



IX
Congresso
GAVeCeLT

La Scienza
dell'Accesso Venoso

Ecoguida nell'accesso venoso centrale: evidenze, raccomandazioni e grado di compliance degli operatori

Antonio La Greca & Daniele G. Biasucci

Fondazione Policlinico Universitario "A. Gemelli"

Università Cattolica del Sacro Cuore - Roma

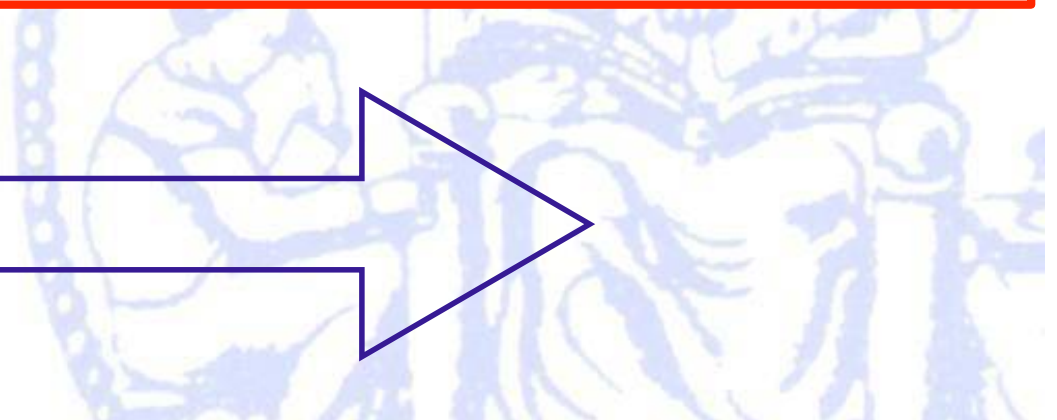
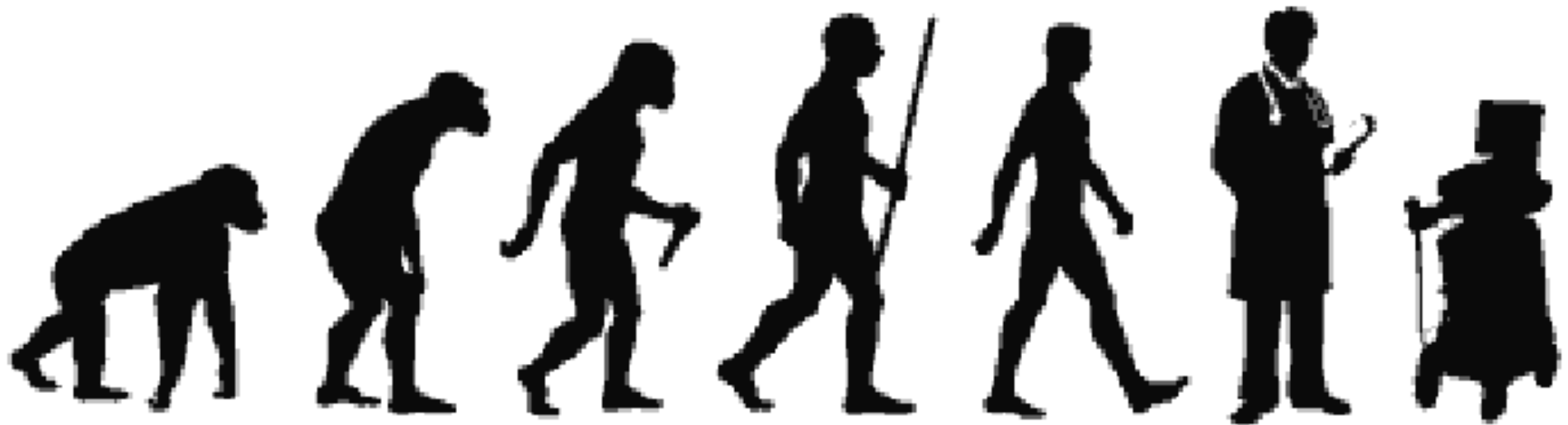


Gemelli



Fondazione Policlinico Universitario A. Gemelli
Università Cattolica del Sacro Cuore

 **Embrace the evolution of medicine**





'there is strong statistical evidence to indicate that US-guided insertion of central catheters is more effective and safer than blind techniques in both adults and children. It may therefore now be considered unethical or lacking in common sense to withhold the use of this option'

Commentary

Can you justify not using ultrasound guidance for central venous access?

Andrew R Bodenham

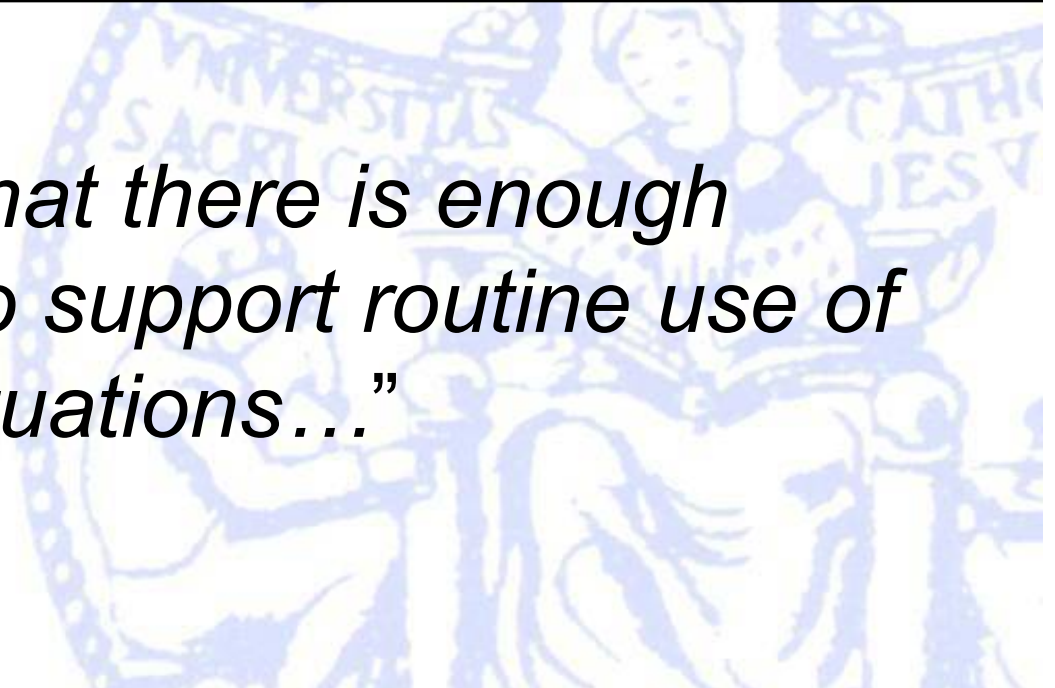
Department of Anaesthesia, Leeds General Infirmary, Leeds, LS1 3EX, UK

Corresponding author: A R Bodenham, Andy.Bodenham@leedsth.nhs.uk

Published: 22 November 2006

Critical Care 2006, 10:175 (doi:10.1186/cc5079)

- “... *It is my belief that there is enough evidence now ... to support routine use of ultrasound in all situations...*”



... era il 1978 quando...

118

Clinical Reports

Vol. 57, Jan.-Feb. 1978
Anesth Analg

Internal Jugular Vein Location with the Ultrasound Doppler Blood Flow Detector

JAMES I. ULLMAN, MD*

ROBERT K. STOELTING, MD†

Indianapolis, Indiana‡

Anesthesia & Analgesia



...alcuni anni più tardi...

Anesthesiology
64:830-831, 1986

Real-time Ultrasonic Guidance for Percutaneous Puncture of the Internal Jugular Vein

To the Editor:—Anatomical landmarks¹ and ultrasound Doppler flowmetry² have been employed for the location of the internal jugular vein (IJV). We have used transcutaneous ultrasonographic scanning to determine the precise location of the IJV and to observe the procedures of venous puncture and catheterization. An ultrasonographic scanner (Echo® Camera, Model SSD-256, Aloka, Japan) equipped with a 5 MHz ultrasound transducer was used to obtain the real-time ultrasound images. With the head rotated approximately 45 degrees contralateral to the side of the puncture, povidone iodine gel was used as the acoustic coupling medium. The probe was sterilized with ethylene oxide and applied longitudinally to the neck (fig. 1). The carotid artery is the only observable structure that bears a fixed relationship to the IJV at the levels scanned.³ Both the IJV and carotid artery are identified as echo-free band images on the oscilloscope (fig. 2). Dur-



FIG. 1. Puncture of the right internal jugular vein. T-shaped probe is positioned in right internal jugular vein.

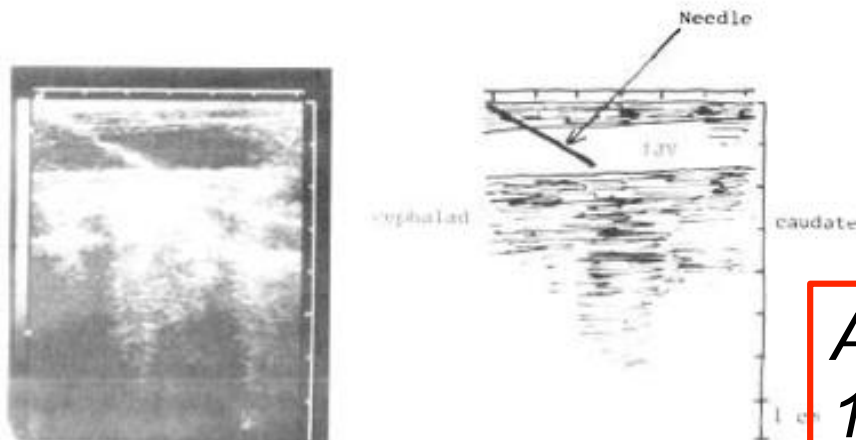


FIG. 2. The longitudinal ultrasound image of the internal jugular vein with the puncture needle in place. The internal jugular vein is observed as an echo-free band.

Anesthesiology,
1986

REFERENCES

References to studies included in this review

Agarwal 2009 *(published data only)*

* Agarwal A, Singh DK, Singh AP. Ultrasonography: a novel approach to central venous cannulation. *Indian Journal of Critical Care Medicine* 2009;13(4):213–6. [DOI: 10.4103/0972-5229.60174]

Alderson 1992 *(published data only)*

* Alderson PJ, Burrows FA, Holtby HM. The use of ultrasound to facilitate central venous cannulation in young children. *Anesthesiology* 1992;77(3A):A1196.

Armstrong 1993 *(published data only)*

* Armstrong PJ, Cullen M, Scott DH. The 'SiteRite' ultrasound machine-an aid to internal jugular vein cannulation. *Anaesthesia* 1993;48(4):319–23.

Bansal 2005 *(published data only)*

Bansal R, Agarwal SK, Tiwari SC, Dash SC. A prospective randomized study to compare ultrasound-guided with nonultrasound-guided double lumen internal jugular catheter insertion as a temporary hemodialysis access. *Renal Failure* 2005;27(5):561–4. [PUBMED: 16152994]

Böck 1999 *(published data only)*

* Böck U, Möllhoff T, Förster R. Ultrasonography guided versus anatomically oriented puncture of the internal jugular vein for central venous catheterization [Ultraschall

gesteuerte versus anatomisch orientierte Punktion der Vena jugularis interna zur zentralvenösen Katheterisierung]. *Ultraschall in der Medizin* 1999;20(3):98–103.

Branger 1994 *(published data only)*

* Branger B, Zabadani B, Vecina F, Juan JM, Dauzat M. Continuous guidance for venous punctures using a new pulsed Doppler probe: efficiency, safety [Guidage continu des ponctions veineuses par une nouvelle sonde Doppler pulsee: efficacite, securite]. *Nephrologie* 1994;15(2):137–40.

Branger 1995 *(published data only)*

* Branger B, Dauzat M, Zabadani B, Vecina F, Lefranc JY. Pulsed Doppler sonography for the guidance of vein puncture: a prospective study. *Artificial Organs* 1995;19(9):933–8.

Chuan 2005 *(published data only)*

* Chuan Wx, Wei W, Yu L. A randomized controlled study of ultrasound prelocation vs anatomical landmark-guided cannulation of the internal jugular vein in infants and children. *Pediatric Anesthesia* 2005;15(9):733–8.

Denys 1993 *(published data only)*

* Denys BG, Uretsky BF, Reddy PS. Ultrasound-assisted cannulation of the internal jugular vein. A prospective comparison to the external landmark-guided technique. *Circulation* 1993;87(5):1557–62.

Gilbert 1995 *(published data only)*

* Gilbert TB, Seneff MG, Becker RB. Facilitation of internal jugular venous cannulation using an audio-guided Doppler ultrasound vascular access device: results from a prospective, dual-center, randomized, crossover clinical study. *Critical Care Medicine* 1995;**23**(1):60-5.

Gratz 1994 *(published data only)*

* Gratz I, Afshar M, Kidwell P, Weiman DS, Shariff HM. Doppler-guided cannulation of the internal jugular vein: a prospective, randomized trial. *Journal of Clinical Monitoring* 1994;**10**(3):185-8.

Grebenik 2004 *(published data only)*

* Grebenik CR, Boyce A, Sinclair ME, Evans RD, Mason DG, Martin B. NICE guidelines for central venous catheterization in children. Is the evidence base sufficient?. *British Journal of Anaesthesia* 2004;**92**(6):827-30.

Hayashi 1998 *(published data only)*

* Hayashi H, Tsuzuku M, Amano M. Simplified echo-guided internal jugular vein puncture: a comparison to the landmark-guided technique. *Anesthesia and Analgesia*. 1998; Vol. 86:SCA89.

Hayashi 2002 *(published data only)*

* Hayashi H, Amano M. Does ultrasound imaging before puncture facilitate internal jugular vein cannulation? Prospective randomized comparison with landmark-guided puncture in ventilated patients. *Journal of Cardiothoracic and Vascular Anesthesia* 2002;**16**(5):572-5.

Heatly 1995 *(published data only)*

* Heatly T, Berger R. Comparison of the conventional landmark technique and an ultrasound-guided approach for the placement of central venous catheters. *American Journal of Respiratory and Critical Care Medicine* 1995;**151**(S):A333.

Hrics 1998 *(published data only)*

* Hrics P, Wilber S, Blanda MP, Gallo U. Ultrasound-assisted internal jugular vein catheterization in the ED. *The American Journal of Emergency Medicine* 1998;**16**(4):401-3.

Johnson 1994 *(published data only)*

* Johnson R, O'Donnell J, Fielder K. Ultrasound guidance for cannulation of the internal jugular vein (IJV) in the critically ill. A randomized prospective study. *Critical Care Medicine* 1994;**22**(1):A28.

Karakitsos 2006 *(published data only)*

* Karakitsos D, Labropoulos N, De Groot E, Patrianakos AP, Kouraklis G, Poularas J, et al. Real-time ultrasound-guided catheterisation of the internal jugular vein: a prospective comparison with the landmark technique in critical care patients. *Critical Care* 2006;**10**(6):R162.

Legler 1983 *(published data only)*

* Legler D, Nugent M. Doppler localization of the internal jugular vein facilitates its cannulation. *Anesthesiology* 1983;
59:A179.



Lin 1998 *(published data only)*

* Lin BS, Huang TP, Tang GJ, Tarng DC, Kong CW. Ultrasound-guided cannulation of the internal jugular vein for dialysis vascular access in uremic patients. *Nephron* 1998;78(4):423-8.

Mallory 1990 *(published data only)*

* Mallory DL, McGee WT, Shawker TH, Brenner M, Bailey KR, Evans RG, et al. Ultrasound guidance improves the success rate of internal jugular vein cannulation. A prospective, randomized trial. *Chest* 1990;98:157-60.

Milling 2005 *(published data only)*

Milling TJ Jr, Rose J, Briggs WM, Birkhahn R, Gaeta TJ, Bove JJ, et al. Randomized, controlled clinical trial of point-of-care limited ultrasonography assistance of central venous cannulation: the Third Sonography Outcomes Assessment Program (SOAP-3) Trial. *Critical Care Medicine* 2005;33(8):1764-9. [PUBMED: 16096454]

Ovezov 2010 *(published data only)*

* Ovezov A, Zakirov I, Vishnyakova M. Effectiveness and safety of the internal jugular vein catheterization in pediatrics: ultrasound navigation vs anatomical landmarks (a prospective, randomized, double-blind study). Electronic poster. Barcelona, ESICM, 2010.

Palepu 2009 *(published data only)*

* Palepu GB, Deven J, Subrahmanyam M, Mohan S. Impact of ultrasonography on central venous catheter insertion in intensive care. *Indian Journal of Radiology and Imaging* 2009;19(3):191-8. [DOI: 10.4103/0971-3026.54877]

Scherhag 1989 *(published data only)*

Scherhag A, Klein A, Jantzen JP. Cannulation of the internal jugular vein using 2 ultrasonic techniques. A comparative controlled study. [Die Vena jugularis interna-Kanülierung mit Hilfe zweier Ultraschallverfahren. Eine vergleichende, kontrollierte Untersuchung]. *Anaesthesist* 1989;38(11):633-8.

Soyer 1993 *(published data only)*

* Soyer P, Lacheheb D, Levesque M. High-resolution sonographic guidance for transjugular liver biopsy. *Abdominal Imaging* 1993;18(4):360-2.

Sulek 2000 *(published data only)*

Sulek CA, Blas ML, Lobato EB. A randomized study of left versus right internal jugular vein cannulation in adults. *Journal of Clinical Anesthesia* 2000;12(2):142-5. [PUBMED: 10818329]

Teichgräber 1997 *(published data only)*

* Teichgräber UK, Benter T, Gebel M, Manns MP. A sonographically guided technique for central venous access. *American Journal of Roentgenology* 1997;169(3):731-3.

Troianos 1990 *(published data only)*

* Troianos CA, Jobes DR, Ellison N. Ultrasound guided cannulation of the internal jugular vein. *Anesthesiology* 1990;73, No 3A:A451.

Le prime esperienze...

- Vena giugulare interna
 - Approccio 'out of plane', in asse corto



Article types

[Clinical Trial \(123\)](#)[Review \(32\)](#)[Customize ...](#)

Text availability

[Abstract \(623\)](#)[Free full text \(137\)](#)[Full text \(563\)](#)

PubMed Commons

[Reader comments \(1\)](#)[Trending articles \(0\)](#)

Publication dates

[5 years \(260\)](#)[10 years \(446\)](#)[Custom range...](#)

Species

[Humans \(612\)](#)[Other Animals \(13\)](#)[Clear all](#)[Show additional filters](#)

Summary ▾ 20 per page ▾ Sort by Most Recent ▾

Send to: ▾

Filters: [Manage Filters](#)

Search results

Items: 1 to 20 of 707

<< First < Prev Page 1 of 36 Next > Last >>

- ☐ [Airway compromise during central venous cannulation in an undiagnosed tubercular retropharyngeal abscess: A case report.](#)

Samanta S, Samanta S, Aggarwal R, Soni KD.

Ann Card Anaesth. 2015 Oct-Dec;18(4):596-8. doi: 10.4103/0971-9784.166483.

PMID: 26440253

[Similar articles](#)

- ☐ [The effectiveness of trendelenburg positioning on the cross-sectional area of the right internal jugular vein in obese patients.](#)

Onal O, Apiliogullari S, Nayman A, Saltali A, Yilmaz H, Celik JB.

Pak J Med Sci. 2015 Jul-Aug;31(4):770-4. doi: 10.12669/pjms.314.7326.

PMID: 26430400 **Free PMC Article**[Similar articles](#)

- ☐ [Emergency percutaneous, bicaval double-lumen, ECMO cannulation in neonates and infants: insights from three consecutive cases.](#)

Moscatelli A, Buratti S, Gregoretti C, Lampugnani E, Salvati P, Marasini M, Ribera E, Fulcheri E, Tuo P.

Int J Artif Organs. 2015 Sep 29;0. doi: 10.5301/ijao.5000432. [Epub ahead of print]

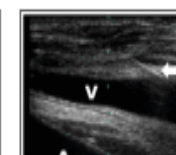
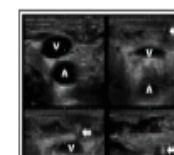
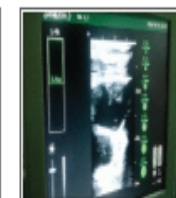
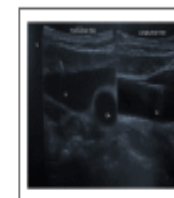
PMID: 26428509

[Similar articles](#)

New feature

Try the new Display Settings option -
Sort by Relevance

Results by year

[Download CSV](#)**PMC Images search for internal jugular vein cannulation and ultrasound**

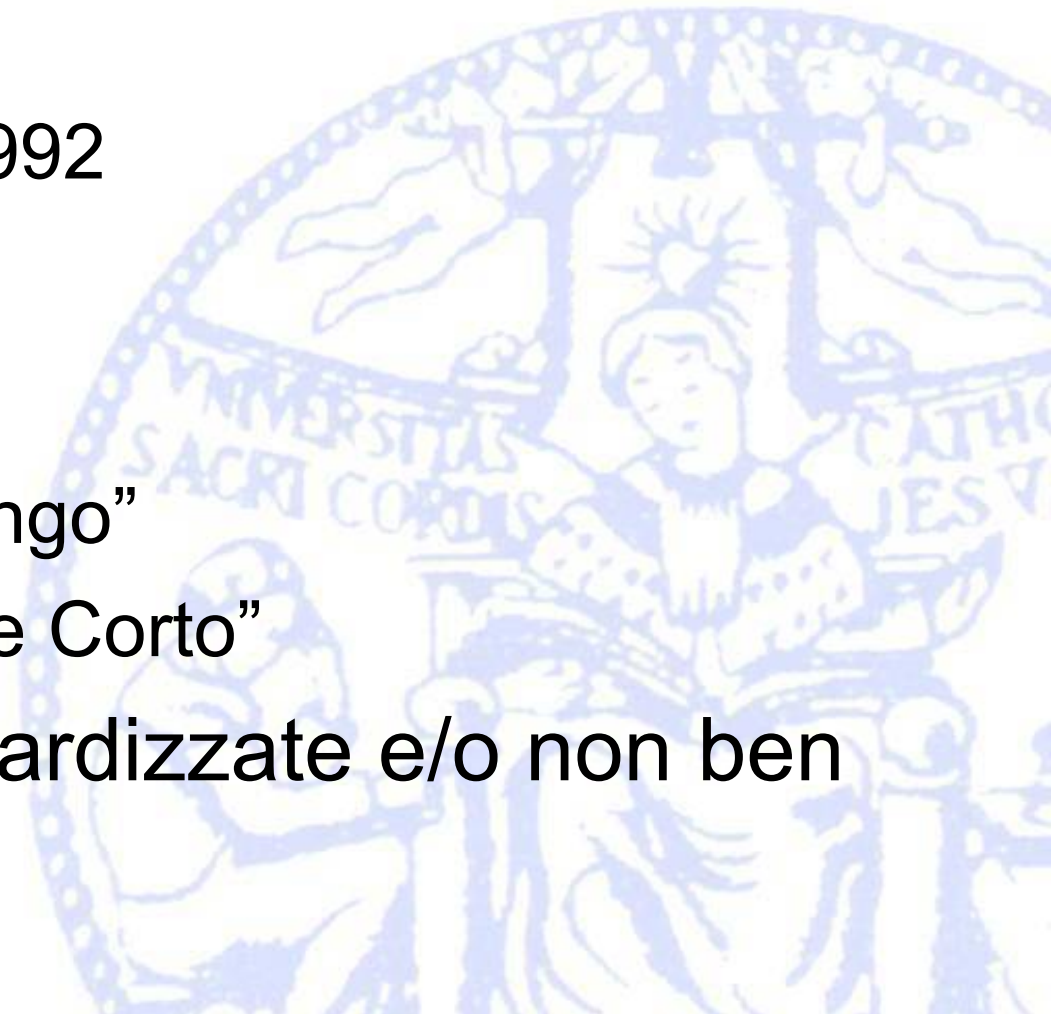
Puntura ecoguidata della VGI

- 439 studi
- 29 RCTs; 2 QRCTs; 2 non chiaro se RCT
- 33 solo VGI
- 2 VGI + SV (?)
- 29 solo Eco
- 6 solo doppler
- 2 Eco-color-doppler



Problemi

- Doppler o Eco-doppler
- Eco-assistenza
 - Alderson PJ, BJA 1992
- Ecoguida real-time
- Solo VGI
 - In-plane + “Asse Lungo”
 - Out-of-plane + “Asse Corto”
- Tecniche non standardizzate e/o non ben descritte nei lavori



Ultrasound guidance versus anatomical landmarks for internal jugular vein catheterization (Review)

Brass P, Hellmich M, Kolodziej L, Schick G, Smith AF



2015



Ultrasound guidance compared with anatomical landmarks for internal jugular vein cannulation for central vein catheterization

Patient or population: patients with internal jugular vein cannulation for central vein catheterization

Settings:

Intervention: ultrasound guidance

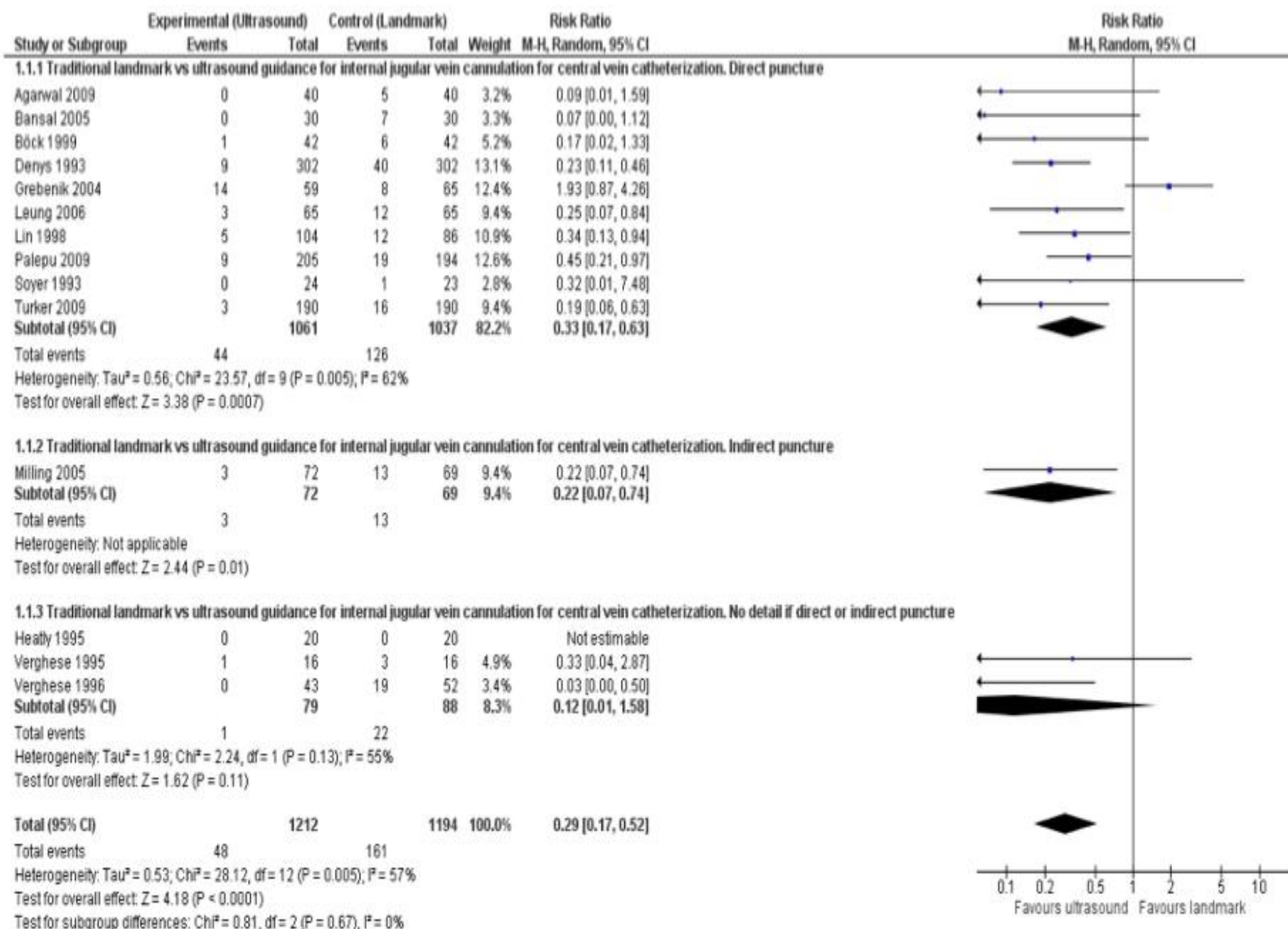
Comparison: anatomical landmark

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	Number of participants (studies)
	Assumed risk	Corresponding risk		
	Anatomical landmark	Ultrasound guidance		
Complication rate total	Study population		RR 0.29 (0.17 to 0.52)	2406 (14 studies)
	135 per 1000	39 per 1000 (23 to 70)		
	Moderate			
	136 per 1000	39 per 1000 (23 to 71)		
Overall success rate	Study population		RR 1.12 (1.08 to 1.17)	4340 (23 studies)
	876 per 1000	982 per 1000 (946 to 1000)		
	Moderate			
	850 per 1000	952 per 1000 (918 to 994)		

Eco vs Doppler/Eco-doppler

Outcomes	Illustrative comparative risks* (95% CI)		Illustrative comparative risks* (95% CI)	
	Assumed risk	Corresponding risk	Assumed risk	Corresponding risk
	Anatomical landmark	Ultrasound guidance	Anatomical landmark	Doppler guidance
Complication rate total	Study population		Study population	
	35 per 1000	39 per 1000 (23 to 70)	149 per 1000	77 per 1000 (24 to 255)
	Moderate		Moderate	
	136 per 1000	39 per 1000 (23 to 71)	188 per 1000	98 per 1000 (30 to 321)
Overall success rate	Study population		Study population	
	876 per 1000	982 per 1000 (946 to 1000)	800 per 1000	872 per 1000 (760 to 1000)
	Moderate		Moderate	
	850 per 1000	952 per 1000 (918 to 994)	800 per 1000	872 per 1000 (760 to 1000)

Figure 4. Forest plot of comparison: I Traditional landmark versus ultrasound guidance for internal jugular vein cannulation for central vein catheterization, outcome: I.I Complication rate total.



Ultrasound guidance versus anatomical landmarks for internal jugular vein catheterization (Review)



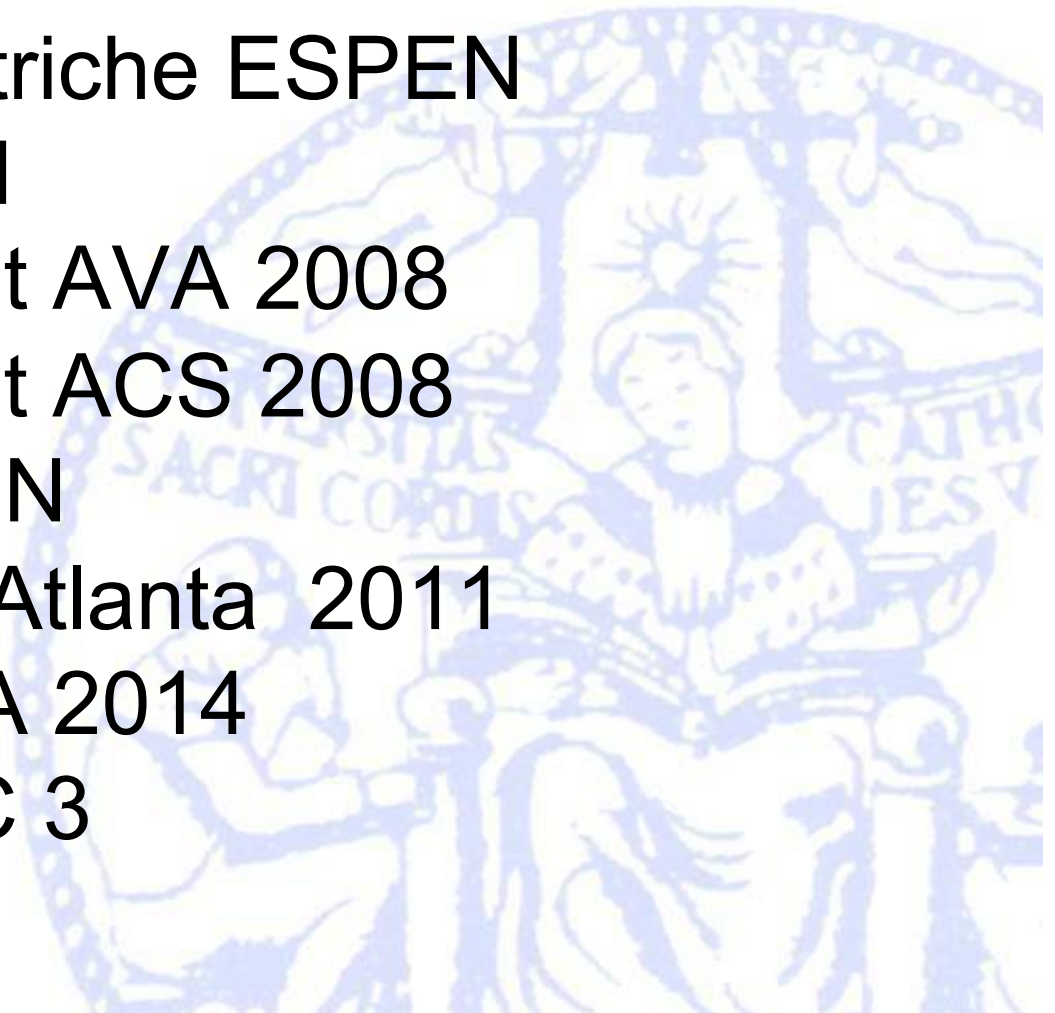
Brass P, Hellmich M, Kolodziej L, Schick G, Smith AF



- Chiaro vantaggio dell'uso dell'eco-guida
- Puntura eco-assistita da abbandonare
- Non chiari vantaggi del doppler

Linee guida internazionali di riferimento

- ☐ Raccomandazioni AHRQ
- ☐ Linee guida NICE
- ☐ Linee guida pediatriche ESPEN
- ☐ Linee guida BCSH
- ☐ Position Statement AVA 2008
- ☐ Position Statement ACS 2008
- ☐ Linee guida ESPEN
- ☐ Linee guida CDC Atlanta 2011
- ☐ Linee Guida SHEA 2014
- ☐ Linee Guida EPIC 3



AHRQ Recommendations



2001

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. Haugom, 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. Neuhouser, 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

Article types

[Clinical Trial \(20\)](#)[Review \(12\)](#)[Customize ...](#)

Text availability

[Abstract \(98\)](#)[Free full text \(30\)](#)[Full text \(96\)](#)

PubMed Commons

[Reader comments \(0\)](#)[Trending articles \(0\)](#)

Publication dates

[5 years \(58\)](#)[10 years \(89\)](#)[Custom range...](#)

Species

[Humans \(94\)](#)[Other Animals \(1\)](#)[Clear all](#)[Show additional filters](#)

Summary ▾ 20 per page ▾ Sort by Most Recent ▾

Send to: ▾

Filters: [Manage Filters](#)[See 10 citations found by title matching your search:](#)[Ultrasound-guided subclavian vein cannulation using a micro-convex ultrasound probe.](#) Lanspa MJ et al. Ann Am Thorac Soc. (2014)[A low-cost reusable phantom for ultrasound-guided subclavian vein cannulation.](#) Cheruparambath V et al. Indian J Crit Care Med. (2012)[Ultrasound-guided subclavian and axillary vein cannulation via an infraclavicular approach: In the tradition of Robert Aubaniac.](#) Shiloh AL et al. Crit Care Med. (2012)

Search results

Items: 1 to 20 of 118

<< First < Prev Page 1 of 6 Next > Last >>

☐ [Ultrasound-Guided Subclavian Vein Catheterization: A Systematic Review and Meta-Analysis:](#)1. [Several Facts Need To Be Noticed.](#)

Jiang L, Zhang M, Ma Y.

Crit Care Med. 2015 Oct;43(10):e474-5. doi: 10.1097/CCM.0000000000001071. No abstract available.

PMID: 26376279

[Similar articles](#)☐ [Ultrasound-guided catheterisation of the subclavian vein: freehand vs needle-guided technique.](#)

2. Maecken T, Heite L, Wolf B, Zahn PK, Litz RJ.

Anaesthesia. 2015 Aug 28. doi: 10.1111/anae.13187. [Epub ahead of print]

PMID: 26316098

[Similar articles](#)

New feature

Try the new Display Settings option -
[Sort by Relevance](#)

Titles with your search terms

[Real-time ultrasound-guided subclavian vein cannulation versus the lar](#) [Crit Care Med. 2011][A descriptive comparison of ultrasound-guided central venous cannula](#) [Acad Emerg Med. 2010][Ultrasound-guided subclavian vein cannulation in infants:](#) [Paediatr Anaesth. 2011][See more...](#)

Find related data

Database:

Search details

("ultrasonography"[Subheading] OR

Ultrasound guidance versus anatomical landmarks for subclavian or femoral vein catheterization (Review)

Brass P, Hellmich M, Kolodziej L, Schick G, Smith AF

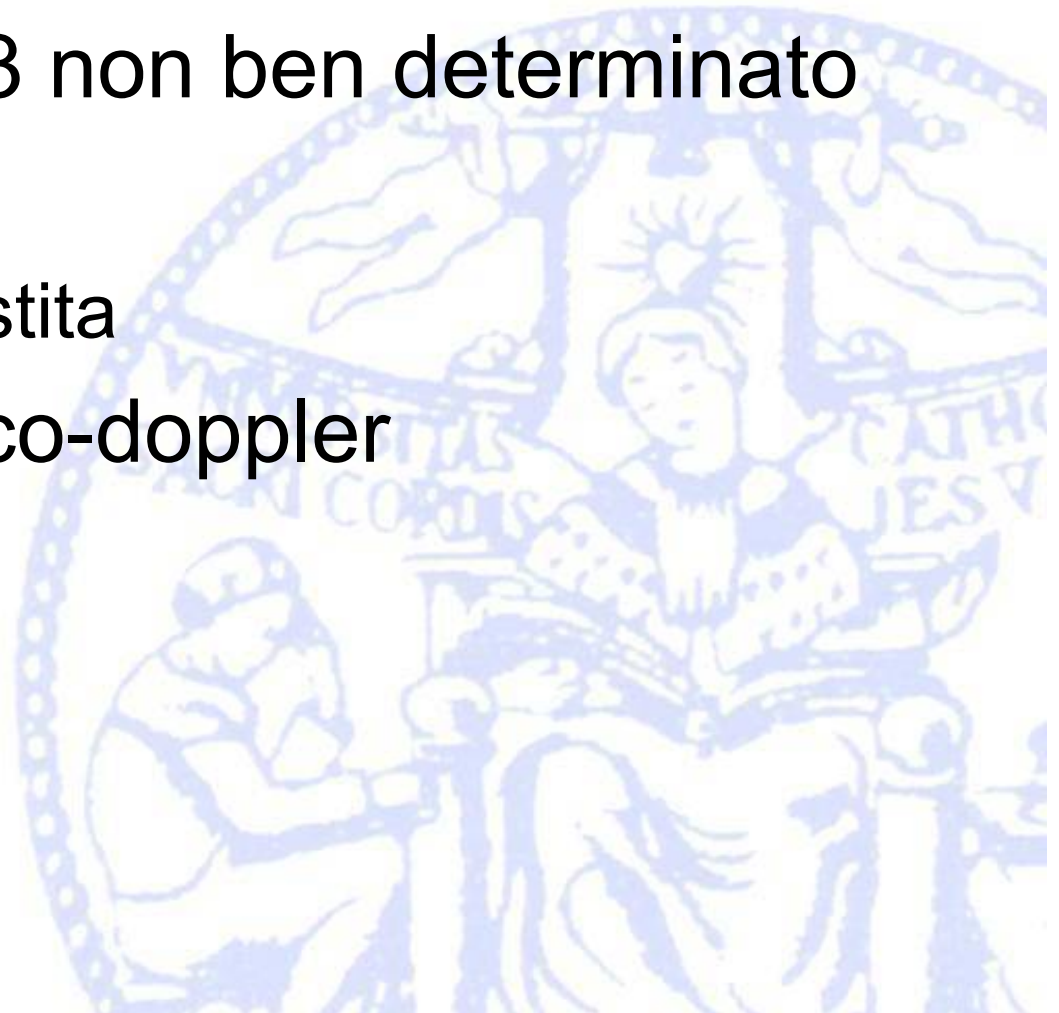


**THE COCHRANE
COLLABORATION®**



Vena Succlavia

- 10 studi
- 6 RCTs, 1 QRCT, 3 non ben determinato
- 6 Eco B-mode
 - 1 puntura eco-assistita
- 4 Eco B-mode + Eco-doppler



Ultrasound or Doppler guidance compared with anatomical landmark for subclavian vein cannulation for central vein catheterization

Patient or population: patients with the need for subclavian vein cannulation for central vein catheterization

Settings:

Intervention: ultrasound or Doppler guidance

Comparison: anatomical landmark

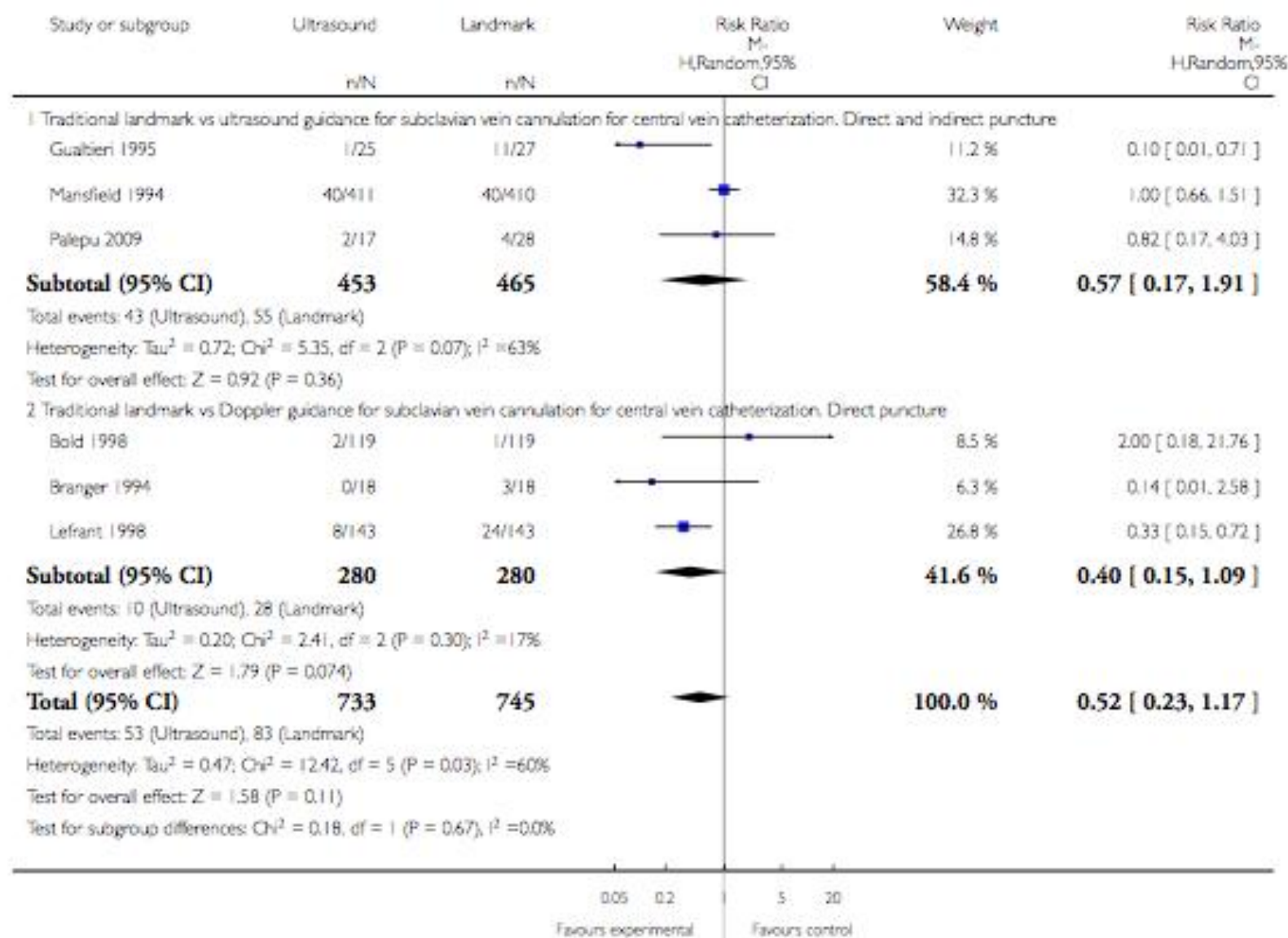
Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Quality of the evidence (GRADE)
	Assumed risk	Corresponding risk			
	Anatomical landmark	Ultrasound or doppler guidance			
Complication rate to	111 per 1000 Moderate 155 per 1000 58 per 1000 (26 to 130) 81 per 1000 (36 to 181)		RR 0.52 (0.23 to 1.17)	1478 (6 studies)	⊕○○○ Very low ^{a,b,c,d}
Overall success rate	877 per 1000 Moderate 899 per 1000 921 per 1000 (851 to 991) 944 per 1000 (872 to 1000)		RR 1.05 (0.97 to 1.13)	1809 (8 studies)	⊕⊕○○ Low ^{d,e,f,g}

Analysis 1.1. Comparison 1 Ultrasound or Doppler guidance vs anatomical landmarks for subclavian vein cannulation for central vein catheterization, Outcome 1 Complication rate total.

Review: Ultrasound guidance versus anatomical landmarks for subclavian or femoral vein catheterization

Comparison: 1 Ultrasound or Doppler guidance vs anatomical landmarks for subclavian vein cannulation for central vein catheterization

Outcome: 1 Complication rate total



Confusione terminologica

- La puntura eco-guidata della vena succlavia è SOVRACLAVEARE
- La puntura eco-guidata in regione sottoclaveare consiste nella puntura di:
 - Vena Ascellare
 - Vena Cefalica al torace



Ultrasound-Guided Subclavian Vein Catheterization: A Systematic Review and Metaanalysis

Manoj M. Lalu, MD, PhD, FRCPC^{1,2}; Ashraf Fayad, MD, FRCPC^{1,2}; Osman Ahmed, MD³;

TABLE 2. Characteristics of Ultrasound Technology and Technique Used in Individual Studies

Study	Ultrasound Technique	Ultrasound Machine	Transducer	Patient Positioning	Approach for Imaging	Axis of Imaging	Approach for Needle	Landmark Technique Approach
Oh et al (27)	Dynamic 2D	SonoSite S-serve (SonoSite, Bothell, WA)	7.5-MHz high-resolution	Trendelenburg	NR	Longitudinal	NR	Infraclavicular
Campbell et al (20)	Dynamic 2D	NR	NR	NR	Infraclavicular	NR	NR	NR
Fragou et al (25)	Dynamic 2D	HD11 XE ultrasound Machine (Philips, Andover, MA)	7.5-MHz high-resolution	Trendelenburg	Infraclavicular	Longitudinal	In plane	Infraclavicular
Alic et al (19), 2009	Dynamic 2D	GE Logiq Book XP	5–13 MHz transducer	NR	NR	Longitudinal	In plane	NR
Palepu et al (26)	Dynamic 2D	SonoSite (Bothell, WA)	6–13 MHz, 38-mm linear-array transducer	Trendelenburg	Infraclavicular—middle third of the clavicle	Transverse	NR	Infraclavicular
Gualtieri et al (23)	Dynamic 2D	Site Rite (Dymax Corporation, Pittsburgh, PA)	7.5 MHz	Trendelenburg	Infraclavicular—lateral aspect of clavicle	Transverse	NR	Infraclavicular
Mansfield et al (3)	Static 2D	Model 633(Hitachi Aloka, Wallingford, CT)	7.5-MHz linear array	Trendelenburg	Infraclavicular	NR	NR	Infraclavicular
Bold et al (22)	Dynamic Doppler	Smart Needle (Peripheral Systems Group, Mountain View, CA)	14-MHz continuous-wave	NR	NR	NA	NR	Infraclavicular
Lefrant et al (21)	Dynamic Doppler	Pulsed Doppler system (Medical Biophysics Laboratory, Faculty of Medicine, Tours, France)	4-MHz pulsed single, circular	Trendelenburg	Infraclavicular	NA	Through probe indentation	Infraclavicular
Branger et al (24)	Dynamic Doppler	Pulsed Doppler system (Medical Biophysics Laboratory, Faculty of Medicine, Tours, France)	4 MHz pulsed, circular	Trendelenburg	Infraclavicular	NA	30° angulation to body of probe	Infraclavicular

NR = not reported, NA = not applicable.

Article types

Clinical Trial (3)
Review (5)
Customize ...

Text availability

Abstract (24)
Free full text (5)
Full text (21)

PubMed Commons

Reader comments (0)
Trending articles (0)

Publication dates

5 years (14)
10 years (21)
Custom range...

Species

Humans (21)
Other Animals (0)

[Clear all](#)

[Show additional filters](#)

Summary ▾ 20 per page ▾ Sort by Most Recent ▾

Send to: ▾

[See 6 citations found by title matching your search:](#)

[Real-time, ultrasound-guided infraclavicular axillary vein cannulation for renal replacement therapy in the critical care unit—A prospective intervention study.](#) Czarnik T et al. J Crit Care. (2015)

[A comparison of longitudinal and transverse approaches to ultrasound-guided axillary vein cannulation.](#)

Sommerkamp SK et al. Am J Emerg Med. (2013)

[Ultrasound-guided subclavian and axillary vein cannulation via an infraclavicular approach: In the tradition of Robert Aubaniac.](#) Shiloh AL et al. Crit Care Med. (2012)

Search results

Items: 1 to 20 of 26

<< First < Prev Page 1 of 2 Next > Last >>

- ☐ [Infraclavicular axillary vein cannulation using ultrasound in a mechanically ventilated general intensive care population.](#)

1. Glen H, Lang I, Christie L.
Anaesth Intensive Care. 2015 Sep;43(5):635-40.
PMID: 26310415
[Similar articles](#)

- ☐ [Real-time, ultrasound-guided infraclavicular axillary vein cannulation for renal replacement therapy in the critical care unit—A prospective intervention study.](#)

2. Czarnik T, Gawda R, Nowotarski J.
J Crit Care. 2015 Jun;30(3):624-8. doi: 10.1016/j.jcrc.2015.01.002. Epub 2015 Jan 8.
PMID: 25697988
[Similar articles](#)

Ultrasound-guided infraclavicular axillary vein cannulation: a useful alternative to the internal jugular vein[†]

R. O'Leary, S. M. Ahmed, H. McLure, J. Oram, A. Mallick, B. Bhambra and A. R. Bodenham*

Department of Anaesthesia, Critical Care and Pain, Leeds Teaching Hospitals NHS Trust, Great George Street, Leeds LS1 3EX, UK

Editor's key points

- Cannulation of the axillary vein (AxV) provides a potential alternative to subclavian vein cannulation that is more amenable to ultrasound (US) guidance.
- A retrospective analysis evaluated the success and complications reported in a large prospectively collected database of central vein catheterization at a large UK centre.
- US-guided internal jugular and AxV cannulation were both effective and relatively safe.



Article types

Clinical Trial (3)

Review (0)

Customize ...

Text availability

Abstract (18)

Free full text (6)

Full text (21)

PubMed Commons

Reader comments (0)

Trending articles (0)

Publication dates

5 years (16)

10 years (20)

Custom range...

Species

Humans (17)

Other Animals (0)

[Clear all](#)

[Show additional filters](#)

Summary ▾ 20 per page ▾ Sort by Most Recent ▾

Send to: ▾

[See 4 citations found by title matching your search:](#)

[Ultrasound-guided supraclavicular cannulation of the right brachiocephalic vein in small infants: a consecutive, prospective case series.](#) Breschan C et al. Paediatr Anaesth. (2015)

[\[Ultrasound-guided cannulation of the brachiocephalic vein in neonates and infants\].](#) Oulego-Eroz I et al. An Pediatr (Barc). (2015)

[Ultrasound-guided left brachiocephalic vein cannulation in children with underlying bleeding disorders: a retrospective analysis.](#) Di Nardo M et al. Pediatr Crit Care Med. (2014)

Search results

Items: 1 to 20 of 22

<< First < Prev Page 1 of 2 Next > Last >>

- ☐ 1. [Ultrasound-guided supraclavicular cannulation of the right brachiocephalic vein in small infants: a consecutive, prospective case series.](#)

Breschan C, Graf G, Jost R, Stettner H, Feigl G, Goessler A, Neuwersch S, Koestenberger M, Likar R.

Paediatr Anaesth. 2015 Sep;25(9):943-9. doi: 10.1111/pan.12700. Epub 2015 Jun 17.

PMID: 26083730

[Similar articles](#)

- ☐ 2. [Ultrasound-guided brachiocephalic vein catheterization in infants weighing less than five kilograms.](#)

Aytekin C, Özyer U, Harman A, Boyvat F.

J Vasc Access. 2015 May 30;0(0):0. doi: 10.5301/jva.5000385. [Epub ahead of print]

PMID: 26044899

[Similar articles](#)

REGIONAL ANAESTHESIA

Consecutive, prospective case series of a new method for ultrasound-guided supraclavicular approach to the brachiocephalic vein in children

C. Breschan^{1*}, M. Platzer¹, R. Jost², H. Stettner³, A.-S. Beyer³, G. Feigl⁴ and R. Likar¹



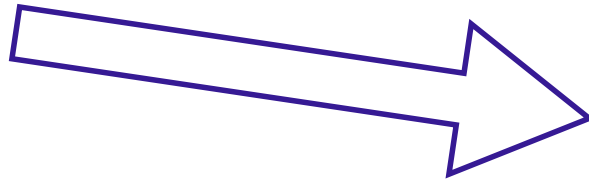


RaCeVA: a guide for a rational choice of the most appropriate vein for central venous catheterization

Mauro Pittiruti

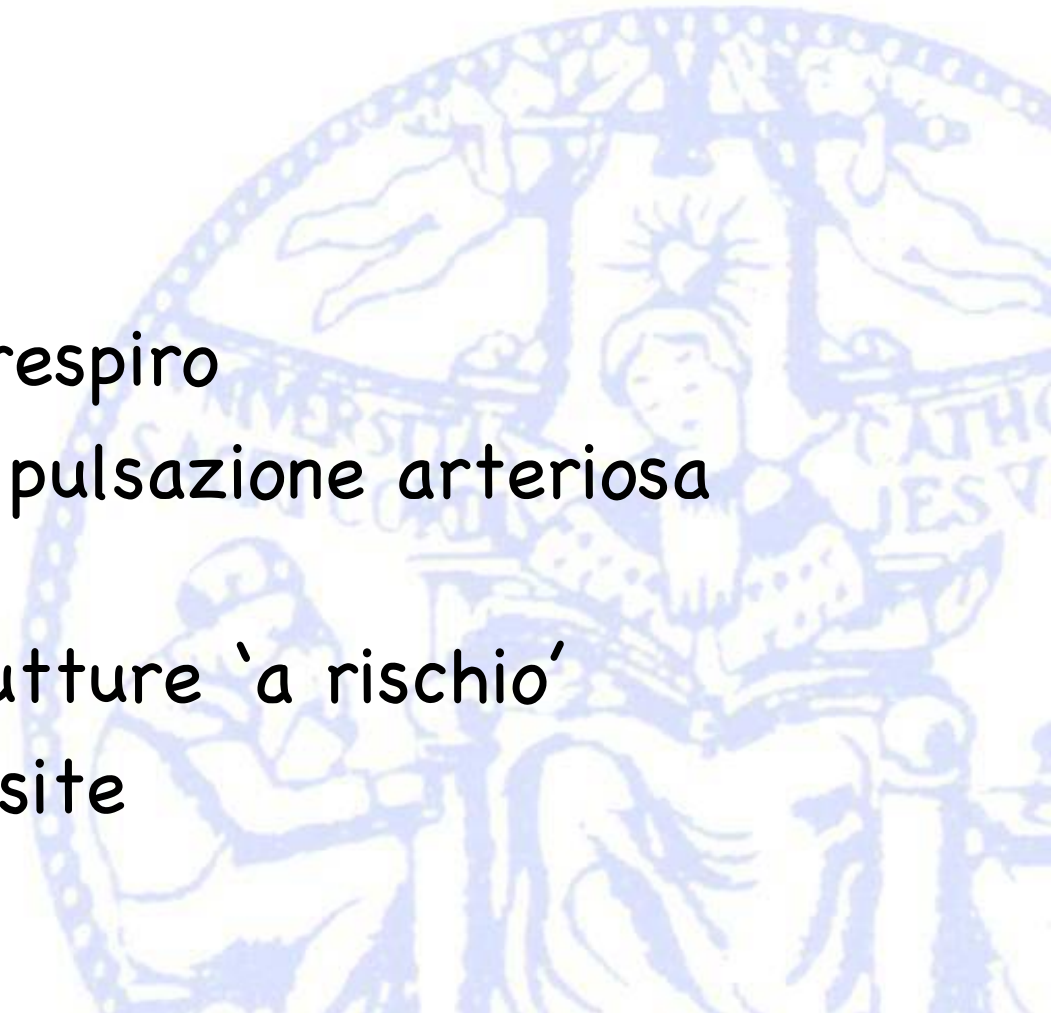
Catholic University, Rome, Italy





Scelta della vena

- **SEI CRITERI** per scegliere la vena da incannulare
 - Calibro
 - Profondità
 - Collassabilità con respiro
 - Compressibilità da pulsazione arteriosa vicina
 - Contiguità con strutture 'a rischio'
 - Praticità dell'exit site



Is long-axis view superior to short-axis view in ultrasound-guided central venous catheterization?

Author information: GE, Kendall J.

+ Author information

Abstract

OBJECTIVE: To evaluate whether using long-axis or short-axis view during ultrasound-guided internal jugular and subclavian central venous catheterization results in fewer skin breaks, decreased time to cannulation, and fewer posterior wall penetrations.

DESIGN: Prospective, randomized crossover study.

SETTING: Urban emergency department with approximate annual census of 60,000.

SUBJECTS: Emergency medicine resident physicians at the Denver Health Residency in Emergency Medicine, a postgraduate year 1-4 training program.

INTERVENTIONS: Resident physicians blinded to the study hypothesis used ultrasound guidance to cannulate the internal jugular and subclavian of a human torso mannequin using the long-axis and short-axis views at each site.

MEASUREMENTS AND MAIN RESULTS: An ultrasound fellow recorded skin breaks, redirections, and time to cannulation. An experienced ultrasound fellow or attending used a convex 8-4 MHz transducer during cannulation to monitor the needle path and determine posterior wall penetration. Generalized linear mixed models with a random subject effect were used to compare time to cannulation, number of skin breaks and redirections, and posterior wall penetration of the long axis and short axis at each cannulation site. Twenty-eight resident physicians participated: eight postgraduate year 1, eight postgraduate year 2, five postgraduate year 3, and seven postgraduate year 4. The median (interquartile range) number of total internal jugular central venous catheters placed was 27 (interquartile range, 9-42) and subclavian was six catheters (interquartile range, 2-20). The median number of previous ultrasound-guided internal jugular catheters was 25 (interquartile range, 9-40), and ultrasound-guided subclavian catheters were three (interquartile range, 0-5). The long-axis view was associated with a significant decrease in the number of redirections at the internal jugular and subclavian sites, relative risk 0.4 (95% CI, 0.2-0.9) and relative risk 0.5 (95% CI, 0.3-0.7), respectively. There was no significant difference in the number of skin breaks between the long axis and short axis at the subclavian and internal jugular sites. The long-axis view for subclavian was associated with decreased time to cannulation; there was no significant difference in time between the short-axis and long-axis views at the internal jugular site. The prevalence of posterior wall penetration was internal jugular short axis 25%, internal jugular long axis 21%, subclavian short axis 64%, and subclavian long axis 39%. The odds of posterior wall penetration were significantly less in the subclavian long axis (odds ratio, 0.3; 95% CI, 0.1-0.9).

CONCLUSIONS: The long-axis view for the internal jugular was more efficient than the short-axis view with fewer redirections. The long-axis view for subclavian central venous catheterization was also more efficient with decreased time to cannulation and fewer redirections. The long-axis approach to subclavian central venous catheterization is also associated with fewer posterior wall penetrations. Using the long-axis view for subclavian central venous catheterization and avoiding posterior wall penetrations may result in fewer central venous catheter-related complications.

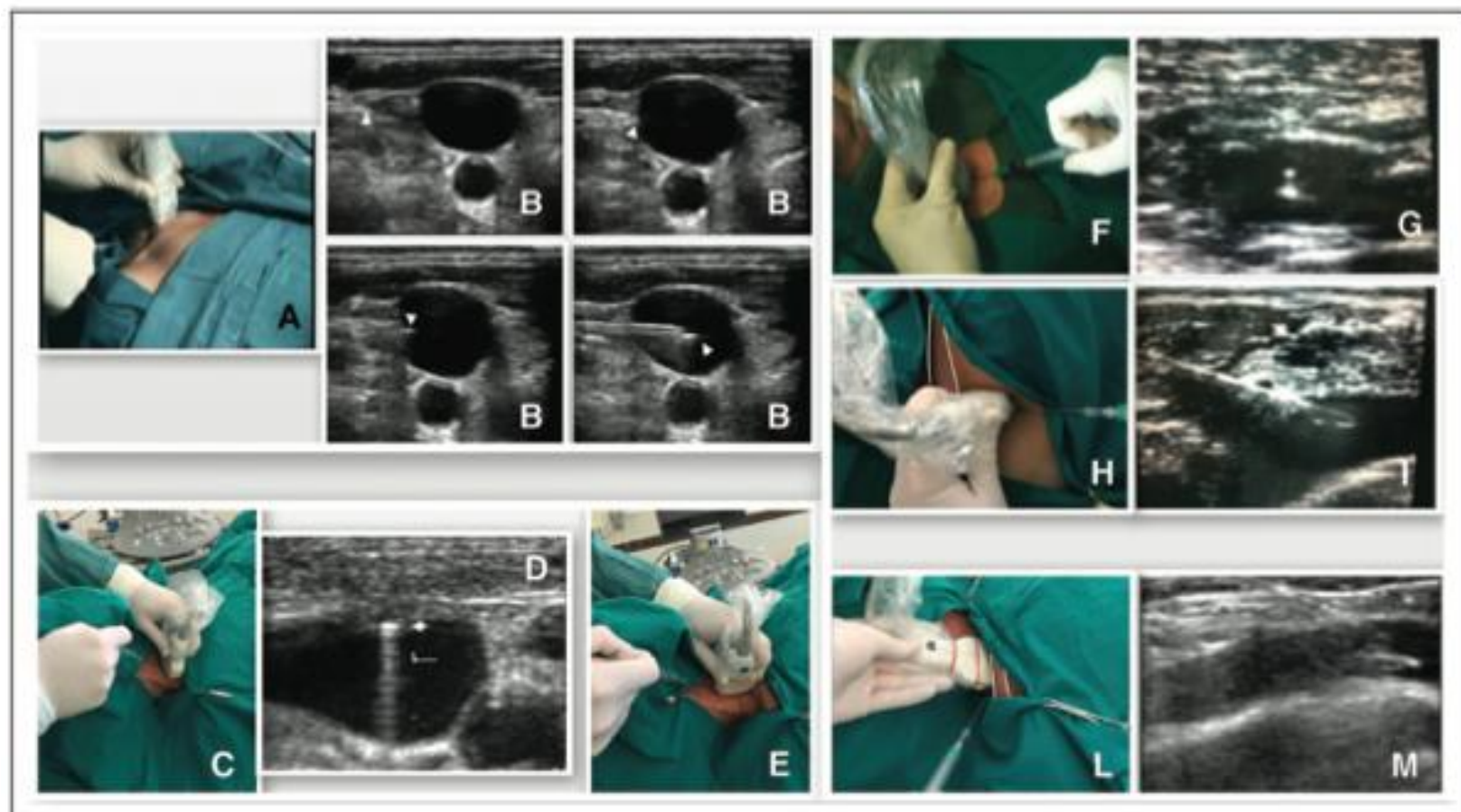
Ultrasound-Guided Central Venous Catheterization: It Is High Time to Use a Correct Terminology

To the Editor:

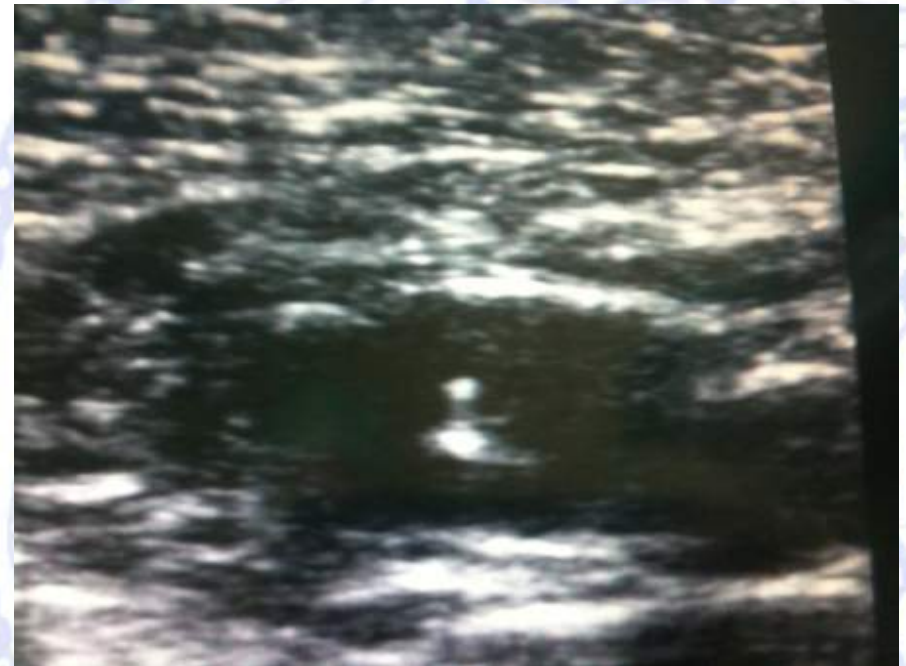
We read with interest the article by Vogel et al (1) on ultrasound-guided puncture of internal jugular vein (IJV) and subclavian vein (ScV). In this article, the authors refer to the long-axis (LA) and short-axis (SA) views as “venipuncture” techniques. This is not correct: LA and SA views are sonographic imaging approaches and refer to the

relationship between the plane of the probe and the axis of the vessel (Fig. 1). In LA view, the plane of the probe is parallel to the LA of the vein (longitudinal scan, Fig. 1, *I* and *M*); in SA view, the plane of the probe is perpendicular to the axis of the vessel (transversal view, Fig. 1, *B*, *D*, and *G*).

Venipuncture techniques are defined not only by this spatial relationship between the plane of the probe and the axis of the vein but also by the relationship between the probe and the needle (Fig. 1, *A*, *F*, *H*, and *L*). Regardless of the vessel view, the needle can be advanced “out-of-plane” (OP), that is, perpendicular to the plane of the probe (Fig. 1*F*), or “in-plane” (IP), that is, within the plane of the probe (2)



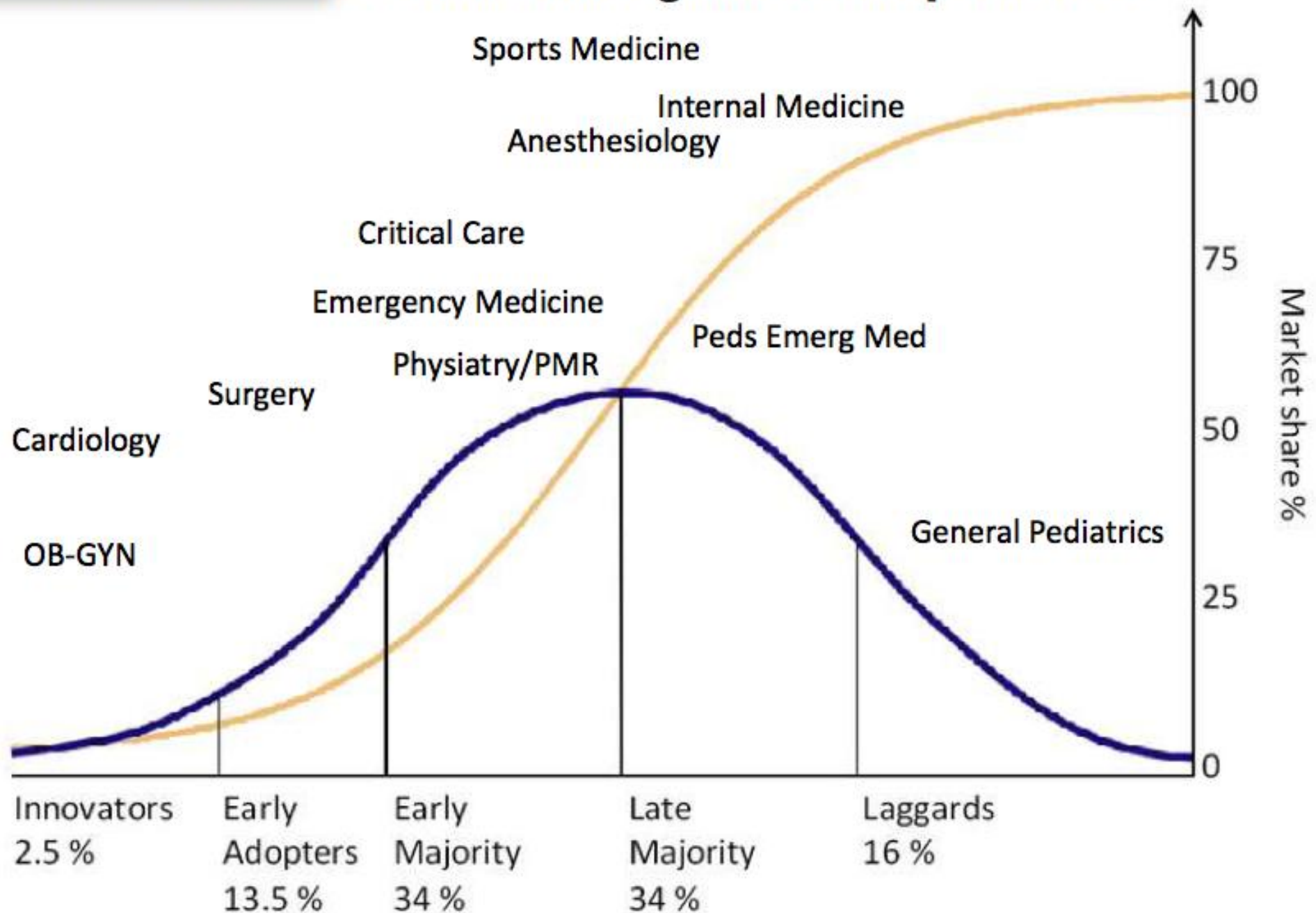
‘In plane’ vs. ‘out of plane’



Asse lungo vs. asse corto



Diffusion of Ultrasound Through Medical Specialties



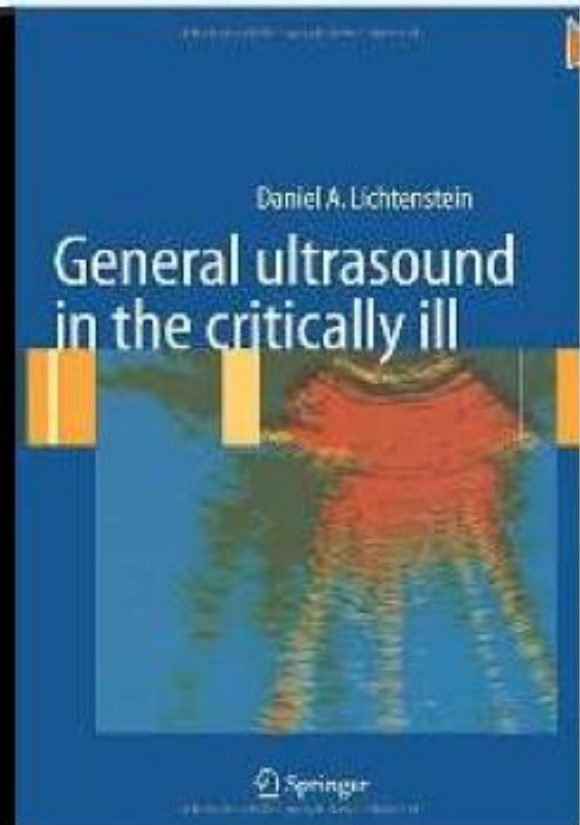
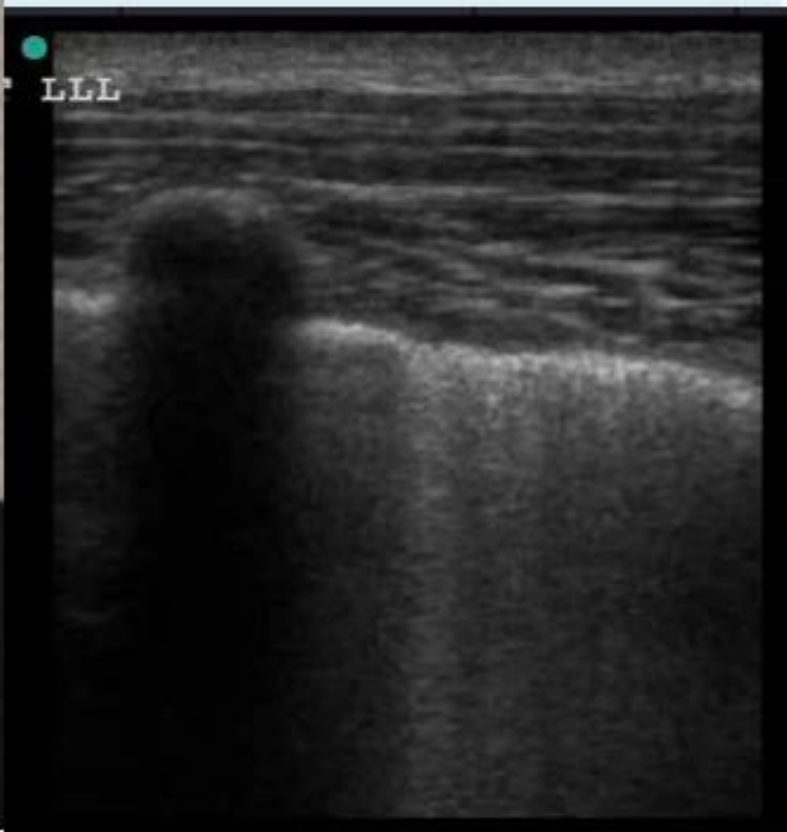
The WHO Estimates that Up to 75% of
the world's population has no access
to any diagnostic imaging



WINFOCUS

World Interactive Network Focused on Critical UltraSound

1989: Daniel Lichtenstein pioneers point-of-care lung ultrasound in the ICU
“Ultrasound is the real stethoscope”



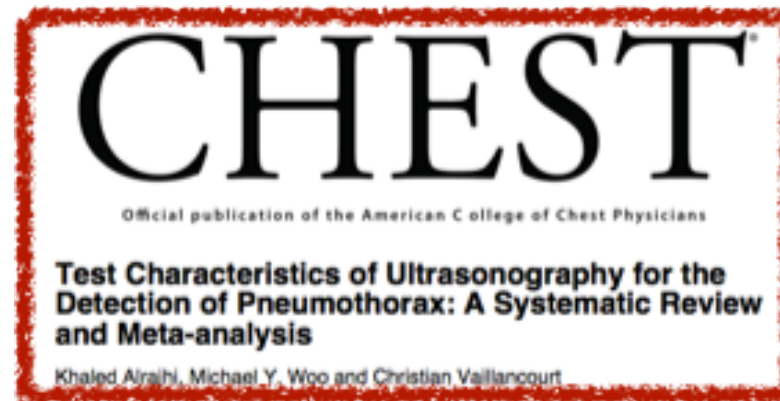
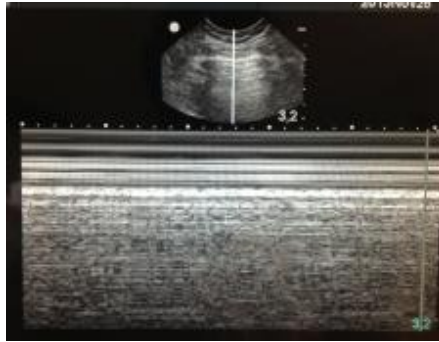
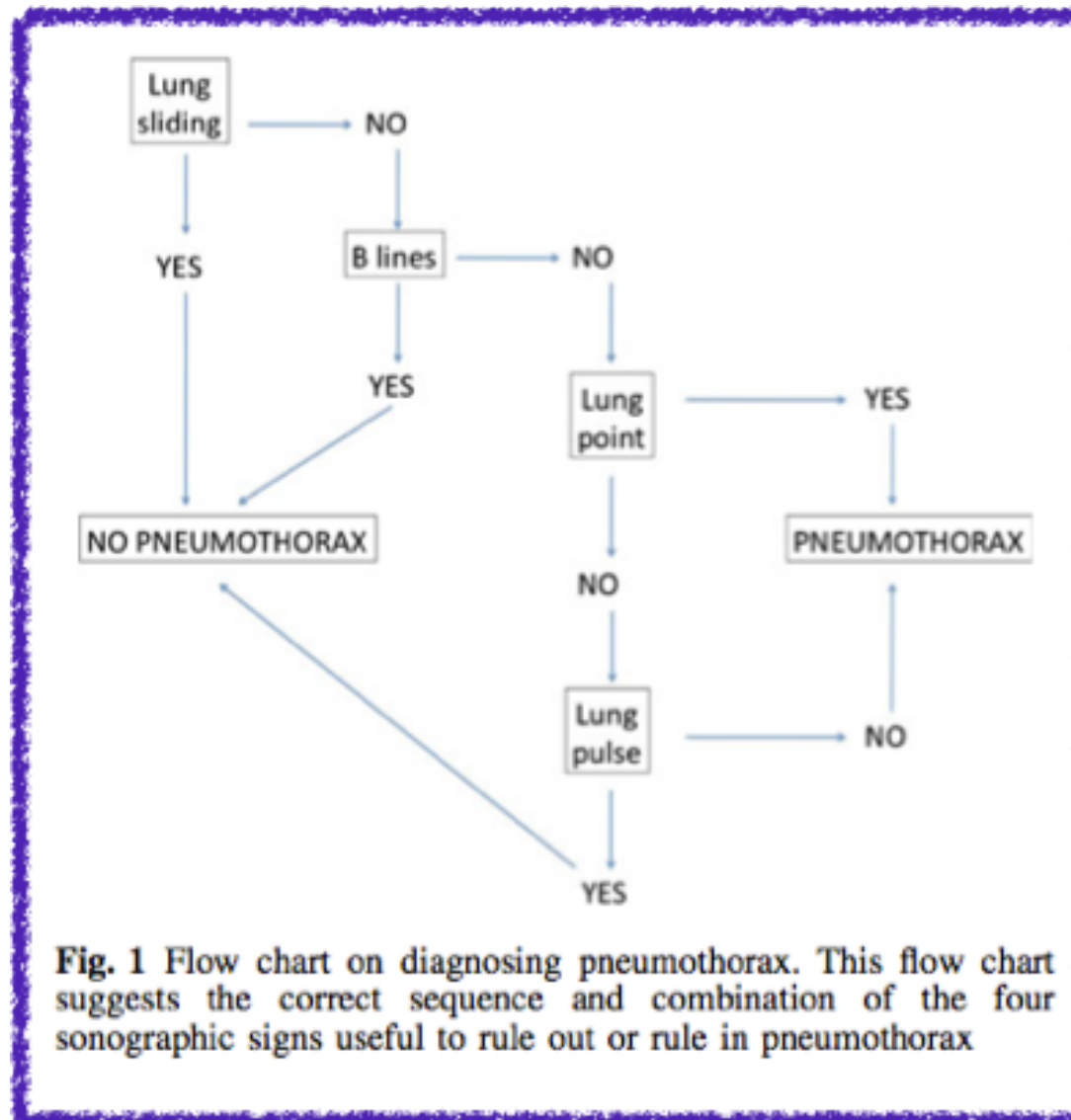


Table 2: Summary of sensitivity and specificity for included studies

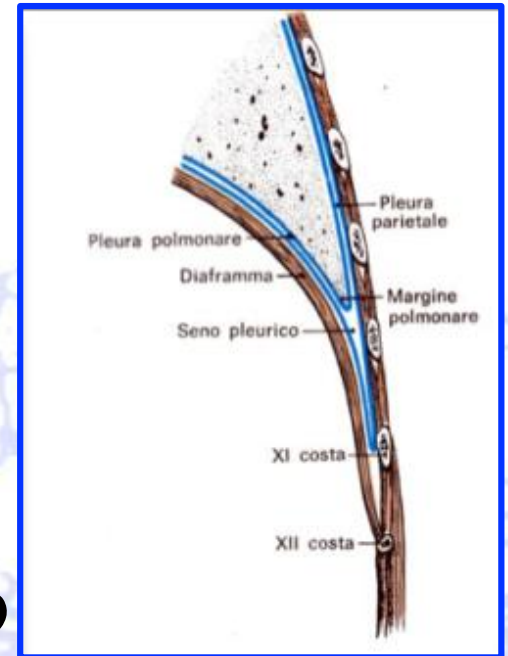
Author	N	Ultrasonography		Chest X-ray	
		Sensitivity	Specificity	Sensitivity	Specificity
Blaivas ¹⁴	176	98.1%	99.2%	75.5%	100.0%
Chung ¹⁵	97	88.2%	89.3%	47.1%	94.0%
Garofalo ¹³	184	95.7%	100%	-	-
Kirkpatrick ¹¹	133	48.8%	98.7%	20.9%	99.6%
Rowan ¹⁶	27	100%	93.8%	36.4%	100.0%
Soldati ¹⁷	186	98.2%	100%	53.6%	100.0%
Soldati ¹⁸	109	92.0%	99.5%	52.0%	100.0%
Zhang ¹⁹	135	86.2%	97.2%	27.6%	100.0%

International evidence-based recommendations for point-of-care lung ultrasound

Intensive Care Med (2012) 38:577–591



Versamento Pleurico/ Emotorace



- Tecnica d'esame nel paziente supino
 - scansioni longitudinali
 - linee ascellari medie e posteriori a livello del diaframma
 - Segno ecografico:
 - segno della tendina costo-frenica o curtain
- 45 sign



policy on privileging US

- (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.

- 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.

Il nuovo concetto che emerge dalla letteratura e dalla pratica clinica è:

• USO '**CLINICO - INTEGRATO**' DELL'ECOGRAFO

- Per la scelta della vena
- Per la venipuntura
- Per la corretta direzione del catetere
- Per la esclusione di complicanze da venipuntura
- Per la verifica della posizione della punta
- Diagnosi di complicanze tardive non infettive: es. trombosi

Article types

[Clinical Trial](#)[Review](#)[Customize ...](#)

Text availability

[Abstract](#)[Free full text](#)[Full text](#)

PubMed Commons

[Reader comments](#)[Trending articles](#)

Publication dates

[5 years](#)[10 years](#)[Custom range...](#)

Species

[Humans](#)[Other Animals](#)[Clear all](#)[Show additional filters](#)

Summary ▾ 20 per page ▾ Sort by Most Recent ▾

Send to: ▾ Filters: [Manage Filters](#)

Search results

Items: 1 to 20 of 1476

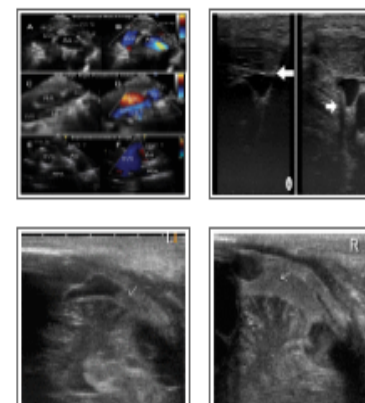
<< First < Prev Page 1 of 74 Next > Last >>

- ☐ [Diagnostic accuracy of point-of-care ultrasound for catheter-related thrombosis in children.](#)
1. Li S, Silva CT, Brudnicki AR, Baker KE, Tala JA, Pinto MG, Polikoff LA, Qin L, Faustino EV; Northeast Pediatric Critical Care Research Consortium. *Pediatr Radiol*. 2015 Oct 6. [Epub ahead of print]
PMID: 26440129
[Similar articles](#)
- ☐ [\[Ultrasound Analysis of the Anatomical Relationships between Vertebral Arteries and Internal Jugular Veins in Adults\].](#)
2. Uno A, Tanaka S, Kanno M, Ishioka Y, Watanabe M, Yamakage M. *Masui*. 2015 Apr;64(4):383-7. Japanese.
PMID: 26419100
[Similar articles](#)
- ☐ [Point-of-Care Ultrasound Diagnosis of a Catheter-Associated Atrial Thrombus.](#)
3. Nelson EL, Greenwood-Erickson M, Frasura SE. *J Emerg Med*. 2015 Sep 22. pii: S0736-4679(15)00685-X. doi: 10.1016/j.jemermed.2015.06.063. [Epub ahead of print]
PMID: 26409679
[Similar articles](#)
- ☐ [Variation in haemodynamic monitoring for major surgery in European nations: secondary analysis of the EuSOS dataset.](#)
- 4.

New feature

Try the new Display Settings option -
[Sort by Relevance](#)

Results by year

[Download CSV](#)[PMC Images search for central venous catheter and ultrasound](#)

What's really new in the field of vascular access? Towards a global use of ultrasound

**Daniele G. Biasucci, Antonio La Greca,
Giancarlo Scoppettuolo & Mauro
Pittiruti**

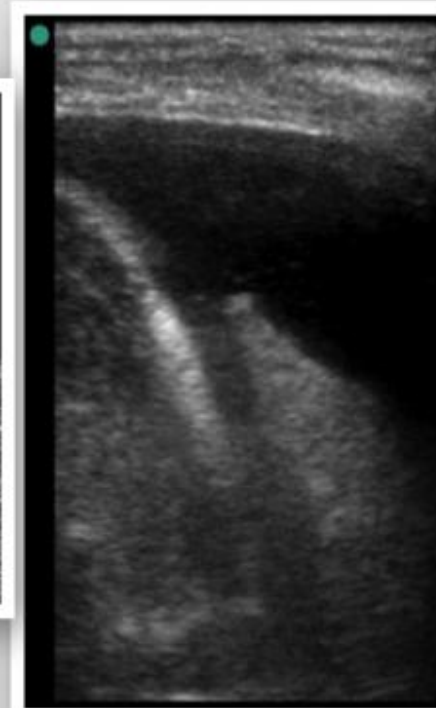
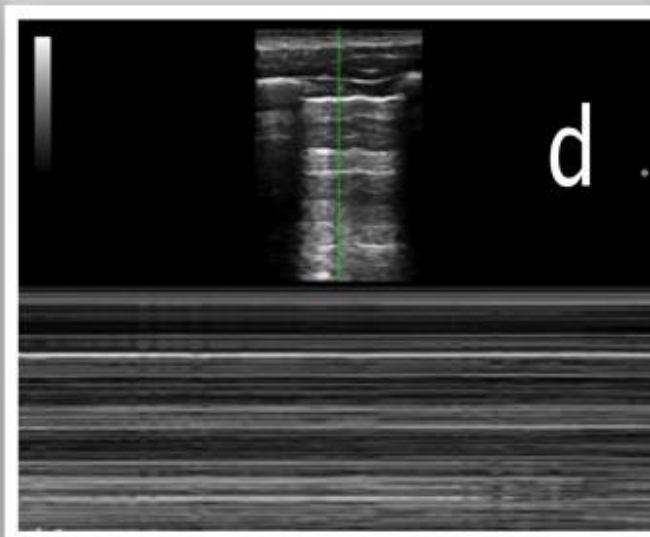
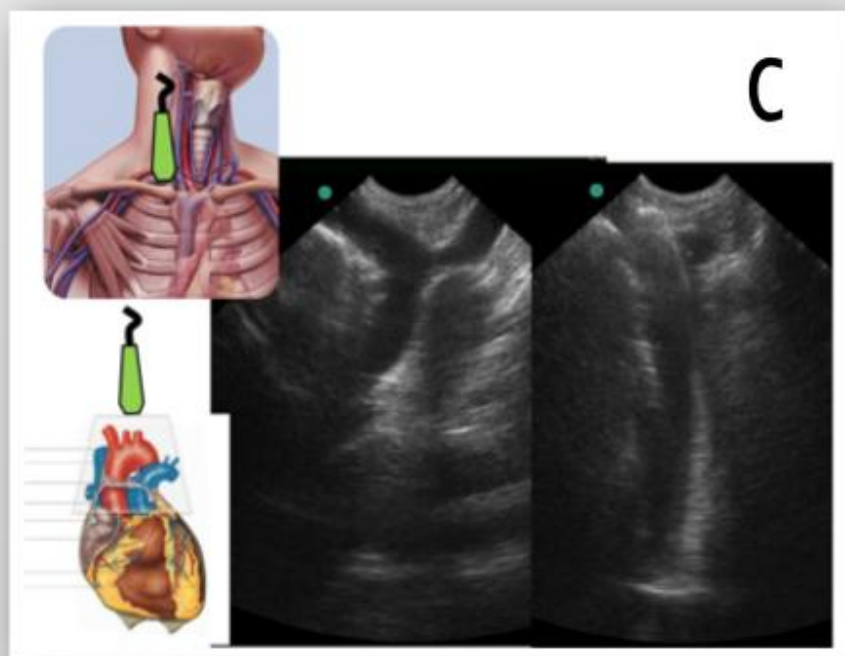
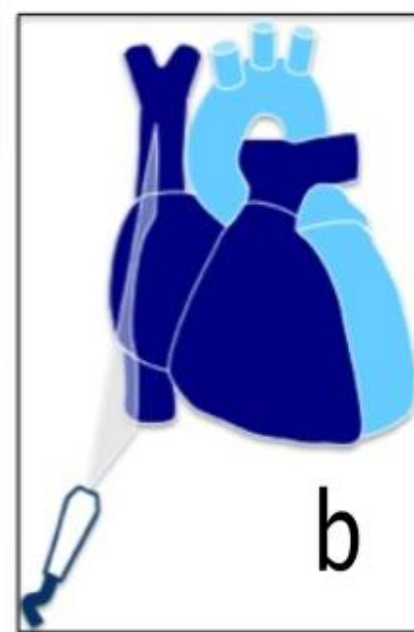
Intensive Care Medicine

ISSN 0342-4642

Intensive Care Med

DOI 10.1007/s00134-015-3728-y





Ultrasonic Examination

An Alternative to Chest Radiography after Central Venous Catheter Insertion?

ERIC MAURY, JEAN GUGLIELMINOTTI, MARC ALZIEU, BERTRAND GUIDET, and GEORGES OFFENSTADT

Service de Réanimation Médicale, Hôpital Saint-Antoine, Assistance Publique-Hôpitaux de Paris, Paris, France

Jerome Bedel
Fabrice Vallée
Arnaud Mari
Beatrice Riu
Benjamin Planquette
Thomas Geeraerts
Michèle Génestal
Vincent Minville
Olivier Fourcade

Guidewire localization by transthoracic echocardiography during central venous catheter insertion: a periprocedural method to evaluate catheter placement

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

Brief Report

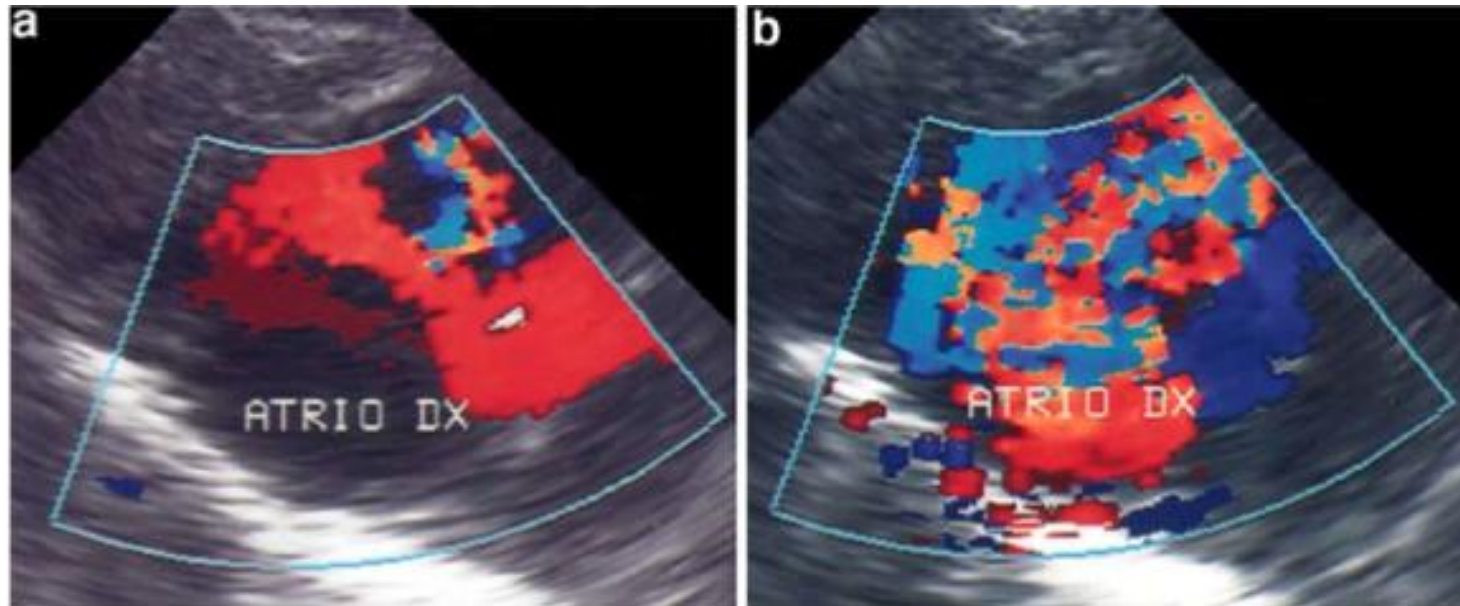
American Journal of Emergency Medicine 32 (2014) 78–81

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

Francesca Cortellaro, MD ^{a,*}, Luca Mellace, MD ^a, Stefano Paglia, MD ^a, Giorgio Costantino, MD ^c, Sara Sher, MD ^b, Daniele Coen, MD ^a

Cecilia Lanza · Marco Russo · Giancarlo Fabrizzi

Central venous cannulation: are routine chest radiographs necessary after B-mode and colour Doppler sonography check?

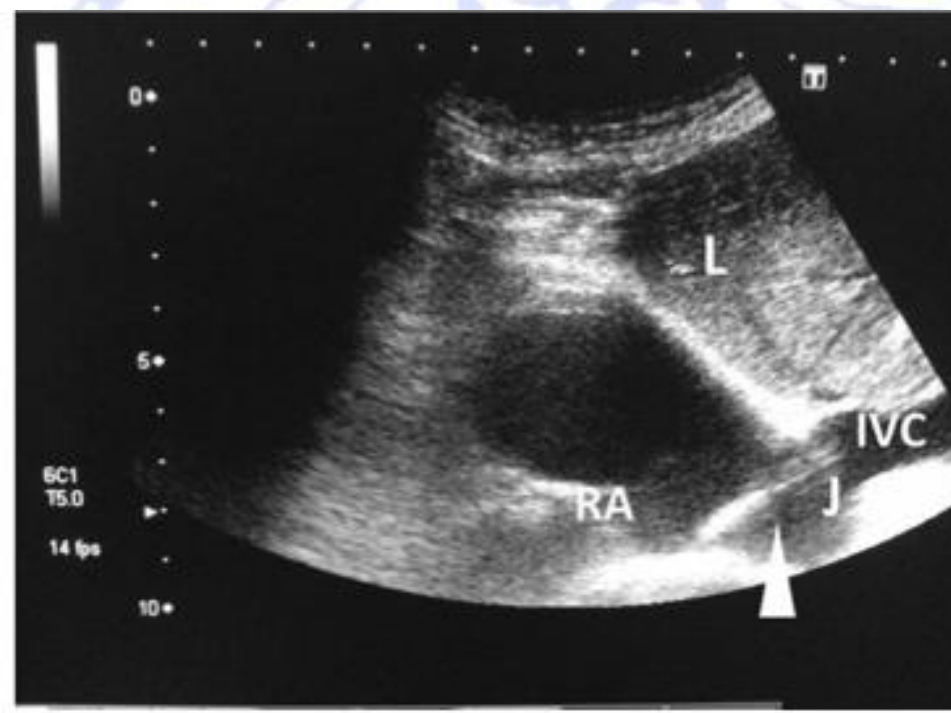
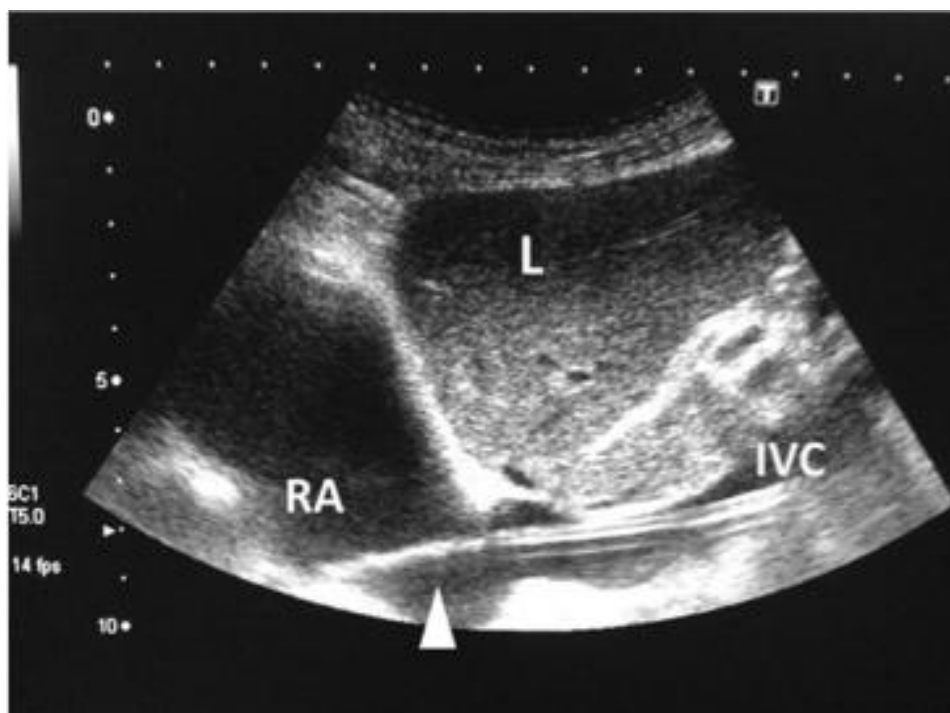


- Color Doppler signals in the vena cava.
- Increased colour signal due to turbulent flow during infusion of saline solution

ORIGINAL ARTICLE – PALLIATIVE CARE

Peripherally Inserted Central Catheter Tip Position: A Novel Empirical-Ultrasonographical Index in a Modern Surgical Oncology Department

Luigi Marano, MD¹, Giuseppe Izzo, MD¹, Giuseppe Esposito, MD¹, Marianna Petrillo, MD¹,



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 Biffi
Eric Desruennes
Lawrence A. Melniker
Susan T. Verghese

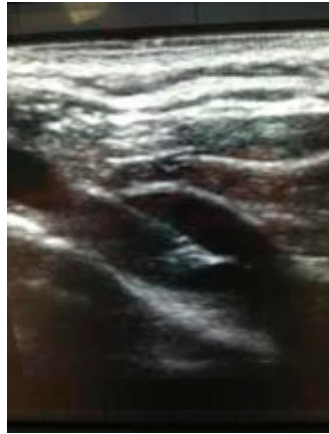
**International evidence-based
recommendations on ultrasound-guided
vascular access**



Valutazione Ecografica Preliminare

Non esiste un sito ideale per il posizionamento di cateteri venosi centrali ma esso deve essere stabilito sulla base dell'integrazione (a) dell'esame ecografico preliminare, (b) del tipo di catetere e (c) della clinica

**VALUTAZIONE ECOGRAFICA
PRELIMINARE**



Puntura Venosa Ecoguidata

2

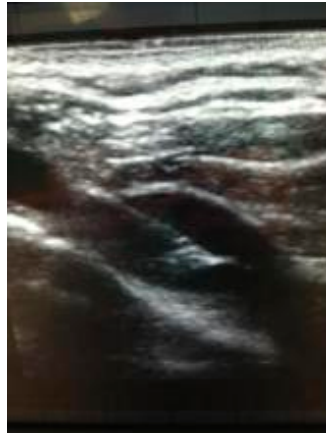
International evidence-based recommendations on ultrasound-guided vascular access

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

Ultrasound vascular access in adults

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

Puntura Venosa Ecoguidata



International evidence-based recommendations on ultrasound-guided vascular access

Table 3 Recommendations on ultrasound vascular access in neonates and children

Ultrasound vascular access in neonates and children

Domain code	Suggested definition	Level of evidence	Degree of consensus	Strength of recommendation
D4.SD1.S1–2	Ultrasound guidance should be routinely used for short- and long-term central venous access in children and neonates	A	Very good	Strong
D4.SD1.S3	Ultrasound vessel imaging with ultrasound assistance as “a minimum” should be routinely performed before internal jugular vein puncture in neonates	A	Very good	Strong
D4.SD1.S4	In neonates, ultrasound screening should be used before subclavian vein puncture. Ultrasound-guided puncture should be considered for catheterization using the supra-clavicular route, but this technique requires experienced operators	C	Some	Weak
D4.SD1.S5	Ultrasound vessel screening should be routinely used before femoral vein puncture. Ultrasound-guided femoral puncture is recommended to decrease inadvertent arterial puncture	B	Very good	Strong
D4.SD1.S6	Ultrasound guidance can be considered when difficult peripheral venous access is required in areas such as the antecubital fossa and ankle. Blind deep antecubital fossa puncture should disappear	C	Very good	Strong
D4.SD1.S7	Ultrasound-guided arterial catheterization improves first-pass success	A	Very good	Strong

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

Domain code	Suggested definition	Grade of evidence	Degree of consensus	Strength of recommendation
D4.SD2.S1	Ultrasound guidance should be used for central venous access in adults	A	Very good	Strong
D4.SD2.S2	Ultrasound guidance should be used for central venous access in adults	A	Very good	Strong
D4.SD2.S3	PICCs should be inserted using ultrasound guidance	A	Very good	Strong
D4.SD2.S4	Ultrasound should be used for central venous access in adults	A	Very good	Strong
D4.SD2.S5	Ultrasound should be used for central venous access in adults	A	Very good	Strong
D4.SD2.S6	Ultrasound should be used for central venous access in adults	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
D5.S1-3	CEUS (contrast-enhanced ultrasound) is a valid method for detecting a central venous catheter tip in the right atrium	A	Very good	Strong

...nel bambino e nel neonato

Ultrasound vascular access in neonates and children

Domain code Suggested definition

D4.SD1.S1-2

Ultrasound guidance should be used for central venous access

D4.SD1.S3

Ultrasound guidance should be used for peripheral venous access

D4.SD1.S4

Ultrasound guidance should be used for arterial access

D4.SD1.S7

Ultrasound guidance can be considered for central venous access in neonates

D4.SD1.S8

Ultrasound guidance should be used for central venous access in children and neonates

D4.SD1.S9

There is no ideal site for cannulation in children; the best site should be determined after ultrasound examination

A

C

C

A

B

A

After central venous catheter placement in paediatric patients including neonates, the ultrasound equipment should remain easily accessible at the patient's bedside to detect early life-threatening catheter-related complications such as pneumothorax, cardiac tamponade and hemothorax

Ultrasound-guided femoral puncture should be routinely used for central venous access in neonates. Blind deep arterial puncture should be avoided. Ultrasound guidance can be considered for central venous access in neonates. Blind deep arterial puncture should be avoided. Ultrasound guidance should be used for central venous access in children and neonates. Ultrasound equipment should remain easily accessible at the patient's bedside to detect early life-threatening catheter-related complications such as pneumothorax, cardiac tamponade and hemothorax

There is no ideal site for cannulation in children; the best site should be determined after ultrasound examination

Central venous access devices in pediatric malignancies: a position paper of Italian Association of Pediatric Hematology and Oncology

Alessandro Crocoli¹, Assunta Tornesello², Mauro Pittiruti³, Angelica Barone⁴, Paola Muggeo⁵, Alessandro Inserra¹, Angelo Claudio Molinari⁶, Valeria Grillenzoni⁷, Viviana Durante⁸, Maria Pia Cicalese⁹, Giulio Andrea Zanazzo¹⁰, Simone Cesaro⁷

Introduction: Treatment of pediatric malignancies is becoming progressively more complex, implying the adoption of multimodal therapies. A reliable, long-lasting venous access represents one of the critical requirements for the success of those treatments. Recent technical innovations—such as minimally invasive procedures for placement, new devices and novel materials—have rapidly spread for clinical use in adult patients, but are still not consistently used in the pediatric population.

Methods: The Supportive Therapy Working Group of Italian Association of Hematology and Oncology (AIEOP) reviewed medical literature focusing on new aspects of central venous access devices (VADs) in pediatric patients affected by oncohematological diseases.

Results: Appropriate recommendations for clinical use in these patients have been discussed and formulated.

Conclusions: The importance of the correct choice, management and use of VADs in pediatric oncohematological patients is a necessary prerequisite for an adequate standard of care, also considering the increased chances of cure and the longer life expectancy of those patients with modern therapies.

Ultrasound should be used for diagnosis of local pathologic conditions before the procedure and for diagnosis of procedure-related complications.

Ultrasound is necessary to assess vein patency before the procedure and to choose the vein most appropriate in terms of caliber, depth and position.

The internal diameter of the vein to be cannulated—as assessed by ultrasound—should be at least three times the external diameter of the catheter, so as to reduce the risk of venous thrombosis.

Ultrasound-guided venipuncture should be adopted, so as to reduce the risk of early and late complications.

Venous cannulation by surgical cutdown should be avoided.

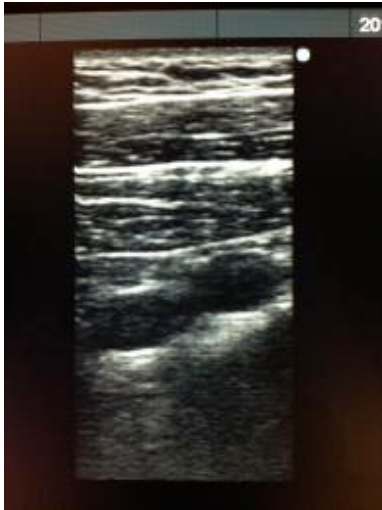
“Blind” percutaneous puncture of central veins (“landmark” venipuncture) should be avoided.

In newborn and infants, internal jugular vein and brachio-cephalic vein are usually the first options for ultrasound-guided central venous access.

Soon after procedures potentially associated with pleural damage, pneumothorax should be excluded by ultrasound scan of the intercostal space.



Ecografia e Accessi Vascolari



Valutazione Ecografica Preliminare

Puntura ecoguidata



Controllo della punta
Diagnosi/Esclusione PNX/Emotorace

ORIGINAL ARTICLE

Intravascular Complications of Central Venous Catheterization by Insertion Site

Jean-Jacques Parienti, M.D., Ph.D., Nicolas Mongardon, M.D.,
Bruno Mégarbane, M.D., Ph.D., Jean-Paul Mira, M.D., Ph.D.,
Pierre Kalfon, M.D., Ph.D., Antoine Gros, M.D., Sophie Marqué, M.D.,
Marie Thuong, M.D., Véronique Pottier, M.D., Michel Ramakers, M.D.,
Benoît Savary, M.D., Amélie Seguin, M.D., Xavier Valette, M.D.,
Nicolas Terzi, M.D., Ph.D., Bertrand Sauneuf, M.D.,
Vincent Cattoir, Pharm.D., Ph.D., Leonard A. Mermel, D.O.,
and Damien du Cheyron, M.D., Ph.D., for the 3SITES Study Group*



Table 2. Catheter-Related and Procedural Characteristics.*

Characteristic	Three-Choice Comparison			Pairwise Comparison†		Pairwise Comparison†		Pairwise Comparison†	
	Jugular (N=845)	Femoral (N=844)	Subclavian (N=843)	Femoral (N=875)	Subclavian (N=878)	Jugular (N=984)	Subclavian (N=981)	Femoral (N=1140)	Jugular (N=1145)
Skin antisepsis and catheter care — no. (%)‡									
Alcoholic chlorhexidine	366 (43.3)	363 (43.0)	380 (45.1)	372 (42.5)	391 (44.5)	439 (44.6)	435 (44.3)	468 (41.1)	477 (41.7)
Alcoholic povidone–iodine	364 (43.1)	361 (42.8)	355 (42.1)	383 (43.8)	374 (42.6)	426 (43.3)	421 (42.9)	500 (43.9)	498 (43.5)
Aqueous povidone–iodine	83 (9.8)	86 (10.2)	82 (9.7)	86 (9.8)	87 (9.9)	86 (8.7)	95 (9.7)	134 (11.8)	131 (11.4)
Other or unknown	32 (3.8)	34 (4.0)	26 (3.1)	34 (3.9)	26 (3.0)	33 (3.4)	30 (3.1)	38 (3.3)	39 (3.4)
Use of anatomical landmarks to guide insertion — no. (%)§	276 (32.7)¶	623 (73.8)¶	723 (85.8)¶	648 (74.1)¶	758 (86.3)¶	314 (31.9)¶	847 (86.3)¶	825 (72.4)¶	360 (31.4)¶
Time for insertion — min	12.6±9.1¶	11.6±9.0¶	12.8±9.2¶	11.6±9.0¶	12.8±9.3¶	12.8±9.5	12.8±9.2	11.7±9.0¶	12.7±9.5¶
Insertion failure — no. (%)	65 (7.7)¶	45 (5.3)¶	124 (14.7)¶	45 (5.1)¶	126 (14.3)¶	75 (7.6)¶	148 (15.1)¶	57 (5.0)¶	100 (8.7)¶
Duration of catheterization — days									
Mean	6.5±5.6	5.9±4.8	6.4±5.3	5.9±4.8¶	6.5±5.4¶	6.7±5.8	6.8±5.7	5.8±4.8¶	6.5±5.4¶
Median (range)	5 (3–9)	5 (2–8)	5 (3–9)	5 (3–9)	5 (2–8)	5 (3–9)	5 (3–9)	5 (2–8)	5 (3–9)
Reason for catheter removal — no. (%)									
No longer required	497 (58.8)	492 (58.3)	485 (57.5)	505 (57.7)	500 (56.9)	570 (57.9)	547 (55.8)	624 (54.7)	641 (56.0)
Death	181 (21.4)	137 (16.2)	151 (17.9)	142 (16.2)	159 (18.1)	211 (21.4)	175 (17.8)	223 (19.6)	259 (22.6)
Suspected catheter infection	89 (10.5)	112 (13.2)	109 (12.9)	119 (13.6)	118 (13.4)	111 (11.3)	143 (14.6)	157 (13.8)	135 (11.8)
Systematic	18 (2.1)	22 (2.6)	20 (2.4)	22 (2.5)	21 (2.4)	19 (1.9)	25 (2.5)	27 (2.4)	26 (2.3)
Other or unknown	60 (7.1)	81 (9.6)	78 (9.3)	87 (9.9)	80 (9.1)	73 (7.4)	91 (9.3)	109 (9.6)	84 (7.3)

* Plus-minus values are means ±SD.

† These comparisons combine insertion-site groups from among the catheters that were randomized in the three-choice scheme with the relevant groups from the relevant two-choice scheme.

‡ Alcoholic chlorhexidine included 2% chlorhexidine with 70% isopropyl alcohol used in a one-step procedure, 0.5% chlorhexidine with 70% ethanol and 0.25% chlorhexidine, 0.025% benzalkonium chloride with 4% benzyl alcohol, both used in a four-step procedure. Alcoholic povidone–iodine included 5% povidone–iodine with 70% ethanol used in a four-step procedure. Aqueous povidone–iodine included 10% povidone–iodine used in a four-step procedure.

§ Other catheters were inserted with the use of ultrasonography.

¶ Results between groups were significant at $P<0.05$, as assessed with the use of generalized-estimating-equation models for each group comparison.

|| Systematic refers to catheter removal after a certain period to prevent catheter complications.

ORIGINAL ARTICLE

Intravascular Complications of Central Venous Catheterization by Insertion Site

Jean-Jacques Parienti, M.D., Ph.D., Nicolas Mongardon, M.D.,

BACKGROUND

Three anatomical sites are commonly used to insert central venous catheters, but insertion at each site has the potential for major complications.

METHODS

In this multicenter trial, we randomly assigned nontunneled central venous catheterization in patients in the adult intensive care unit (ICU) to the subclavian, jugular, or femoral vein (in a 1:1:1 ratio if all three insertion sites were suitable [three-choice scheme] and in a 1:1 ratio if two sites were suitable [two-choice scheme]). The primary outcome measure was a composite of catheter-related bloodstream infection and symptomatic deep-vein thrombosis.

Intravascular Complications of Central Venous Catheterization by Insertion Site

Jean-Jacques Parienti, M.D., Ph.D., Nicolas Mongardon, M.D.,

Catheterization was achieved by means of the Seldinger technique with the use of anatomical landmarks or ultrasonographic guidance. After

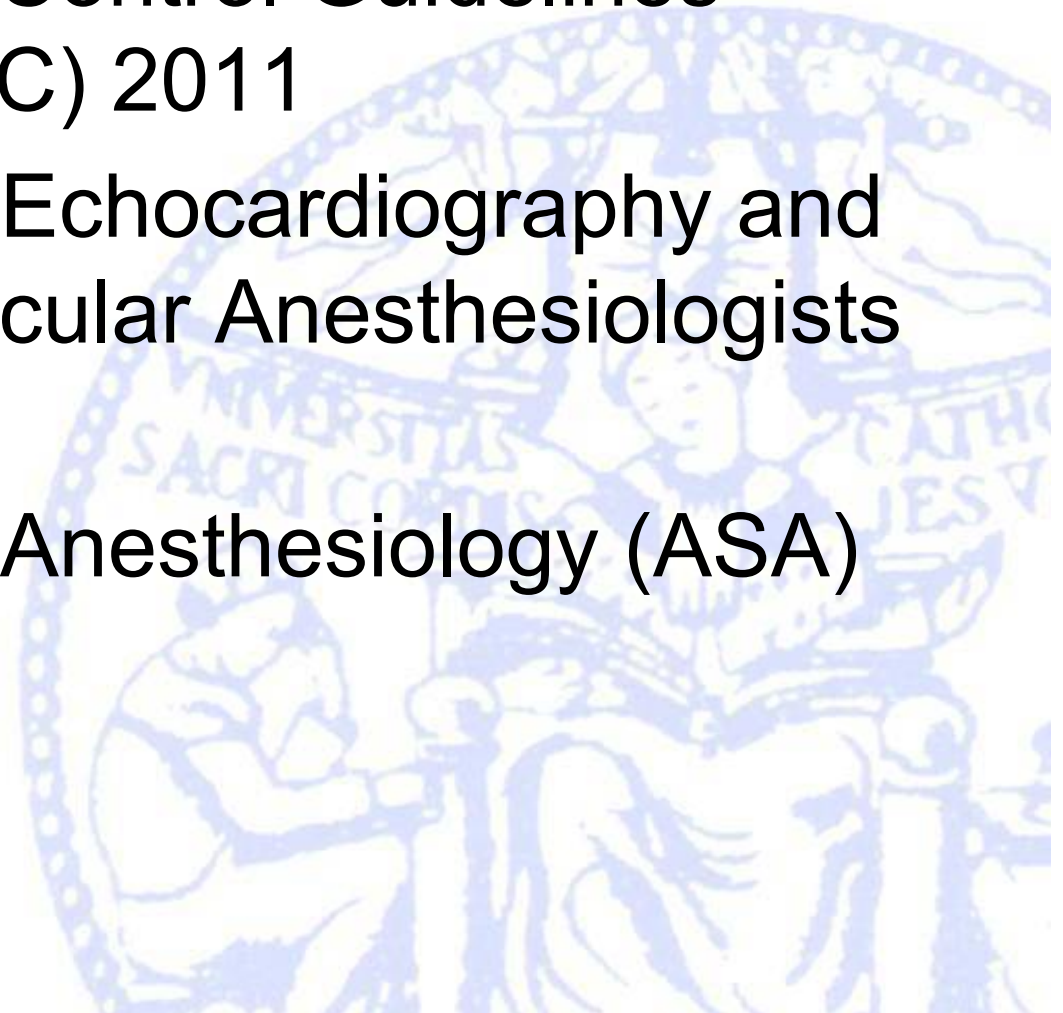
cedural characteristics are shown in Table 2. The use of anatomical landmarks was more frequent in the subclavian and femoral groups than in the jugular group. Catheterization was performed

In conclusion, in the 3SITES study, we found that catheterization of the subclavian vein was associated with a lower risk of the composite outcome of catheter-related bloodstream infection and symptomatic deep-vein thrombosis than that associated with catheterization of either the jugular vein or femoral vein. However, subclavian-vein catheterization was associated with a higher risk of mechanical complications, primarily pneumothorax.

INCIDENTI DI PERCORSO

...

- Centers for Disease Control Guidelines Prevention ICRI (CDC) 2011
- American Society of Echocardiography and Society of Cardiovascular Anesthesiologists (ASE-SCA) 2012
- American Society of Anesthesiology (ASA) 2012



Summary of Recommendations: Guidelines for the Prevention of Intravascular Catheter-related Infections

Naomi P. O'Grady,¹ Mary Alexander,² Lillian A. Burns,³ E. Patchen Dellinger,⁴ Jeffrey Garland,⁵ Stephen O. Heard,⁶ Pamela A. Lipsett,⁷ Henry Masur,¹ Leonard A. Mermel,⁸ Michele L. Pearson,⁹ Issam I. Raad,¹⁰ Adrienne G. Randolph,¹¹ Mark E. Rupp,¹² Sanjay Saint,¹³ and the Healthcare Infection Control Practices Advisory Committee (HICPAC) (Appendix 1)

7. Use ultrasound guidance to place central venous catheters (if this technology is available) to reduce the number of cannulation attempts and mechanical complications. Ultrasound guidance should only be used by those fully trained in its technique. [60–64]. Category 1B



Centers for Disease Control and Prevention

Your Online Source for Credible Health Information

Guidelines for Performing Ultrasound Guided Vascular Cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

January 2012 • Volume 114 • Number 1

ANESTHESIA & ANALGESIA

Christopher A. Troianos, MD, Gregg S. Hartman, MD, Kathryn E. Glas, MD, MBA, FASE,

7.4. Recommendation for IJ Vein Cannulation

It is recommended that properly trained clinicians use real-time ultrasound during IJ cannulation whenever possible to improve cannulation success and reduce the incidence of complications associated with the insertion of large-bore catheters. This recommendation is based on category A, level 1 evidence.

The writing committee recognizes that static ultrasound (when not used in real time) is useful for the identification of vessel anatomy by skin-marking the optimal entry site for vascular access and for the identification of vessel thrombosis and is superior to a landmark-guided technique.

Guidelines for Performing Ultrasound Guided Vascular Cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

January 2012 • Volume 114 • Number 1

ANESTHESIA & ANALGESIA

Christopher A. Troianos, MD, Gregg S. Hartman, MD, Kathryn E. Glas, MD, MBA, FASE,

8.4. Recommendation for SC Vein Cannulation

Current literature does not support the routine use of ultrasound for uncomplicated patients undergoing SC vein cannulation. Individual operators should not attempt cannulation more than twice, as the incidence of complication, particularly pneumothorax, rises significantly with additional attempts. *High-risk patients may benefit from ultrasound screening of the SC vein before attempted cannulation to identify vessel location and patency and to specifically identify thrombus before attempted cannulation.* The recommendation for ultrasound guidance during SC vein cannulation is based on category A (supportive), level 3 evidence.

Guidelines for Performing Ultrasound Guided Vascular Cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

January 2012 • Volume 114 • Number 1

ANESTHESIA & ANALGESIA

Christopher A. Troianos, MD, Gregg S. Hartman, MD, Kathryn E. Glas, MD, MBA, FASE,

9.4. Recommendation for FV Cannulation

The scientific evidence for real-time ultrasound-guided FV cannulation is category C, level 2: equivocal with insufficient scientific evidence to support a recommendation for routine use. In addition, complications during FV cannulation are less severe than those that occur with SC and IJ vein cannulation. It is therefore the recommendation of this writing committee that real-time ultrasound be used only for examining the FV to identify vessel overlap and patency when feasible.

Guidelines for Performing Ultrasound Guided Vascular Cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

January 2012 • Volume 114 • Number 1

ANESTHESIA & ANALGESIA

Christopher A. Troianos, MD, Gregg S. Hartman, MD, Kathryn E. Glas, MD, MBA, FASE,

10.2. Recommendations for Pediatric Patients

It is the recommendation of this writing committee that trained clinicians use real-time ultrasound during IJ cannulation whenever possible to improve cannulation success and reduce the incidence of complications associated with the insertion of large-bore catheters in pediatric patients. This recommendation is based on category A, level 1 supportive literature. It is also the recommendation of this council that trained clinicians use real-time ultrasound during FV cannulation whenever possible to improve cannulation success and reduce the incidence of complications associated with insertion of large-bore catheters in pediatric patients. This is a category C, level 2 recommendation.



Practice Guidelines for Central Venous Access

A Report by the American Society of Anesthesiologists Task Force on Central Venous Access

Anesthesiology 2012; 116:539-73

***Selection of insertion site
“based on clinical need
and practitioner
judgment, experience,
and skill”.***

Recommendations for Guidance and Verification of Needle, Wire, and Catheter Placement

The following steps are recommended for prevention of mechanical trauma during needle, wire, and catheter placement in elective situations:

- Use static ultrasound imaging before prepping and draping for prepuncture identification of anatomy to determine vessel localization and patency when the internal jugular vein is selected for cannulation. Static ultrasound may be used when the subclavian or femoral vein is selected.
- Use real time ultrasound guidance for vessel localization and venipuncture when the internal jugular vein is selected for cannulation (see fig. 1). Real-time ultrasound may be used when the subclavian or femoral vein is selected. The Task Force recognizes that this approach may not be feasible in emergency circumstances or in the presence of other clinical constraints.
- After insertion of a catheter that went over the needle or a thin-wall needle, confirm venous access.^{††} Methods for confirming that the catheter or thin-wall needle resides in the vein include, but are not limited to, ultrasound, manometry, pressure-waveform analysis, or venous blood gas measurement. Blood color or absence of pulsatile flow

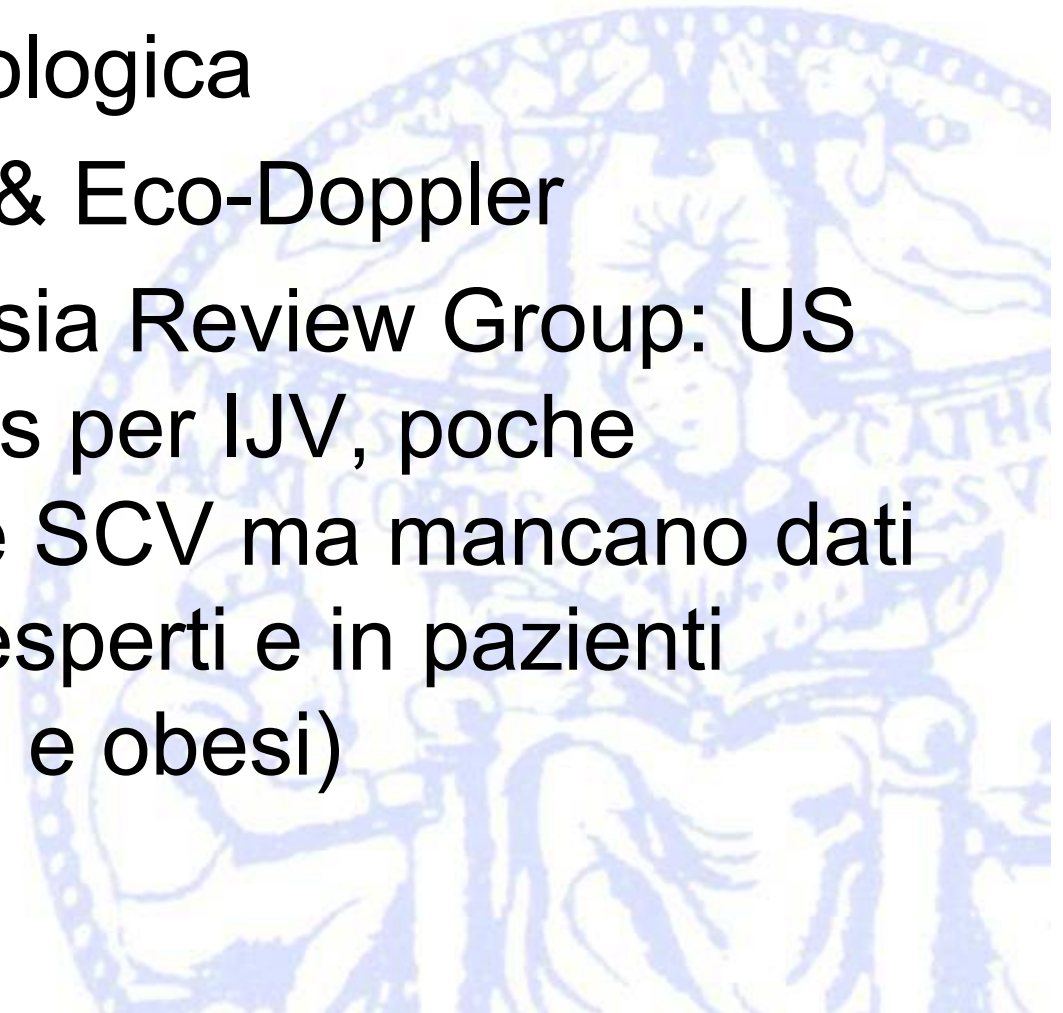
???

- **Perché la puntura ecoguidata non è ancora recepita come standard?**



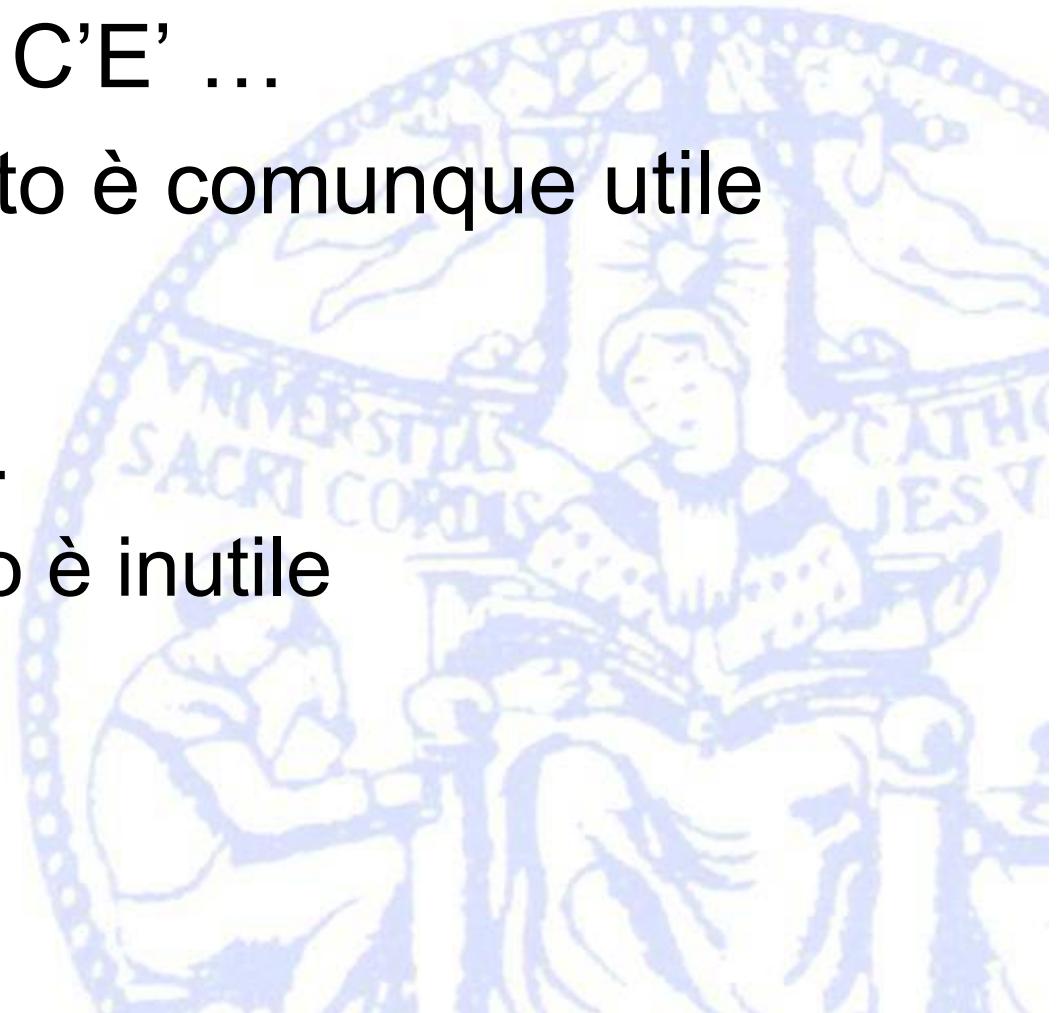
Lack of EBM

- Non ci sono molti studi fatti bene
- Confusione terminologica
- Ecografia B-mode & Eco-Doppler
- Cochrane Anesthesia Review Group: US meglio di landmarks per IJV, poche differenze per FV e SCV ma mancano dati su operatori poco esperti e in pazienti difficili (es. bambini e obesi)



I paradossi dell'EBM

- L'EVIDENZA NON C'E' ...
... ma l'intervento è comunque utile
- L'EVIDENZA C'E' ...
... ma l'intervento è inutile



Utilizzare l'EBM “cum grano salis”

Hazardous journeys

Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomised controlled trials

Gordon C S Smith, Jill P Pell

BMJ VOLUME 327 20–27 DECEMBER 2003 bmj.com

Abstract

Objectives To determine whether parachutes are effective in preventing major trauma related to gravitational challenge.

Design Systematic review of randomised controlled trials.

Data sources: Medline, Web of Science, Embase, and the Cochrane Library databases; appropriate internet sites and citation lists.

Study selection: Studies showing the effects of using a parachute during free fall.

Main outcome measure Death or major trauma, defined as an injury severity score > 15 .

Results We were unable to identify any randomised controlled trials of parachute intervention.

Conclusions As with many interventions intended to prevent ill health, the effectiveness of parachutes has not been subjected to rigorous evaluation by using randomised controlled trials. Advocates of evidence based medicine have criticised the adoption of interventions evaluated by using only observational data. We think that everyone might benefit if the most radical protagonists of evidence based medicine organised and participated in a double blind, randomised, placebo controlled, crossover trial of the parachute.

accepted intervention was a fabric device, secured by strings to a harness worn by the participant and released (either automatically or manually) during free fall with the purpose of limiting the rate of descent. We excluded studies that had no control group.

Definition of outcomes

The major outcomes studied were death or major trauma, defined as an injury severity score greater than 15.⁶

Meta-analysis

Our statistical approach was to assess outcomes in parachute and control groups by odds ratios and quantified the precision of estimates by 95% confidence intervals. We chose the Mantel-Haenszel test to assess heterogeneity, and sensitivity and subgroup analyses and fixed effects weighted regression techniques to explore causes of heterogeneity. We selected a funnel plot to assess publication bias visually and Egger's and Begg's tests to test it quantitatively. Stata software, version 7.0, was the tool for all statistical analyses.

Results

Our search strategy did not find any randomised controlled trials of the parachute.



Parachutes reduce the risk of injury after gravitational challenge, but their effectiveness has not been proved with randomised controlled trials



A survey of the use of ultrasound guidance in internal jugular venous cannulation*

T. McGrattan,¹ J. Duffy,² J. S. Green³ and N. O'Donnell⁴

Table 5 Availability of ultrasound within 5 min.

Theatres	1146 (78%)
Intensive care unit	1128 (77%)
Emergency medicine department	426 (29%)

Table 6 Use of ultrasound as first choice throughout UK.

England	253 (24%)
Scotland	38 (23%)
Wales	17 (26%)
Northern Ireland	5 (11%)



This survey suggests a discrepancy between 'best care' as promoted by NICE and everyday practice within the UK. It remains unclear whether patients are being harmed because of the lack of ultrasound



ORIGINAL CONTRIBUTION

Use of Ultrasound Guidance for Central Venous Catheter Placement: Survey From the American Board of Emergency Medicine Longitudinal Study of Emergency Physicians

Matthew S. Buchanan, DO, Brandon Backlund, MD, Michael M. Liao, MD, MSc, Jun Sun, MS, Rita K. Cydulka, MD, MS, Rebecca Smith-Coggins, MD, and John Kendall, MD

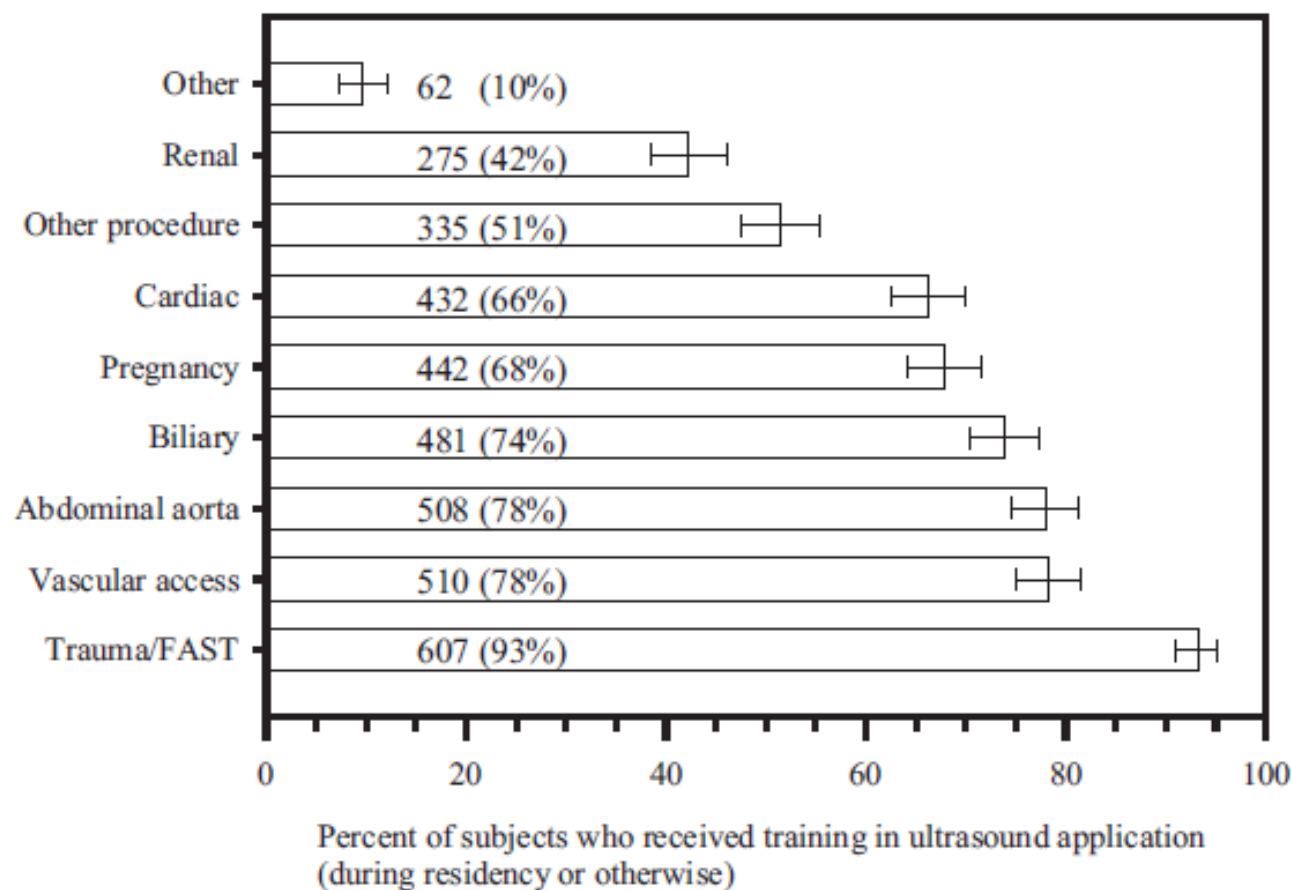
Use of US to Guide CVC Placement

Respondents reported placing anywhere from 0% to 100% of their CVCs using US guidance; 361 of 814 (44%) said 0%, 317 of 814 (49%) said at least 50%, 160 of 814 (20%) said at least 90%, and 73 of 814 (9%) said 100%. Fifty-two of 866 (6%) did not answer this question. Excluding respondents who never use US

ORIGINAL CONTRIBUTION

Use of Ultrasound Guidance for Central Venous Catheter Placement: Survey From the American Board of Emergency Medicine Longitudinal Study of Emergency Physicians

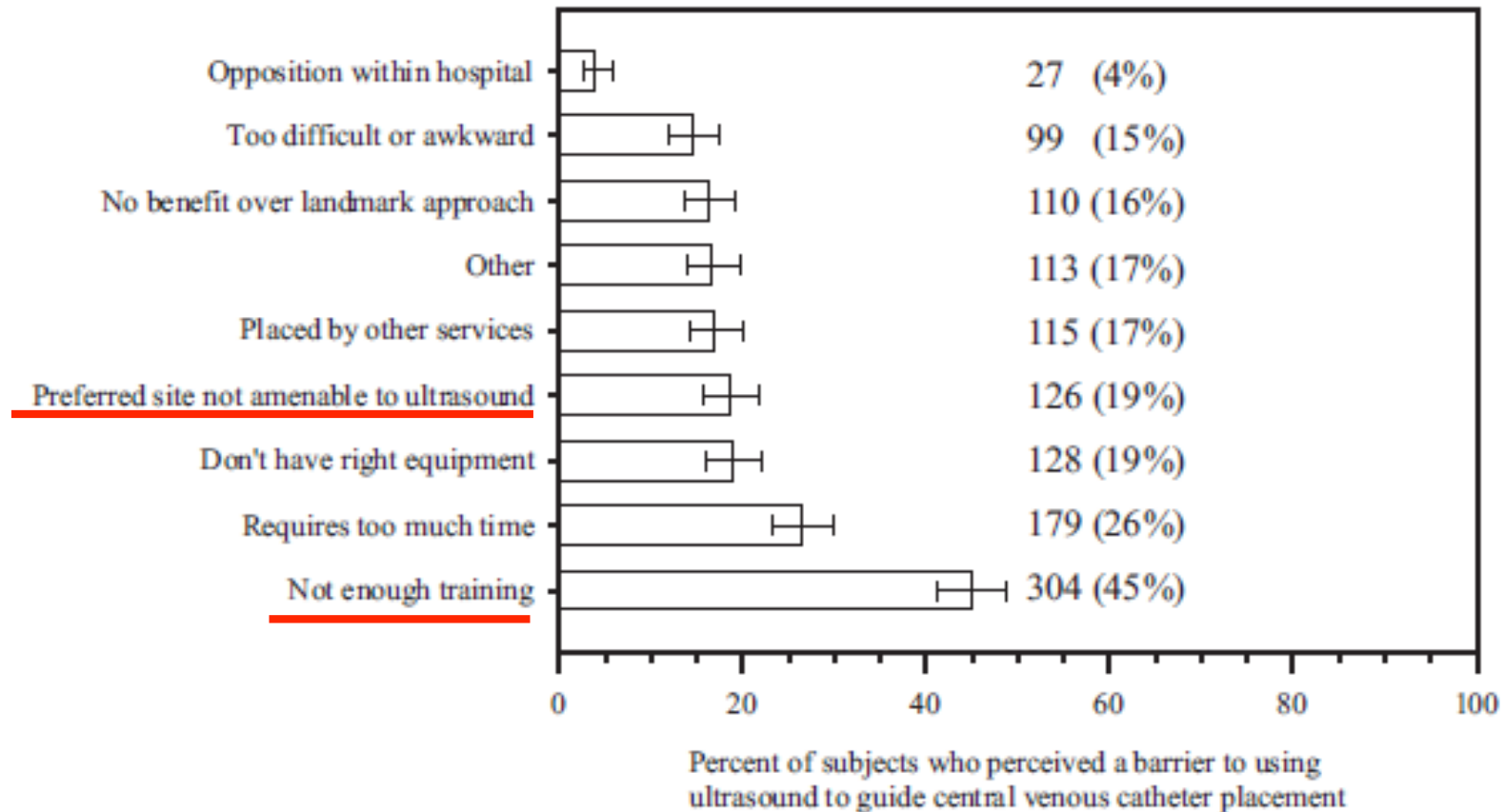
Matthew S. Buchanan, DO, Brandon Backlund, MD, Michael M. Liao, MD, MSc, Jun Sun, MS, Rita K. Cydulka, MD, MS, Rebecca Smith-Coggins, MD, and John Kendall, MD



ORIGINAL CONTRIBUTION

Use of Ultrasound Guidance for Central Venous Catheter Placement: Survey From the American Board of Emergency Medicine Longitudinal Study of Emergency Physicians

Matthew S. Buchanan, DO, Brandon Backlund, MD, Michael M. Liao, MD, MSc, Jun Sun, MS, Rita K. Cydulka, MD, MS, Rebecca Smith-Coggins, MD, and John Kendall, MD





ORIGINAL CONTRIBUTION

Use of Ultrasound Guidance for Central Venous Catheter Placement: Survey From the American Board of Emergency Medicine Longitudinal Study of Emergency Physicians

Matthew S. Buchanan, DO, Brandon Backlund, MD, Michael M. Liao, MD, MSc, Jun Sun, MS, Rita K. Cydulka, MD, MS, Rebecca Smith-Coggins, MD, and John Kendall, MD

CONCLUSIONS

Among emergency physicians, the translation of evidence to clinical practice regarding the benefits of ultrasound guidance for central venous catheter placement is poor and still faces many barriers. Training and education are potentially the best ways to overcome such barriers.

Inadvertent Carotid Artery Cannulation During Ultrasound Guided Central Venous Catheterization

Michael B. Stone, MD, RDMS



US-GUIDED COMPLICATIONS ?

An unseen danger: Frequency of posterior vessel wall penetration by needles during attempts to place internal jugular vein central catheters using ultrasound guidance*

Michael Blaivas, MD, RD, MS; Srikar Adhikari, MD, RDMS

Crit Care Med 2009 Vol. 37, No. 8

*Inadvertent cannulation of a
metastatic cystic lymph node during
ultrasound guided central venous
catheter insertion*

Charoo Sekhri FRCA

CAN J ANESTH 54: 8 www.cja-jca.org August, 2007



Fig 1. CT radiograph of mid-cervical region

- “... the use of ultrasound remains highly **operator-dependent**, despite technological advances.”

Ultrasound Training
Recommendations for Medical
and Surgical Specialties



- Complications during US-guided CVC placement can occur
- Understanding how these complications can occur provides the operator with a mechanism to prevent their occurrence
- Operator **training** and experience are important in determining the complications associated with the procedure

Before we go too far: Ultrasound-guided central catheter placement* AB Levitov Crit Care Med 2009 Vol. 37, No. 8

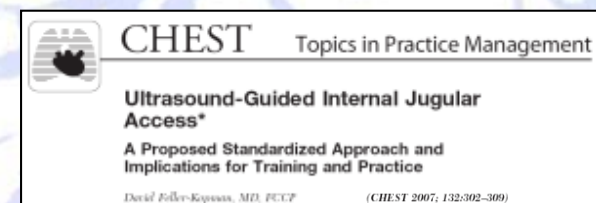
- Operator **inexperience** or the use of unsuitable equipment, particularly in the more challenging patient, may increase rather than decrease complications

British Journal of Anaesthesia 96 (4): 414–17 (2006)
doi:10.1093/bja/ae032

Editorial II A. R. Bodenham

Ultrasound imaging by anaesthetists: training and accreditation issues

- There is a **learning curve** associated with sonography, and guidance based on misinformation can harm our patients



Ultrasound Guidance & Training

“It is therefore our responsibility to develop training guidelines and incorporate them into our daily practice as well as our fellowship programs”



CHEST

Topics in Practice Management

Ultrasound-Guided Internal Jugular Access*

A Proposed Standardized Approach and Implications for Training and Practice

(CHEST 2007; 132:302–309)

D. Feller-Kopman 2007

La Consensus WoCoVA

British Journal of Anaesthesia Page 1 of 10
doi:10.1093/bja/aes499

BJA

Evidence-based consensus on the insertion of central venous access devices: definition of minimal requirements for training

N. Moureau¹, M. Lamperti^{2*}, L. J. Kelly³, R. Dawson⁴, M. Elbarbary⁵, A. J. H. van Boxtel⁶ and M. Pittiruti⁷



Training in US Guided VA Today

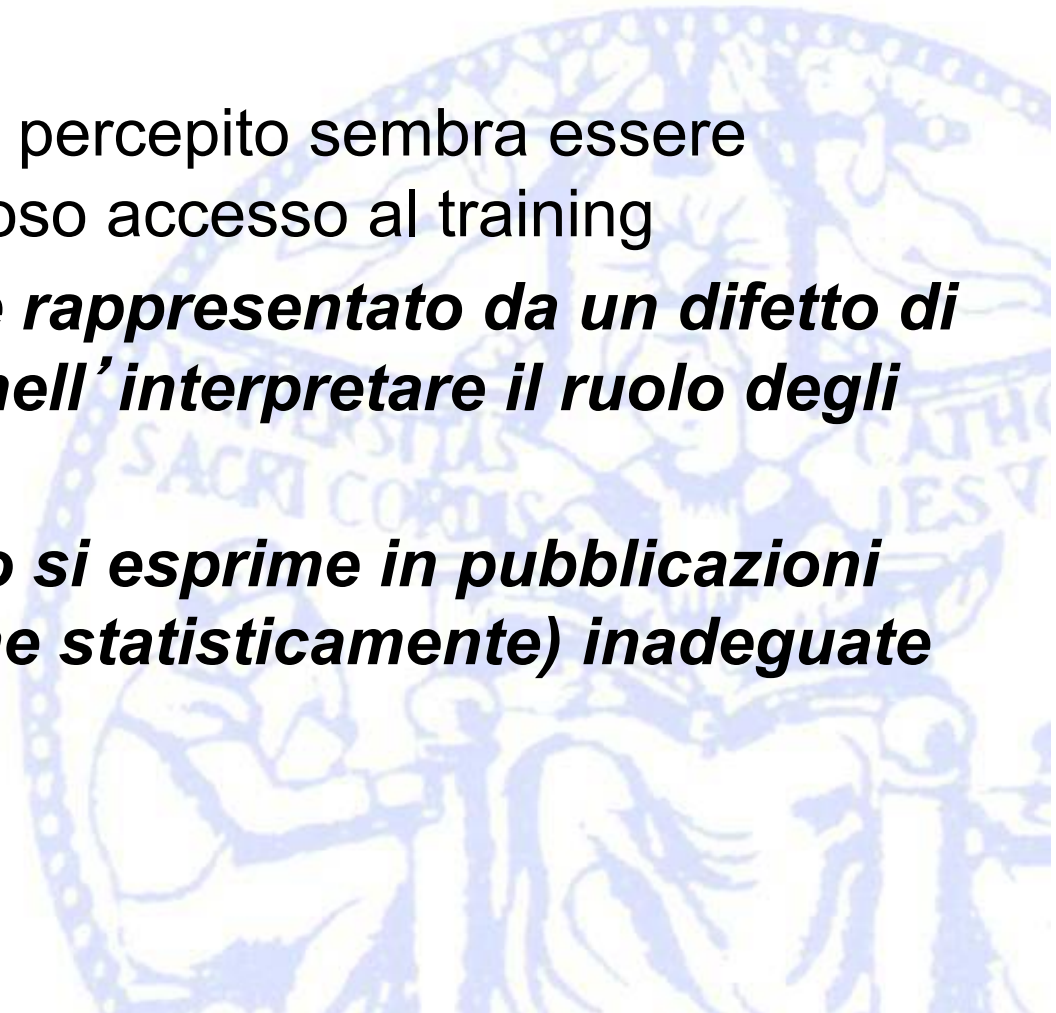
- Didactic Lectures = Knowledge
- Laboratory Training
 - Ultrasound examination on healthy volunteer
 - Hands-on Simulation
- Proctoring Phase
 - Direct observation
 - **Tutored procedures on real patients**
- **Personal ‘untutored’ Learning Curve**
- Final Clinical Audit

Simulation
Training

Clinical Training

Conclusioni

- La diffusione dell' ecoguida fra gli operatori è ancora incompleta
- L' ostacolo maggiormente percepito sembra essere rappresentato dal difficoltoso accesso al training
- ***Un ostacolo «occulto» è rappresentato da un difetto di evoluzione «culturale» nell'interpretare il ruolo degli ultrasuoni***
- ***Questo ostacolo occulto si esprime in pubblicazioni concettualmente (più che statisticamente) inadeguate***



Grazie

