GAVeCeLT

XII PICC Day

Riunione monotematica annuale dedicata ai PICC e ai Midline

Il punto sulla *tip navigation*: indicazioni e costo-efficacia delle metodiche disponibili

Daniele G. Biasucci

U.O.C. Rianimazione, Terapia Intensiva e Tossicologia Clinica

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Università Cattolica del Sacro Cuore - Roma

EcoTIME

Ecografia in Terapia Intensiva e Medicina dell'Emergenza

Gemelli

Fondazione Policlinico Universitario A. Gemelli
Università Cattolica del Sacro Cuore

Cosa si intende per costo-efficacia

efficace quando raggiunge l'obiettivo clinico per il quale è usato

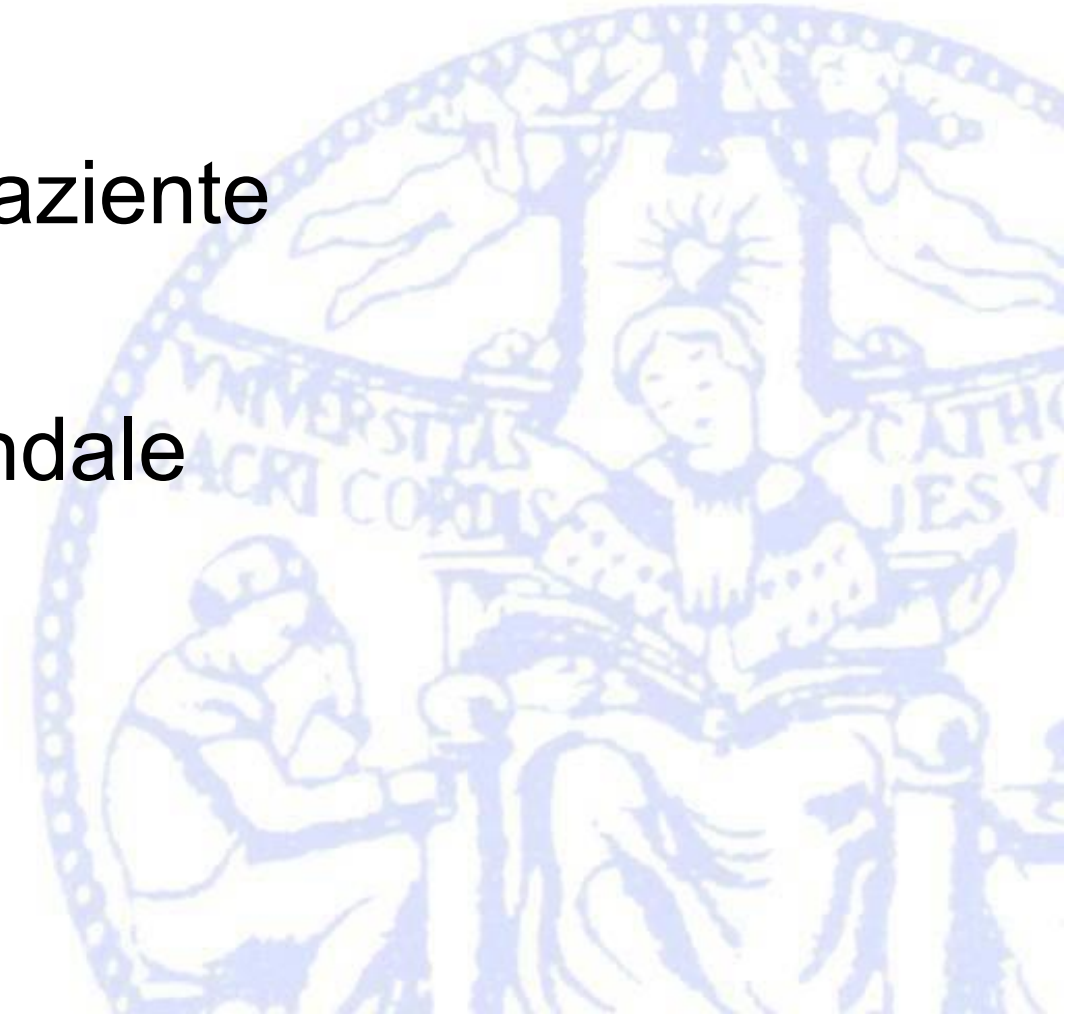
efficiente quando raggiunge l'obiettivo clinico prefissato con le risorse minori o senza spreco di risorse

costo-efficace quando offre un vantaggio in termini di rapporto tra le risorse impiegate e l'obiettivo clinico raggiunto

I nostri obiettivi:

(in ordine di priorità)

1. SICUREZZA del paziente
2. EFFICACIA clinica
3. EFFICIENZA aziendale



Due ordini di fattori

- Risorse impiegate
  - Materiali, tempi, ambiente utilizzato, apparecchiature, risorse umane impiegate, etc.
- Costi delle complicanze ‘attese’ sia al momento dell’impianto che durante la gestione
  - Stimate sulla base del rischio % desunto dalla letteratura

Complicanze

- **Malposizionamento primario (o secondario)** che comporta:
  - ritardo nella inizio della terapia e necessità di riprogrammazione per **sostituzione del presidio** a causa del malfunzionamento
  - aumento del rischio trombotico

Tip navigation vs Tip location

- Le tecniche di ‘tip location’ permettono di individuare la corretta posizione della punta del VAD se esso è stato fatto procedere nella giusta direzione
- Le tecniche di ‘tip navigation’ permettono di indirizzare correttamente la progressione del catetere la cui corretta posizione della punta sarà verificata con una tecnica di ‘tip location’ integrata

Tip Navigation

- Le tecniche di tip navigation, in condizioni standard, non sostituiscono le tecniche di tip location.
- Le tecniche di tip navigation possono ridurre il rischio di malposizionamento in quelle particolari categorie di pazienti in cui non possono essere usate le tecniche di ‘tip location’ (es. ECG nei pazienti portatori di PM o con FA)

Tecniche di ‘Tip Navigation’

- Imaging-based
  - Fluoroscopia, ecografia ed ecocardiografia
- Tracking Elettromagnetico +/- IC-ECG
  - Sherlock 3CG (Bard), VPS Rhythm (Teleflex), Navigator (Corpak), CathRite (Micronix) …
- Pressure based
  - Cat-Finder (Elcam)
- ECG-based
  - Delta, Pilot (Vygon)
- Doppler-based +/- IC-ECG
  - Vasonova (Teleflex)

LIMITI della fluoroscopia

Simultaneamente ‘tip navigation’ e ‘tip location’

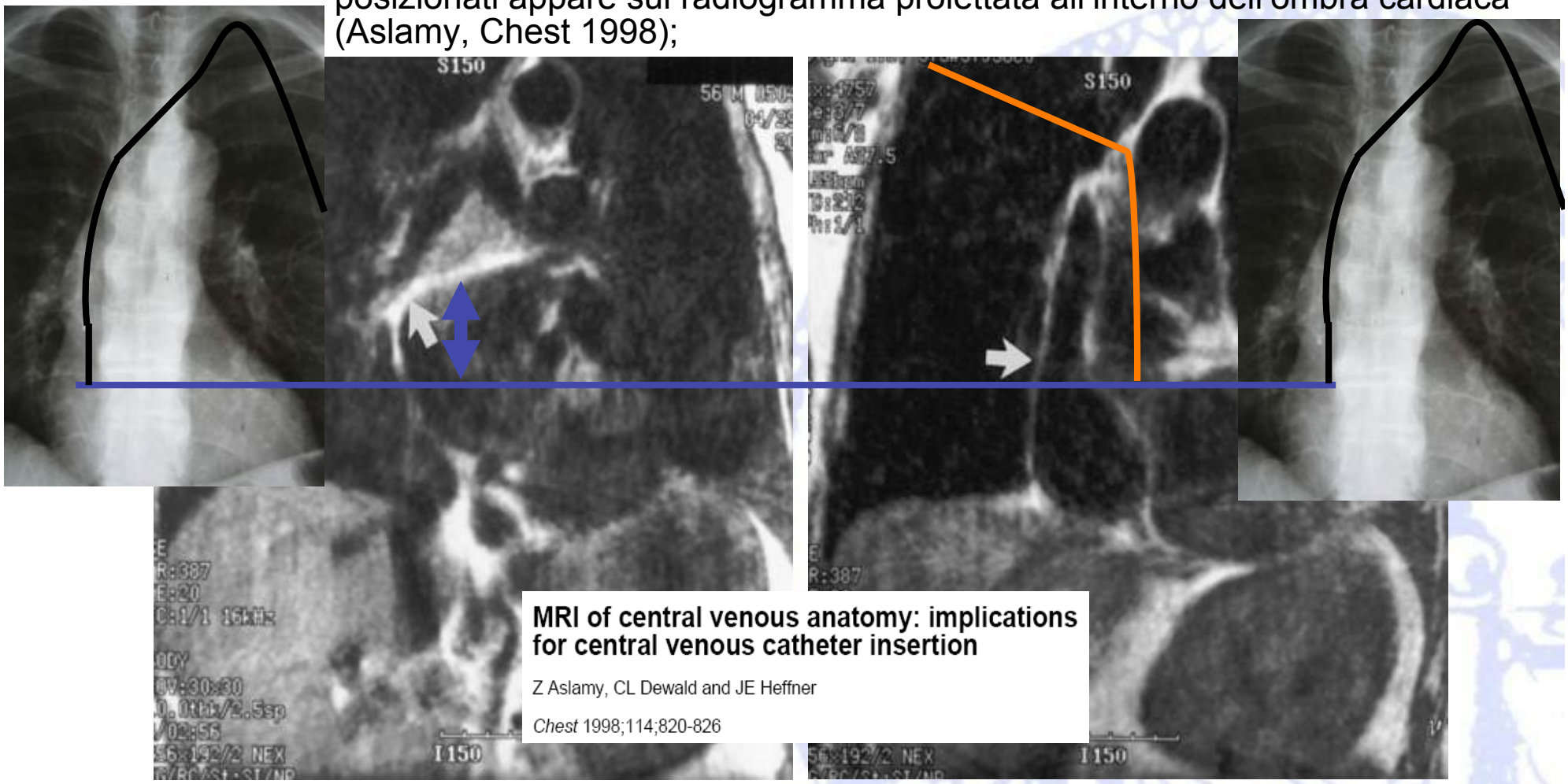
Costosa

Difficoltà logistiche e organizzative

Limiti dei reperi radiologici

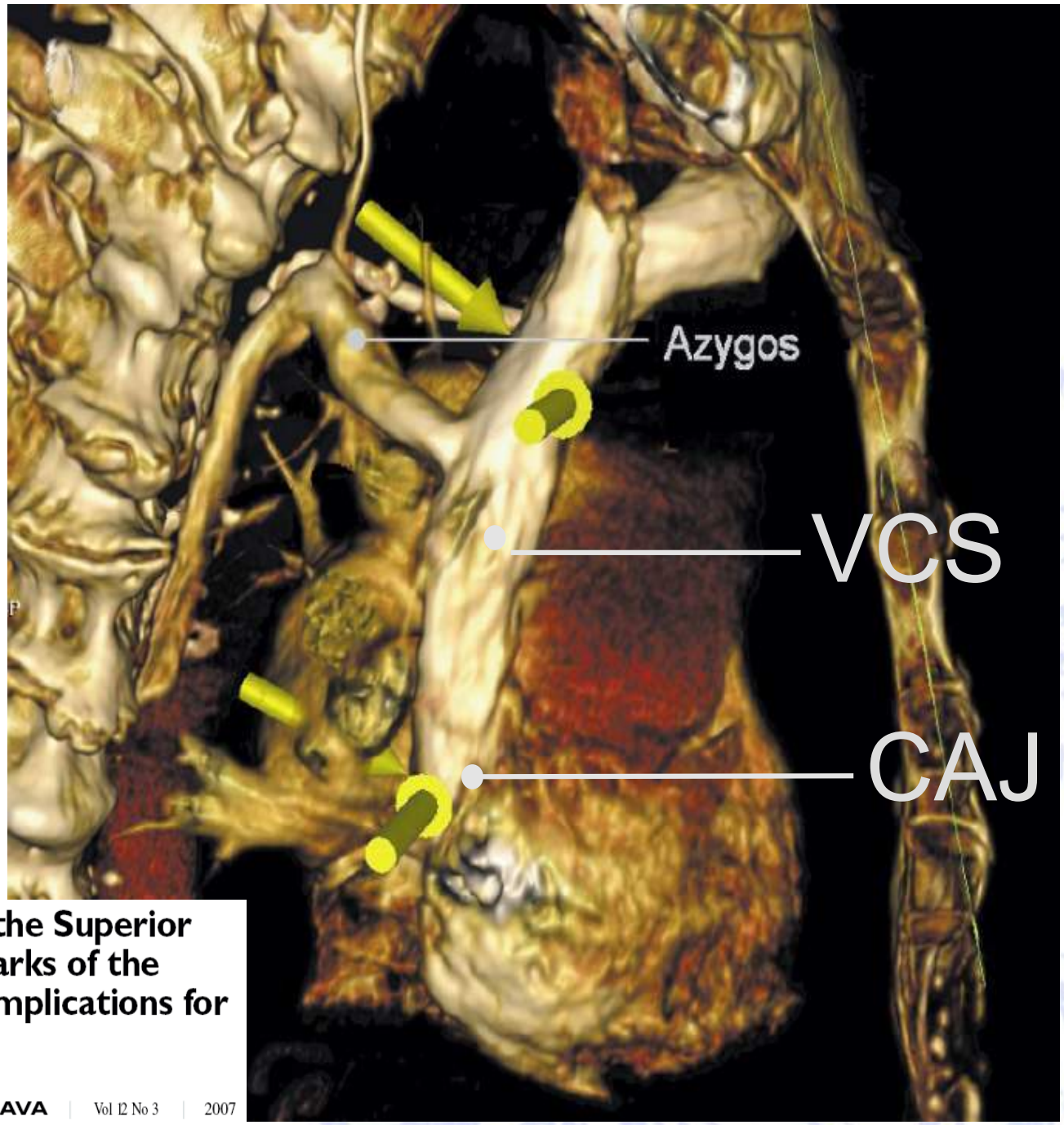
Inaffidabilità dei reperi radiologici comuni

- Incrocio tra silhouette cardiaca destra e linea mediastinica destra (vena cava superiore):
  - anatomia reale mal rappresentata dall'immagine proiettiva:
    1) nel 38% dei pazienti il profilo cardiaco destro radiologico è composto dalla opacità dell'atrio sinistro che deborda sull'immagine del destro nella sua porzione cranio-laterale, con il risultato che la punta di cateteri ben posizionati appare sul radiogramma proiettata all'interno dell'ombra cardiaca (Aslamy, Chest 1998);



2) la vena cava superiore si impianta **dorsalmente** e non cranialmente sull'atrio destro, **tra terzo medio e terzo prox.** dell'atrio stesso e **tangenzialmente** ad esso (Testut, Gray, Aslamy)

   la punta di cateteri con punta ben posizionata all'imbocco in sede giunzionale appare sul radiogramma proiettata all'interno dell'ombra cardiaca.



A Study of the Relationship of the Superior Vena Cava to the Bony Landmarks of the Sternum in the Supine Adult: Implications for Magnetic Guidance Systems

Costi dell'impianto di un PICC

Dati presentati da M.Smith (Wisconsin) al congresso DIVLD – Parigi, 2011

	operatore	ambiente	attrezzatura	altri op.
$ 5000	chirurgo	Sala operatoria	fluoroscopia	ferrista
$ 2800	radiologo	Sala radiologica	fluoroscopia	tecnico rad.
$ 1800	anestesista	bedside	no fluoro	
$ 875	infermiere	bedside	no fluoro	

Raccomandazioni AHRQ

2013

Annals of Internal Medicine | SUPPLEMENT

The Top Patient Safety Strategies That Can Be Encouraged for Adoption Now

Paul G. Shekelle, MD, PhD; Peter J. Pronovost, MD, PhD; Robert M. Wachter, MD; Kathryn M. McDonald, MM; Karen Schoelles, MD, SM; Sydney M. Dy, MD, MSc; Kaveh Shojania, MD; James T. Reston, PhD, MPH; Alyce S. Adams, PhD; Peter B. Angood, MD; David W. Bates, MD, MSc; Leonard Bickman, PhD; Pascale Carayon, PhD; Sir Liam Donaldson, MBChB, MSc, MD; Naihua Duan, PhD; Donna O. Farley, PhD, MPH; Trisha Greenhalgh, BM BCH; John L. Haughom, MD; Eileen Lake, PhD, RN; Richard Lilford, PhD; Kathleen N. Lohr, PhD, MA, MPhil; Gregg S. Meyer, MD, MSc; Marlene R. Miller, MD, MSc; Duncan V. Neuhauser, PhD, MBA, MHA; Gery Ryan, PhD; Sanjay Saint, MD, MPH; Stephen M. Shortell, PhD, MPH, MBA; David P. Stevens, MD; and Kieran Walshe, PhD

Table 2. Patient Safety Strategies Ready for Adoption Now

Strongly encouraged

- Preoperative checklists and anesthesia checklists to prevent operative and postoperative events
- Bundles that include checklists to prevent central line–associated bloodstream infections
- Interventions to reduce urinary catheter use, including catheter reminders, stop orders, or nurse-initiated removal protocols
- Bundles that include head-of-bed elevation, sedation vacations, oral care with chlorhexidine, and subglottic suctioning endotracheal tubes to prevent ventilator-associated pneumonia
- Hand hygiene
- The do-not-use list for hazardous abbreviations
- Multicomponent interventions to reduce pressure ulcers
- Barrier precautions to prevent health care–associated infections
- Use of real-time ultrasonography for central line placement
- Interventions to improve prophylaxis for venous thromboembolisms

Encouraged

- Multicomponent interventions to reduce falls
- Use of clinical pharmacists to reduce adverse drug events
- Documentation of patient preferences for life-sustaining treatment
- Obtaining informed consent to improve patients' understanding of the potential risks of procedures
- Team training
- Medication reconciliation
- Practices to reduce radiation exposure from fluoroscopy and CT
- The use of surgical outcome measurements and report cards, such as those from ACS NSQIP
- Rapid-response systems
- Use of complementary methods for detecting adverse events or medical errors to monitor for patient safety problems
- Computerized provider order entry
- Use of simulation exercises in patient safety efforts

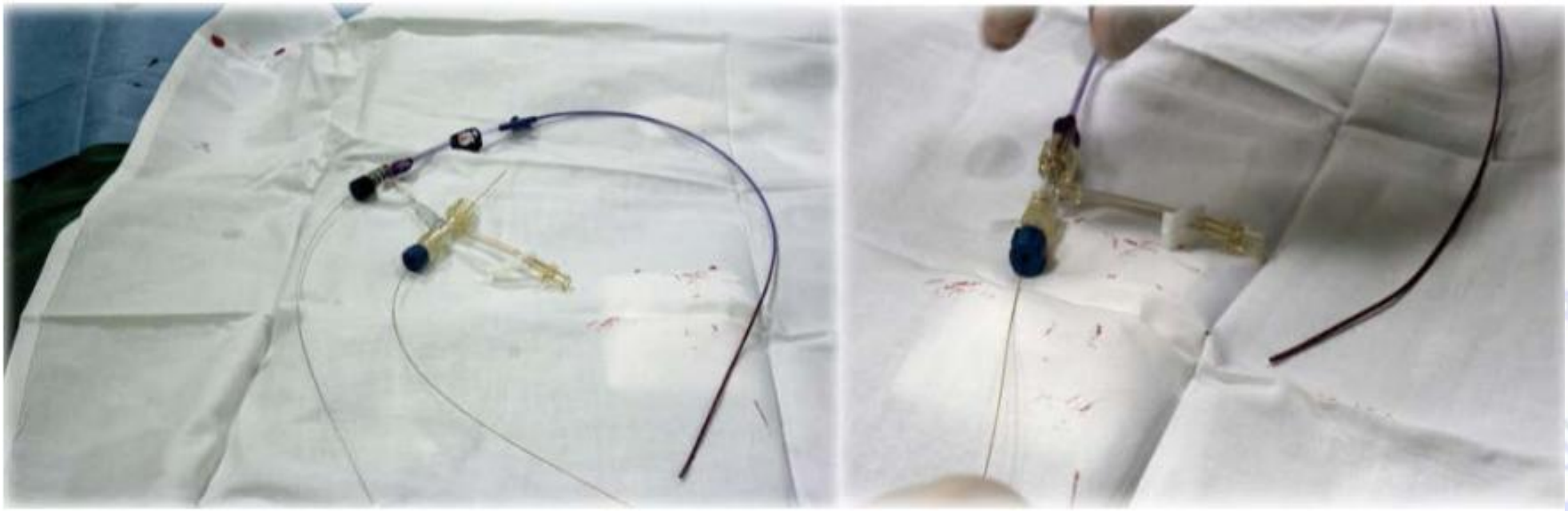
TRACKING ELETTROMAGNETICO

Dispositivi ‘hand-held’ (Navigator, Cath-Finder)

Vecchia metodica ‘manuale’ di visualizzazione diretta o anatomica

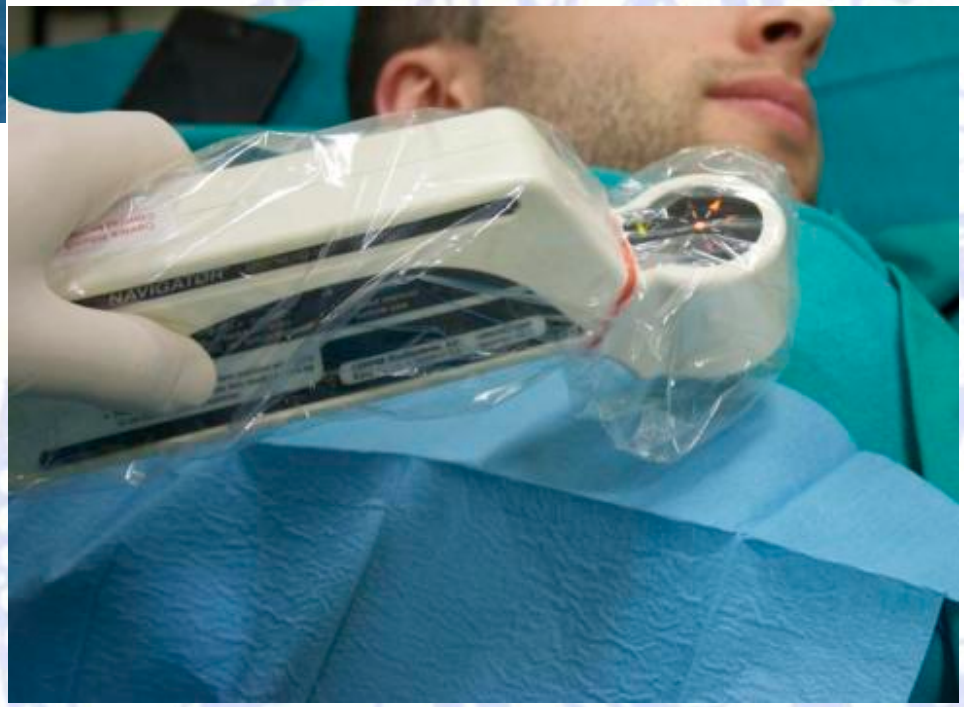
Naylor, JAVA 2007

- Inserito all’interno del copri-sonda sterile



- Necessità di mandrino elettromagnetico dedicato

VGI omolaterale



BCF controlaterale

- Localizzazione approssimativa della giunzione cavo-atriale al livello del III spazio intercostale sulla linea parasternale dx

Pittiruti et al.: tip navigation + tip location = an algorithm for maximizing cost effectiveness

In 30 PICC insertions, we adopted Navigator for tip navigation and IC-ECG for tip location (performed using Nautilus).

The Navigator device consists of a sterile stylet (diameter 1.1 Fr, length 106 cm) placed inside the catheter so that the tip of the stylet is at 1 mm from the tip.

During insertion, the tip of the catheter can be followed and detected by an electromagnetic device.

Also, the system tells whether the tip is pointing in the right direction or not.

Pittiruti et al.: tip navigation + tip location = an algorithm for maximizing cost effectiveness

In all patients, the tip location verified by IC-ECG corresponded to the electromagnetic detection of the tip below the third

ward.

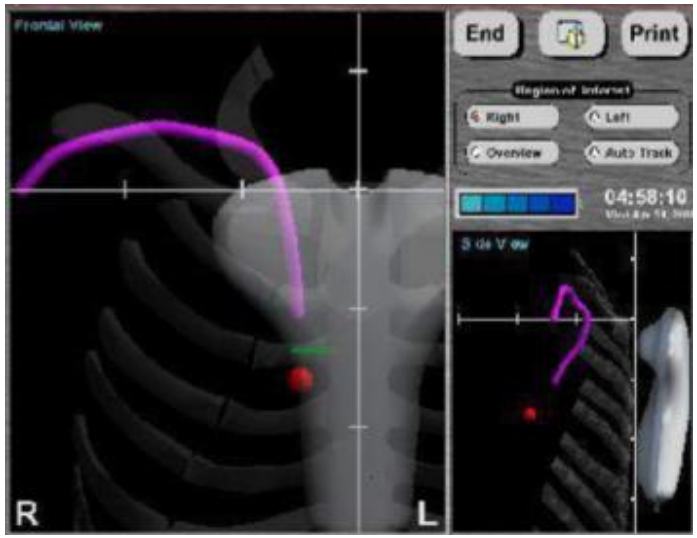
In 3 cases, the Navigator detected that the tip had accidentally entered the ispilateral internal jugular vein and allowed us to

In 2 cases, IC-ECG was not confirming the correct tip location, though the PICC had been threaded for the estimated length: the Navigator detected the tip of the catheter in the contralateral brachio-cephalic vein, pointing to the contralateral clavicle: this allowed to correct its direction.

EBM

- Solo abstracts presentati a congressi
- No studi pubblicati su riviste ‘indexed’ con sistema di ‘peer-review’
- Non dati significativi su costo-efficacia
- Limitata disponibilità

Tracking Elettromagnetico + IC-ECG


Frontal View
End
Print
Right
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Overview
Auto Track
04:58:10
R
L


Teleflex
60
Arrow®
VPS Rhythm® Device
with Optional TipTracker™
Technology

Efficacy of the CathRite system to guide bedside placement of peripherally inserted central venous catheters in critically ill patients: a pilot study

Critical Care and Resuscitation • Volume 9 Number 3 • September 2007

Simon J G Hockley, Vida Hamilton, Robert J Young,

Table 2. Comparison of outcomes between the CathRite and blind placement groups (number of patients)

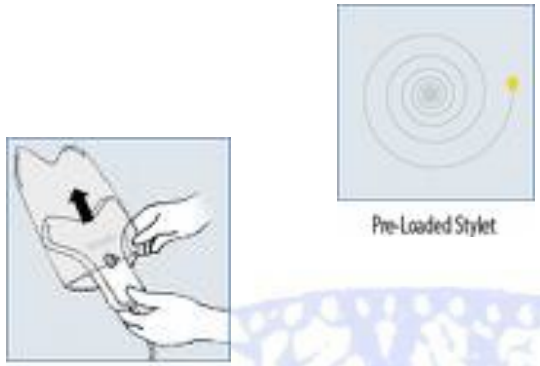
	CathRite system ($n = 19$)	Blind placement ($n = 19$)
PICC guidance into the SVC	19 (100%)*	14 (74%)
Placement in the lower third of the SVC	14 (74%)*	8 (42%)

*$P < 0.05$.
PICC = peripherally inserted central catheter. SVC = superior vena cava.

- ✧Prospective Randomized trial
- ✧22 Exp. vs 22 Anthro. Meas.
- ✧CXR

- Time to completion of catheter insertion was 31.4 +/- 16.2 minutes in the CathRite group compared with 24.6 +/- 14.5 minutes in the control group (P = 0.18)

Sherlock II Tip Location System



Lelkes V, Kumar A, Shukla PA, Contractor S, Rutan T. **Analysis of the Sherlock II tip location system for inserting peripherally inserted central venous catheters**. *Clin Imaging 2013 Sep-Oct; 37(5): 917-2*

Raccomandazioni NICE (UK) 2016

Key Points for Decision Makers

The Sherlock 3CG® TCS has already been implemented in 16 NHS sites, and routine use of chest X-rays for confirming PICC tip location has been eliminated in some of these.

Use of the Sherlock 3CG® TCS appears to be approximately cost neutral compared to blind PICC insertion, based on the available low quality evidence. It may be cost saving if there are reductions in nurse time, X-ray provision, portering or the number of reinsertions required.

There is some evidence that the Sherlock 3CG® TCS can improve tip positioning accuracy compared to blind placement of PICCs.

There is no evidence on the effect of Sherlock 3CG® TCS on the time to treatment, length of stay, clinical outcomes or patient experience.

Appl Health Econ Health Policy (2016) 14:41–49
DOI 10.1007/s40258-015-0192-3

REVIEW ARTICLE

Sherlock 3CG® Tip Confirmation System for Placement of Peripherally Inserted Central Catheters: A NICE Medical Technology Guidance

Megan Dale[1] · Ailish Higgins[2] · Grace Carolan-Rees[1]

References	Study design and details	Population	Intervention and previous technology	Accuracy of Sherlock 3CG® TCS (ECG tip placement in agreement with	Comments by the EAC
hnston (peer reviewed paper) [13]	Consecutive case series (UK)	ICU patients needing PICC insertion, excluding those not in sinus rhythm ($n = 250$) 11/250 (4.4 %) excluded	Sherlock 3CG® TCS. Previously used chest X-ray confirmation	79.5 % of PICCs in acceptable position (mid and lower SVC/CAJ/high RA	Peer-reviewed publication. Aims, methods, patient population, result and exclusion criteria are fully reported. Chest X-rays reviewed b at least 2 authors
	additional information from author	PICC insertion ($n = 65$ in original study, $n = 225$ total, including follow up) 11/225 (4.9 %) excluded	Previously used chest X-ray confirmation	position (lower 1/3 of SVC or CAJ)	peer reviewed
Adams [9]	Case series (USA), abstract and poster	People needing PICC insertion excluding those without identifiable p-wave ($n = 333$) 55/333 (16.5 %) excluded	Sherlock 3CG® TCS. Previously used chest X-ray confirmation	96.4 % on 1st review 98.2 % on 2nd review	Full critical appraisal not possible, not peer reviewed
Stewart [11]	Case series (Australia), abstract and poster	Unknown, abstract states "over 65" patients treated	Sherlock 3CG® TCS. Previously used chest X-ray confirmation	96 % within CAJ 4 % within RA Number unable to confirm tip location using Sherlock 3CG® TCS not reported	Minimal information available, full critical appraisal not possible, not peer reviewed. Information should be treated cautiously
Parikh [10]	Prospective case series (USA), abstract and poster. Two phases, with increased nurse training in 2nd phase. Additional patients after trial also reported	People needing PICC insertion excluding those with AF, atrial flutter, increased risk of bleeding and without identifiable p-wave 1st phase $n = 65$, 3/65 (4.6 %) excluded, 2nd phase, $n = 182$ 35/182 (19.2 %) excluded	Sherlock 3CG® TCS. Previously used Sherlock II TLS (magnetic tracking) plus chest X-ray confirmation	Phase 1:83 % placed within SVC or CAJ Phase 2: 96 % placed within SVC or CAJ	Poster, not peer reviewed, but with sufficient detail for partial critical appraisal. Clear patient population, tip position criteria, exclusion criteria, assessment by 2 independent operators For follow up phase patients, 437/567 (77 %) used Sherlock 3CG® TCS, 109/437 (25 %) still required a chest X-ray
Symington [14]	Prospective case series (USA). Presentation	People needing a PICC insertion ($n = 63$)	Sherlock 3CG® TCS. Previously used Sherlock II TLS (magnetic tracking) plus chest x = ray confirmation	98.4 % placed in acceptable position	Minimal information available, full critical appraisal not possible, not peer reviewed

Anaesthesia 2014, 69, 1322–1330 doi:10.1111/anae.12785

Original Article

Evaluation of the Sherlock 3CG Tip Confirmation System on peripherally inserted central catheter malposition rates

A. J. Johnston,[1] A. Holder,[2] S. M. Bishop,[2] T. C. See[3] and C. T. Streater[4]

Table 3 Incorrectly/malpositioned peripherally inserted central catheters for two different definitions of adequate catheter tip. Values are number (proportion (95% CI)). High right atrium is defined as within 2 cm of the cavo–atrial junction.

	Sherlock 3CG positioning
tip position	**n = 239**
Low superior vena cava/cavo–atrial junction	134 (56.1% (50–62%))
Mid superior vena cava/low superior vena cava/cavo–atrial junction/high right atrium	49 (20.5 (16–26%))

Improving the patient experience with real-time PICC placement confirmation

Clare Bidgood

British Journal of Nursing, 2016, Vol 25, No 10

Service development of a nurse-led community-based PICC insertion service

Eva Bedford, Dee Waterhouse

British Journal of Nursing, 2017, (IV Therapy Supplement) Vol 26, No 2

- Malposizioni sensibilmente più basse!

ClinicoEconomics and Outcomes Research

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Time and resources of peripherally inserted central catheter insertion procedures: a comparison between blind insertion/chest X-ray and a real time tip navigation and confirmation system

- Endpoint primario: *time to treatment start*
- Endpoint secondario: cost-effectiveness

Time measurement	Study arm						p-Value
	Sherlock 3CG™ TCS			BI/CXR			
Time from initiation of procedure to release for IV therapy	33.93	25.63	60	176.32	249.84	60	0.001
Time associated with initial PICC placement	33.93	25.63	60	29.05	7.84	60	n/a
Time associated with confirming tip after initial placement	0	0	0	78.04	51.67	60	n/a
PICC nurse time associated with initial PICC insertion	42.00	16.35	60	42.50	16.81	60	n/a
PICC nurse time associated with malposition adjustment after initial insertion	0	0	0	11.67	7.97	7	n/a
Subject time in IR	0	0	0	100.40	107.06	6	n/a

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ORIGINAL RESEARCH

Time and resources of peripherally inserted central catheter insertion procedures: a comparison between blind insertion/chest X-ray and a real time tip navigation and confirmation system

Attribute	Study arm		p-Value
	Sherlock 3CG™ TCS (n=60)	BI/CXR (n=60)	
Number of subjects with malposition during initial PICC insertion	0 (0%)	12 (20%)	<0.001
Number of subjects with remaining malposition during first malposition adjustment	0 (0%)	2 (3%)	n/a
Number of subjects with no malposition	60 (100%)	48 (80%)	n/a

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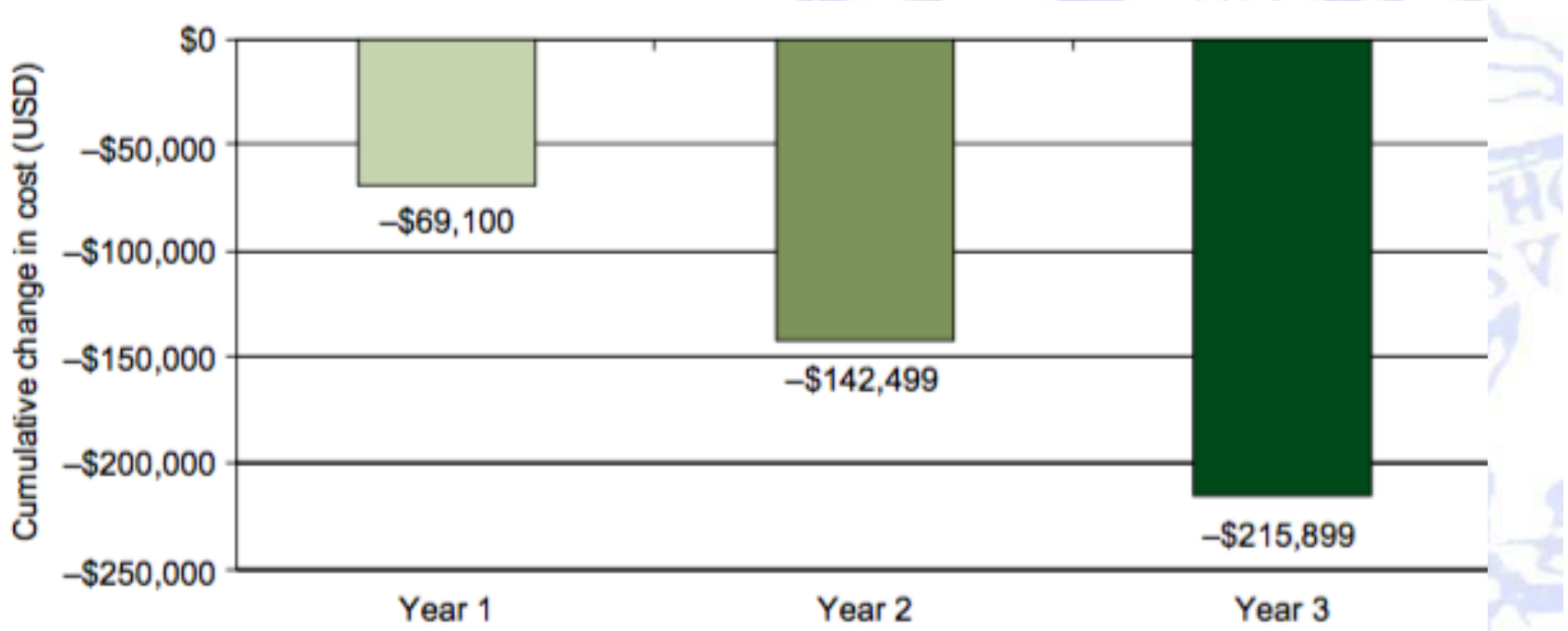
ORIGINAL RESEARCH

Time and resources of peripherally inserted central catheter insertion procedures: a comparison between blind insertion/chest X-ray and a real time tip navigation and confirmation system



J Int Med Res. 2018 Sep 4:300060518793802. doi: 10.1177/0300060518793802. [Epub ahead of print]

Clinical impact of the Sherlock 3CG® Tip Confirmation System for peripherally inserted central catheters.

Yamagishi T[1], Ashida H[1], Igarashi T[1], Matsui Y[1], Nozawa Y[1], Higuchi T[1], Ojiri H[1].

⊕ Author information

Abstract

Objective This study was performed to evaluate the technical success rate and catheter tip malposition rate of peripherally inserted central catheter (PICC) placement using the Sherlock 3CG® Tip Confirmation System (TCS). Methods In total, 114 patients who underwent PICC insertion via the Sherlock 3CG® TCS from October 2017 to February 2018 were retrospectively evaluated. The primary endpoints were the technical success rate, malposition rate, and mean procedure time. The secondary endpoints were the sex-related difference in the malposition rate, radiologist's experience level, and side of insertion. Technical success was defined as procedure completion using only the Sherlock 3CG® TCS without a guidewire or fluoroscopy guidance. In accordance with the North American guidelines, an adequate position was defined as the lower third of the superior vena cava and the cavoatrial junction. Results The technical success rate was 97% (111/114). The malposition rate was 16% (18/111), and four catheters were repositioned. There were no significant differences in the malposition rate between the sexes, radiologist's level of experience, or side of insertion. Conclusions PICC placement using the Sherlock 3CG® TCS yielded a high technical success rate and low catheter tip malposition rate regardless of the radiologist's level of experience or side of insertion.

- Malposizioni: 16%

Journal of Infusion Nursing. 41(5):301–308, SEP 2018
DOI: 10.1097/NAN.0000000000000293, PMID: 30188452
Issn Print: 1533-1458
Publication Date: 2018/09/01

Print

Evaluation of a Magnetic Tracking and Electrocardiogram-based Tip Confirmation System for Peripherally Inserted Central Catheters in Pediatric Patients

Nina Rosche; Wolfgang Stehr

- Malposizioni: 7,44%
- Da 7 a 18 minuti più veloce
- Reference standard: CXR

Original research article

JVA The Journal of Vascular Access

Clinical use of Sherlock-3CG® for positioning peripherally inserted central catheters

The Journal of Vascular Access
1–6

DOI: 10.1177/1129729818805957
journals.sagepub.com/home/jva
SAGE

Mauro Pittiruti[1], Giancarlo Scoppettuolo[2], Laura Dolcetti[2] and Alessandro Emoli[3]

- US-based tip navigations + IC-ECG compared with Sherlock 3CG

Original research article

JVA | The Journal of Vascular Access

Clinical use of Sherlock-3CG® for positioning peripherally inserted central catheters

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1–6

DOI: 10.1177/1129729818805957
journals.sagepub.com/home/jva
SAGE

Mauro Pittiruti[1], Giancarlo Scoppettuolo[2], Laura Dolcetti[2] and Alessandro Emoli[3]

	Feasibility	Accuracy
Tip navigation		
Sherlock-3CG®	105/130 (81%)	105/105 (100%)
Ultrasound	130/130 (100%)	130/130 (100%)
Tip location		
Sherlock-3CG	120/128 (94%)	120/120 (100%)[a]
Nautilus®	128/128 (100%)	128/128 (100%)[a]

VPS RHYTHM

Similar basic principles as Sherlock 3CG

- Electromagnetic tracking + IC-ECG
- External detector ("panoramic" view)
- Screen (not direct on chest cage) representation of the catheter

Difference

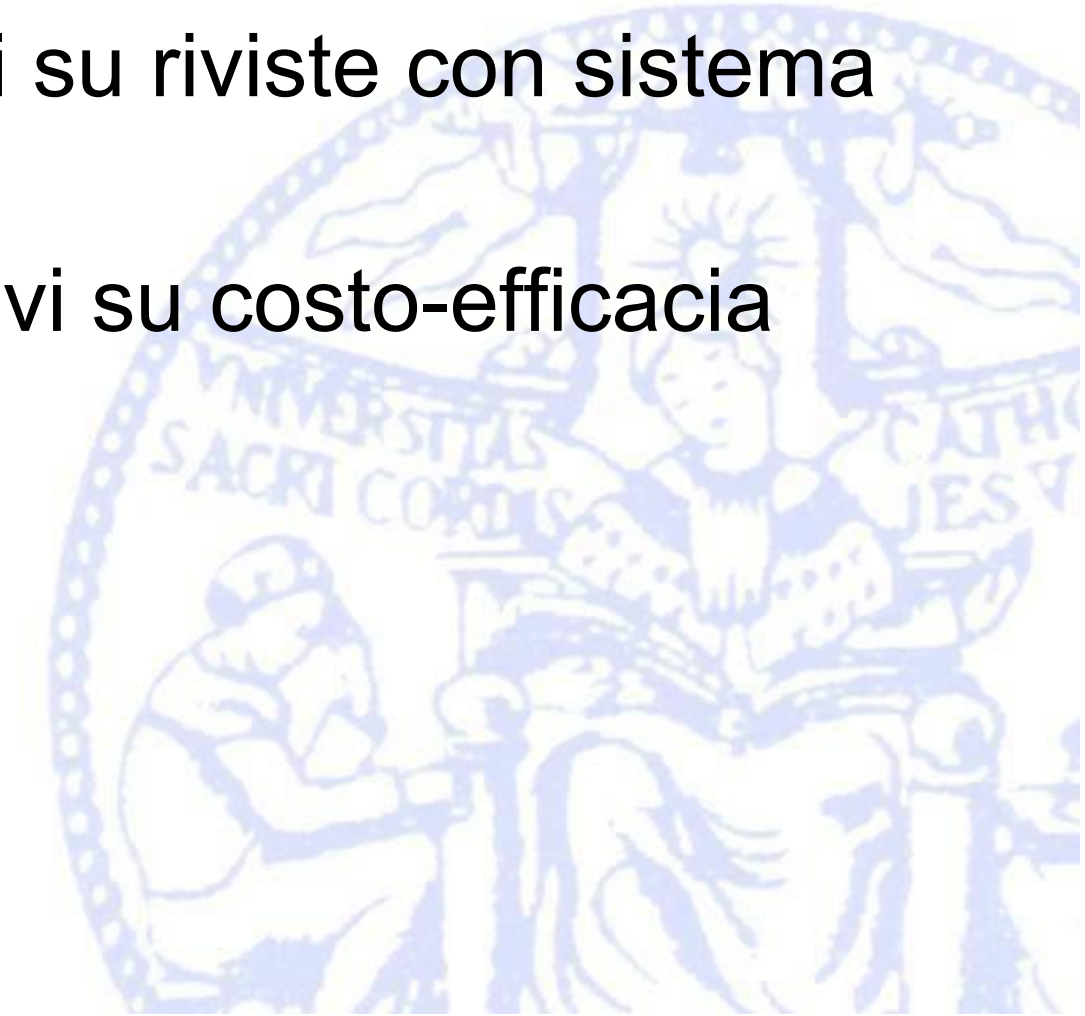
- The shield has 3 magnets which create a magenitc field
- No magnetic (only metal) stylet needed

VPS RHYTHM

FDA clearance for use in PM patients

EBM

- Solo abstracts presentati a congressi
- No studi pubblicati su riviste con sistema di ‘peer-review’
- Non dati significativi su costo-efficacia

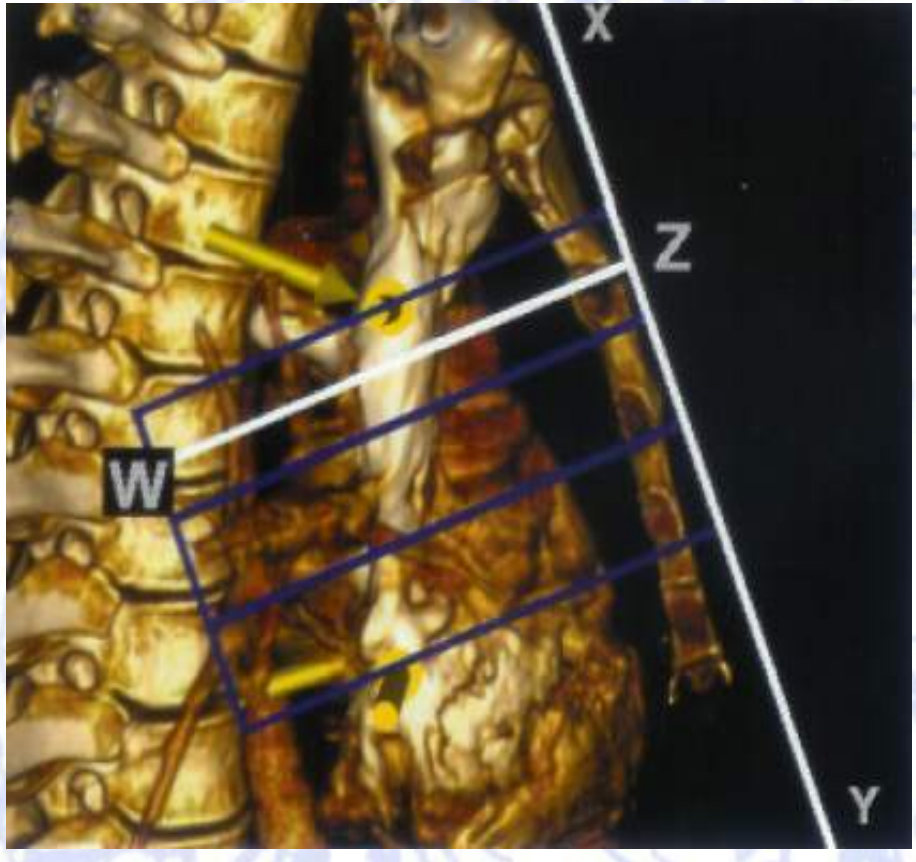


- Proiezione di strutture mediastiniche, tridimensionali, sulla parete toracica
- Danno per scontato che i rapporti anatomici tra sterno e le strutture target sia fisso
- Necessità di ulteriori studi

A Study of the Relationship of the Superior Vena Cava to the Bony Landmarks of the Sternum in the Supine Adult: Implications for Magnetic Guidance Systems

Antonia A. Claasz, BSc (Hons), PhD, and Don P. Chorley

JAVA | Vol 12 No 3 | 2007



Vasonova: ECG + Doppler

Green Arrow – Keep going
The catheter is moving with the flow of the blood towards the heart.

Orange Circle – Do not enter
The catheter is moving against the flow of the blood. It needs to be pulled back and redirected.

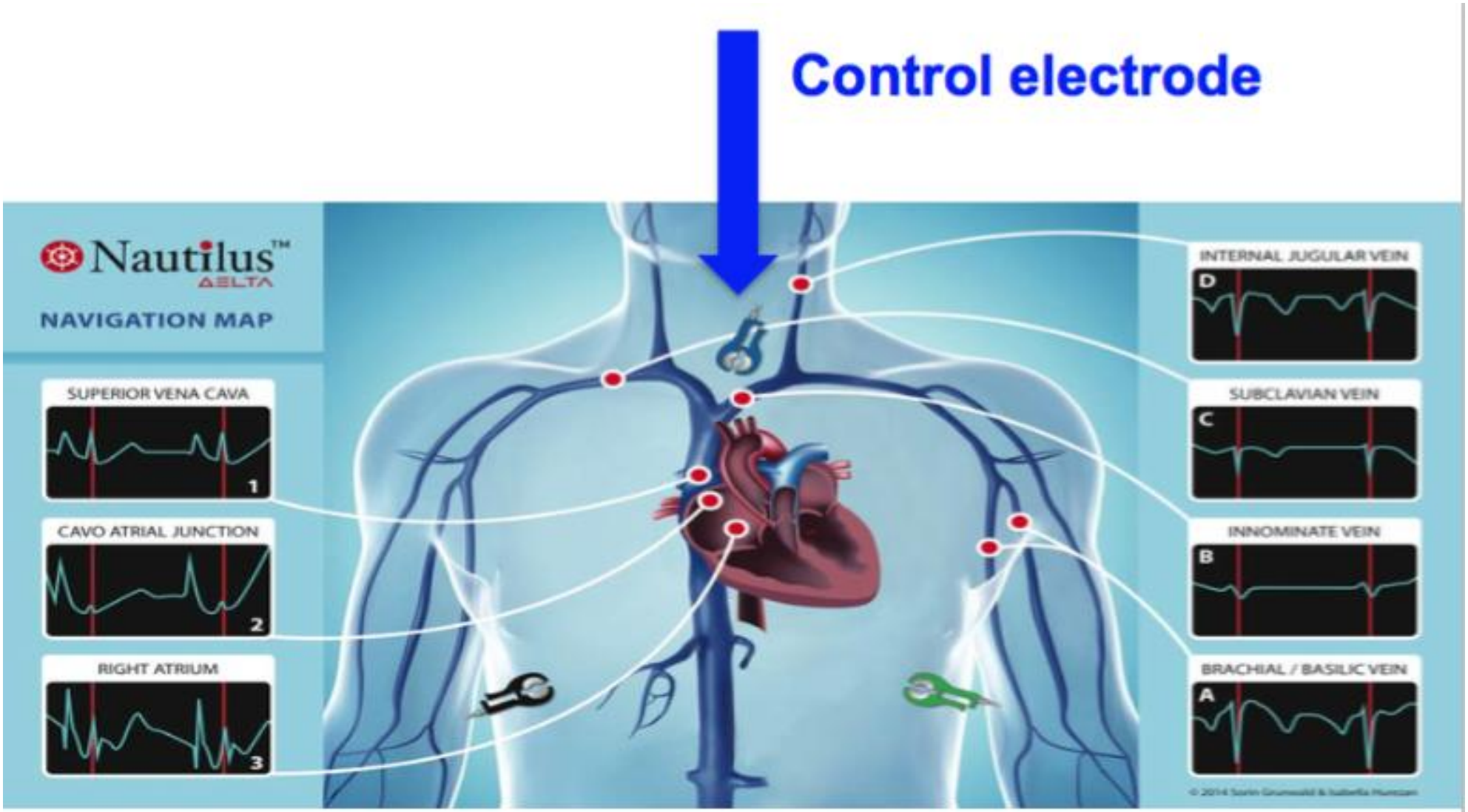
Yellow Triangle – Redirect catheter
The catheter is possibly against the blood vessel wall. It needs to be pulled back and repositioned.

Blue Bull's Eye – Correct Placement
The catheter tip has arrived within the lower ⅓ SVC and the CAJ.

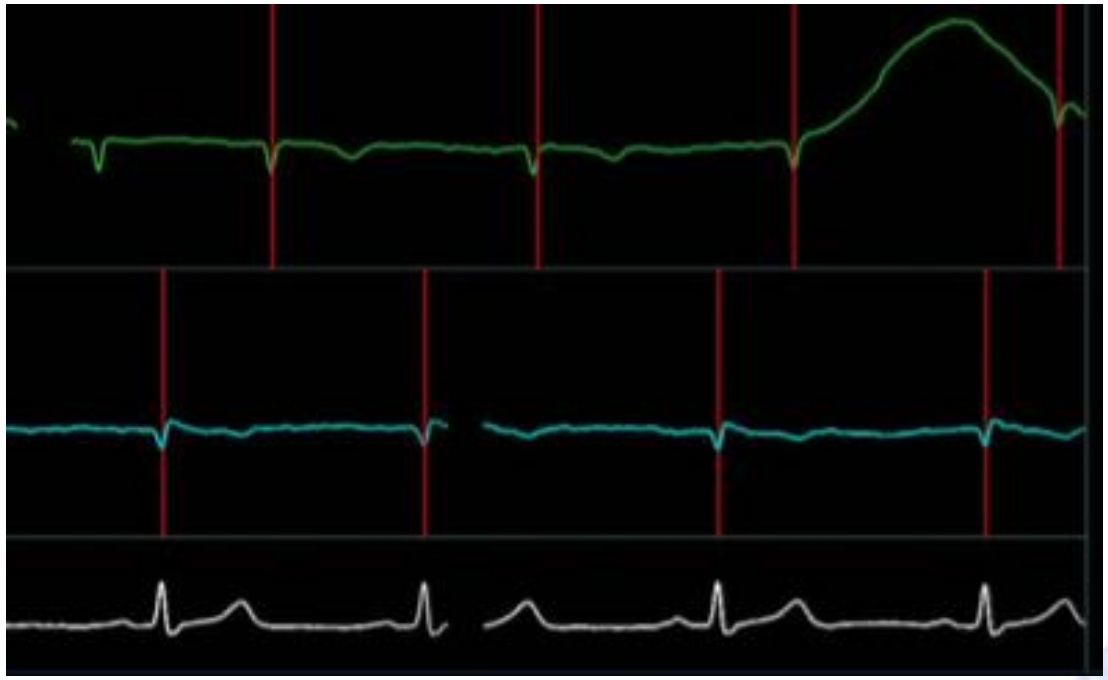
Girgenti et al. **Successfully Eliminating Chest Radiography by Replacing It with Dual Vector Technology and an Algorithm for PICC Placement** *(JAVA, June 2014)*

Tuttavia…

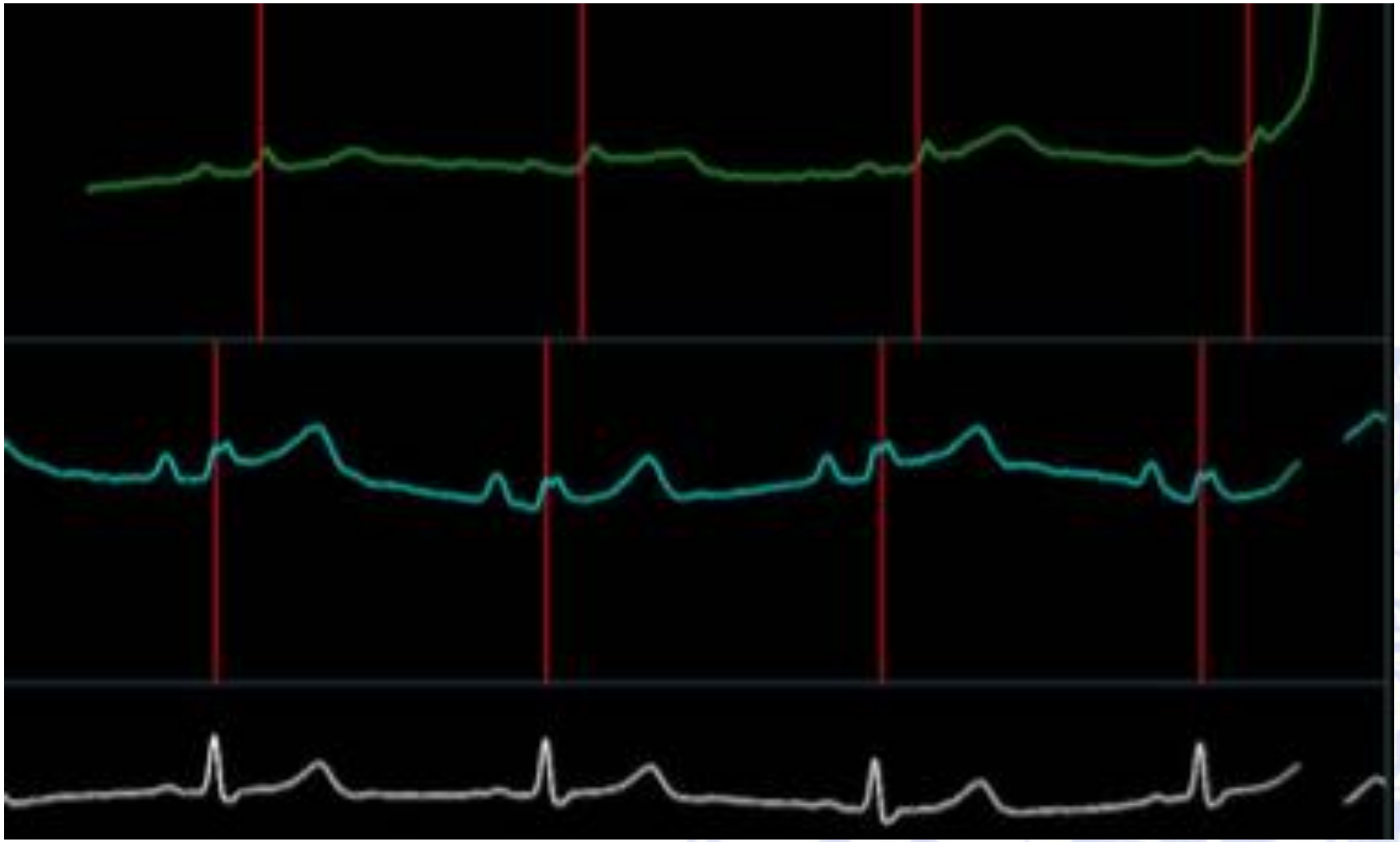
- Si tratta di dispositivi che hanno un costo
- Di tali metodiche integrate resta da dimostrare la costo-efficacia rispetto alla sola metodica ECG unita alla tip navigation ecografica
- Sono necessari studi per provarne la costo-efficacia


Control electrode
Nautilus™
ΔELTA
NAVIGATION MAP
SUPERIOR VENA CAVA
1
CAVO ATRIAL JUNCTION
2
RIGHT ATRIUM
3
INTERNAL JUGULAR VEIN
D
SUBCLAVIAN VEIN
C
INNOMINATE VEIN
B
BRACHIAL / BASILIC VEIN
A

- R negativa → non ancora in vena anonima



- R che si riduce → regione del giugulo
- Punta catetere al di sotto dell'elettrodo di riferimento (al giugulo)



- R positiva → Vena Anonima

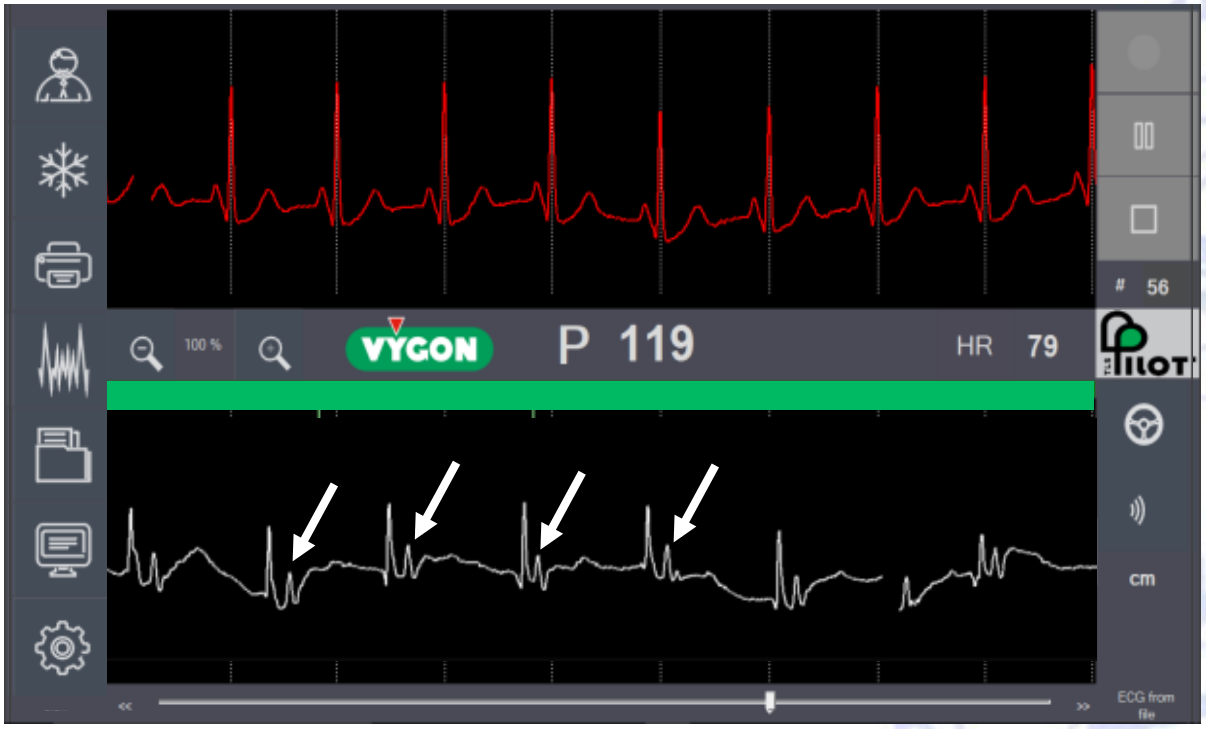
- R positiva + modifiche onda P per tip location con IC-ECG

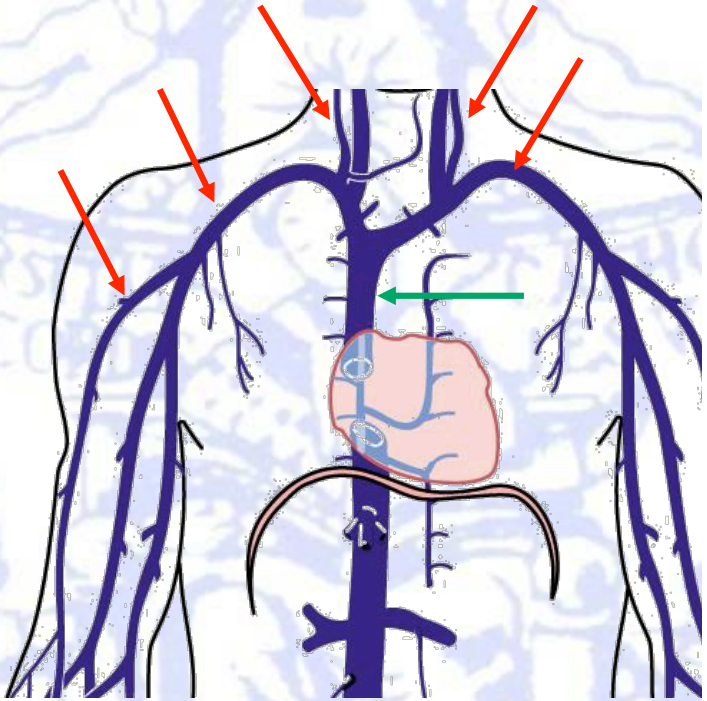
Pilot (Vygon)

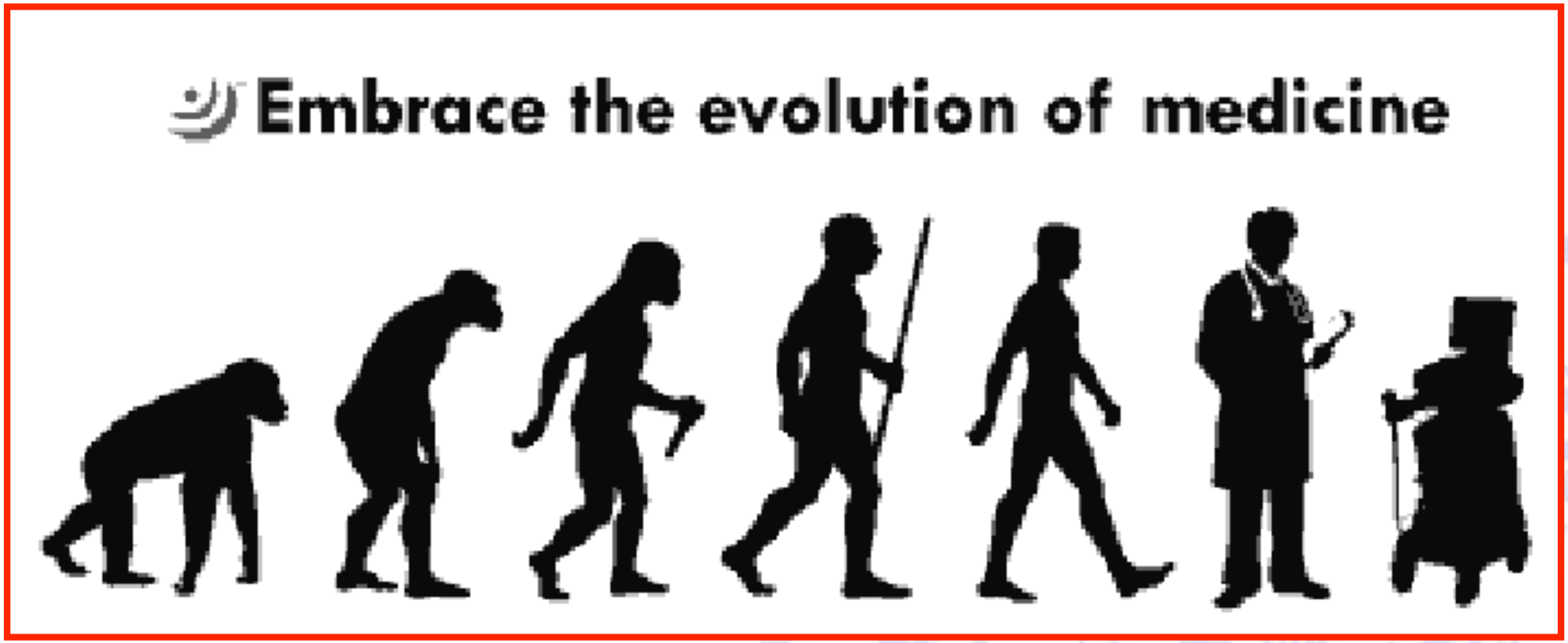
- Codice colore per identificare l'avanzamento del catetere

Verde = Il catetere è in vena cava superiore

Rosso = Il catetere non è in vena cava






Embrace the evolution of medicine

The *Global Use of US* in the field of VA

- Modern US application in the field of VA is not only limited to US-guided venipuncture but it can be extended to assist all steps of VA:
  - (a) rational choice of appropriate vein and proper approach
  - ***(b) prevention of malposition***
    - ***Ultrasound 'tip navigation' technique***
    - ***Ultrasound 'tip location' technique***
  - ***(c) ruling out of respiratory complications***
  - (d) detection of CRT or fibrin sleeve

Biasucci DG et al, ICM 2015

AMA policy on privileging US

AMERICAN MEDICAL ASSOCIATION

(1) Ultrasound imaging is within the scope of practice of appropriately trained physicians;

(2) [...] broad and diverse use and application of ultrasound imaging technologies exist in medical practice;

(3) [...] each hospital medical staff should review and approve criteria for granting ultrasound privileges based upon background and training for the use of ultrasound technology and strongly recommends that these criteria are in accordance with recommended training and education standards developed by each physician's respective specialty.

American College of Emergency Physicians®
ADVANCING EMERGENCY CARE

POLICY STATEMENT

- Emergency ultrasound examinations are performed and interpreted by emergency physicians […] in the setting of the ED or a non-ED emergency setting such as out-of-hospital, battlefield, space, clinic, or any remote setting.
- […] may also be performed in other hospital settings if needed for emergent situations. Other medical specialties may wish to use this document if they perform emergency ultrasounds in the manner described above.
- […] is a goal-directed focused ultrasound examination that answers brief and important clinical questions in an organ system or for a clinical symptom or sign involving multiple organ systems Emergency ultrasound is synonymous with the terms bedside, point-of-care, focused, clinical and physician performed. […]
- […] as described above uses a different paradigm than traditional, consultative ultrasound such as those ultrasound exams performed in US laboratories or departments
- Emergency ultrasound is an emergency medicine procedure, and should not be considered in conflict with exclusive “imaging” contracts seen with consultative ultrasound.

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

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International evidence-based recommendations on ultrasound-guided vascular access

Intensive Care Med. 2012 Jul;38(7):1105-17.

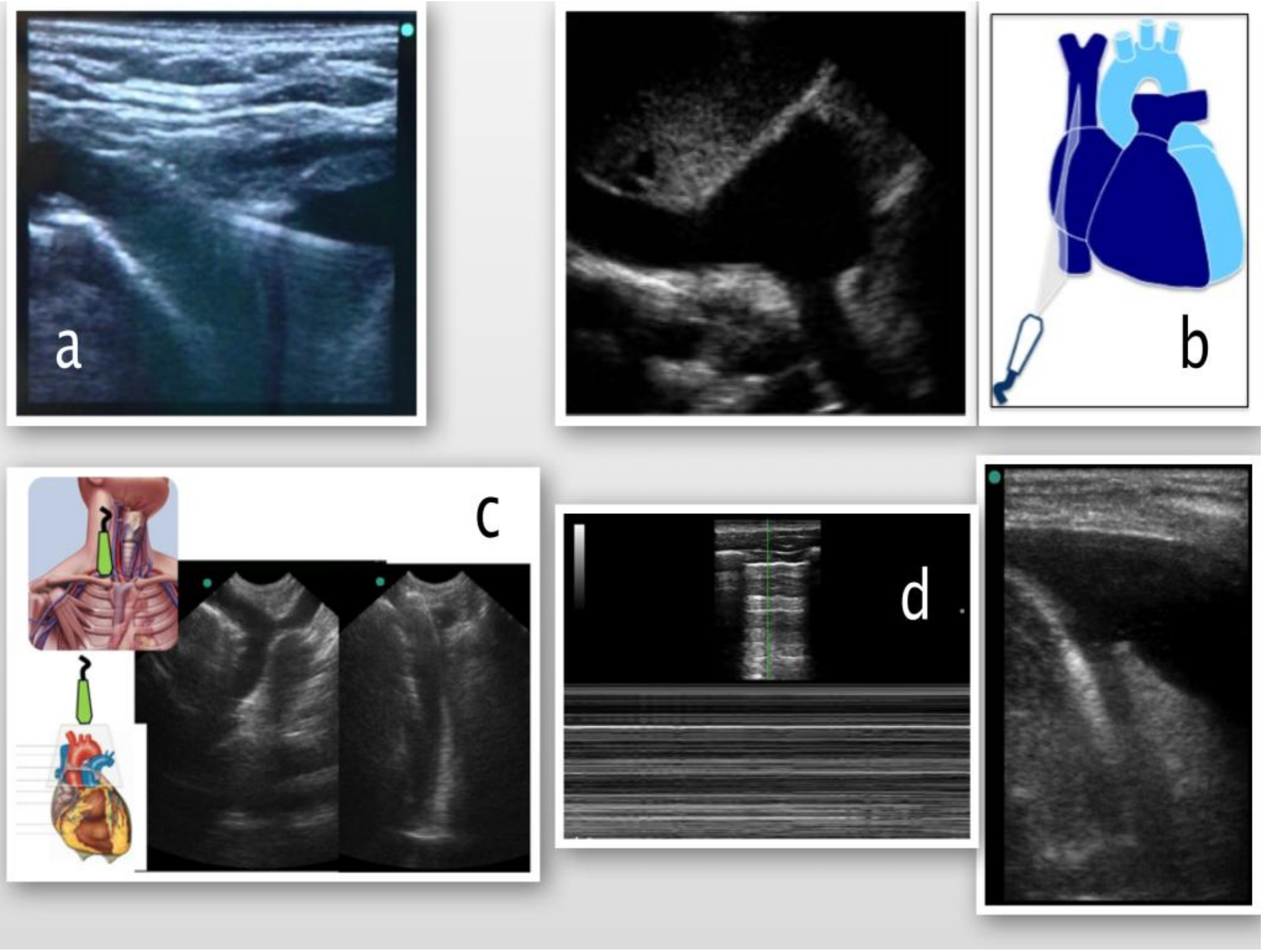
Table 4 Recommendations on ultrasound vascular access in adults and cost-effectiveness

Ultrasound vascular access in adults

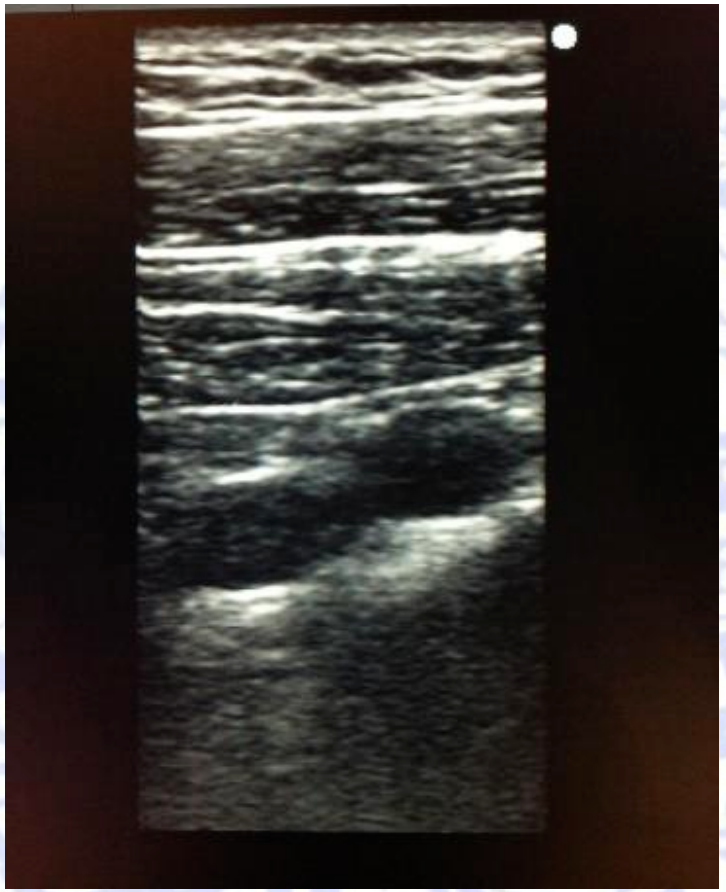
Domain code	Suggested definition		Degree of consensus	Strength of recommendation
D4.SD2.S1	Ultrasound guidance should be [illegible] central venous access in	A	[illegible]	
D4.SD2.S2	Ultrasound guidance [illegible] central venous	A		Strong
D4.SD2.S3	PICCs sh[illegible] [illegible]vel by ultrasound		[illegible]good	Strong
D4.SD2.S4	[illegible]que [illegible]e taken into consid[illegible] [illegible]venous line when d[illegible]		Very good	Strong
D4	[illegible] arterial catheterizat[illegible] [illegible]d should be used ro[illegible]	A	Very good	Strong
D4.S1	[illegible]ound can accurately [illegible] routinely performed [illegible] when the pleu[illegible] [illegible]should be [illegible]ter cannulation [illegible]ed	B	Very good	Strong
D4.SD2.S7	CEUS (co[illegible]) is a valid method for det[illegible] [illegible]meter tip in the right atrium	B	Very good	Strong
Cost-effectiveness	[illegible] for vascular cannulation			
D5.S1–3	[illegible]ascular access has to be used because it [illegible]nical benefits and reduced overall costs of care [illegible]t cost-effective	A	Very good	Strong

Ultrasound can accurately detect pneumothorax and should be routinely performed after central venous catheter cannulation when the pleura could have been damaged

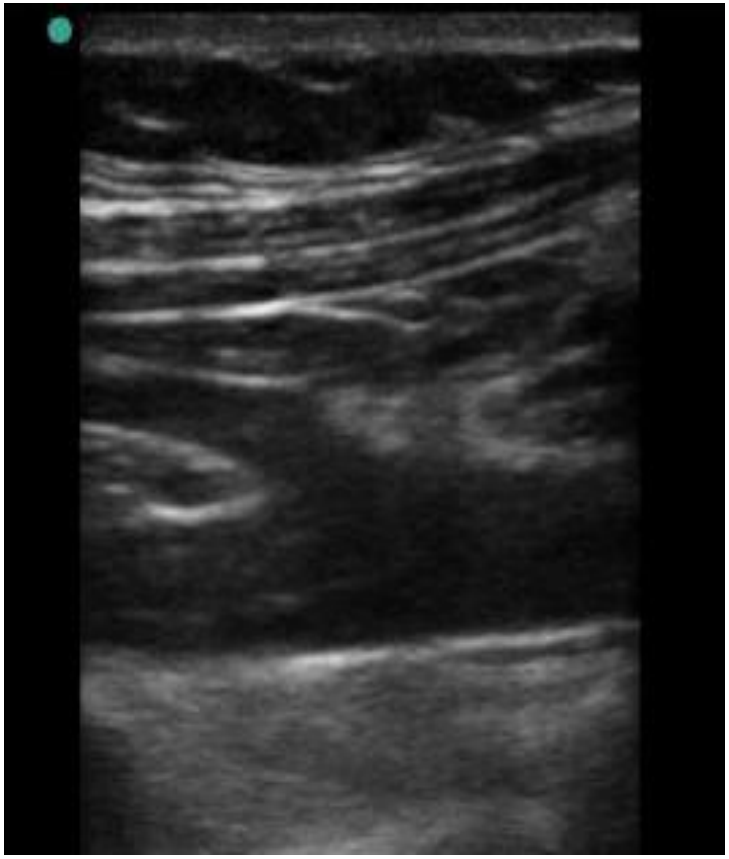
CEUS (contrast-enhanced ultrasound) is a valid method for detecting a central venous catheter tip in the right atrium


a
b
c
d

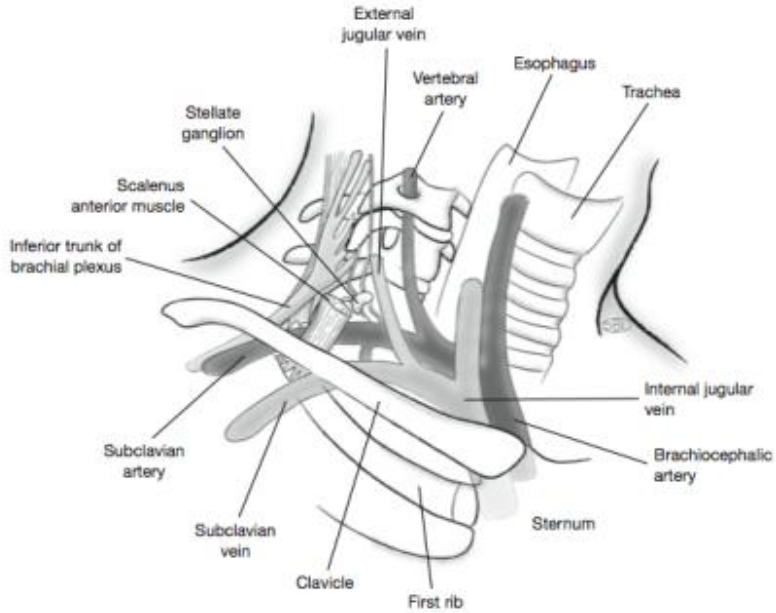
Axillary Vessels and Cephalic Vein

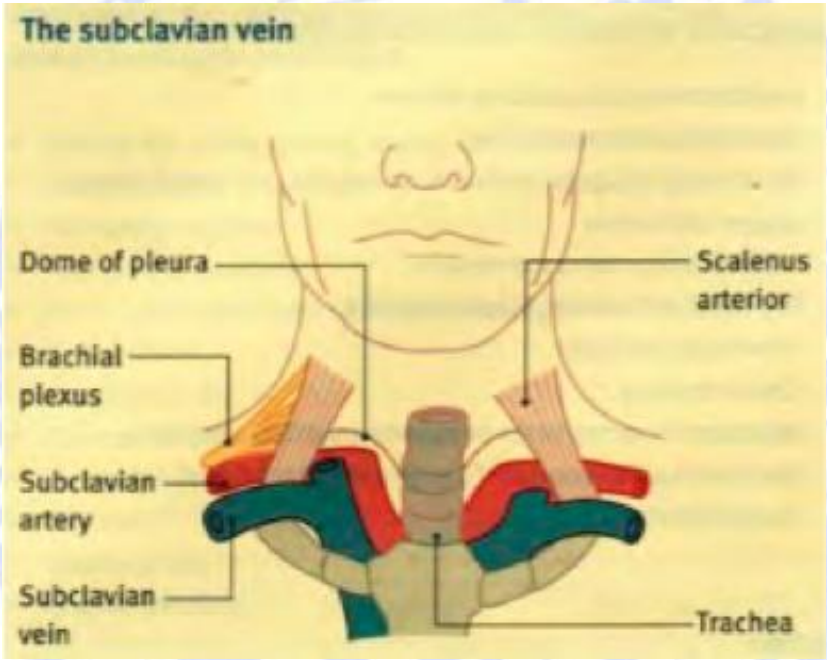


Axillary Vessels and Cephalic Vein



Subclavian Vein

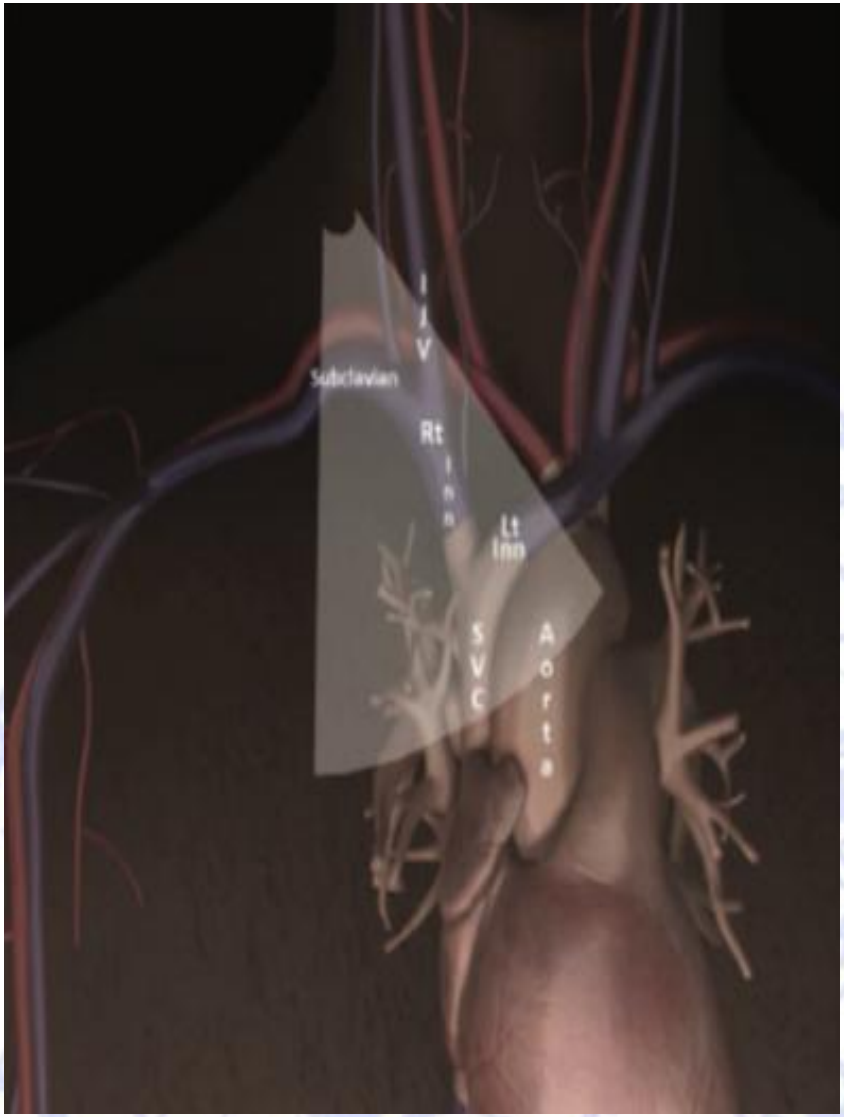




Confluence and Subclavian Artery

Brachiocephalic Vein

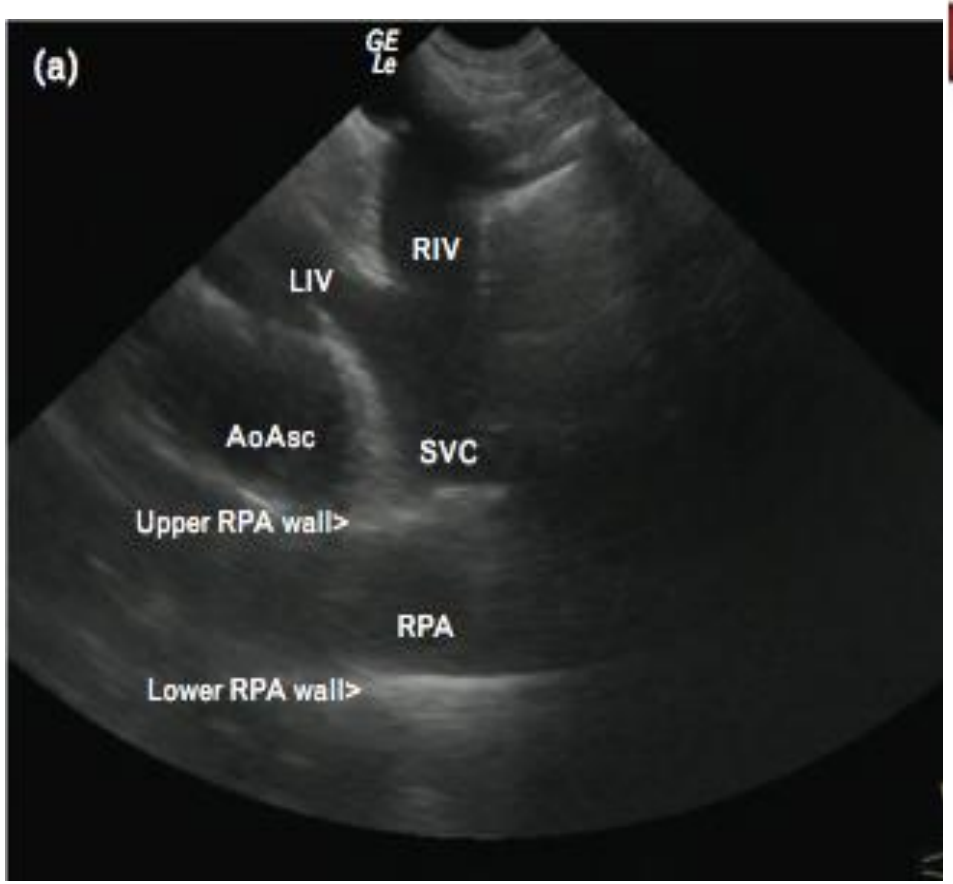
Superior Vena Cava

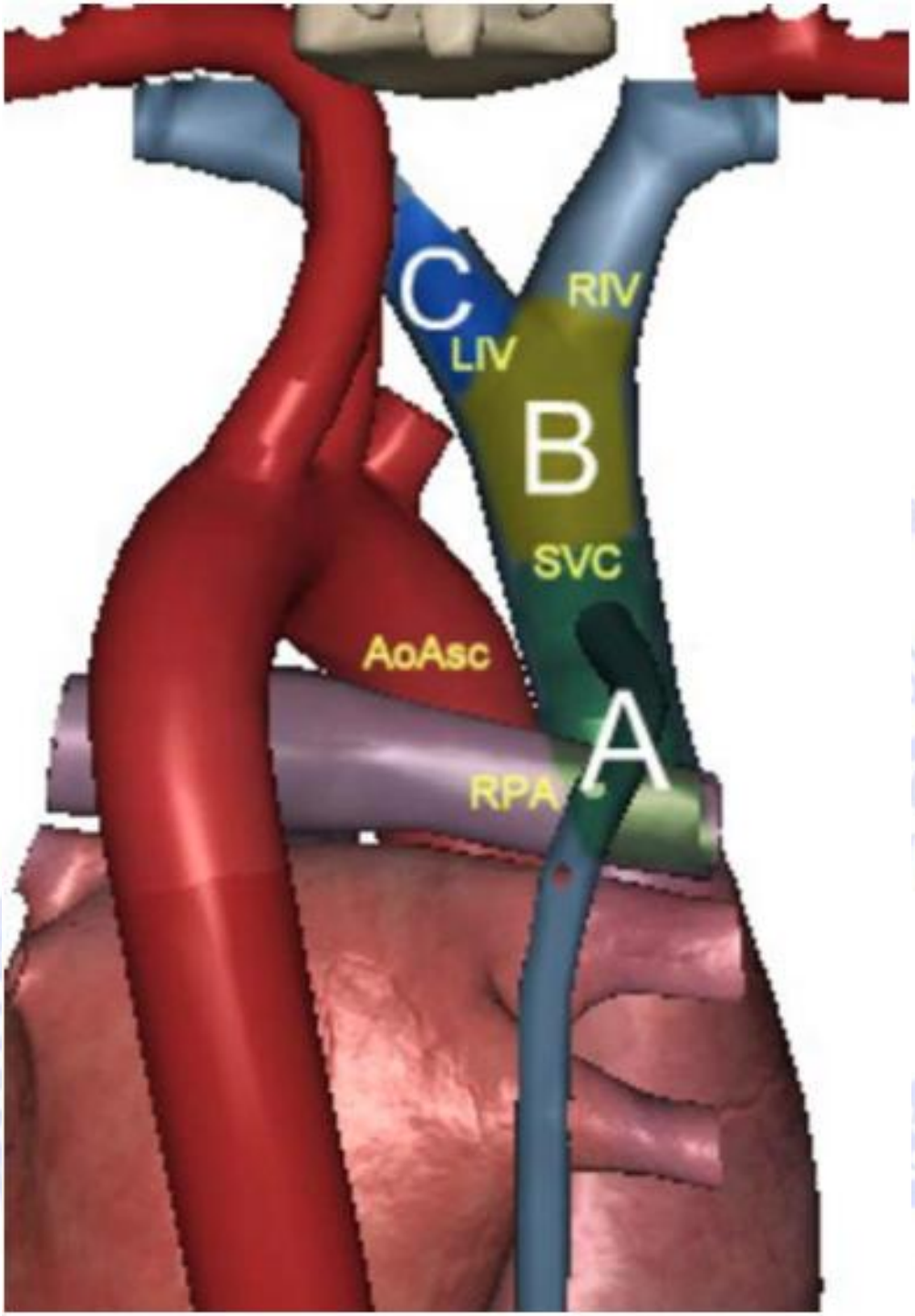


Using Ultrasound to Identify the Central Venous Catheter Tip in the Superior Vena Cava

ICU DIRECTOR

Keith Killu, MD, Alton Parker, MD, Victor Coba, MD, Mathilda Horst, MD, and Scott Dulchavsky, MD, PhD





EJA

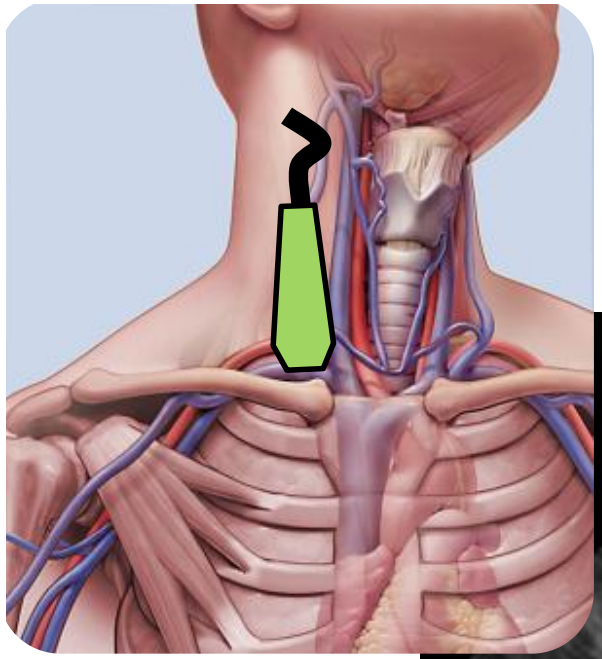
Eur J Anaesthesiol 2015; **32**:29–36

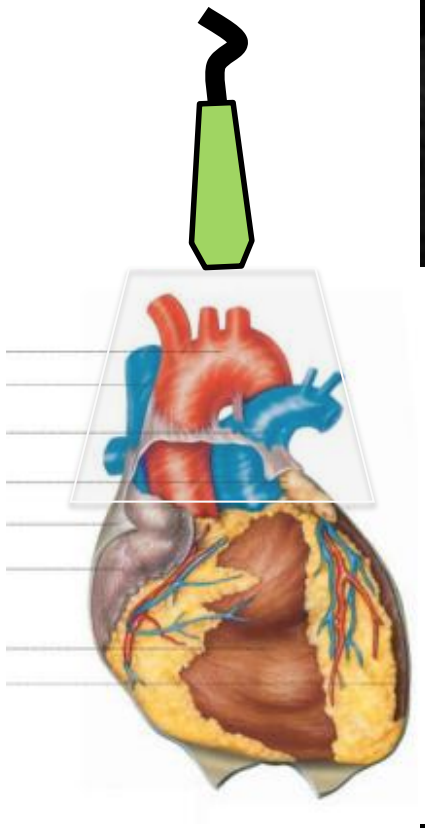
ORIGINAL ARTICLE

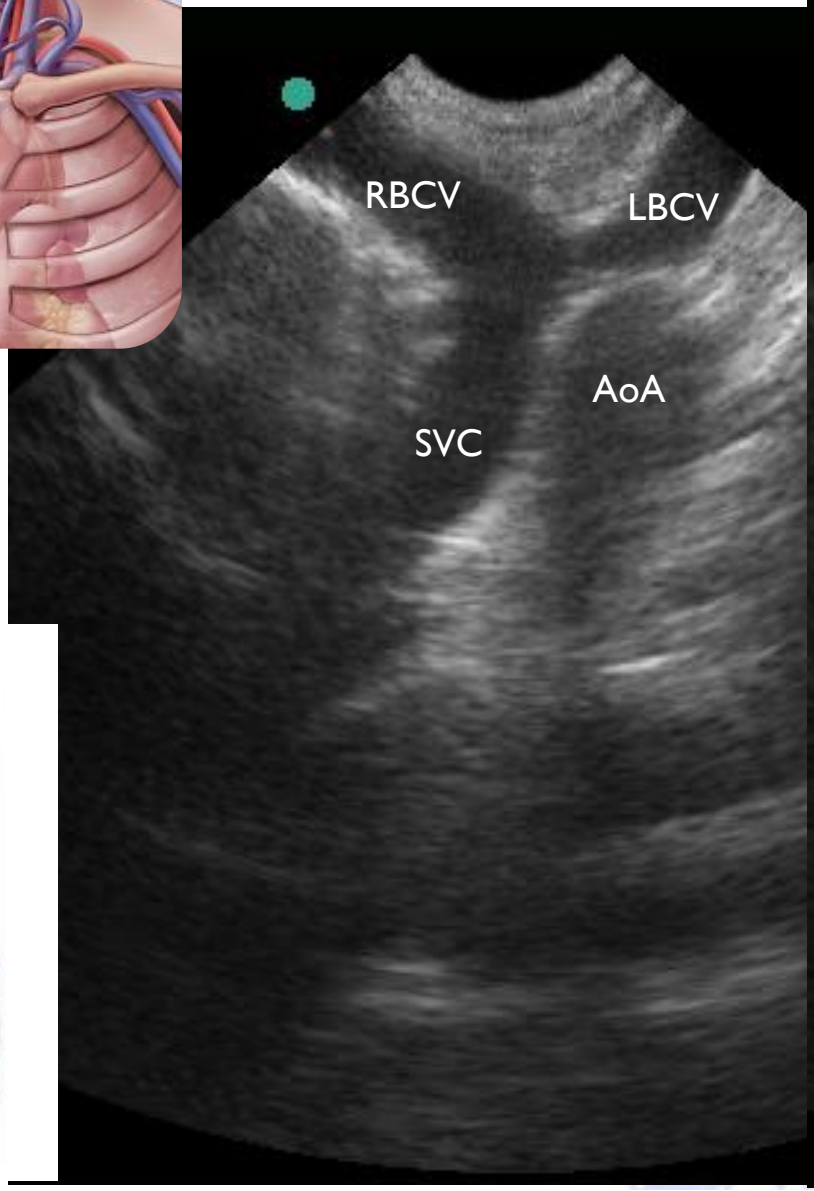
Ultrasound confirmation of central venous catheter position via a right supraclavicular fossa view using a microconvex probe

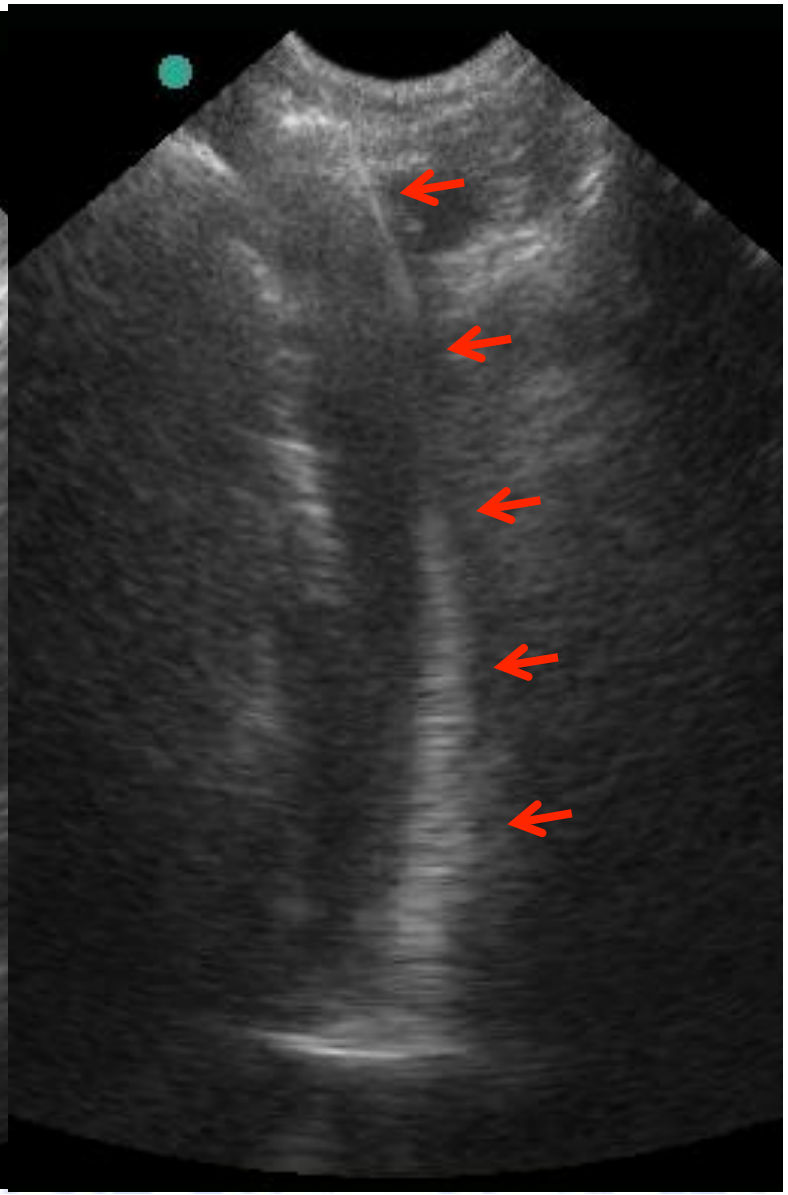
An observational pilot study

Se-Chan Kim*, Ingo Heinze*, Alexandra Schmiedel, Georg Baumgarten, Pascal Knuefermann, Andreas Hoeft and Stefan Weber






RBCV
LBCV
AoA
SVC



US-based tip location & tip navigation: EBM

- 4 diversi protocolli
  - 1) ***vascular US and TTE***
  - 2) TTE combined with contrast-enhanced US (CEUS)
  - 3) ***a combination of 1 and 2***
  - 4) ***supraclavicular US (SCU)***

AUTHOR	YEAR	Study Design	patients	US technique
Maury	2001	observational prospective	81	Vascular US + TTE
Miccini	2016	observational prospective	302	Vascular US + TTE
Bedel	2013	observational prospective	98	Vascular US + TTE
Blans	2016	observational prospective	53	Vascular US + TTE + CEUS
Matsushima	2010	observational prospective	69	Vascular US + TTE + CEUS
Meggiolaro	2015	observational prospective	105	Vascular US + TTE + CEUS
Vezzani	2010	observational prospective	111	Vascular US + TTE + CEUS
Zanobetti	2013	observational prospective	210	Vascular US + TTE + CEUS
Park	2014	prospective (pediatric)	108	Vascular US + TTE
Alonso-Quintela	2015	prospective (pediatric)	40	Vascular US + TTE
Arellano	2014	observational	100	Vascular US + TTE

EJA

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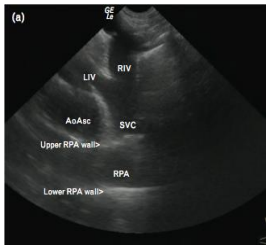

JVA
ISSN 1129-7298

J Vasc Access 2016; 00 (00): 000-000
DOI: 10.5301/jva.5000518

ORIGINAL ARTICLE

Ultrasound-guided supraclavicular central venous catheter tip positioning via the right subclavian vein using a microconvex probe

Se-Chan Kim[1], Ingo Gräff[1], Alexandra Sommer[2], Andreas Hoeft[1], Stefan Weber[1]

Electrocardiography-controlled central venous catheter tip positioning in patients with atrial fibrillation

Folkert Steinhagen[1], Maximilian Kanthak[1], Guido Kukuk[2], Christian Bode[1], Andreas Hoeft[1], Stefan Weber[3] and Se-Chan Kim[1,4]

JVA The Journal of Vascular Access

Improving the "global use" of ultrasound for central venous access: a new supraclavicular scan by microconvex probe

A La Greca[1*], DG Biasucci[2], A Emoli[3], M Pittiruti[1]

Critical Ultrasound Journal
a SpringerOpen Journal

From 7th WINFOCUS Italian Congress on Ultrasound in Emergency, Anaesthesiology and Critical Care
Lodi, Italy. 26-29 March 2014

Using Ultrasound to Identify the Central Venous Catheter Tip in the Superior Vena Cava

ICU DIRECTOR

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US-based tip navigation: EBM

- In 6 degli 11 studi in cui TTE è stato associato a tip navigation con sonda lineare la prevalenza di malposizioni è stata 0%
- In tutti gli studi in cui è stata usata la microconvex per la prevenzione del malposizionamento primario la prevalenza di questo è stata 0

US-based tip navigation: EBM

- Specificità 100% (95% CI: 94.4–100)
- Sensibilità non calcolabile per l’assenza di malposizionamento primario

US-Based tip navigation

- Limiti della letteratura
  - Reference standard inaccurato → CXR
  - Tecnica non standardizzata
  - Training degli operatori non specificato
- Questioni aperte
  - Tecnica
  - Sonde
  - Training

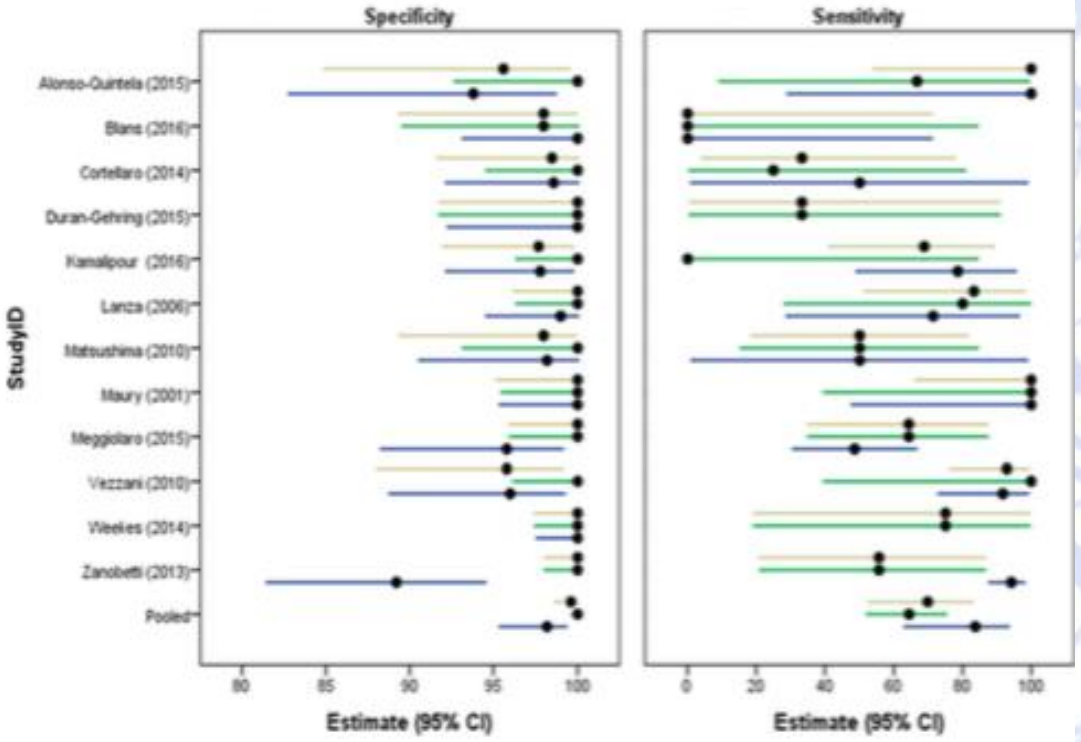
Smit et al. Critical Care (2018) 22:65
https://doi.org/10.1186/s13054-018-1989-x

Critical Care

REVIEW Open Access

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

Jasper M. Smit[1,2*], Reinder Raadsen[1,2], Michiel J. Blans[3], Manfred Petjak[4], Peter M. Van de Ven[5] and Pieter R. Tuinman[1,2]



- ***"….CVC position, according to our meta-analysis, is best verified by vascular US combined with TTE…"***
- Theoretically, the best protocol is an US method incorporating a scan of the central vessels bilaterally (if needed) and visualizing the migration of the CVC tip into the heart through CEUS

Original research article

JVA The Journal of Vascular Access

Clinical use of Sherlock-3CG® for positioning peripherally inserted central catheters

The Journal of Vascular Access
1–6

DOI: 10.1177/1129729818805957
journals.sagepub.com/home/jva
SAGE

Mauro Pittiruti[1], Giancarlo Scoppettuolo[2], Laura Dolcetti[2] and Alessandro Emoli[3]

- US-based tip navigations + IC-ECG compared with Sherlock 3CG

Original research article

JVA | The Journal of Vascular Access

Clinical use of Sherlock-3CG® for positioning peripherally inserted central catheters

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1–6

DOI: 10.1177/1129729818805957
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SAGE

Mauro Pittiruti[1], Giancarlo Scoppettuolo[2], Laura Dolcetti[2] and Alessandro Emoli[3]

	Feasibility	Accuracy
Tip navigation		
Sherlock-3CG®	105/130 (81%)	105/105 (100%)
Ultrasound	130/130 (100%)	130/130 (100%)
Tip location		
Sherlock-3CG	120/128 (94%)	120/120 (100%)[a]
Nautilus®	128/128 (100%)	128/128 (100%)[a]

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

Crit Care Med 2010 Vol. 38, No. 2

- Risparmio di 2,81 euro per ogni procedura

US-based tip navigation

- Necessita di integrazione con tecniche di ‘tip location’
- Ragionevolmente efficace come tecnica di ‘tip navigation’
  - Ci permette di visualizzare la direzione della guida e/o del catetere evitando che vada dove non deve e verificando che venga inidirizzato verso la giunzione cavo-atriale

Ultrasound Navigation

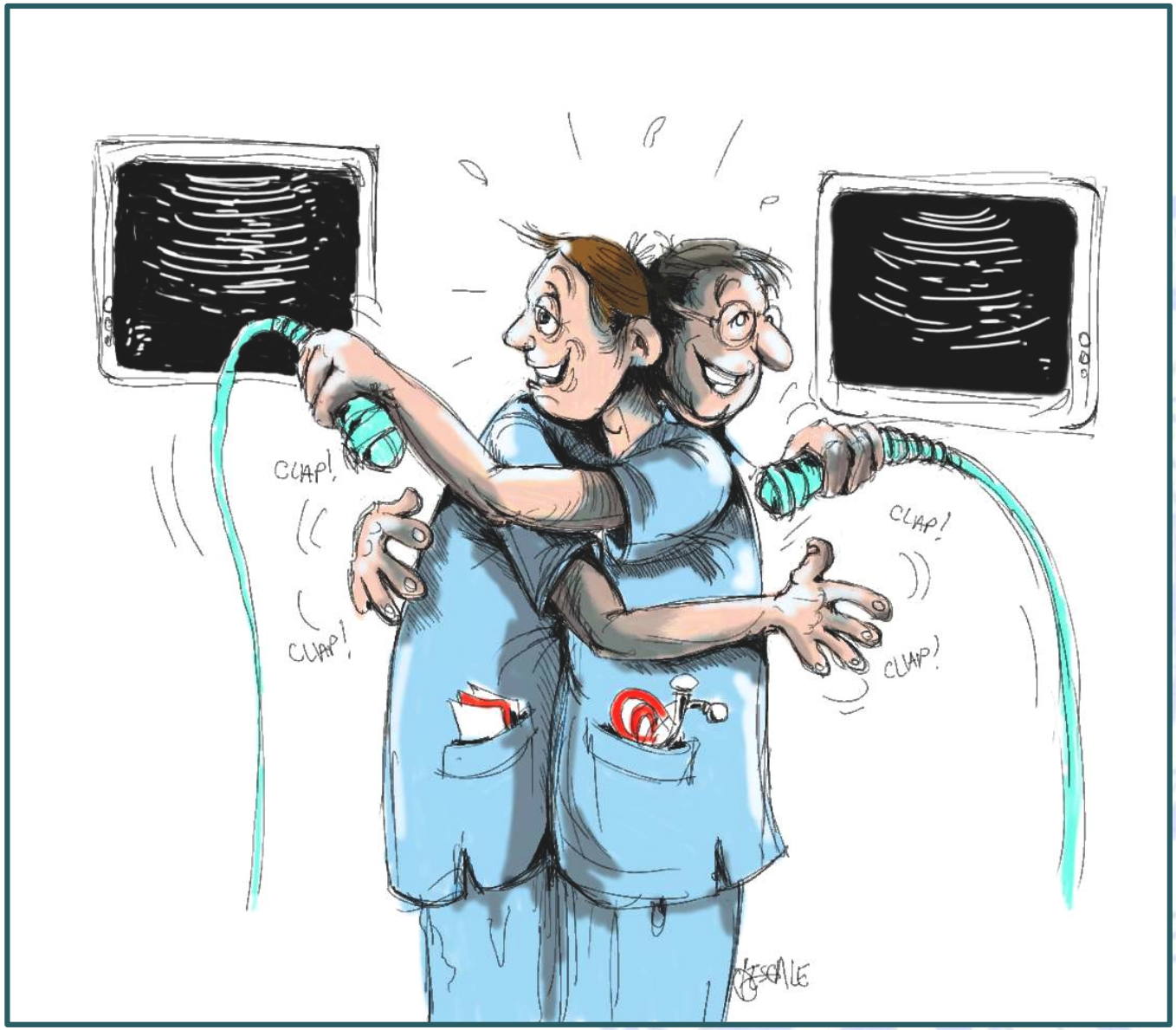
- Necessita di ulteriori studi per valutarne la costo-efficacia
- Il buon senso suggerisce che il costo è basso

Costo efficacia della ‘tip navigation’

Come per qualunque tecnica, per ottenere la massima costo-efficacia dalla tip navigation, occorre:

- Una scelta razionale del materiale, dei metodi, delle risorse umane e dell’ambiente
- Adeguata valutazione e pianificazione
- L’affidamento della manovra a personale addestrato
- Una organizzazione logistica appropriata

Grazie




EcoTIME
Ecografia in Terapia Intensiva e Medicina dell'Emergenza
Corso di Perfezionamento in
ECOGRAFIA CLINICA-INTEGRATA
PER L'INTENSIVISTA:
DALL'EMERGENZA MEDICO-CHIRURGICA
AI REPARTI DI TERAPIA INTENSIVA
Anno Accademico 2018-2019

INFO E CONTATTI

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