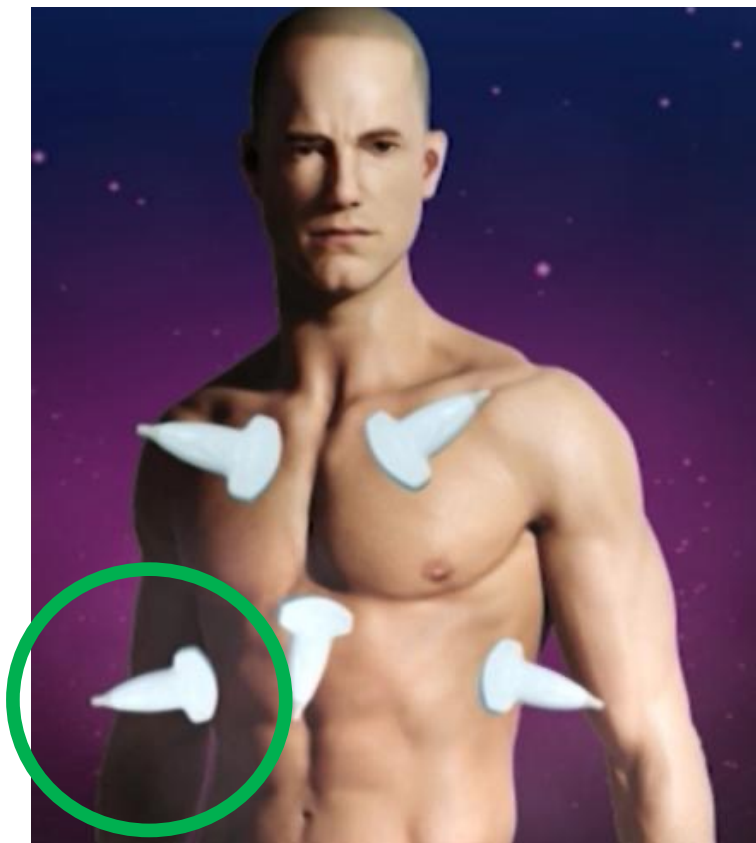


Patrick J. Lynch, Wikimedia commons

Apical 4-chamber

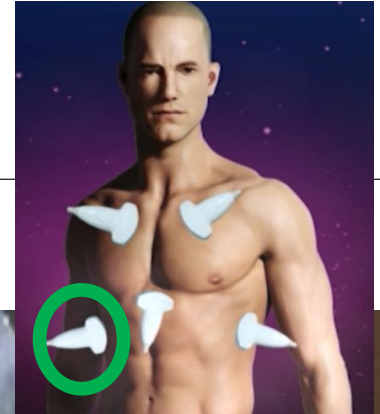
Acoustic windows: rescue strategies

Lateral Trans-hepatic 4 Chambers



Acoustic windows: rescue strategies

Lateral Trans-hepatic 4 Chambers



Which quantifiable parameters

- How to EFFECTIVELY measure the «time to bubble»?
- Which «time to bubble» cutoffs are reliable ?

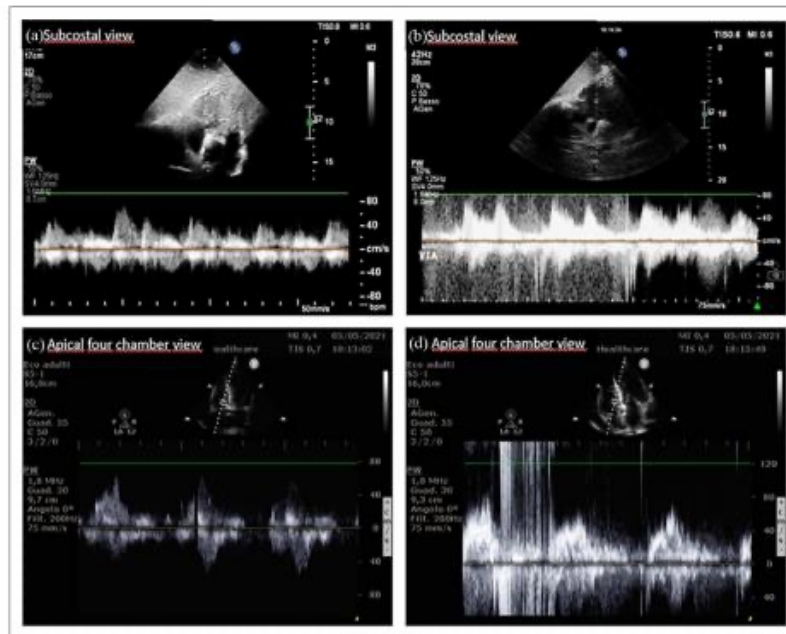


Figure 3. Example of MBT with pulse Doppler: (a) subcostal view; tricuspid Pulse Doppler before microbubble injection, (b) subcostal view; tricuspid Pulse Doppler during microbubble injection: MES appear immediately after the injection, (c) apical four chamber view; tricuspid Pulse Doppler before microbubble injection, and (d) apical four chamber view; tricuspid Pulse Doppler during microbubble injection: MES appear immediately after the injection.

Original research article

Can the length of a catheter change the time to bubble at the tip performing the “Bubble Test”? A bench study

Davide Giustivi¹, Stefano Elli², Chiara Airoidi³, Federica Lo Izzo⁴, Michela Rossini⁵, Antonio Gidaro⁶, Alberto Lucchini^{7,8} and Daniele Privitera⁵

Original research article

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

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

Original research article

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

Antonio Gidaro¹, Francesco Casella¹, Chiara Cogliati¹, Antonio La Greca², Francesca Lugli¹, Chiara Trione¹, Maria Calloni¹, Chiara Melchionda¹, Federica Samartin¹, Emanuele Salvi¹ and Elisa Ceriani¹

JVA | The Journal of Vascular Access

The Journal of Vascular Access
1-7
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11207296231199505
journals.sagepub.com/home/jva
SAGE

JVA | The Journal of Vascular Access

The Journal of Vascular Access
2020, Vol. 21(6) 861-867
© The Author(s) 2020
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11207296201919664
journals.sagepub.com/home/jva
SAGE

JVA | The Journal of Vascular Access

The Journal of Vascular Access
1-7
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11207296221191664
journals.sagepub.com/home/jva
SAGE

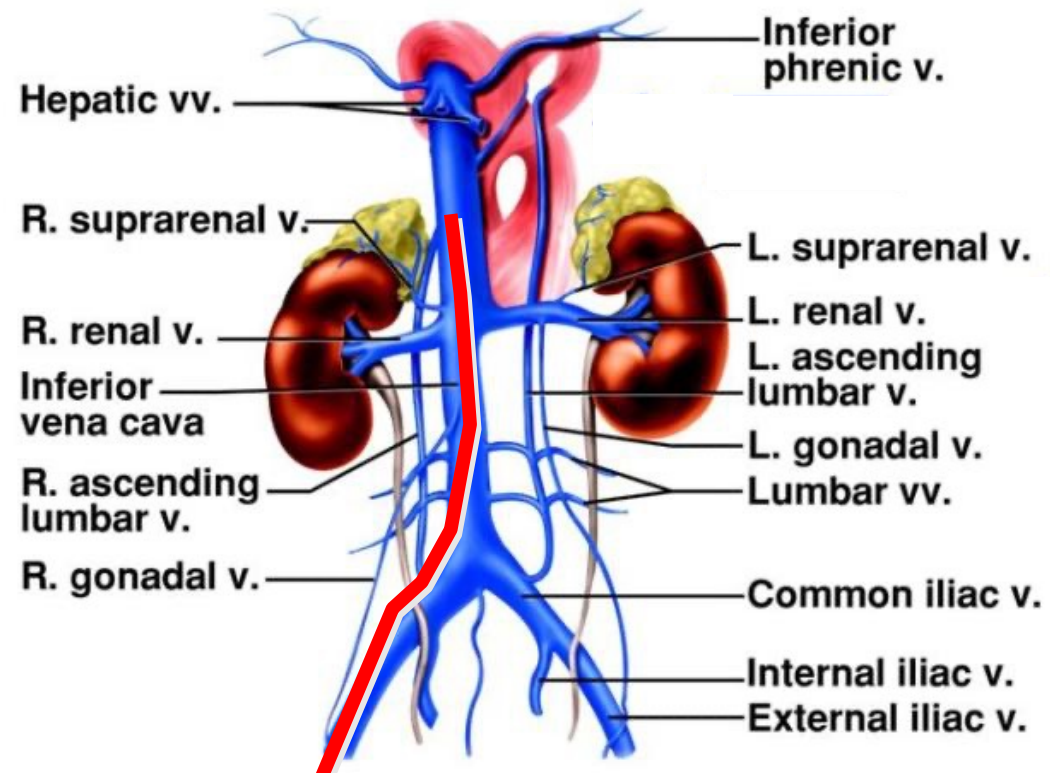
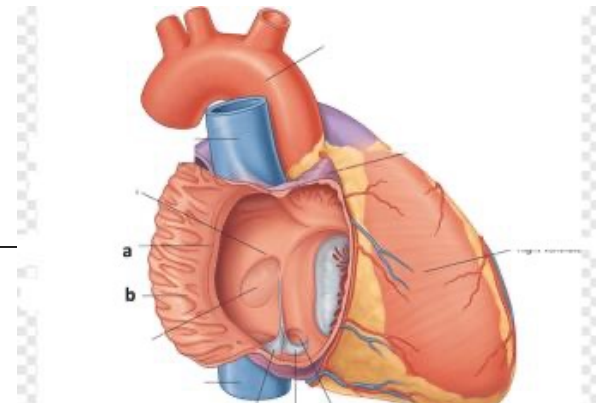
REPRODUCIBILITY



A last clue: IC-ECG + US for femoral lines

Avoid malposition in tributary veins

Reach the desired final tip position (which position? Sure more proximally than the common iliac)



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

Pierre Gibault^{1,2}, Eric Desruennes², Jean-Louis Bourgain²

Original research article

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

Mengdan Ma^{1,2}, Jinghui Zhang^{1,2}, Jianmei Hou², Zhihong Gong², Zixin Hu¹, Shujie Chen¹, Xiaoya Kong¹ and Zhengkun Shi³

Case report

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

Mark D Weber, Adam S Himebauch and Thomas Conlon

Intracavitary electrocardiography for femorally inserted central catheter tip location in adult patients

YingFang Duan BM¹ | XiaoYan Hu MM¹ | YuXin Zhu BM² | Xi Zhao BM¹ | XinXin Yin BM² | HaiMan Zhang BM¹ | Yu Wang BM¹

Pediatric Anesthesia 2005 | 15: 297-300

doi:10.1111/j.1460-9592.2005.01433.x

Umbilical vein catheterization under electrocardiogram guidance

BAN C.H. TSUI MSc MD*, GARETH J. RICHARDS MBBs† AND JOHN VAN AERDE MD PhD†

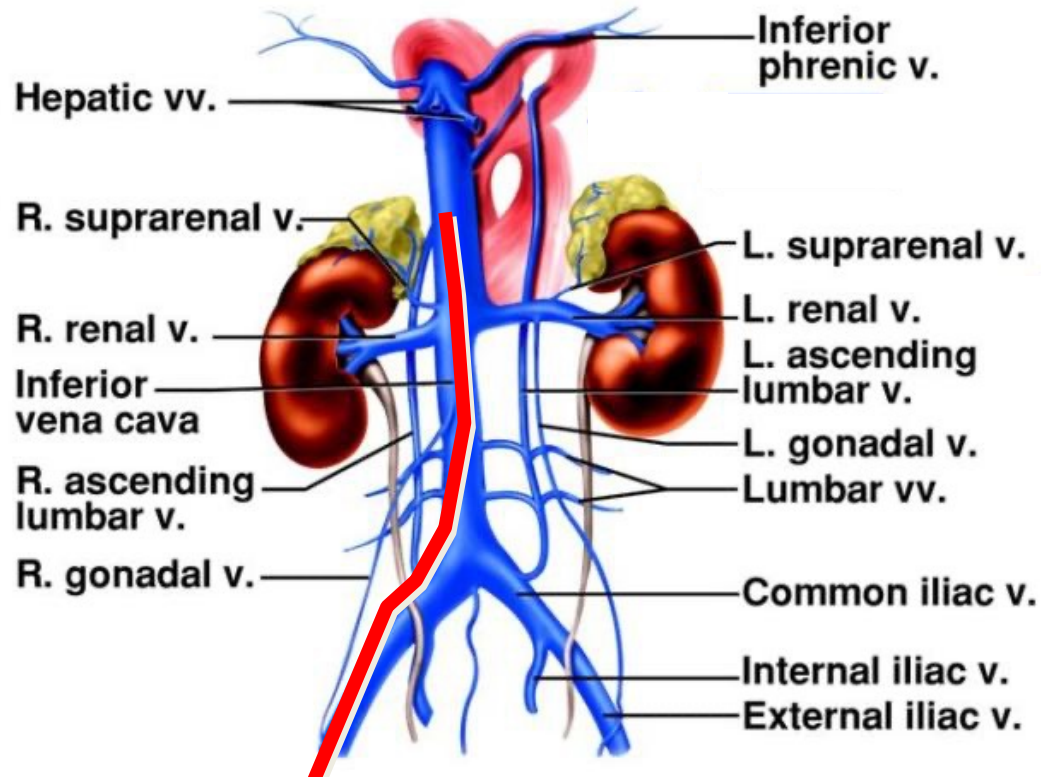
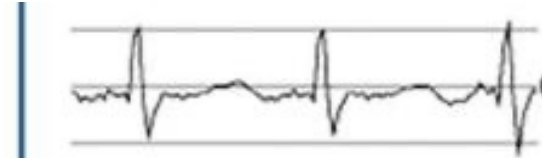
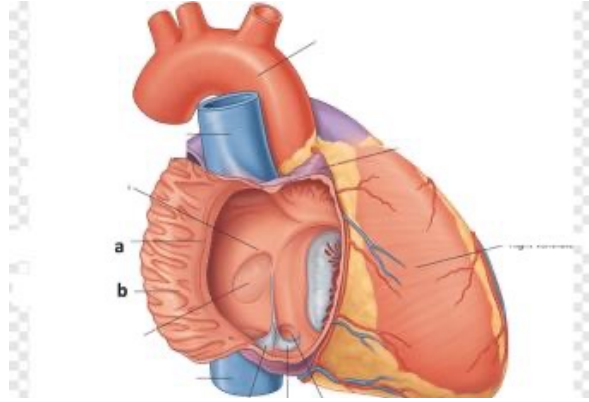
*Departments of Anesthesiology and Pain Medicine and †Pediatrics, Neonatology, University of Alberta Hospital and Stollery Children's Hospital, Edmonton, Alberta, Canada

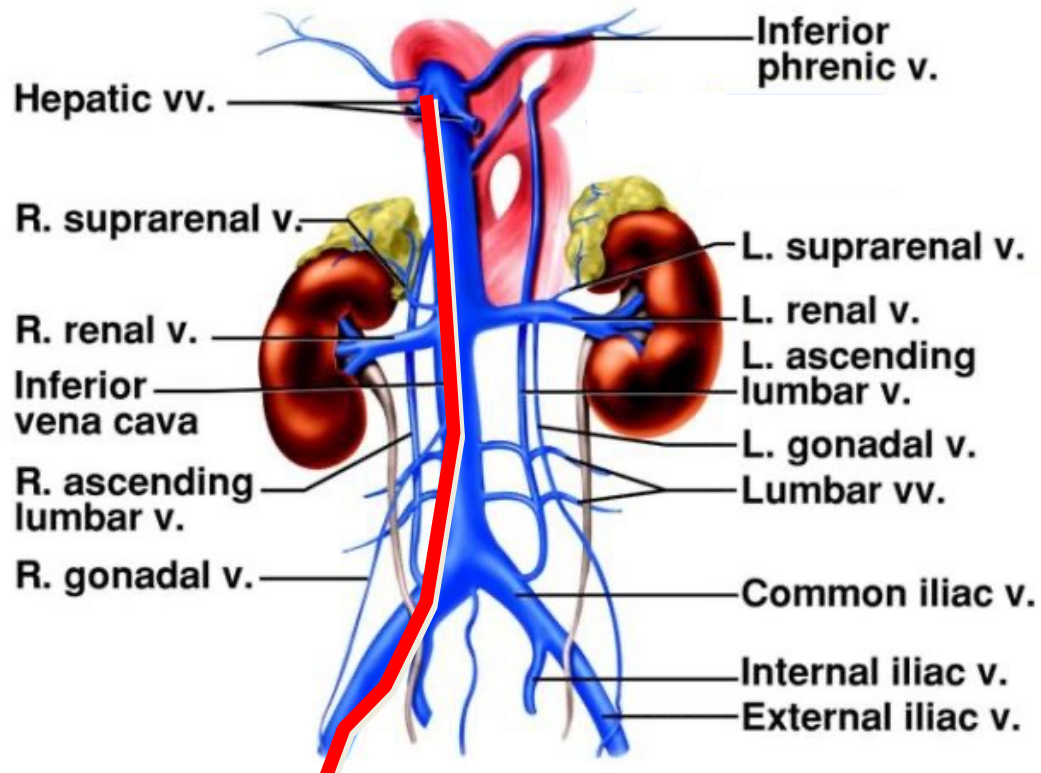
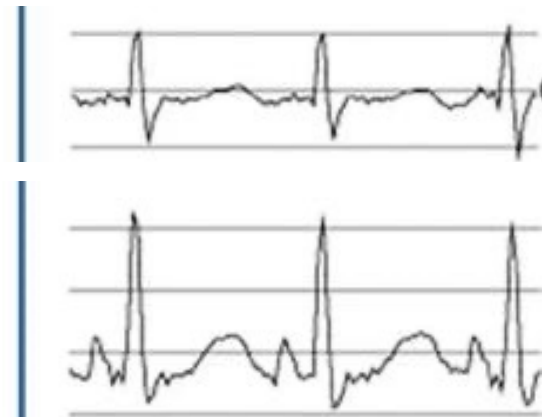
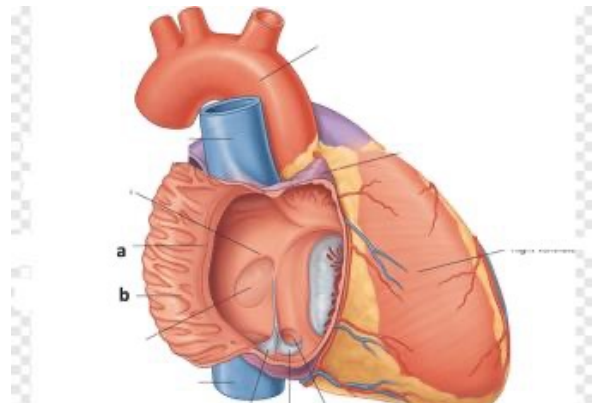


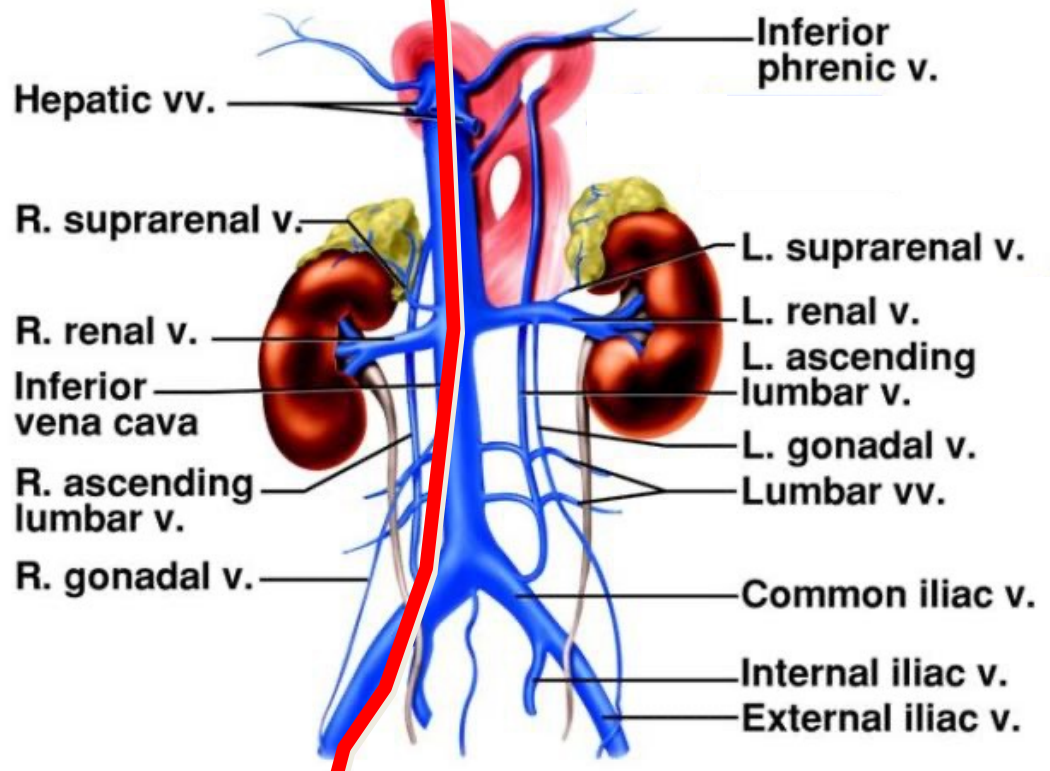
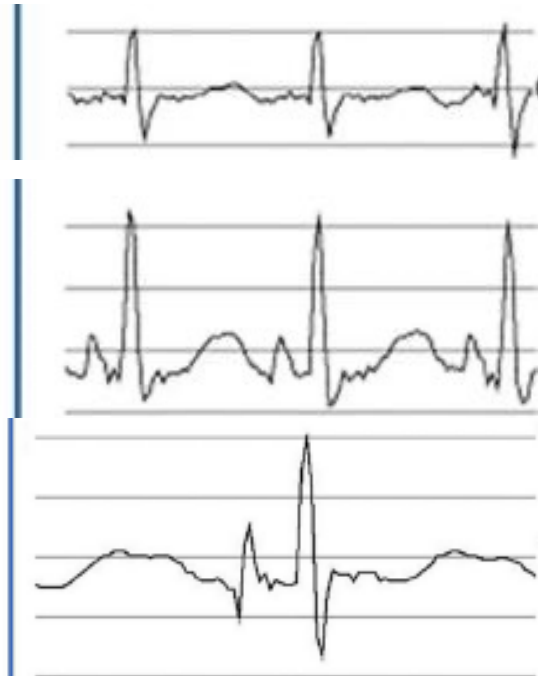
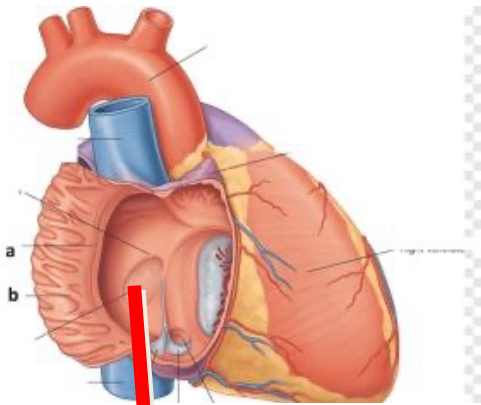
Application of a modified electrocardiogram-guided technique for umbilical venous catheterisation in neonates: A retrospective trial

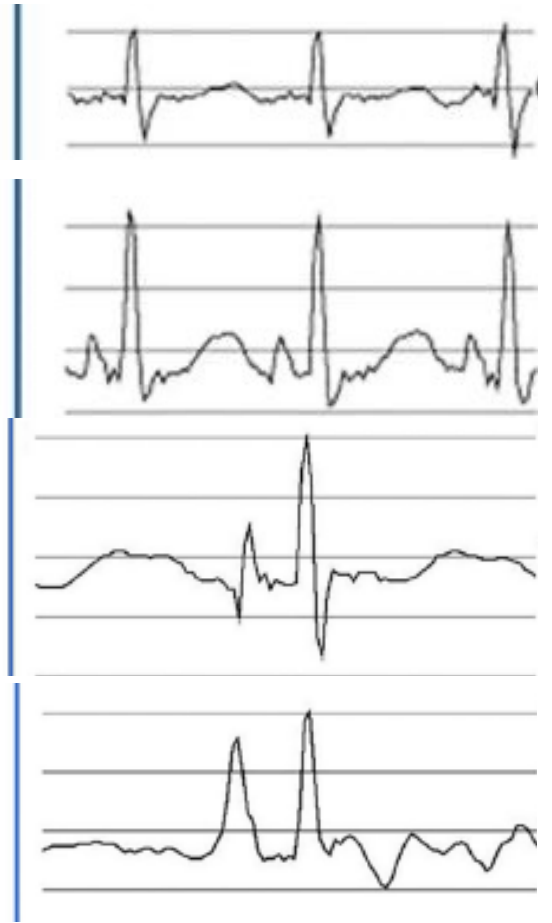
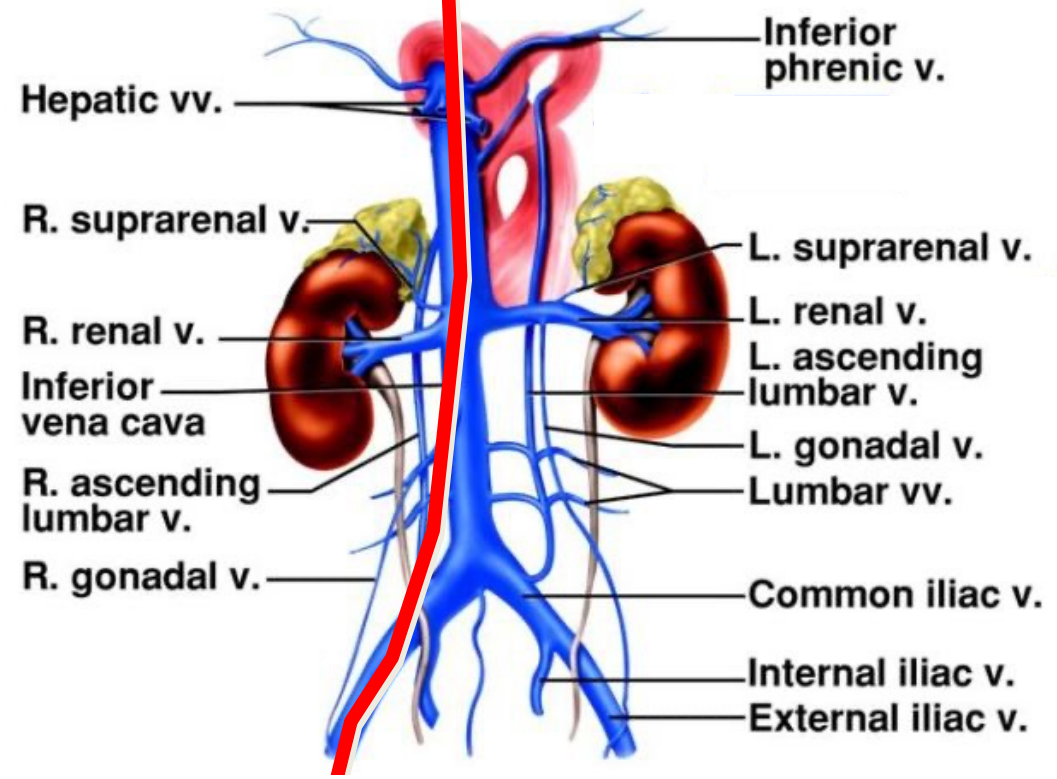
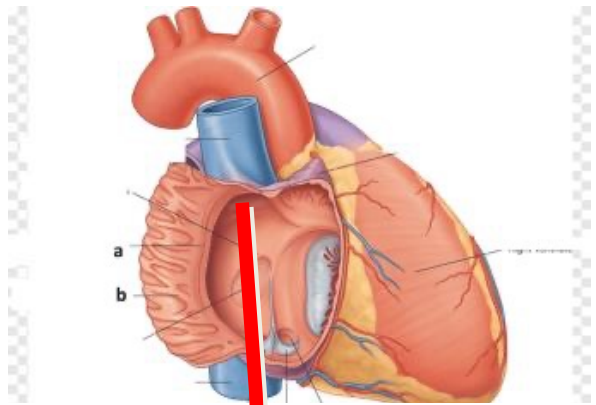
Liyuan Wu,^{1,2} Min Peng,^{1,2} Tian Cao,^{1,2} Yonghui Yang,¹ Qin Wang,^{1,2} Kaiju Luo¹ and Pingyang Chen¹

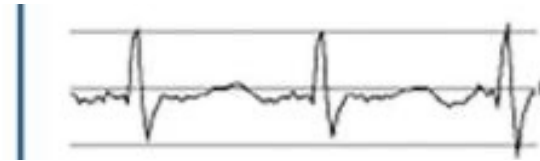
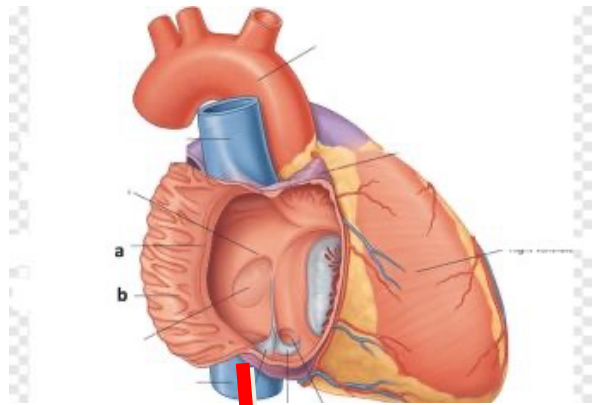
¹Division of Neonatology, Department of Pediatrics, and ²Clinical Nursing Teaching and Research Section, The Second Xiangya Hospital, Central South University, Changsha, China









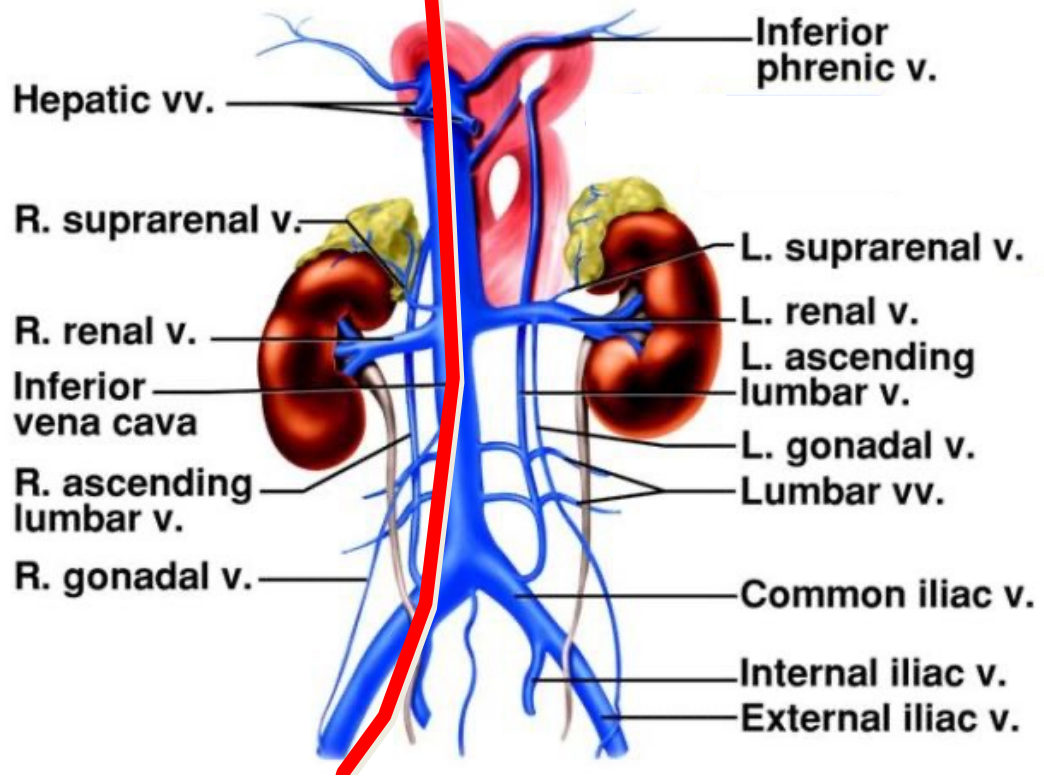


Inferior atriocaval junction (ultrasound) landmark: the Eustachian valve

Inferior atriocaval electrical landmark: transition from biphasic to flat (an area, not a spot)

Negative p-wave as a marker of the «terminal» inferior vena cava not constant

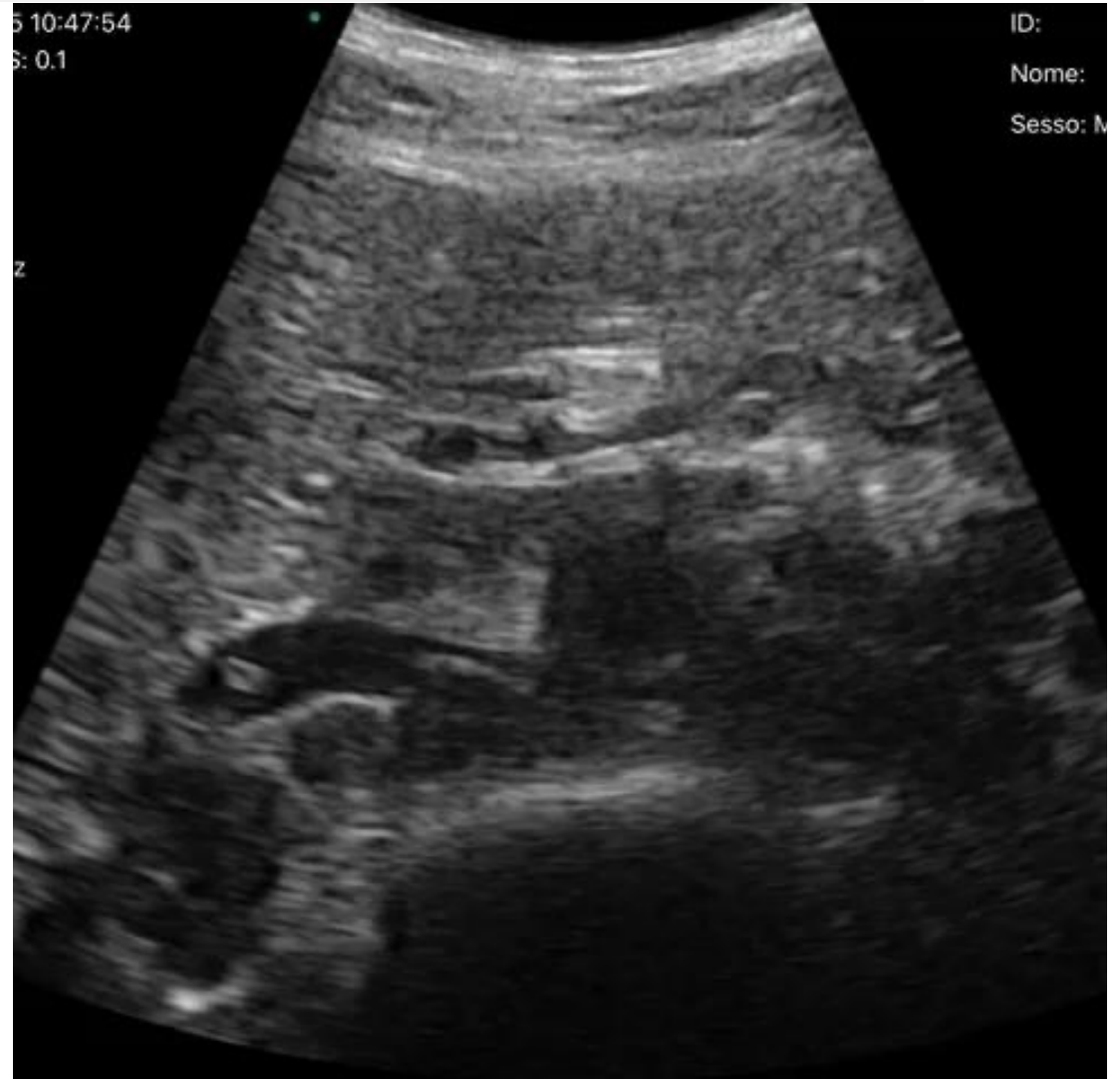
Catheter long enough to reach the p-wave modifications



As soon as p-wave flattens again during catheter withdrawal

FEMORAL LINES

Different optimal tip position (retrohepatic) = direct tip location possible



FEMORAL LINES

Different optimal tip position (retrohepatic) = direct tip location possible



Techniques in vascular access

JVA | The Journal of Vascular Access

The Journal of Vascular Access
1-5
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11297298231178063
journals.sagepub.com/home/jva
S Sage

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

Maria Giuseppina Annetta¹ , Bruno Marche², Giovanna Mercurio¹ and Mauro Pittiruti² 

Techniques in vascular access

JVA | The Journal of Vascular Access

The Journal of Vascular Access
1-7
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11297298231153979
journals.sagepub.com/home/jva
S SAGE

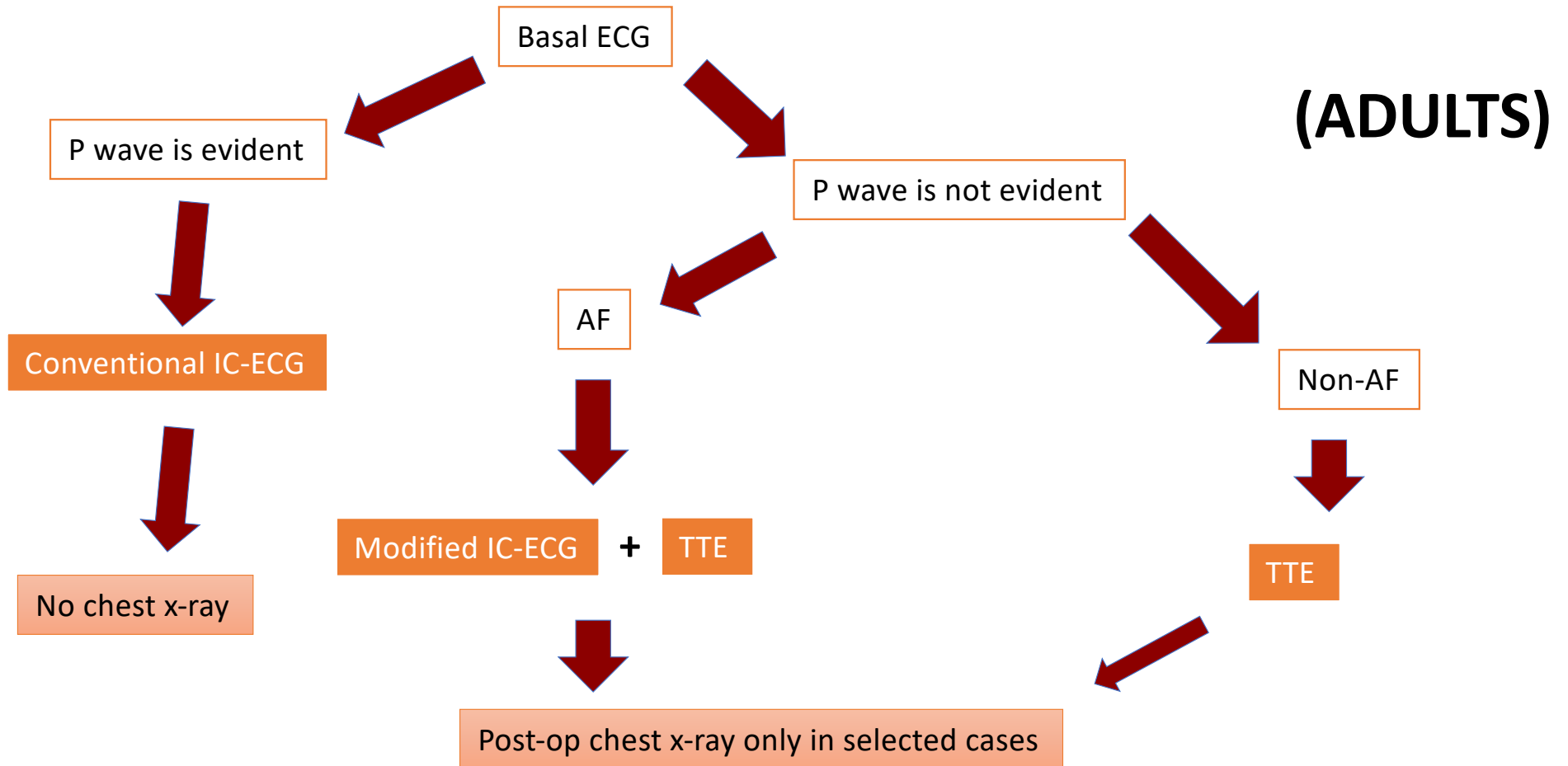
Applicability and feasibility of intraprocedural tip location of femorally inserted central catheters by transhepatic ultrasound visualization of the inferior vena cava in adult patients

Maria Giuseppina Annetta¹ , Bruno Marche¹, Igor Giarretta² and Mauro Pittiruti¹ 

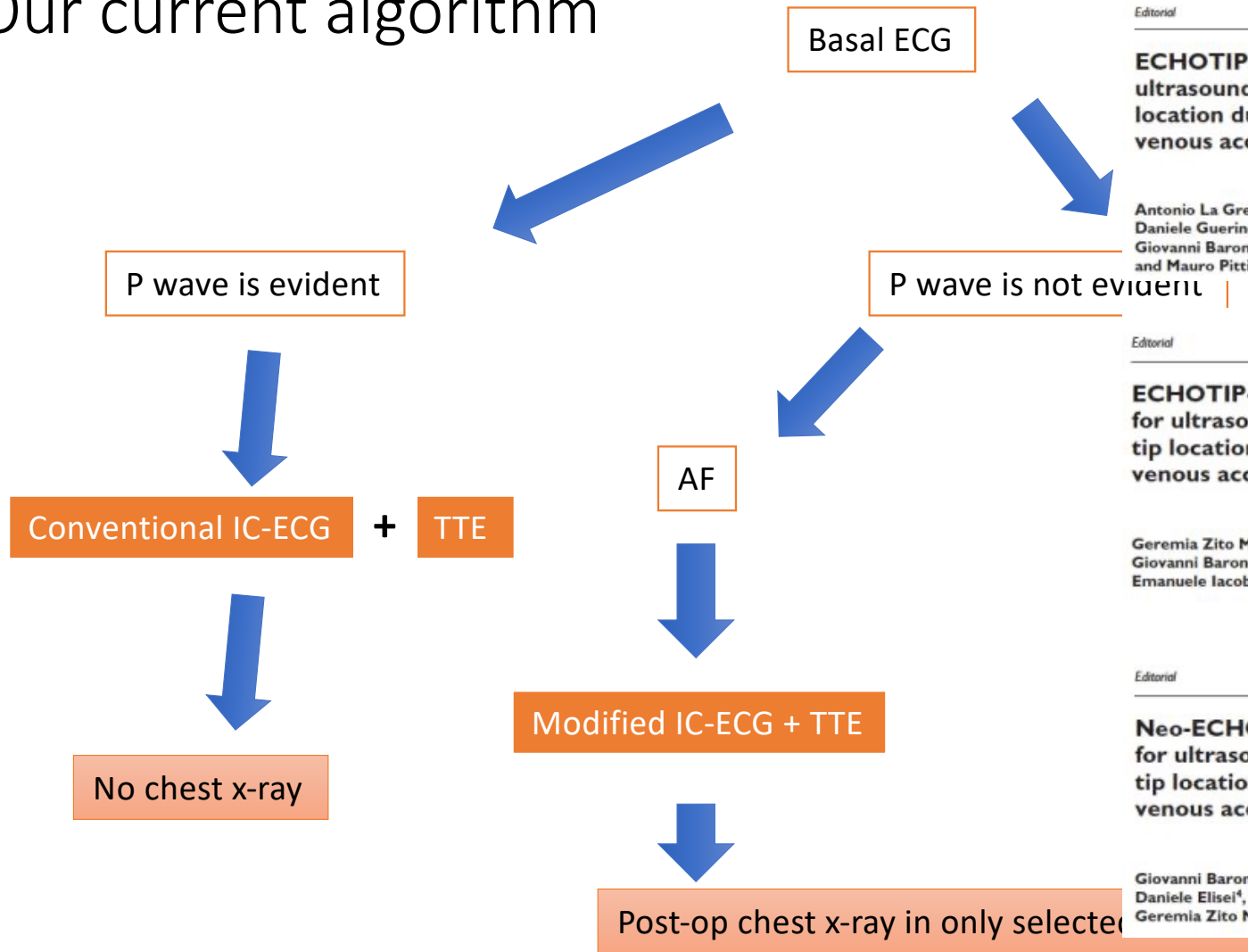
**A last clue:
IC-ECG + US for femoral lines**

**Tip location by US (direct visualization+bubble)
+
IC-ECG as a support**

ALL YOU NEED IS AN ALGORITHM



Our current algorithm



Editorial

The Journal of Vascular Access
1-10
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11297298211044325
journals.sagepub.com/home/jva
SAGE

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

Antonio La Greca¹, Emanuele Iacobone², Daniele Elisei³, Daniele Guerino Biasucci³, Vito D'Andrea⁴, Giovanni Barone⁵, Geremia Zito Marinosci⁴ and Mauro Pittiruti¹

Editorial

The Journal of Vascular Access
1-9
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11297298211031391
journals.sagepub.com/home/jva
SAGE

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

Geremia Zito Marinosci^{1*}, Daniele Guerino Biasucci^{2*}, Giovanni Barone³, Vito D'Andrea⁴, Daniele Elisei⁵, Emanuele Iacobone⁶, Antonio La Greca⁴ and Mauro Pittiruti⁴

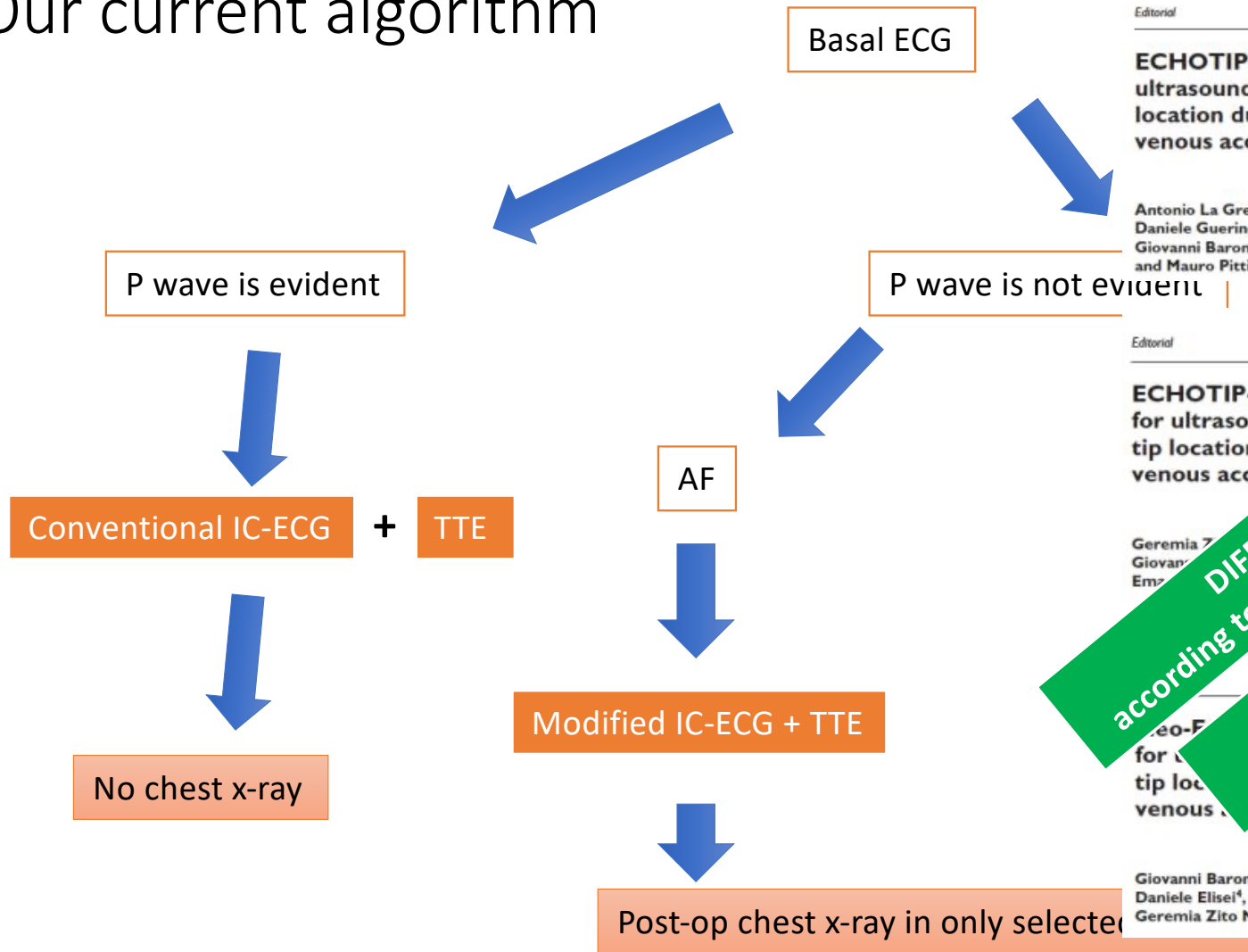
Editorial

The Journal of Vascular Access
1-10
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/11297298211007703
journals.sagepub.com/home/jva
SAGE

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

Giovanni Barone¹, Mauro Pittiruti², Daniele G Biasucci³, Daniele Elisei⁴, Emanuele Iacobone⁴, Antonio La Greca², Geremia Zito Marinosci⁵ and Vito D'Andrea⁴

Our current algorithm



Editorial

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

Antonio La Greca¹, Emanuele Iacobone², Daniele Guerino Biasucci³, Vito D'Andrea⁴, Giovanni Barone⁵, Geremia Zito Marinoscio⁶ and Mauro Pittiruti¹

Editorial

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

Geremia Zito Marinoscio⁶, Daniele Guerino Biasucci³, Antonio La Greca¹, Emanuele Iacobone², Vito D'Andrea⁴, Giovanni Barone⁵ and Mauro Pittiruti¹

Editorial

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

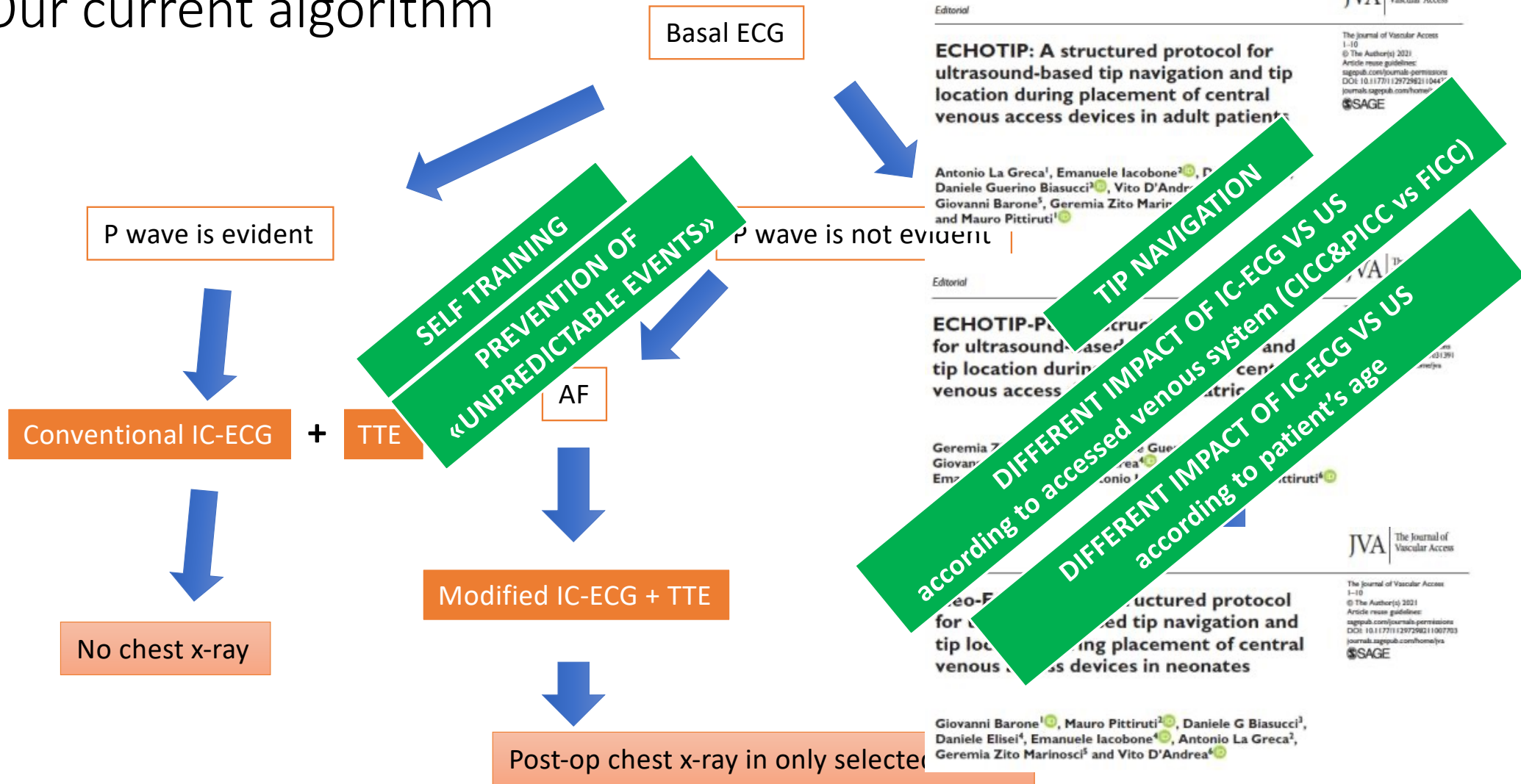
Giovanni Barone¹, Mauro Pittiruti², Daniele G Biasucci³, Daniele Elisei⁴, Emanuele Iacobone⁵, Antonio La Greca², Geremia Zito Marinoscio⁶ and Vito D'Andrea⁴

JVA | The Journal of Vascular Access

The Journal of Vascular Access
1-10
© The Author(s) 2021
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/1129729821100471
journals.sagepub.com/home/jva
SAGE

TIP NAVIGATION
DIFFERENT IMPACT OF IC-ECG VS US
according to accessed venous system (CICC&PICC vs FICC)
DIFFERENT IMPACT OF IC-ECG VS US
according to patient's age

Our current algorithm





GRAZIE !!!

Gemelli



antonio.lagreca@unicatt.it

antonio.lagreca@policlinicogemelli.it