



***Metodi radiologici
vs.
Metodi ecografici
nella diagnosi delle
COMPLICANZE
associate agli accessi
venosi***

Elisei Daniele
U.O. Anestesia e Rianimazione
AREA VASTA 3, MACERATA

REVIEW ARTICLE

Central Venous Access Catheters: Radiological Management of Complications

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Potential complications associated with central venous access devices

Complications	Periprocedural	Early postprocedural	Late postprocedural
Procedural			
Arterial puncture	+	—	—
Air embolism	+	+	+
Pneumothorax	++	+	—
Hematoma	++	+	—
Perforation (heart, great vessels)	+	+	+
Cardiac arrhythmias	+	+	+
Plexus irritations	+	+	—
Device related			
Catheter dislocation/migration/malposition	+	+	+
Pinch-off syndrome	—	++	+++
Catheter fracture/embolism	+	++	++
Fibrin sheath formation	—	+	++
Catheter thrombosis	—	+	+
Migration/torsion of port reservoir	+	+	+
Vascular			
Thrombosis	—	++	+++
Arterio-venous fistula	+	+	+
Infection			
Skin necrosis/affection	—	++	++

Complications were classified according to the time point of appearance.

Complicanze periprocedurali

- 5-19% **NEJM 2003;348:1123-33**
- 7% **ICM 2007;33(6):1055-9**
- 19,5% **Minerva Anesthesiol 2012;78:1234-40**
- 7,5% **Intern Med J 2012;42(8):901-6**
- 0,7-2,1% **NEJM 2015;373:1220-9**

Complicanze periprocedurali con ecografia



J Ultrasound (2013) 16:161–170
DOI 10.1007/s40477-013-0046-5

REVIEW

Ultrasonography as a guide during vascular access procedures and in the diagnosis of complications

A. Vezzani • T. Manca • A. Vercelli •
A. Braghieri • A. Magnacavallo



- **0% ICM 2013**
- **2% Crit Care Med 2011**
- **0,3 % World Journal of Surgical Oncology 2010**
- **1,5% Crit Care 2006**

Saugel et al. *Critical Care* (2017) 21:225
DOI 10.1186/s13054-017-1814-y

Critical Care

REVIEW

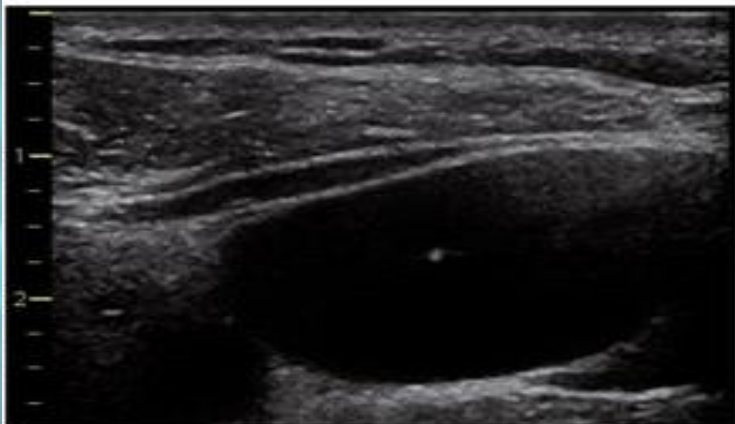
Open Access

Ultrasound-guided central venous catheter placement: a structured review and recommendations for clinical practice

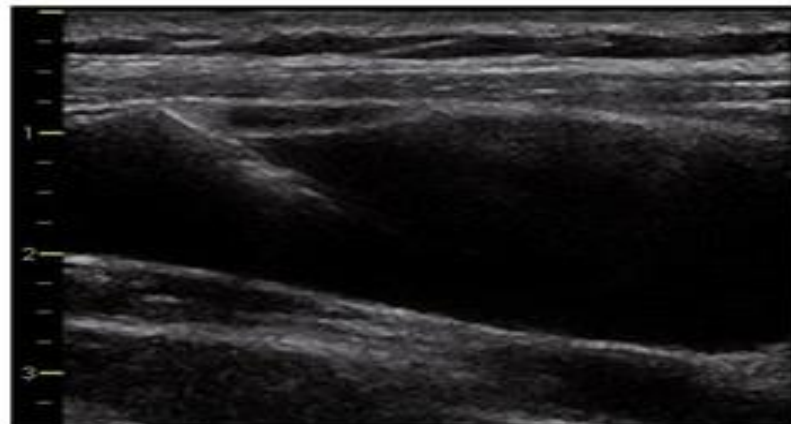


Bernd Saugel^{1*} , Thomas W. L. Scheeren² and Jean-Louis Teboul³

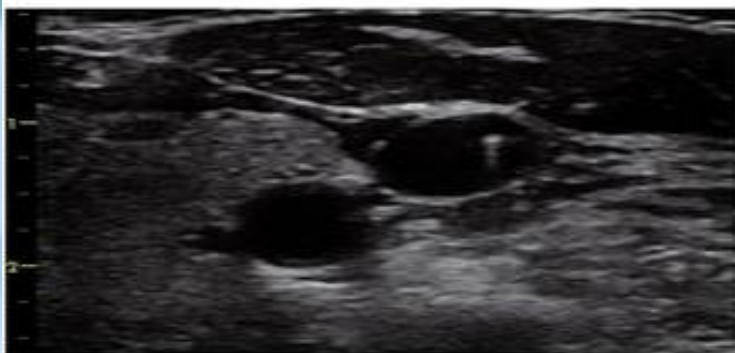
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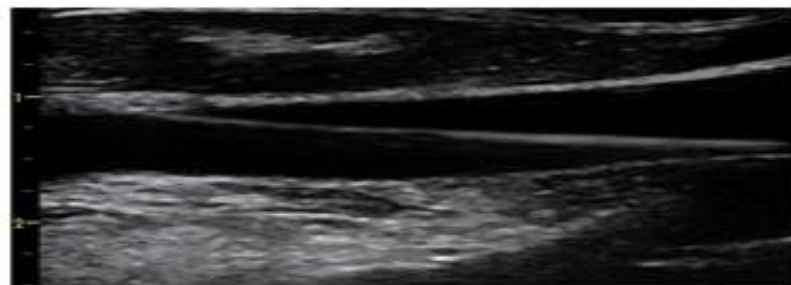
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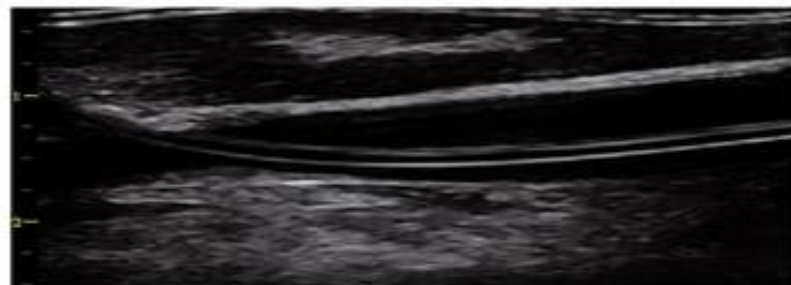
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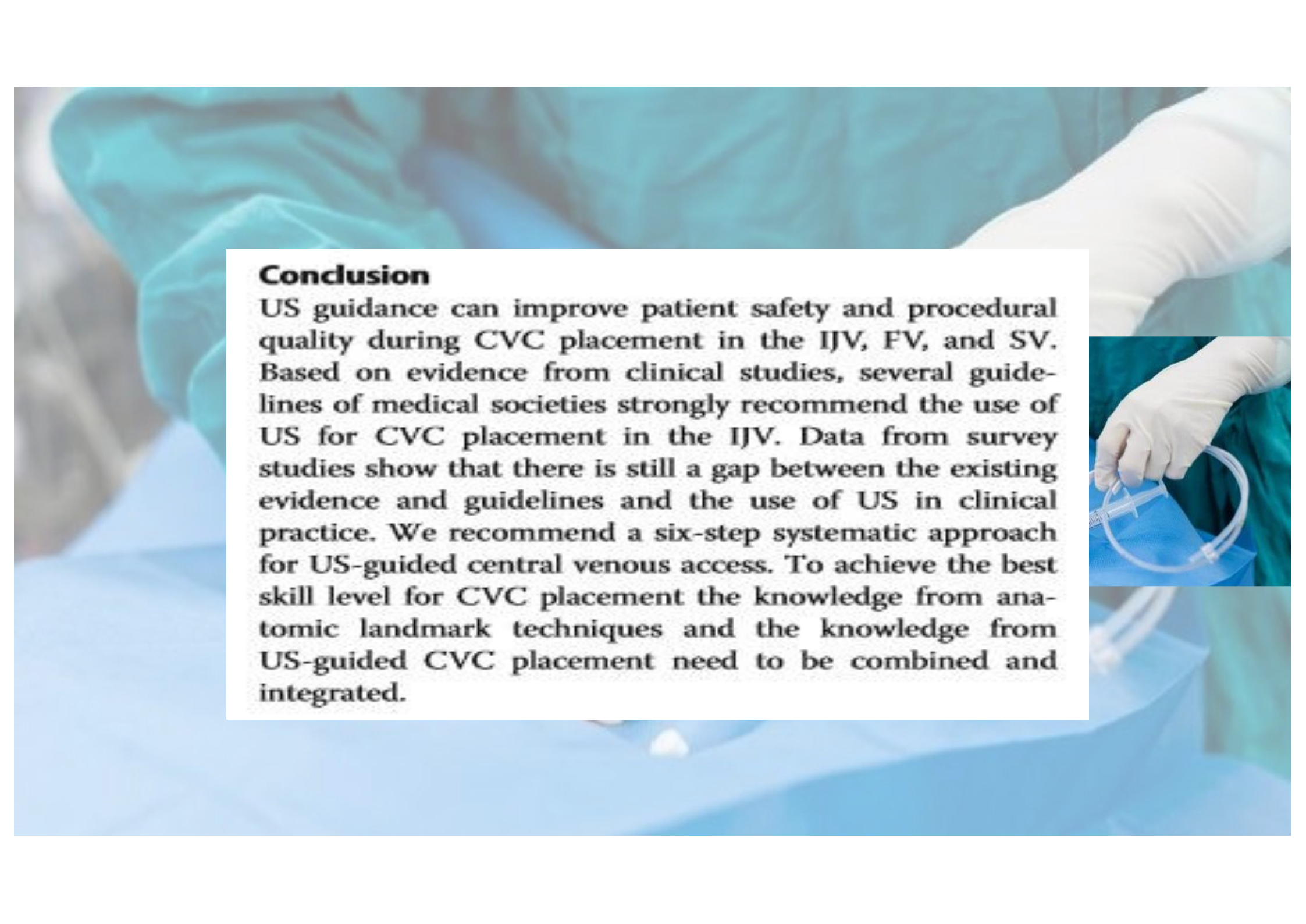


e



f





Conclusion

US guidance can improve patient safety and procedural quality during CVC placement in the IJV, FV, and SV. Based on evidence from clinical studies, several guidelines of medical societies strongly recommend the use of US for CVC placement in the IJV. Data from survey studies show that there is still a gap between the existing evidence and guidelines and the use of US in clinical practice. We recommend a six-step systematic approach for US-guided central venous access. To achieve the best skill level for CVC placement the knowledge from anatomic landmark techniques and the knowledge from US-guided CVC placement need to be combined and integrated.

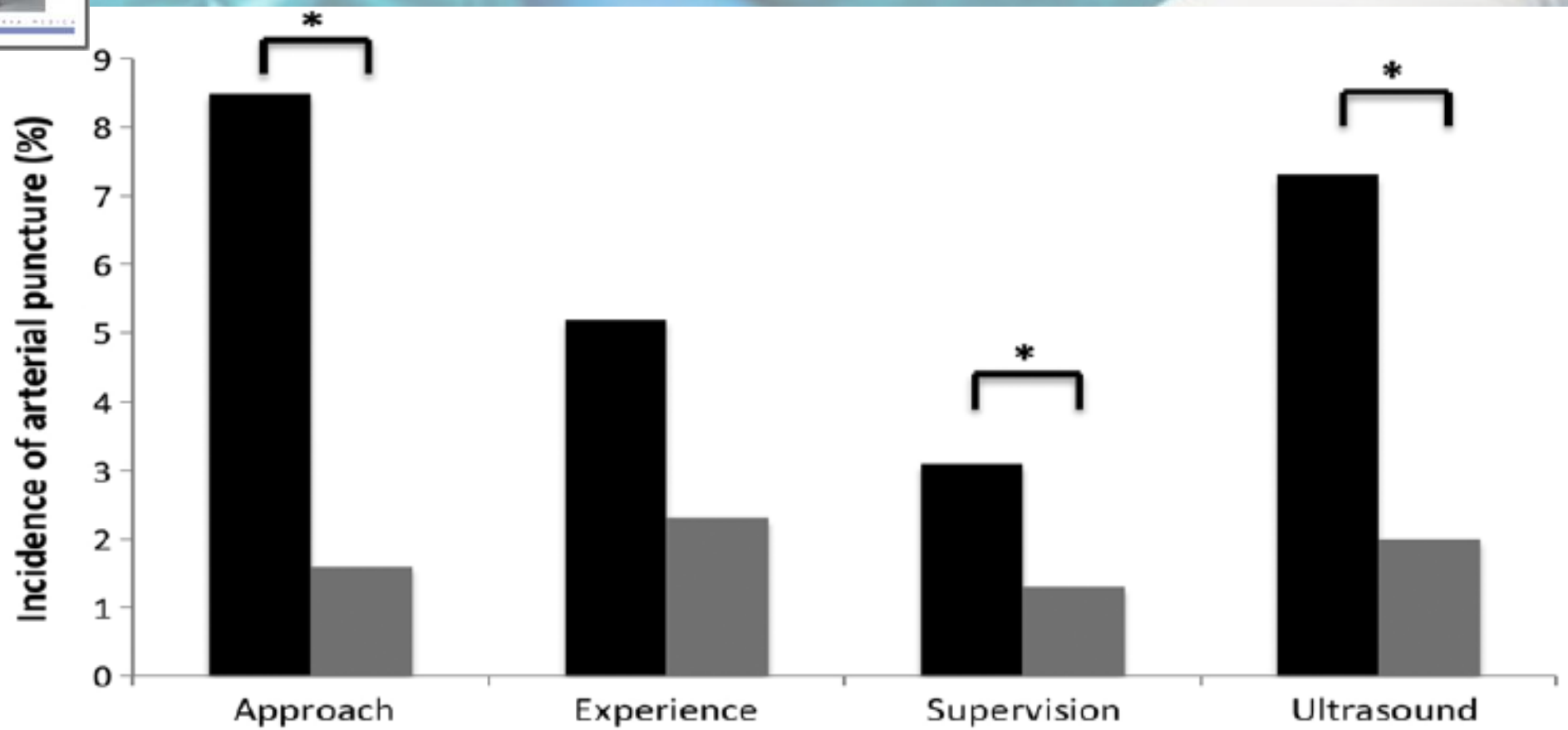
Journal of Hospital Medicine

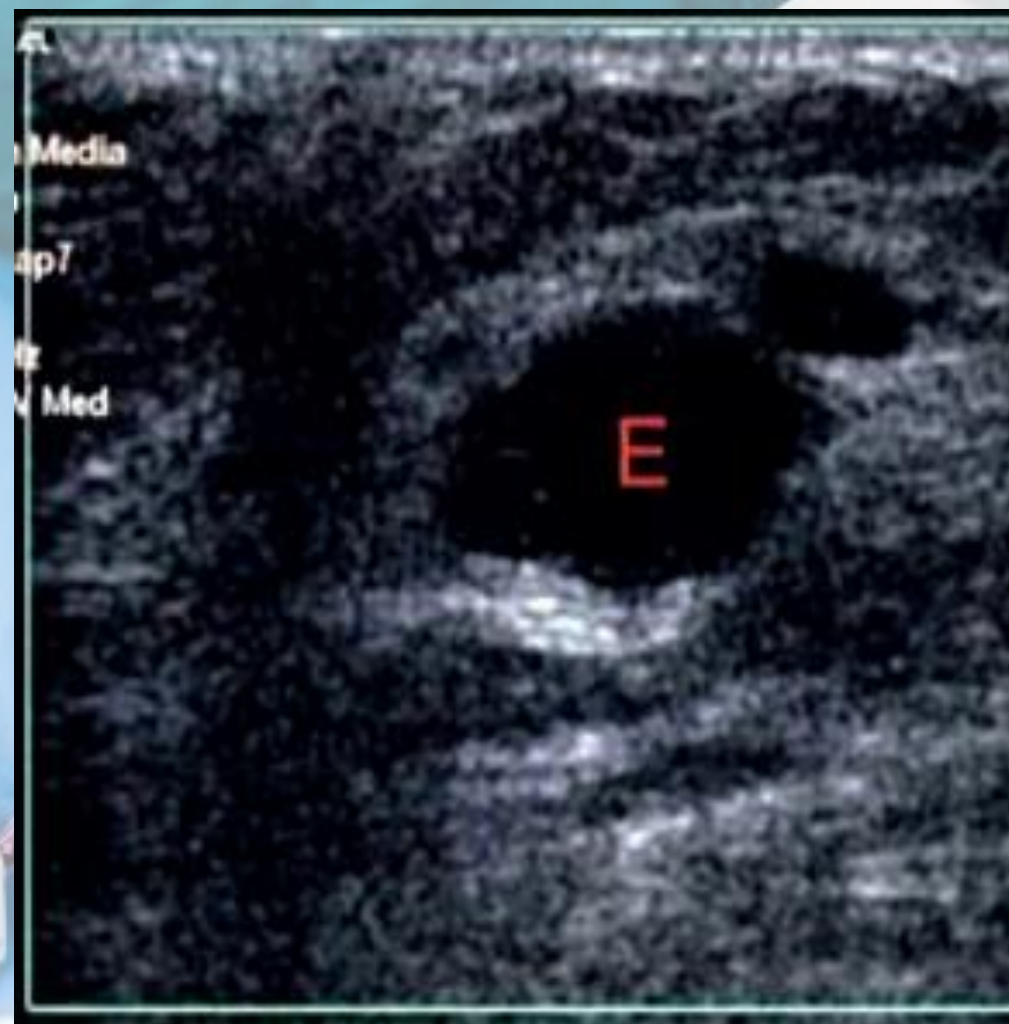
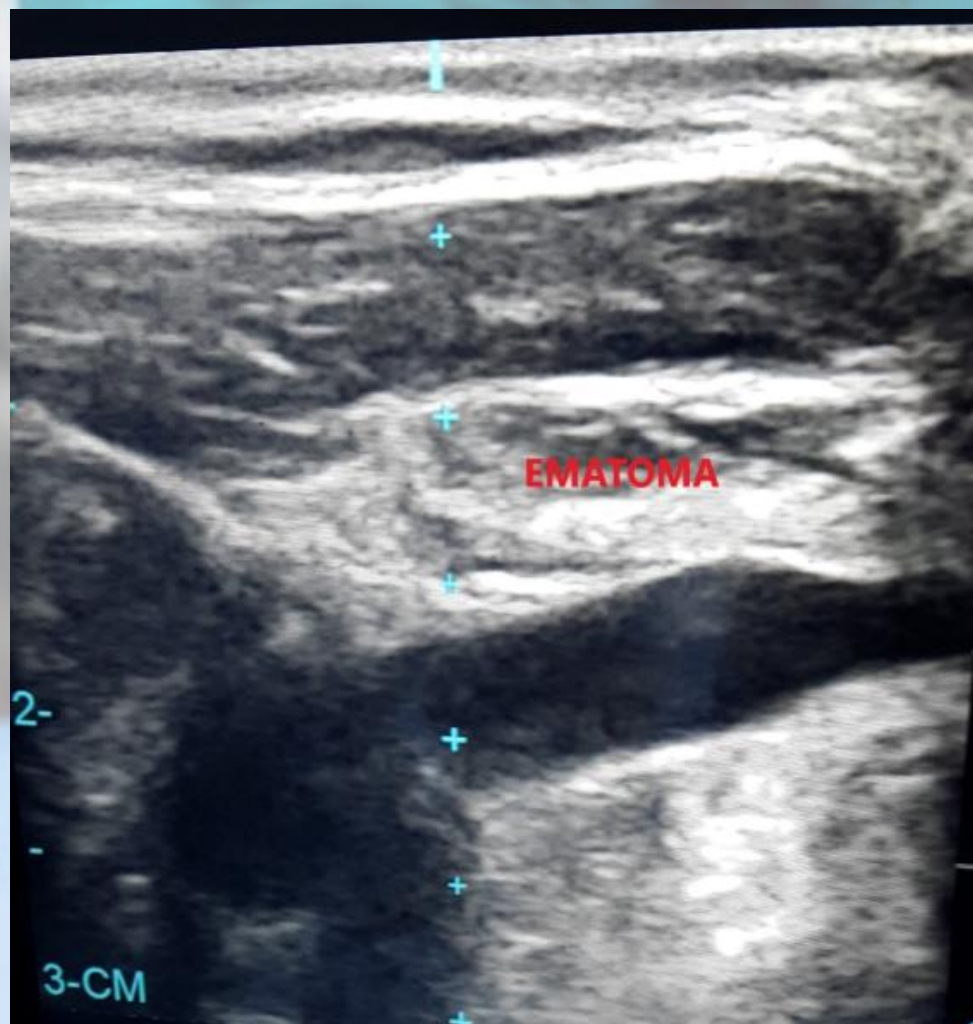


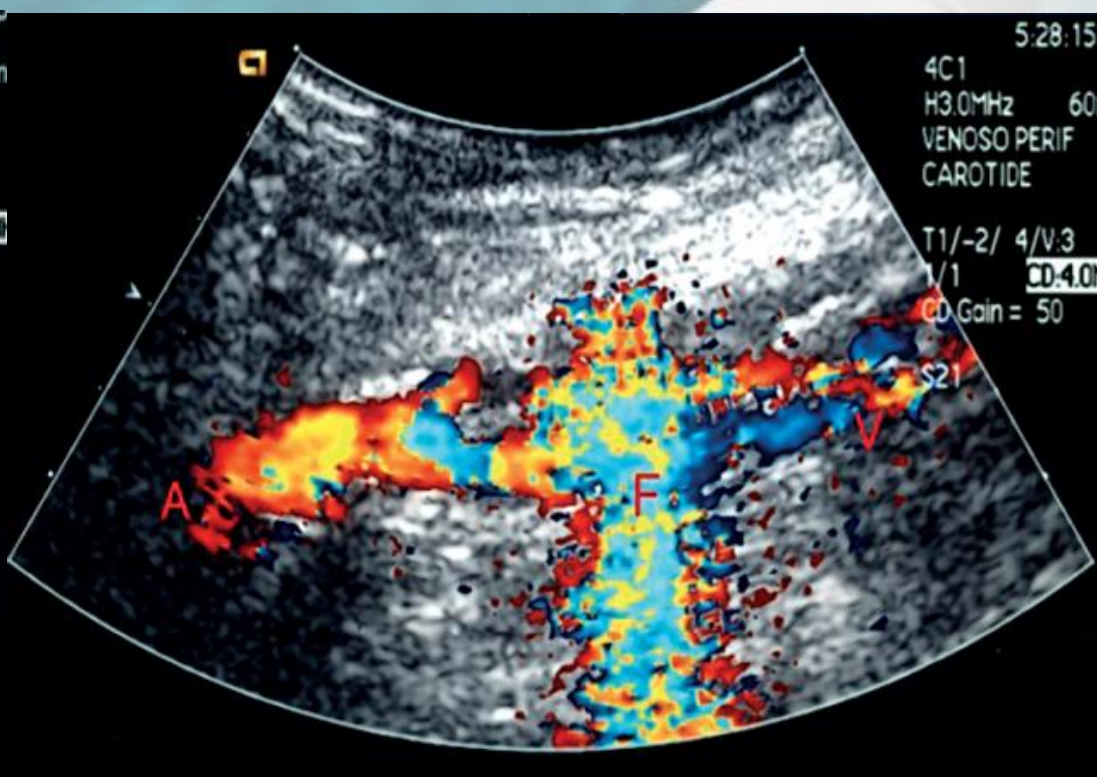
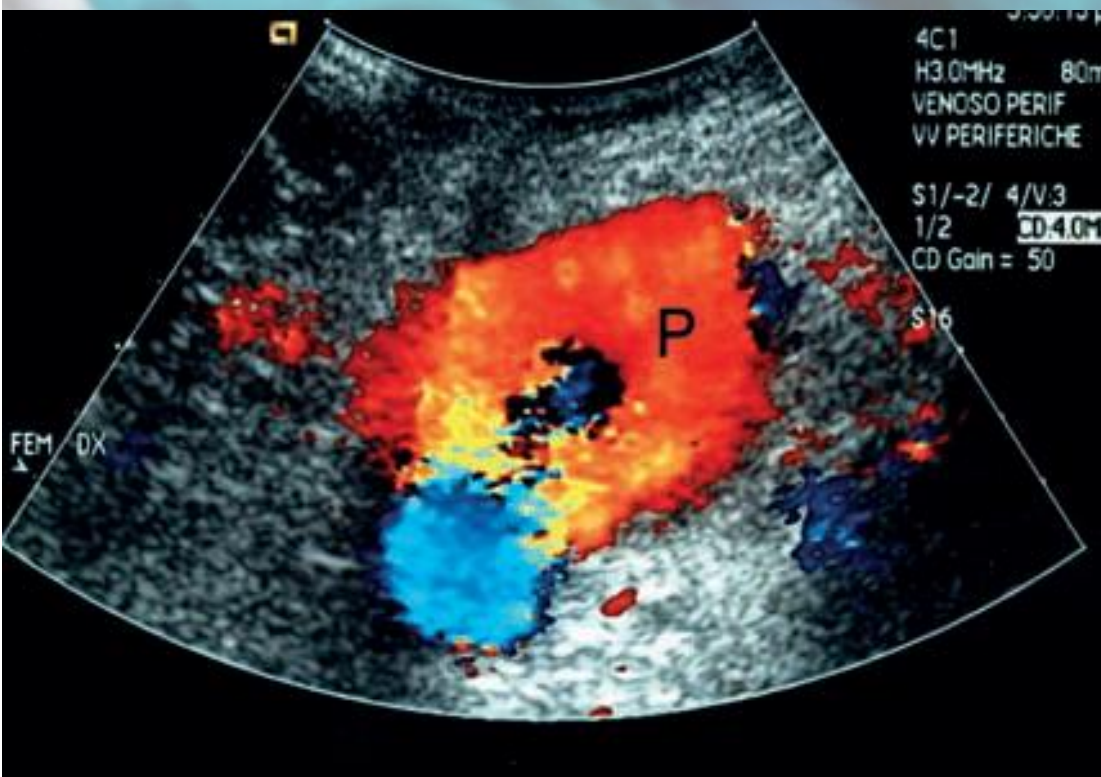
20	Use real-time ultrasound guidance for radial artery access to increase the first-pass success rate, reduce the time to cannulation, and reduce the risk of complications.	Very Good	Strong
Postprocedure			
21	Rule out postprocedure pneumothorax by detection of bilateral lung sliding using a high-frequency linear transducer.	Very Good	Strong
22	Use ultrasound with rapid infusion of agitated saline to visualize a right atrial swirl sign to detect catheter tip misplacement during CVC insertion.	Very Good	Strong

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Puntura arteriosa accidentale







Pseudoaneurisma

Fistola artero-venosa



Fig 1. Chest radiograph shows right superior mediastinal mass with ipsilateral pleural effusion.



Fig 2. Computed tomography scan shows the guidewire entangled inside the superior vena cava hematoma.

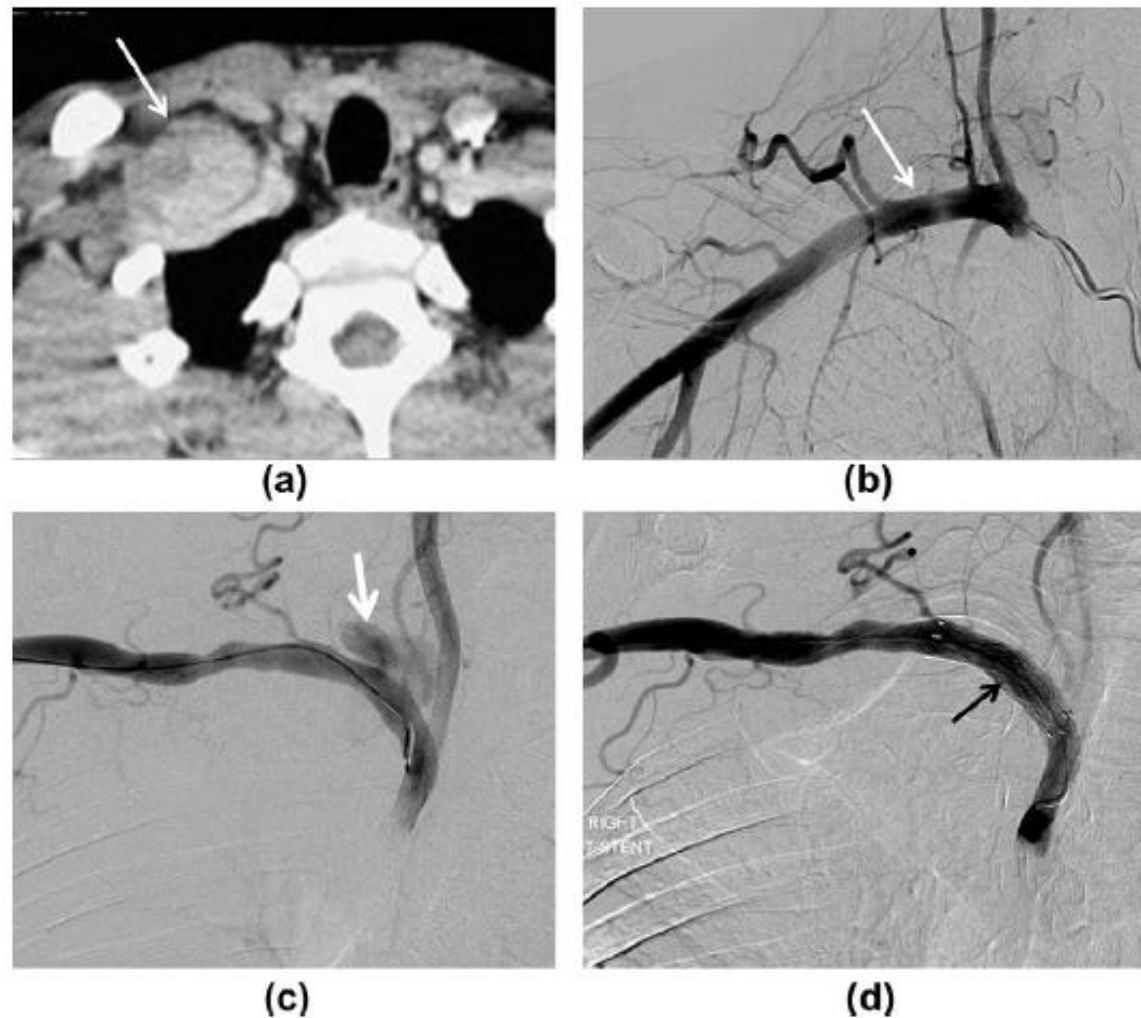


Figure 4 Arterial puncture in a 34-year-old man who had inadvertent puncture of the right subclavian artery during blind insertion of a CVC. Axial reformatted image of a CT angiogram (a) showed a large pseudoaneurysm (arrow) arising from the right subclavian artery caused by the arterial puncture. This was treated by temporary subclavian artery balloon occlusion of the neck of the aneurysm. Digital subtraction angiogram (DSA) (b) after the balloon-assisted thrombosis showed complete exclusion of the pseudoaneurysm (arrow) and patency of the right subclavian artery. (c–d) Arterial puncture in a 74-year-old man who had a right IJV CVC with inadvertent arterial puncture. Subsequent DSA (c) showed

Delayed malposition of a double-lumen hemodialysis catheter that caused hemorrhage and hypovolemic shock

A case report

I-Chen Chen, MD^a, Shih-Chia Yang, MD^a, Kuan-Ting Liu, MD^{a,b}, Yen-Hung Wu, MD^{a,*}



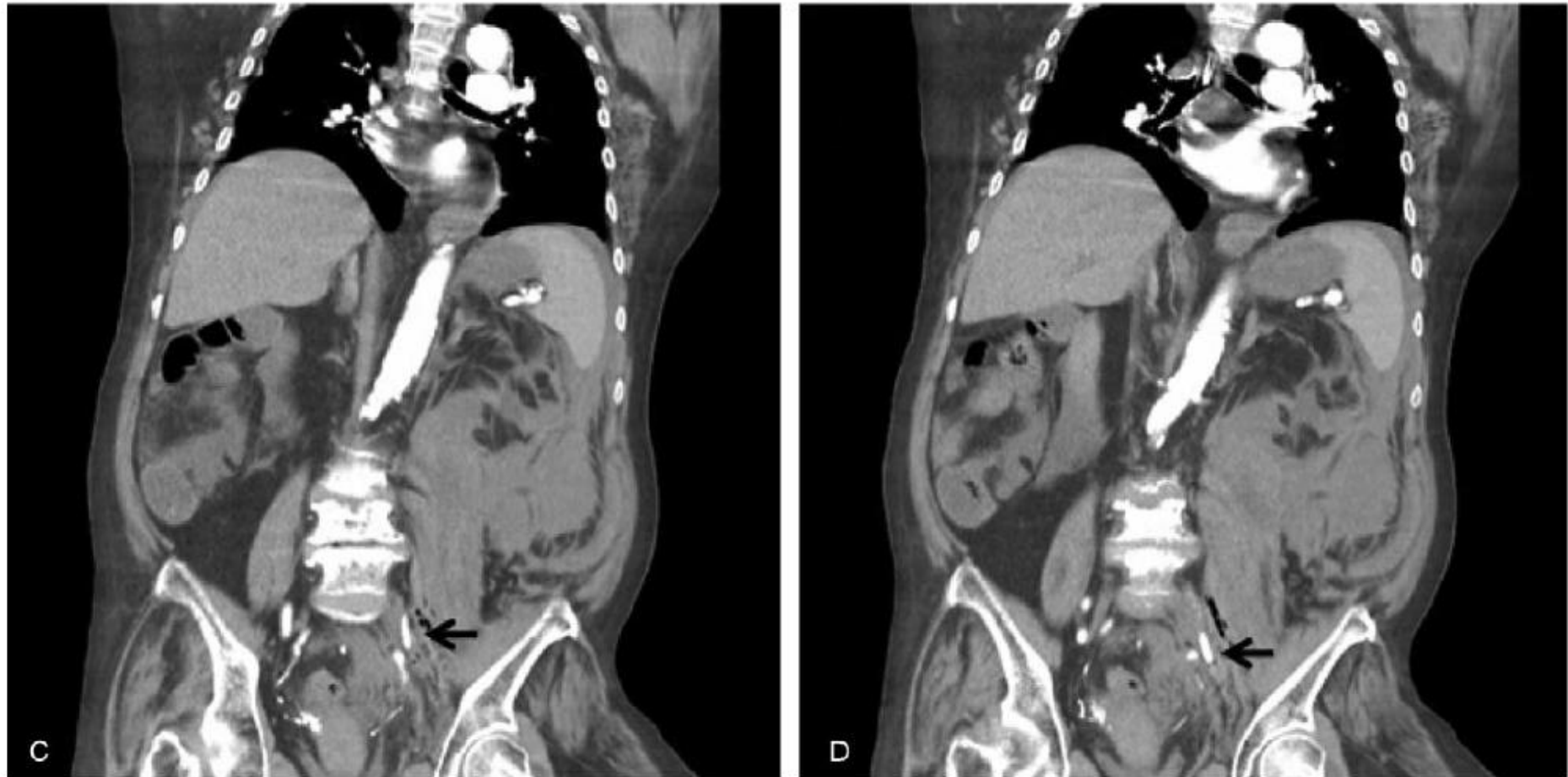


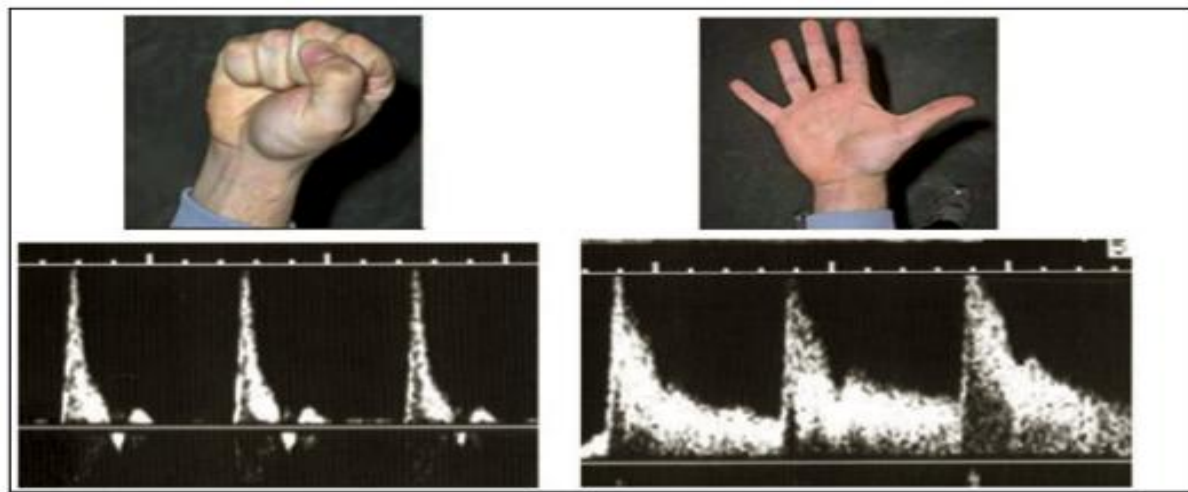
Figure 1. Computed tomography image of the patient showing a double-lumen catheter tip protruding from the left iliac vein (arrow) and hematoma in the retroperitoneal space and pelvic cavity.

Fistola Arterovenosa



ECO-COLOR-DOPPLER E FISTOLA ARTERO-VENOSA: UTILIZZO PRE E POST-CHIRURGICO

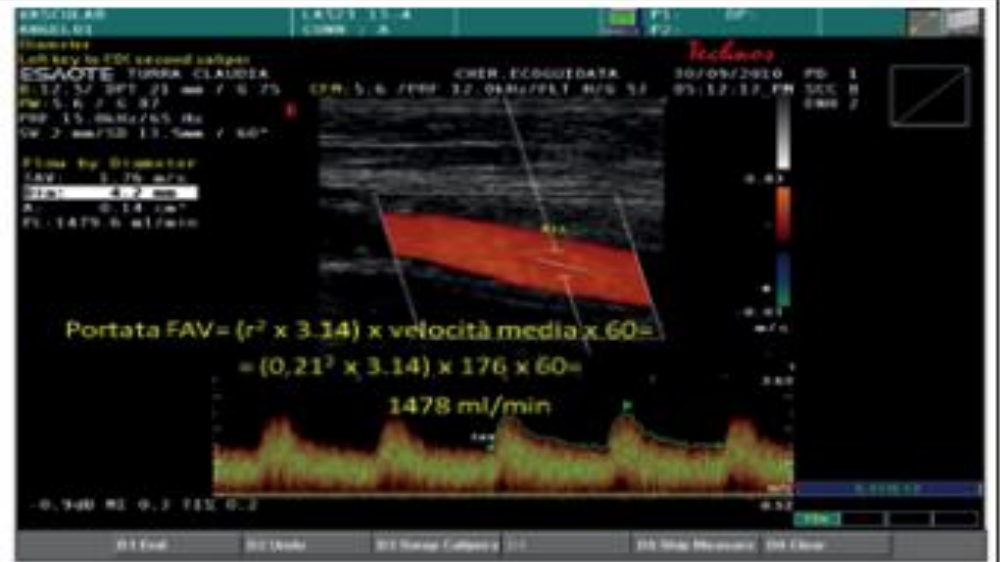
Pasquale Zamboli¹, Maria Calabria¹, Andrea Camocardi¹, Fulvio Fiorini², Alessandro D'Amelio³, Carmelo Lo Dico⁴, Antonio Granata⁵

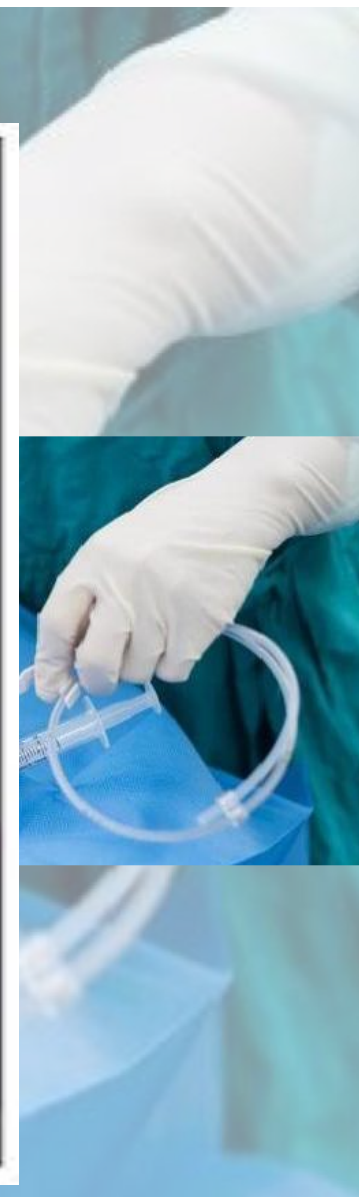
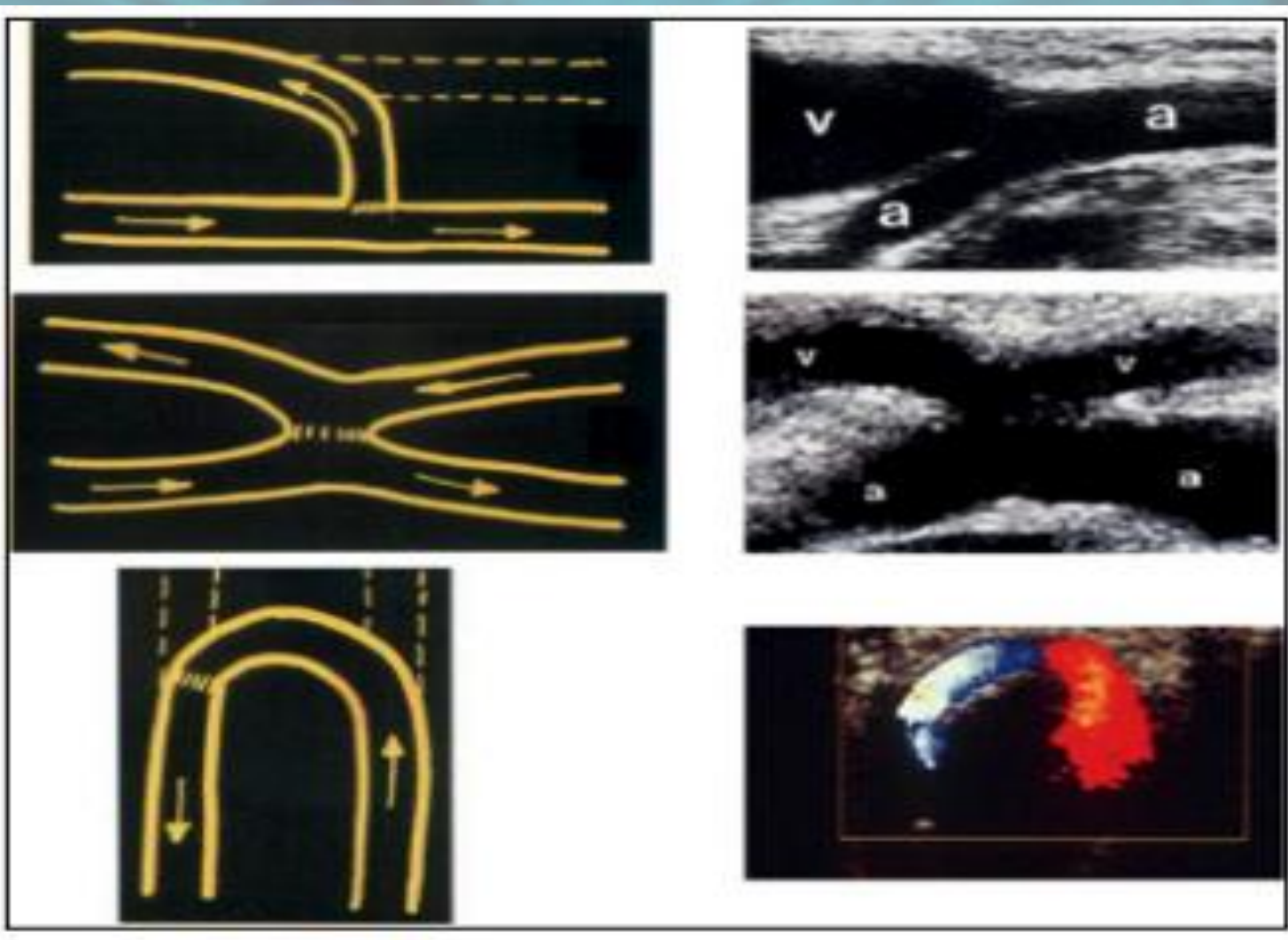


Si basa sul calcolo della velocità media in relazione all'area di sezione del vaso:



$$\text{Flusso (ml/min)} = \text{Velocità media (cm/sec)} \times \text{Area (r}^2 \pi \text{ in cm}^2) \times 60 \text{ secondi}$$





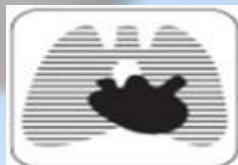


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REVIEW

Ultrasonography as a guide during vascular access procedures and in the diagnosis of complications

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CHEST

Original Research

PULMONARY PROCEDURES

Diagnosis of Pneumothorax by Radiography and Ultrasonography

A Meta-analysis

Wu Ding, MM; Yuehong Shen, MM; Jianxin Yang, MM; Xiaofun He, MM;
and Mao Zhang, MD





Diagnosis of Pneumothorax by Radiography and Ultrasonography

A Meta-analysis

Wu Ding, MM; Yuehong Shen, MM; Jianxin Yang, MM; Xiaojun He, MM;
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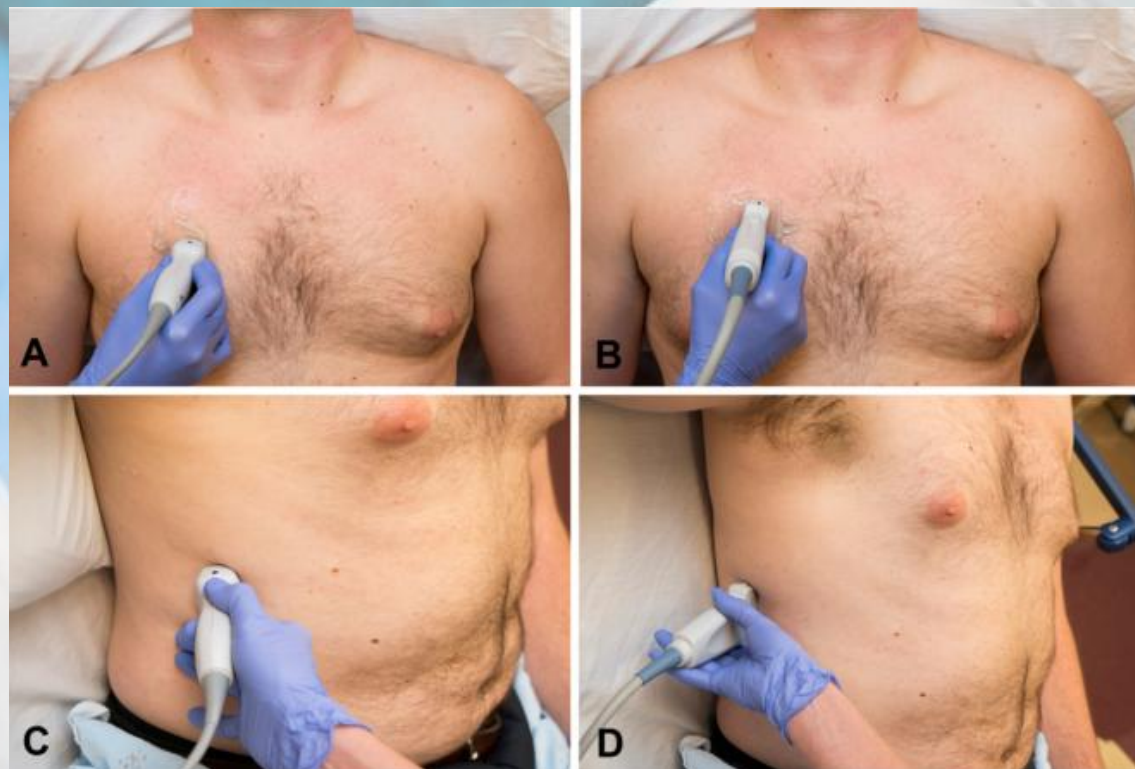
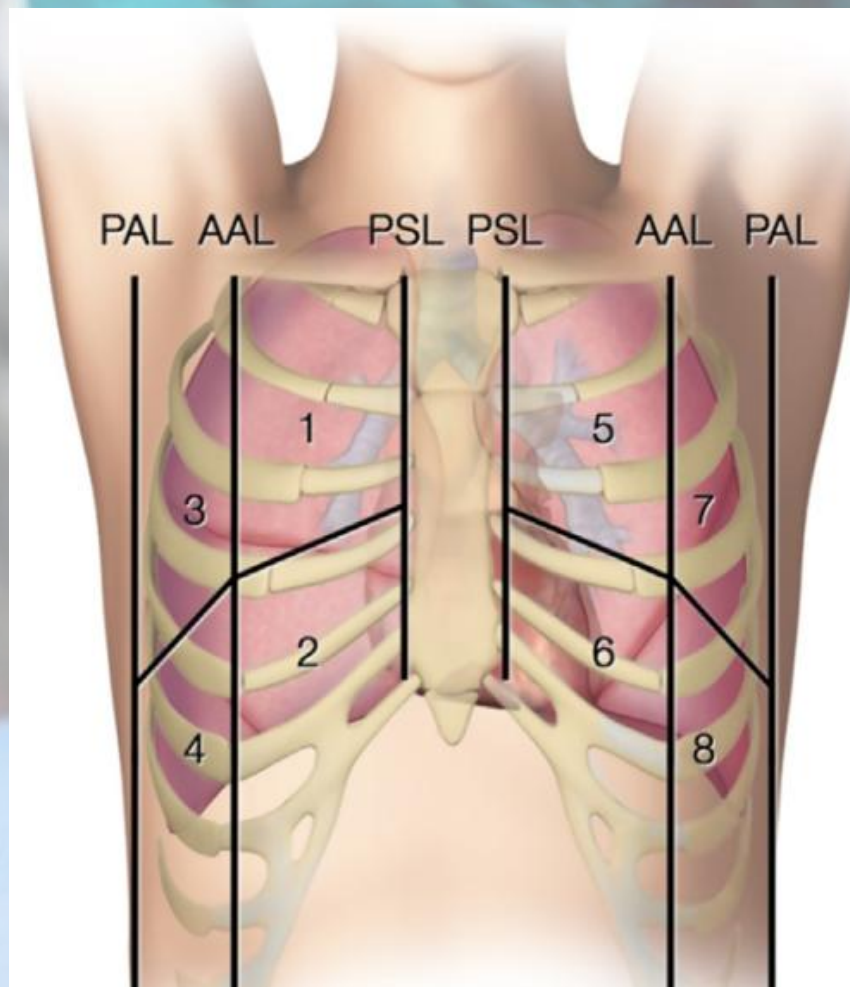
Objective: This study compares, by meta-analysis, the use of anterior-posterior chest radiography (CR) with transthoracic ultrasonography for the diagnosis of pneumothorax.

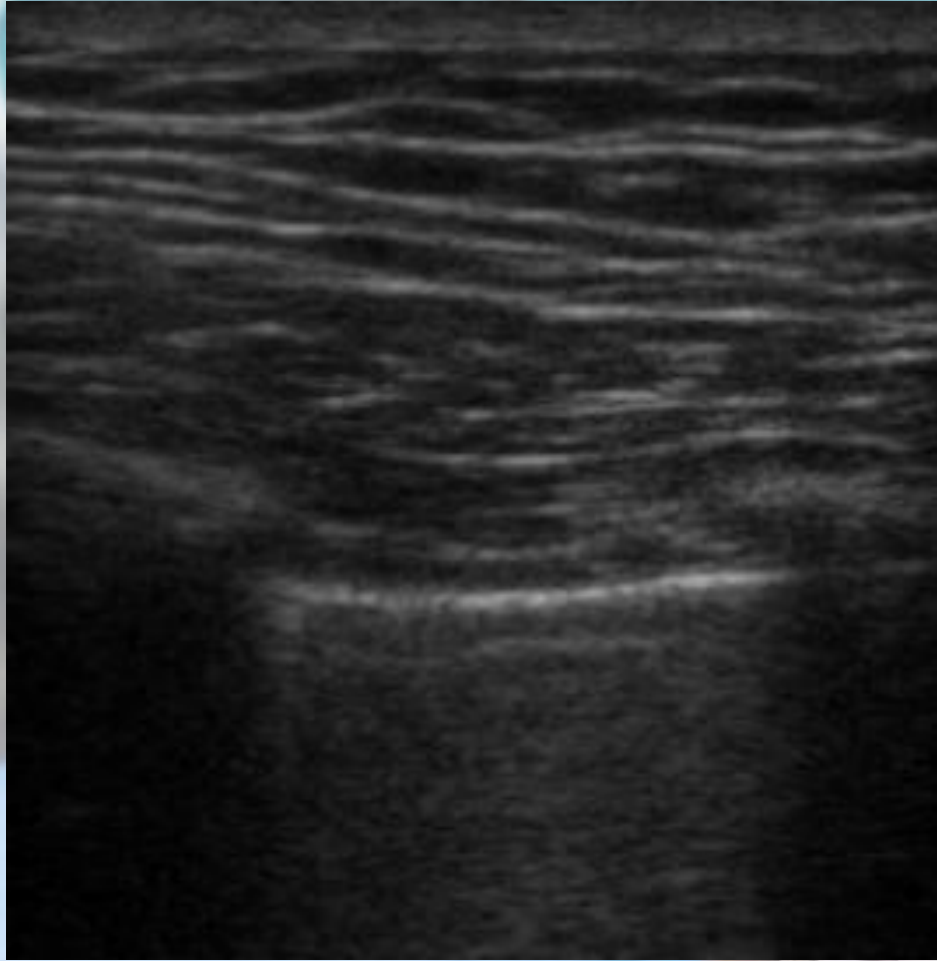
Methods: English-language articles on the performance of CR and ultrasonography in the diagnosis of a pneumothorax were selected. In eligible studies, data were recalculated, and the forest plots and summary receiver operating characteristic (sROC) curves were analyzed.

Results: Pooled sensitivity and specificity were 0.88 and 0.99, respectively, for ultrasonography, and 0.52 and 1.00, respectively, for CR. For ultrasonography performed by clinicians other than radiologists, pooled sensitivity and specificity were 0.89 and 0.99, respectively. The sROC areas under the curve were compared, and no significant differences between ultrasonography and CR were found. Meta-regression analysis implied that the operator is strongly associated with accuracy (relative diagnostic OR, 0.21; 95% CI, 0.05-0.96; $P = .0455$).

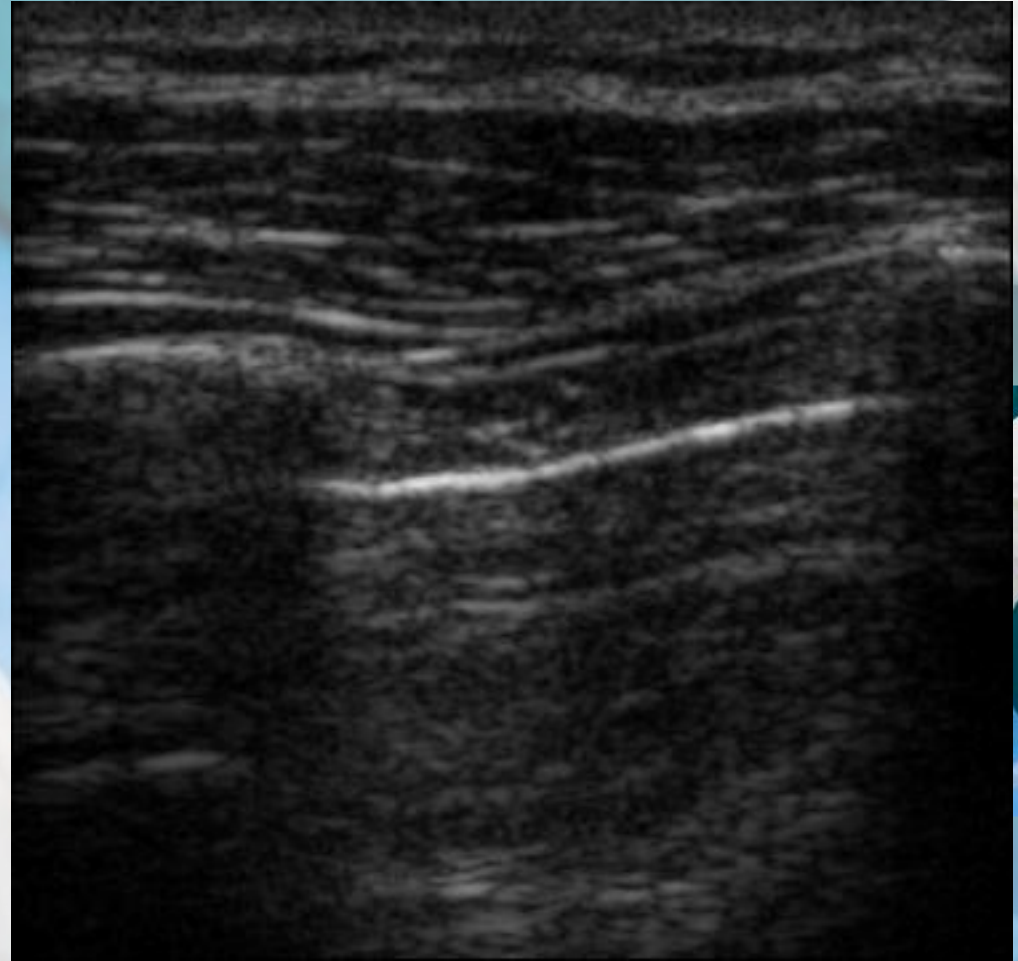
Conclusions: The meta-analysis indicated that bedside ultrasonography performed by clinicians had higher sensitivity and similar specificity compared with CR in the diagnosis of pneumothorax, but the accuracy of ultrasonography in the diagnosis of pneumothorax depended on the skill of the operators.

CHEST 2011; 140(4):859-866

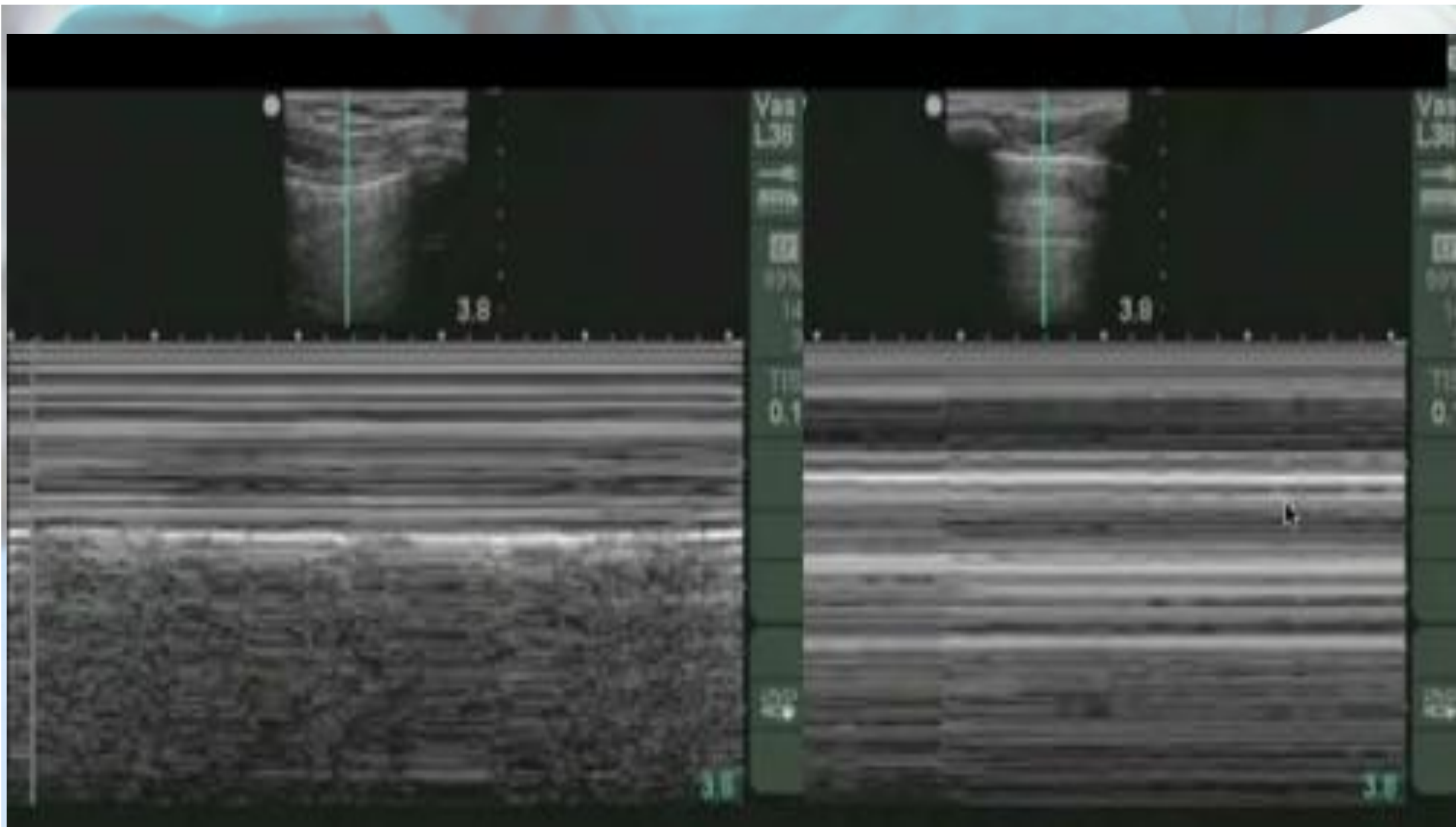




Normal Lung
-Gliding and sliding
-Comet tails



PNX
-No comet tails
-No gliding/sliding



American Journal of Emergency Medicine 35 (2017) 1738–1742



Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem



Diagnostic

A novel method of assessing for lung sliding using Doppler imaging☆



Gabriel Rose, DO, Sebastian Siadecki, MD, Ryan Tansek, MD, Nadia Baranchuk, MD, Turandot Saul, MD*

Mount Sinai St. Luke's Mount Sinai West, Department of Emergency Medicine, 1111 Amsterdam Avenue, New York, NY 10025, United States

American Journal of Emergency Medicine 35 (2017) 1738–1742

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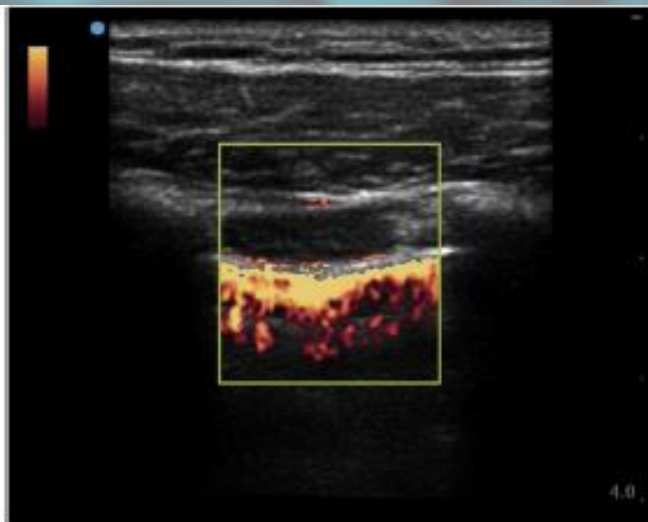


Fig. 11. High frequency probe. Normal lung. Power doppler image demonstrating doppler flow below the pleural line.

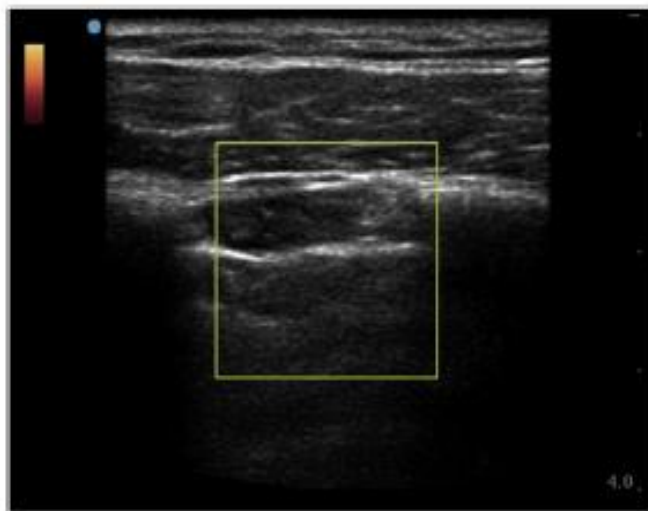


Fig. 12. High frequency probe. Pneumothorax. Power doppler image demonstrating no evidence of flow below the pleural line.

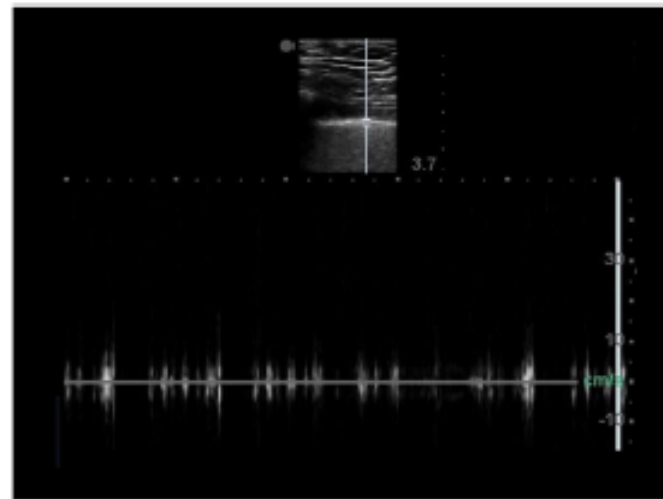


Fig. 13. High frequency probe. Normal lung. Spectral doppler imaging demonstrating Doppler flow (positive and negative deflection) below the pleural line.

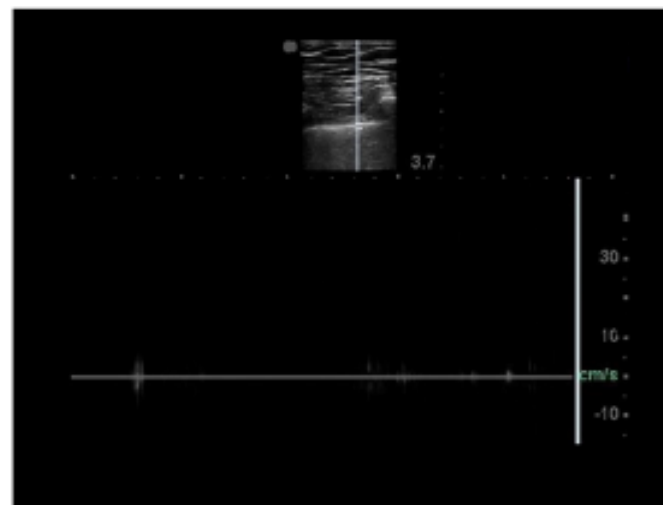
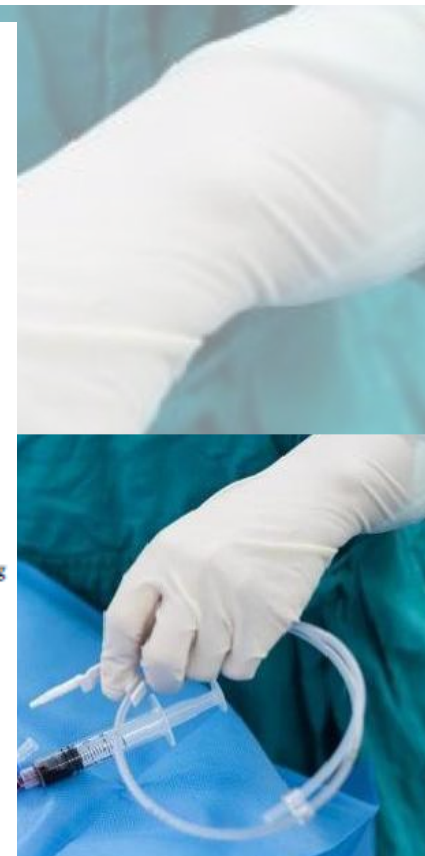


Fig. 14. High frequency probe. Pneumothorax. Spectral doppler imaging demonstrating the absence of movement (positive and negative deflection) below the pleural line.



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Vol. 24, No. 1

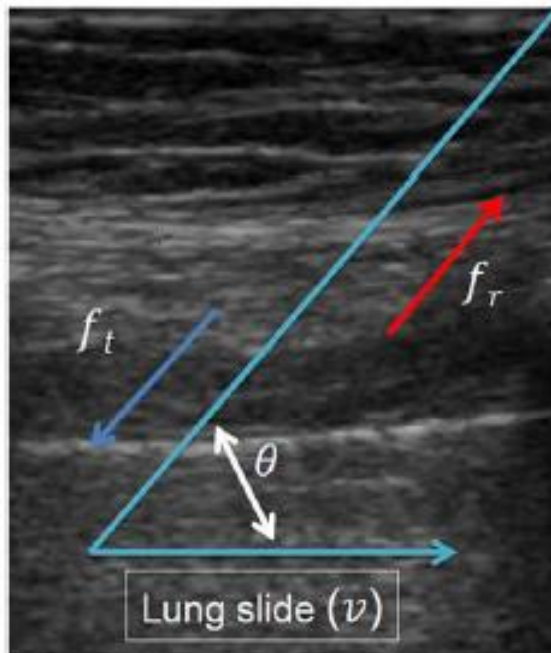
Color and Power Doppler Sonography for Pneumothorax Detection

John R. Richards, MD, Julianne M. Awrey, MD, Sarah E. Medeiros, MD, John P. McGahan, MD 

TECHNICAL INNOVATION



f_t = transmitted frequency (MHz)
 f_r = reflected frequency (MHz)
 v = lung slide velocity (m/s)
 θ = Doppler angle
 C = speed of sound in soft tissue (m/s)



Doppler frequency shift =

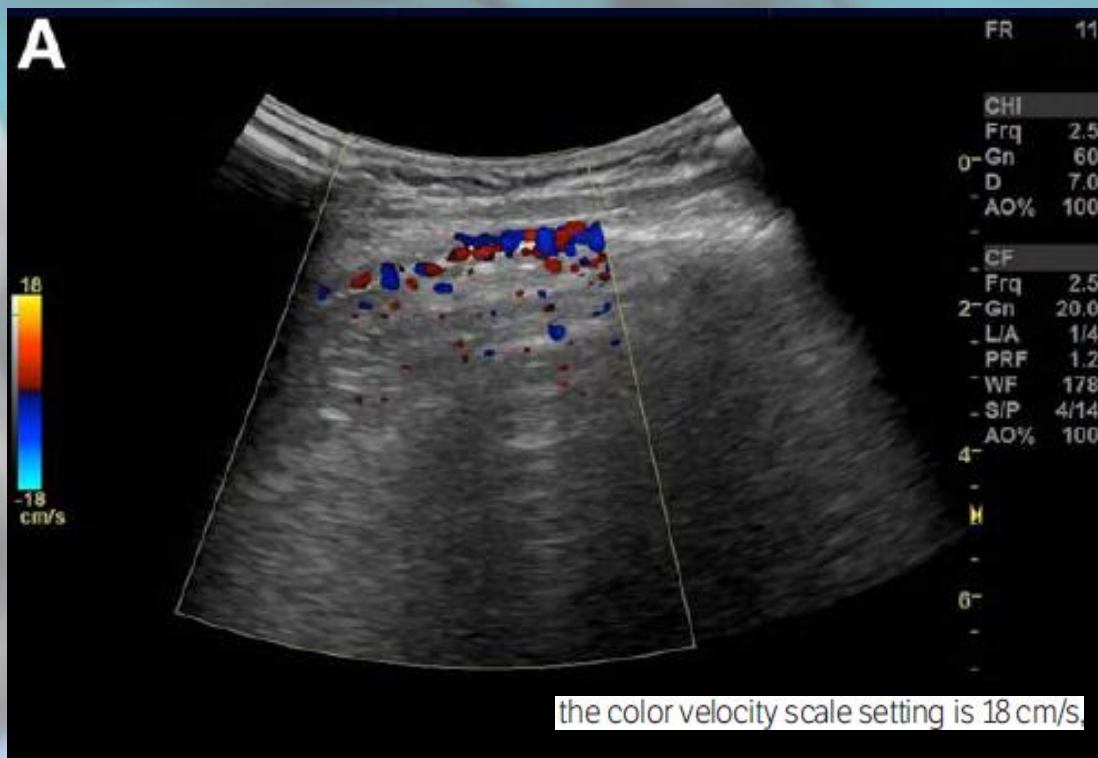
$$f_t - f_r = \frac{2 \times f_t \times v \times \cosine \theta}{C}$$

Lung slide velocity =

$$v = \frac{(f_r - f_t) \times C}{2 \times (f_t) \times (\cosine \theta)}$$

Pleural Line





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November 2014 Vol 33, No 11

Original Research

1879 Sonographic Appearance of Juvenile Fibrosarcoma of the Breast
Kim et al

1889 Combination of 2- and 3-Dimensional Contrast-Enhanced Ultrasonography for Diagnosis of Intra-Axial Masses
Du et al

1903 Clinical Response to Focused Ultrasound Applied to Women With Vaginal Intraepithelial Neoplasia
Jin et al

1909 Dissected Endometriosis Manifesting as Ovarian Cancer in Pregnancy
Günaydin et al

1917 Reference Ranges for 2-Dimensional Sonographic Lung Measurements in Healthy Women: A Longitudinal Study
Brito et al

1925 Sonographic Confirmation of Intraductal Extension of a Mammary Intraductal Papilloma
Baklanov et al

1932 The Tumor Track Sign: A Characteristic Sonographic Feature of Follicular Luteal Dysfunction After Transvaginal Aspiration
Jung et al

1941 ¹⁸F-NaF Bone Scintigraphy Uptake in Metastatic Prostate Cancer: A Retrospective Study
Khan et al

1948 Evaluation of the Impact of Patient Position on Axial Velocity via Laser Tracking Technology in a Rabbit Model
Qin et al

1957 Ultrasound 3-Dimensional Image Monitoring and Area-Based Feature Extraction Detection for Ultrasound Contrast Agent Distribution in a Vascular Bed Region
Kim et al

1973 Contrast-Enhanced Sonography for Quantitative Assessment of Portal Hypertension in Patients With Liver Cirrhosis
Qin et al

1981 Transperitoneal Sonographic and Splanchnic Complex Evaluation in Chronic Small Intestine
Baklanov et al

1985 Sonographic Assessment of Uterine Size in Turkish Migrants With Familial Mediterranean Fever in Childhood
Ozdemir et al

1989 Sonographic Findings in Patients With Chronic Congestive Heart Failure
Karak Tugay et al

TECHNICAL INNOVATIONS

1993 Real-time Image Fusion for Successful Prostate Cancer Radiotherapy: A Retrospective Study
Feldman et al

2003 Development of an Anthropomorphic Shoulder Phantom Model That Simulates Bony Anatomy for Sonographic Measurement of the Acromioclavicular Distance
Adams et al

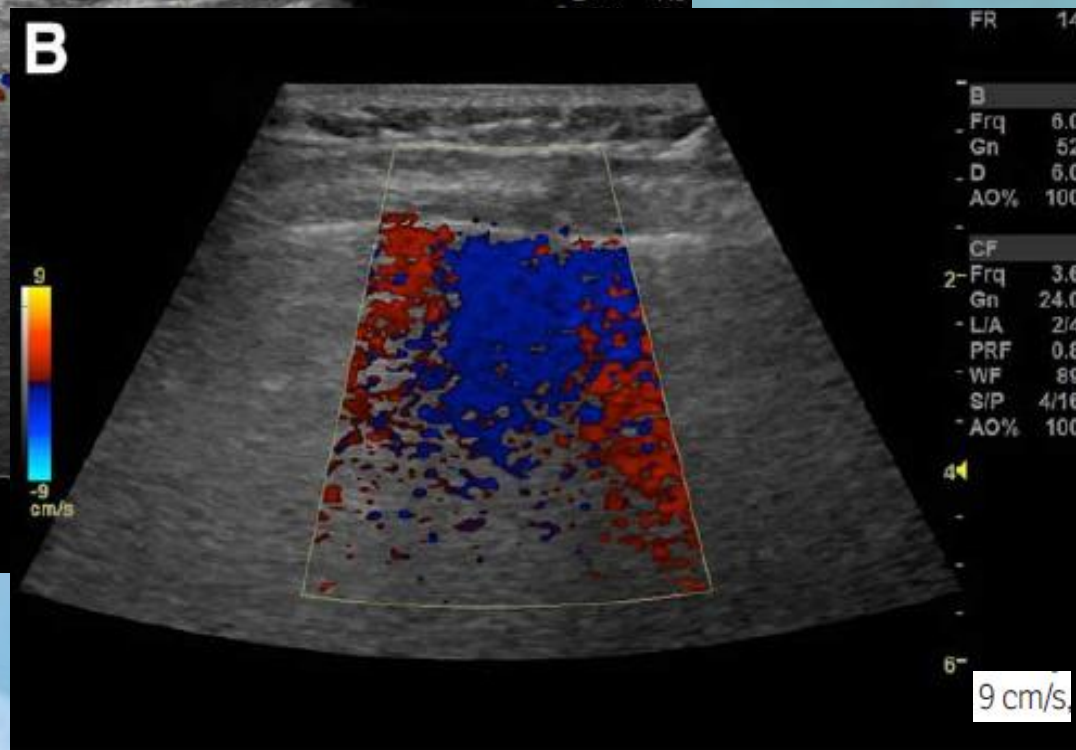
2005 Sonographic Evaluation of the Uteral Support Tension Using a New Approach
Baklanov et al

Case Reports

2010 Three-Dimensional Sonography in the Differential Diagnosis of Intestinal, Angioma, and Intestine Perforation in a Pregnant Woman
Tuzi et al

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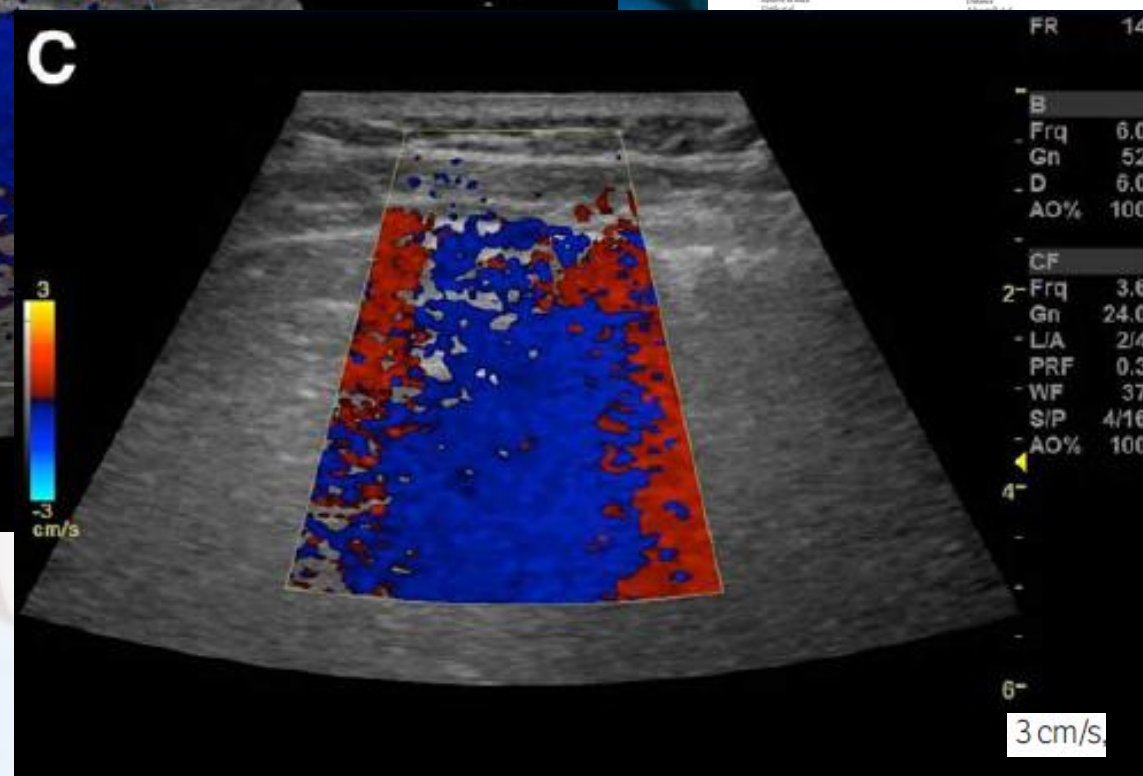
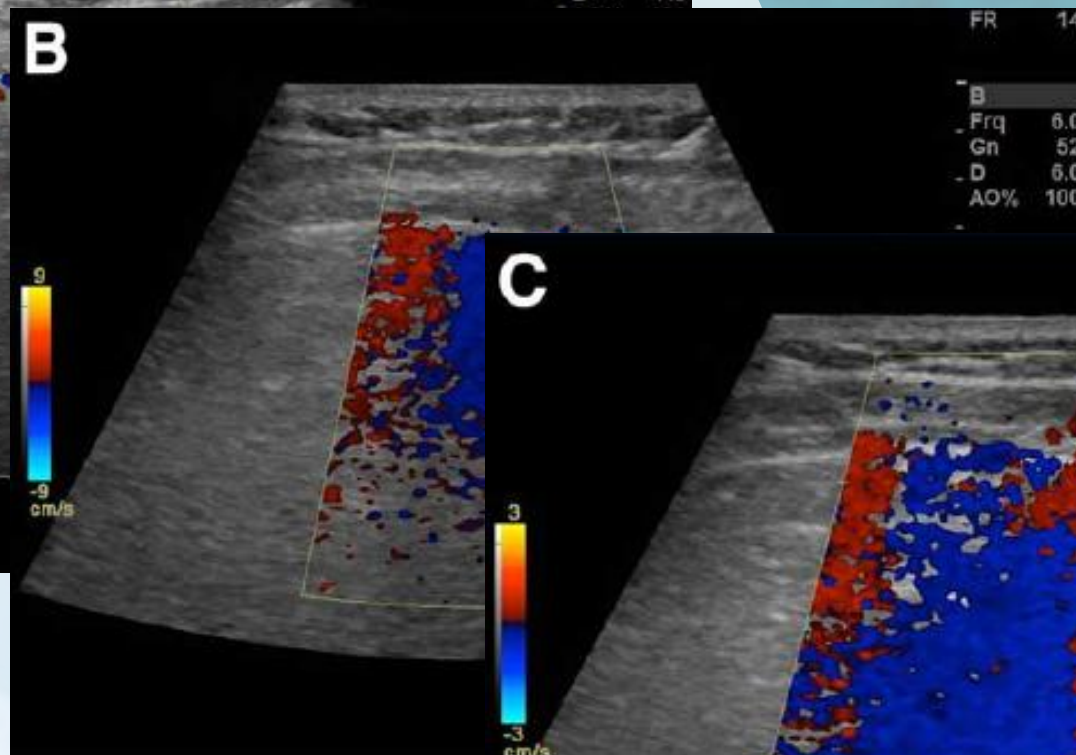
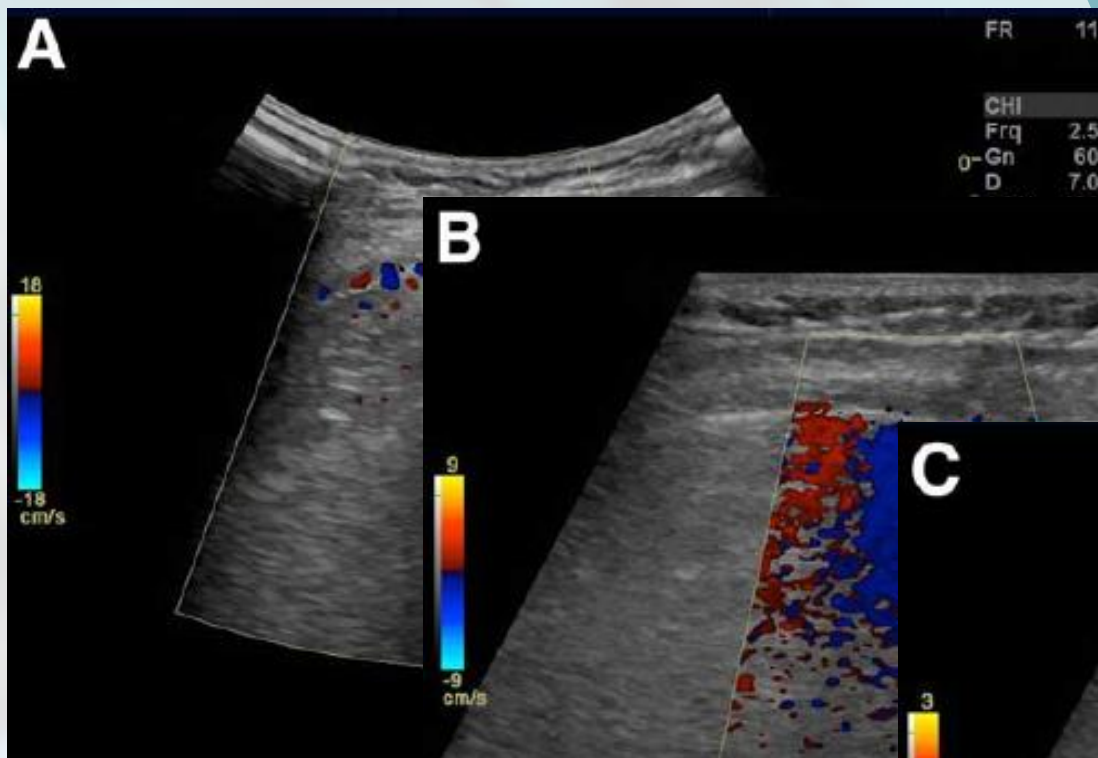
November 2014 Vol 33, No 11

Original Research 1879 Sonographic Appearance of Juvenile Fibrosarcoma of the Breast <i>Rin et al.</i> 1889 Combination of 2- and 3-Dimensional Contrast-Enhanced 2-Dimensional Sonography for Diagnosis of Small Adrenal Masses <i>Do et al.</i> 1903 Clinical Response to Focused Ultrasound Applied to Women With Vaginal Intraepithelial Neoplasia <i>Pat et al.</i> 1909 Decidualized Endometrium Manifesting as Ovarian Cancer in Pregnancy <i>Grimbergen et al.</i> 1917 Reference Ranges for 2-Dimensional Sonographic Lung Measurements in Healthy Females: A Longitudinal Study <i>Britto et al.</i> 1925 Sonographic Confirmation of Intubation: Comparison of 3 Methods in a Pig Model <i>Radwan et al.</i> 1932 The Train Track Sign: A Characteristic Sonographic Feature of Follicular Luteal Dysfunction After Transcervical Insemination <i>Im et al.</i> 1941 ¹⁸F-NaF Bone Scintigraphy Uptake in Metastatic Prostate Cancer: A Retrospective Study <i>Ueda et al.</i> 1948 Evaluation of the Impact of Patient Motion on Arterial Stenosis via Laser Tracking Technology in a Rabbit Model <i>Qin et al.</i>	1957 Ultrasound 3-Dimensional Image Monitoring and Area-Based Feature Extraction Detection for Ultrasound Contrast Agent Distribution in a Vascular Bed Region <i>Seif et al.</i> 1973 Contrast-Enhanced Sonography for Quantitative Assessment of Portal Hypertension in Patients With Liver Cirrhosis <i>Qin et al.</i> 1981 Transperineal Sonographic and Sphincter Complex Evaluation in Chronic Anal Fissure <i>Reber et al.</i> 1985 Sonographic Assessment of Uterine Size in Turkish Migrants With Familial Mediterranean Fever in Childhood <i>Orhan et al.</i> 1989 Sonographic Findings in Patients With Chronic Congestive Heart Failure <i>Karak Tugay et al.</i> TECHNICAL INNOVATIONS 1993 Real-time Image Fusion for Successful Prostate Cancer Radiotherapy: A Retrospective Study <i>Talbot et al.</i> 2003 Development of an Anthropomorphic Shoulder Phantom Model That Simulates Bony Structures for Sonographic Measurement of the Acromioclavicular Distance <i>Adams et al.</i> 2005 Sonographic Evaluation of the Distal Biceps Tendon Using a New Approach <i>Reber et al.</i> Case Series 2010 Three-Dimensional Sonography in the Differential Diagnosis of Intestinal, Angioma, and Intussusception in a Pediatric Patient <i>Tanaka et al.</i>
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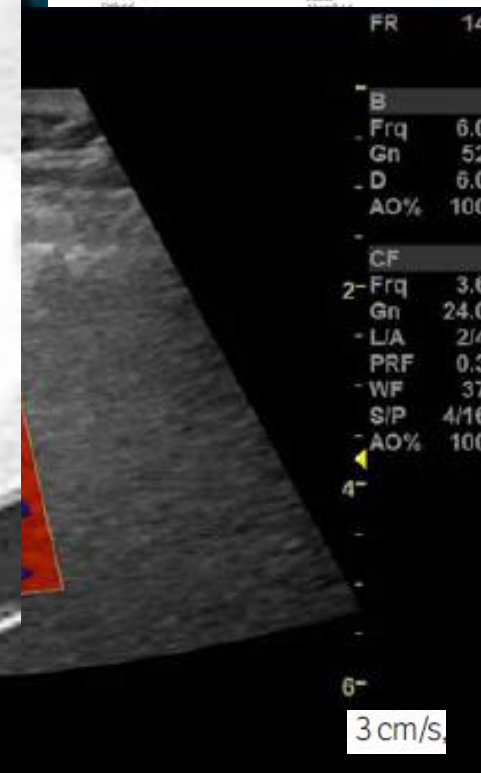


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Injury

journal homepage: www.elsevier.com/locate/injury



Injury
International Journal of the Care of the Injured

Review

Chest ultrasonography for the emergency diagnosis of traumatic pneumothorax and haemothorax: A systematic review and meta-analysis

Leonardo Jönck Staub^{a,f,*}, Roberta Rodolfo Mazzali Biscaro^b, Erikson Kaszubowski^e, Rosemeri Maurici^{c,d}

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^cDepartment of Clinical Medicine, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil

^dGraduate Program in Medical Sciences, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil

^eDepartment of Psychology, Federal University of Santa Catarina, Florianópolis, Santa Catarina, Brazil

^fIntensive Care Unit, Nereu Ramos Hospital, Florianópolis, Santa Catarina, Brazil



ORIGINAL ARTICLE

Emergency ultrasound in the acute assessment of haemothorax

A Brooks, B Davies, M Smethhurst, J Connolly

.....

Emerg Med J 2004;21:44-46







Transthoracic Echocardiography: Pitfalls and Limitations as Delineated at Cardiac CT and MR Imaging¹

Sachin B. Malik, MD
Natalie Chen, MD
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Joe Y. Hsu, MD

Abbreviations: SSFP = steady-state free precession, TTE = transthoracic echocardiography

RadioGraphics 2017; 37:383–406

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Content Codes: **CA CT MR US**

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SA-CME LEARNING OBJECTIVES

After completing this journal-based SA-CME activity, participants will be able to:

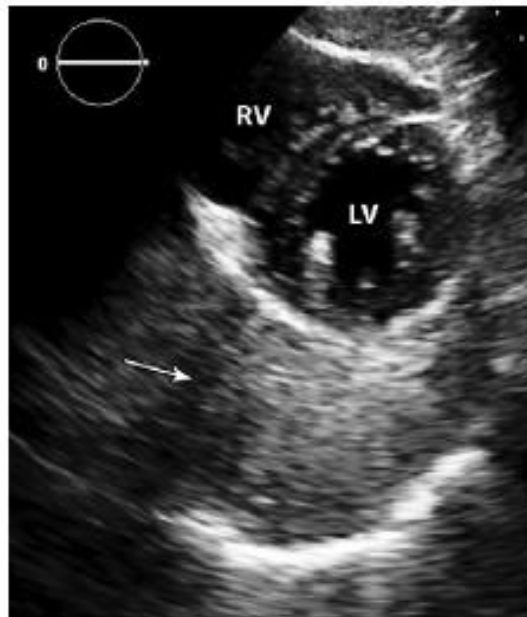
- Understand the fundamental imaging planes and anatomy of a routine TTE examination.
- Identify common pitfalls and limitations of TTE that could lead to a referral for cardiac CT or MR imaging.
- Discuss cardiac CT and MR imaging cases that highlight common pitfalls and limitations of TTE.

Transthoracic echocardiography (TTE) is a critical tool in the field of clinical cardiology. It often serves as one of the first-line imaging modalities in the evaluation of cardiac disease owing to its low cost, portability, widespread availability, lack of ionizing radiation, and ability to evaluate both anatomy and function of the heart. Consequently, a large majority of patients undergoing a cardiac computed tomography (CT) or magnetic resonance (MR) imaging examination will have a TTE available for review. Therefore, it is imperative that cardiac imagers be familiar with the fundamentals of a routine TTE examination and common TTE pitfalls and limitations that may lead to a referral for cardiac CT or MR imaging. The four standard TTE windows and their corresponding views will be discussed and the relevant anatomy highlighted. Common pitfalls and limitations of TTE will be highlighted using cardiac CT and MR imaging as the problem-solving modality. In this article, we have categorized the relevant pitfalls and limitations of TTE into four broad categories: (a) masses and mass mimics (crista terminalis, eustachian valve, right ventricle moderator band, atrioventricular groove fat, left ventricular band [or left ventricular false tendon], hiatal hernia, caseous calcification of the mitral annulus, lipomatous hypertrophy of the interatrial septum, cardiac tumors), (b) poorly visualized apical lesions (aneurysm, thrombus, infarct, and hypertrophic and other nonischemic cardiomyopathies), (c) evaluation for ascending thoracic aortic dissections (false positive, false negative, dissecting aneurysms), and (d) pericardial disease (acute and chronic/constrictive pericarditis, pericardial tamponade, pericardial cysts and diverticula, congenital absence of the pericardium).

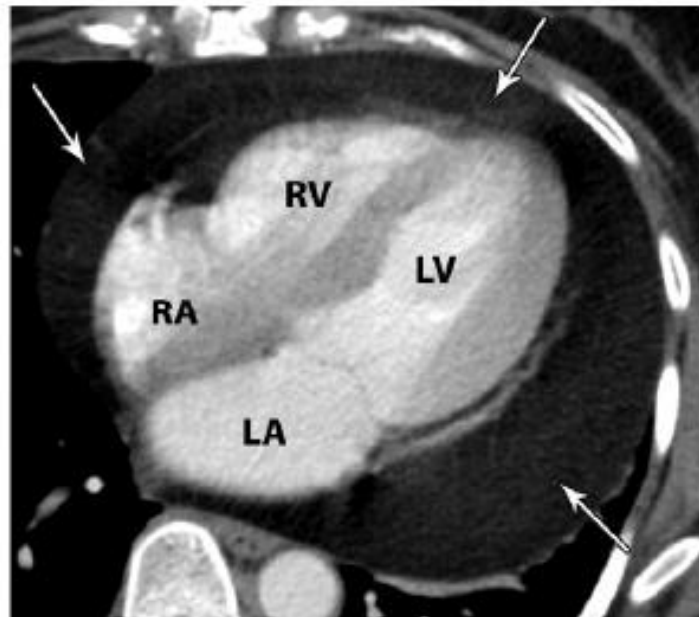
Online supplemental material is available for this article.

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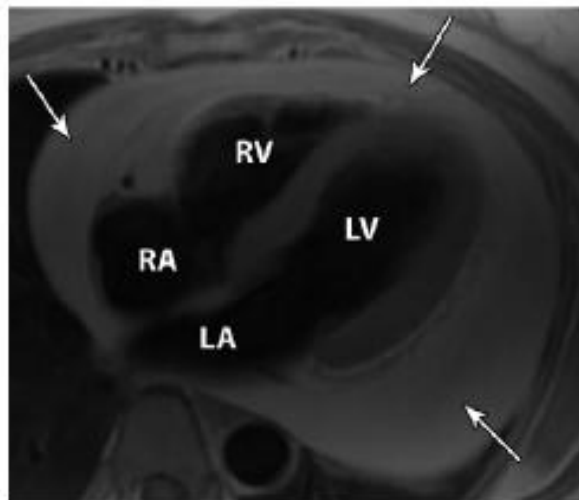




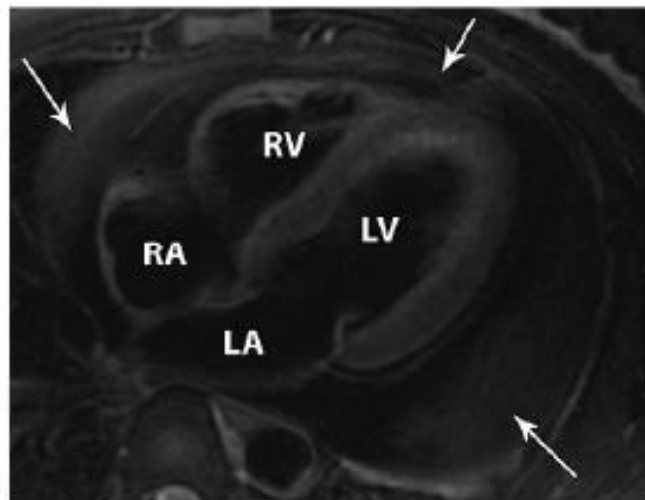
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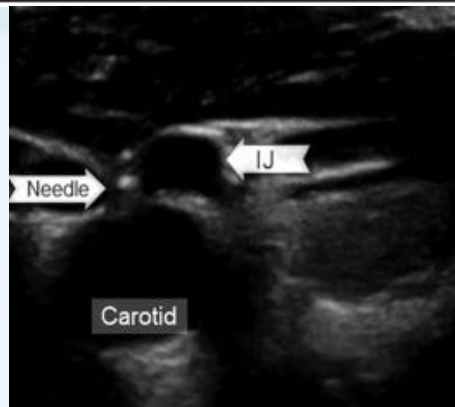


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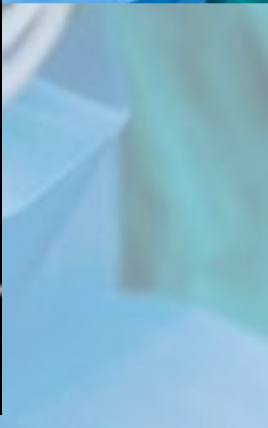
Video Analysis of Accidental Arterial Cannulation With Dynamic Ultrasound Guidance for Central Venous Access

Age	Mechanism of Injury	Outcome
67	Needle went through IJV into Carotid artery	Patient died
75	Needle went though femoral vein into femoral artery	Vascular surgery for arteriovenous fistula
48	Needle went though IJV and entered carotid artery underneath the IJV	Surgery for tear and focal dissection of carotid artery
67	Guidewire traveled through IJV and its posterior wall and into carotid artery	Hematoma with respiratory distress requiring emergent intubation
69	Needle penetrated the carotid artery which was very close to the IJV	Emergency carotid artery repair; patient died of complications
14	Needle penetrated rear wall of IJV and entered carotid artery	Central catheter removed and bleeding eventually stopped



J Ultrasound Med 2009; 28:1239-1244







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Ultrasound-Enabled Noninvasive Management of Inadvertent Carotid Cannulation

Stacy Libricz, PA-C; Ayan Sen, MD; Victor Davila, MD; Jeff Mueller, MD; Alyssa Chapital, MD, PhD; Samuel Money, MD





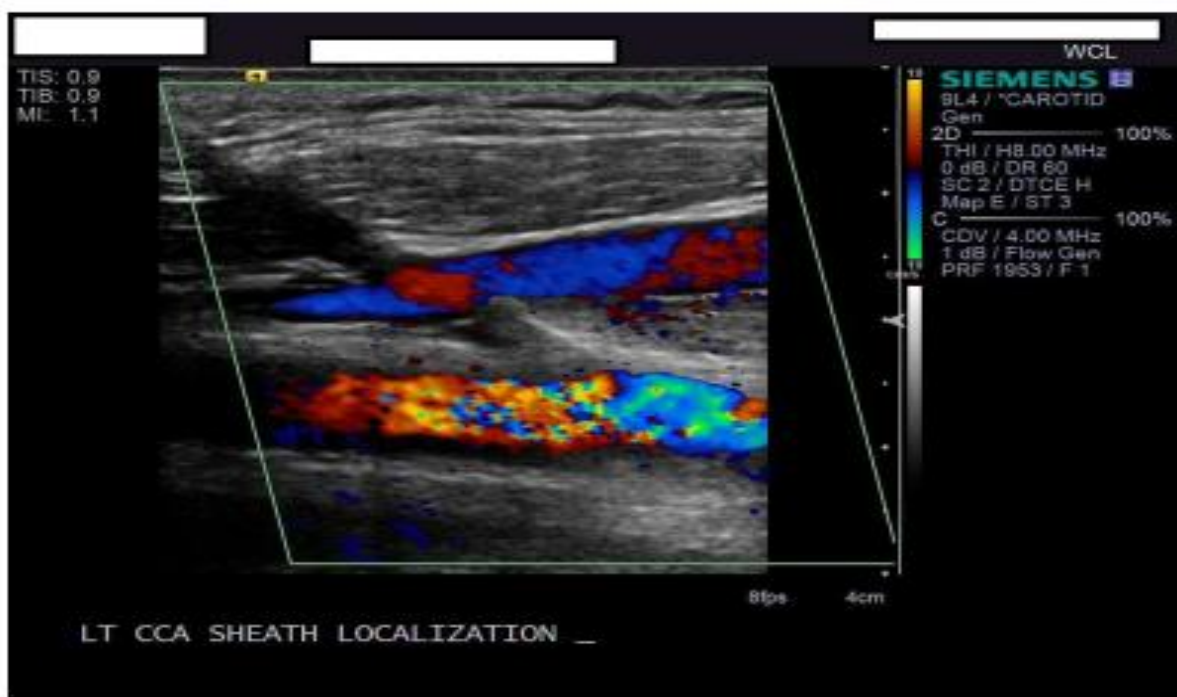
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Figure 1. Central Venous Sheath in the Carotid Artery Before Removal and Compression





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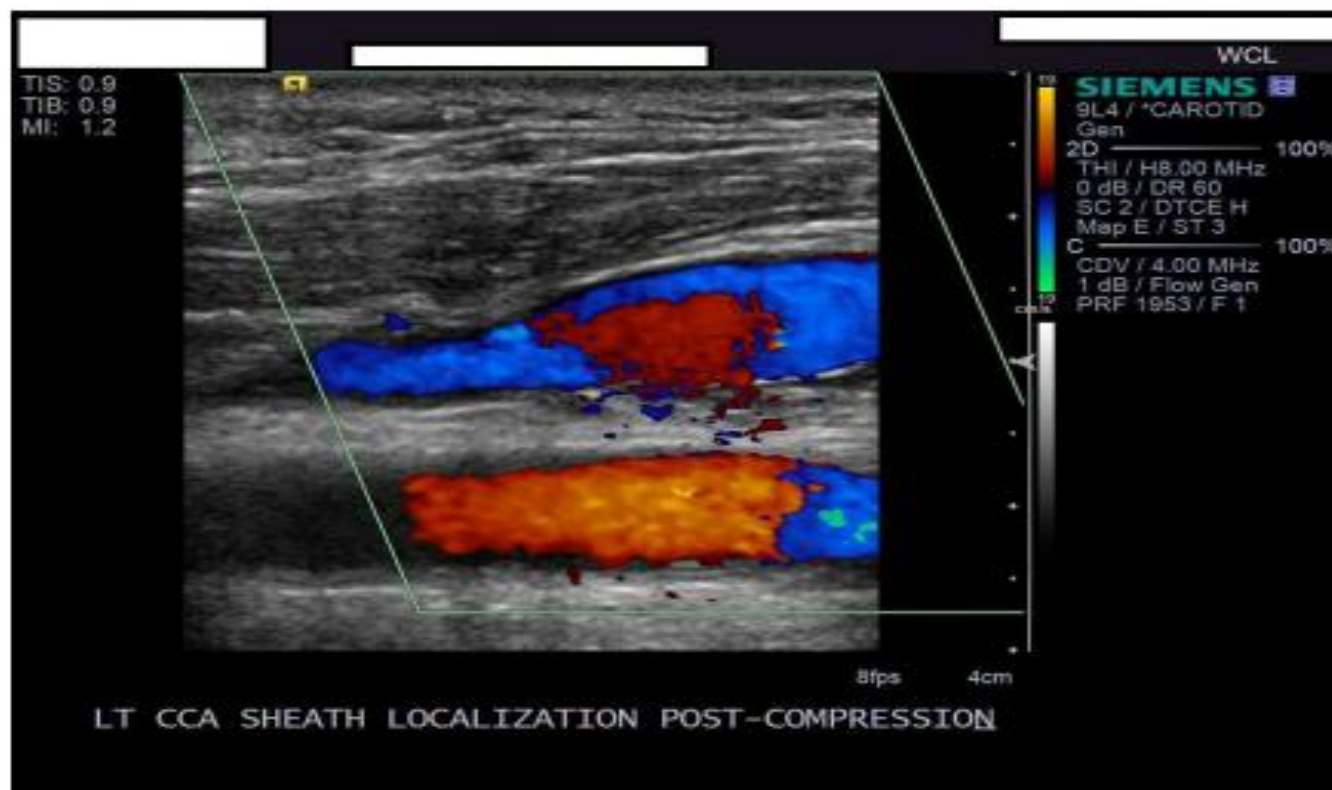
on the recommendation of the senior vascular surgeon, it was decided to proceed with ultrasound-guided compression and removal of the catheter—an ultrasound-enabled “pull-and-pressure” technique. The catheter was pulled, and the ultrasound technician held sonographic compression for 60 minutes with real-time visualization of the carotid and internal jugular vessels. Post ultrasound-enabled compression images were acquired after 60 minutes of compression and 24 hours later. No color flow was noted between the internal jugular vein and

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Figure 2. Internal Jugular and Carotid Artery After Removal of Venous Sheath and Ultrasound-Enabled Compression





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such procedure. Good communication between the operative team, vascular surgery and radiology is vital. Endovascular or surgical treatment should still be the first line approach in inadvertent carotid artery cannulation. However, in a restricted group of patients who have hemodynamic instability and high risk of operative intervention, ultrasound-enabled pull-and-pressure technique can be considered. Thorough and serial neurologic evaluation should be done after injury/repair to assess for signs of acute ischemia.





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| NEW PARADIGMS IN ANTICOAGULATION AND THROMBOLYSIS |



Central venous catheter-related thrombosis

William Geerts¹

¹Thromboembolism Program, Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ontario, Canada

Investigation of suspected CRT

Because asymptomatic CRT is relatively common and the benefit of treating such thrombi is uncertain, patients should not be routinely screened for CRT or investigated for minor arm symptoms. The physical examination alone is neither sensitive nor specific for CRT.⁴ The diagnostic modality of choice for most patients with suspected CRT is compression DUS, which has high sensitivity and specificity.^{4,33} Compression of the subclavian and innominate veins is not possible; therefore, direct visualization of thrombus around the catheter and absence of color flow with distal compression or respiratory variation are necessary to identify DVT in these veins. The use of contrast CT or MRI should be considered in patients with a high clinical suspicion of intrathoracic CRT and normal or nondiagnostic DUS.

Clinical Case Reports

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Clinical Case Reports

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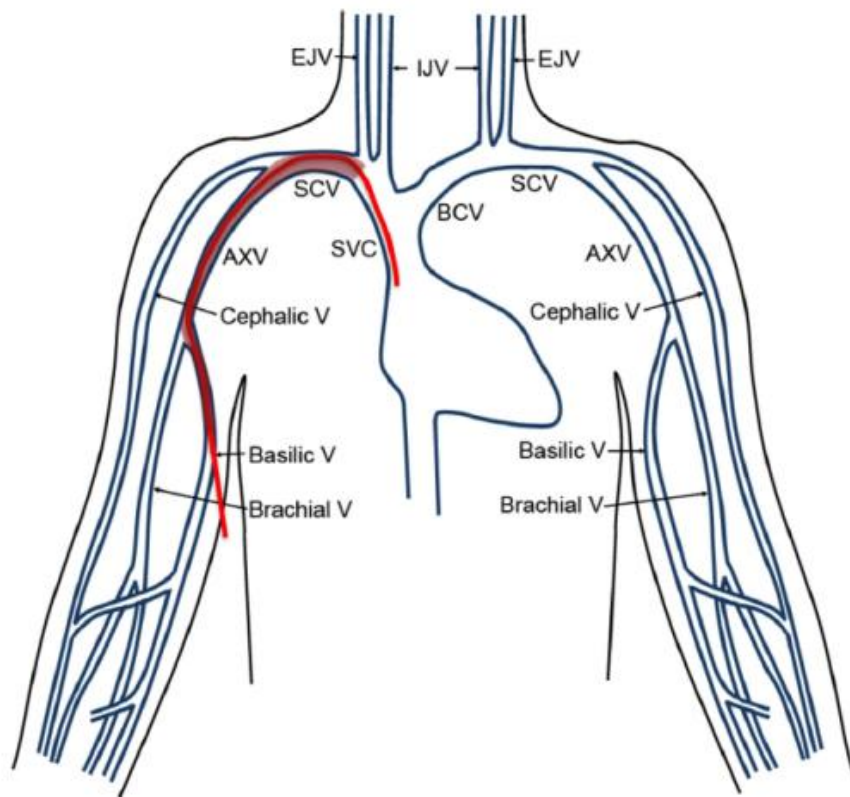
CASE REPORT

Upper extremity deep vein thrombosis: a complication of an indwelling peripherally inserted central venous catheter

Peter J. Carr & James C. R. Rippey

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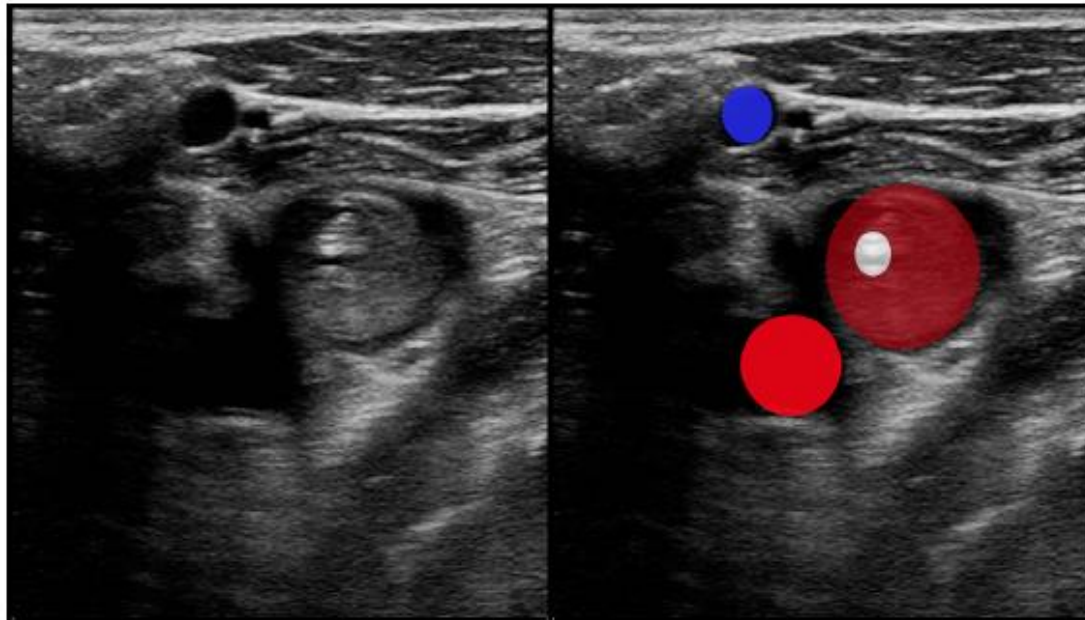


Figure 4. Dual images (original left; legend right). A transverse view of the axillary vein with PICC in place, surrounded by echogenic thrombus that is distending the vein (dark red). The axillary artery (red) and cephalic vein (blue) are also seen.

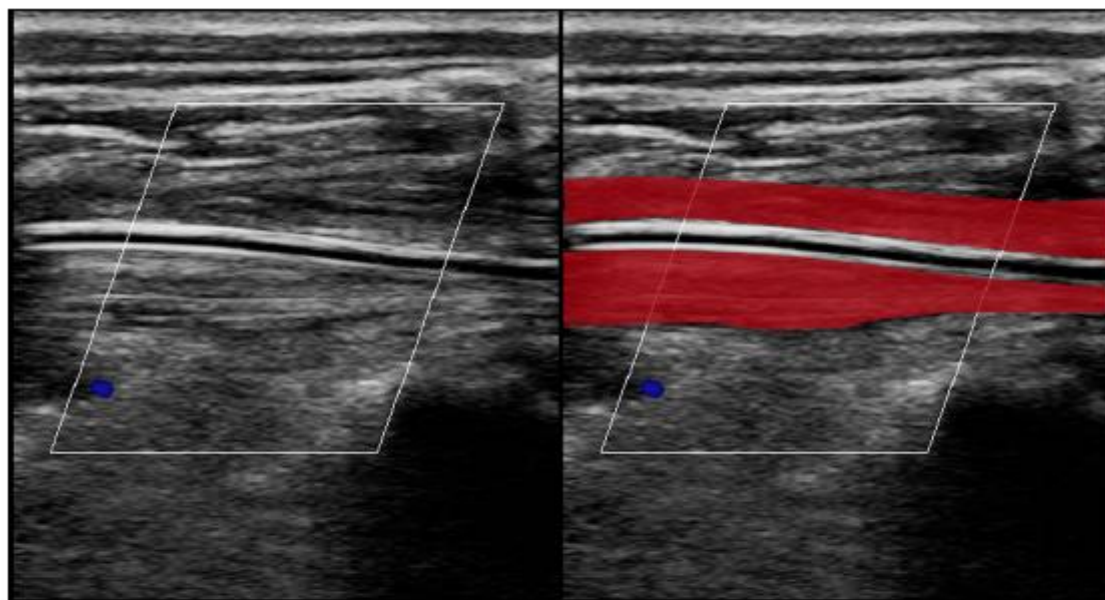


Figure 5. Dual images (original left; legend right). A longitudinal view of the axillary vein containing the PICC. The line is surrounded by echogenic thrombus (red). [Correction added on 3 February 2015, after first online publication: Figures 5 and 6 captions were interchanged]

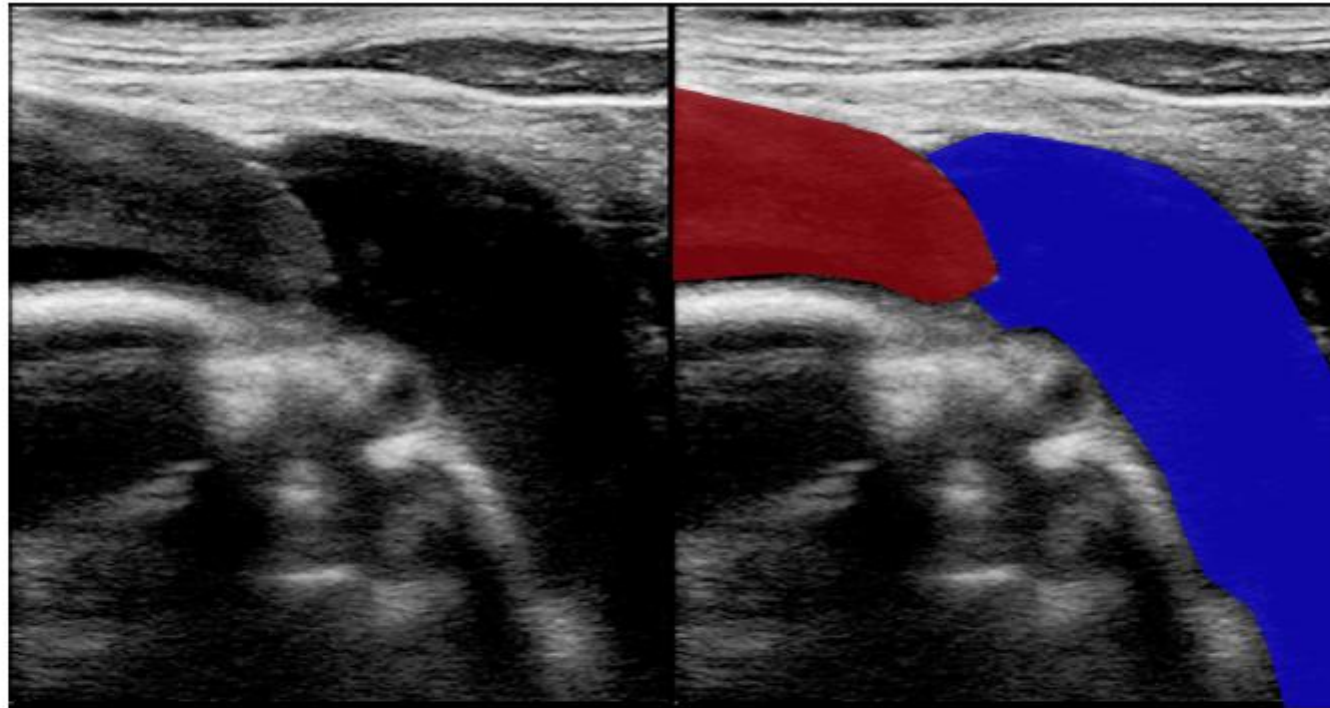


Figure 3. Dual images (original left; legend right). This image shows the occlusive subclavian vein thrombus (dark red) ending as it meets the right internal jugular vein to form the right brachiocephalic vein (blue).

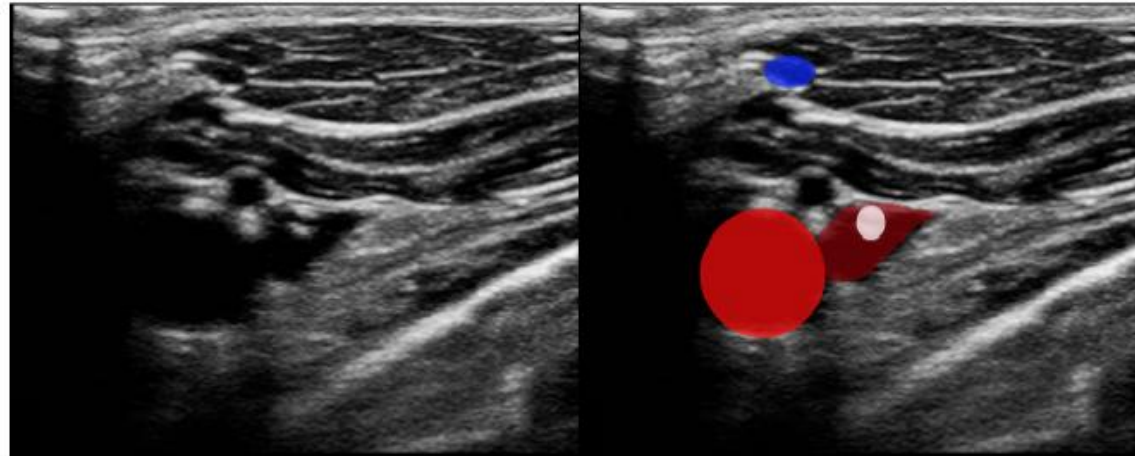


Figure 6. Dual images (original left; legend right). A transverse view of the axillary vein with PICC in place (dark red). The vein is no longer distended, and the blood flowing freely around the PICC is anechoic. The axillary artery (red) and cephalic vein (blue) are again seen, the cephalic vein is no longer distended. [Correction added on 3 February 2015, after first online publication: Figures 5 and 6 captions were interchanged]

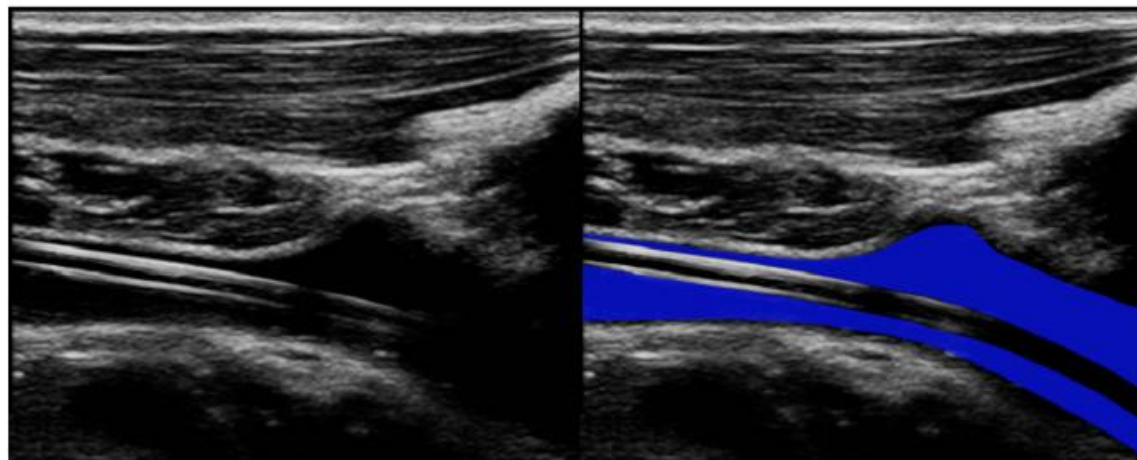


Figure 7. Dual images (original left; legend right). A longitudinal view of the axillary vein containing the PICC. Resolution of the thrombus has occurred with blood now flowing freely around the PICC (blue).

ORIGINAL ARTICLE

Accuracy of diagnostic tests for clinically suspected upper extremity deep vein thrombosis: a systematic review

M. DI NISIO,* G. L. VAN SLUIS,† P. M. M. BOSSUYT,‡ H. R. BÜLLER,† E. PORRECA* and A. W. S. RUTJES* § ¶

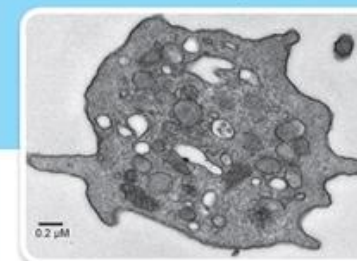
*Department of Medicine and Aging, Centre for Aging Sciences (CeS.I.), 'University G.D'Annunzio' Foundation, Chieti, Italy; †Department of Vascular Medicine and ‡Department of Clinical Epidemiology, Biostatistics and Bioinformatics, Academic Medical Center, University of Amsterdam, Amsterdam, the Netherlands; §University of Berne, Institute of Social and Preventive Medicine (ISPM), Finkenhubelweg, Berne, Switzerland; and ¶Consorzio Mario Negri Sud, Laboratory of Clinical Epidemiology of Cardiovascular Disease, Department of Clinical Pharmacology and Epidemiology, Chieti, Italy

Thrombosis
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Thrombosis and
Haemostasis

International Journal for Vascular Biology and Medicine

Number 10 • Volume 119 • Pages 1540–1711 • October 2019



- Theme Issue: Platelets
- Disruption of fibrin clots with extracellular chaperones
- Benefits of the ABC pathway for atrial fibrillation inducibility

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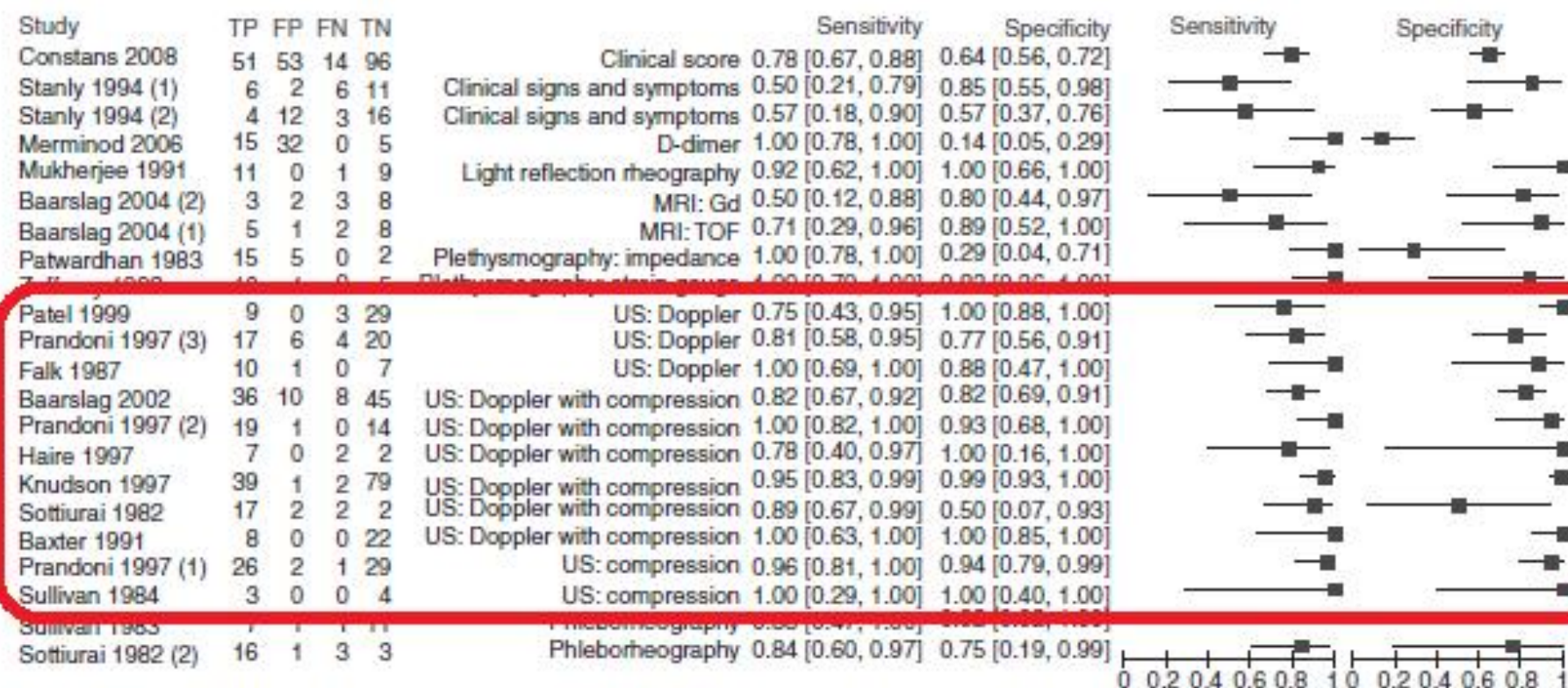


Fig. 3. Forest plots of sensitivity and specificity of included studies. The squares represent the sensitivity and specificity of one study, the black line its confidence interval. Studies are grouped by type of index test. If a study reported accuracy data for more than one type of test comparison, its results are included more than once. *Sensitivity and specificity based on segment (upper extremity) level. Abbreviations: FN, false negative; FP, false positive; Gd, gadolinium enhanced; MRI, magnetic resonance imaging; TN, true negative; TOF, time-of-flight; TP, true positive; US, ultrasonography. Stanley 1994 (1) included only patients with a central catheter, Stanley (2) included only patients without a central catheter.

Ultrasonography

Nine studies evaluated in total 11 test comparisons, including compression ultrasonography (two studies) [14,15], Doppler ultrasonography (three studies) [15–17], and (color) Doppler ultrasonography with compression (six studies) [15,18–22]. The bivariate random effects approach resulted in summary estimates of sensitivity and specificity of 97% (95% CI, 90–100%) and 96% (95% CI, 87–100%) for compression ultrasonography, 84% (95% CI, 72–97%) and 94% (95% CI, 86–100%) for Doppler ultrasonography, and 91% (95% CI, 85–97%) and 93% (95% CI, 80–100%) for Doppler ultrasonography with compression. The differences between estimates of sensitivity and specificity of the three ultrasonographic techniques were not significantly different ($P = 0.3$ for sensitivity and $P > 0.7$ for specificity), and did not substantially explain the variation observed.

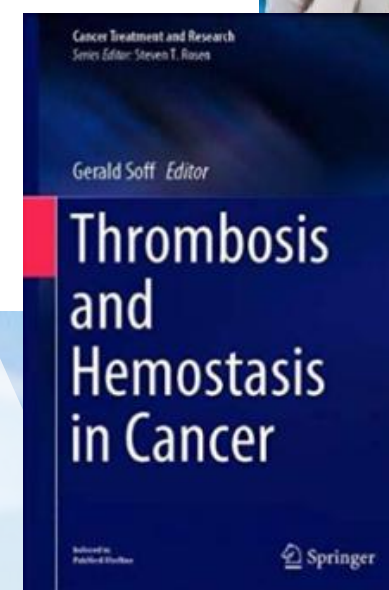




Etiology and Management of Upper-Extremity Catheter-Related Thrombosis in Cancer Patients

Anita Rajasekhar and Michael B. Streiff

8



diagnostic approach to UEDVT.

Although the reference standard for diagnosis of UEDVT is contrast venography, venous duplex ultrasonography remains the first-line diagnostic test for CRT. A systematic review of 793 patients from 17 studies with UEDVT reported a sensitivity and specificity of 97 and 96% for compression ultrasound, 84 and 94% for Doppler ultrasound, and 91 and 93% for duplex ultrasound, although the studies were small and heterogeneous [70]. Since the thoracic cavity and clavicle interfere with Doppler flow assessment and compression of the brachiocephalic and subclavian vein and the superior vena cava, CT venography (CTV) should be considered in patients with a negative ultrasound and high clinical suspicion. In patients with suspected UEDVT, the American College of Chest Physicians (ACCP) guideline recommends duplex ultrasound over other initial tests, including highly sensitive D-dimer or venography (Grade 2C). If the ultrasound is negative and clinical suspicion remains high, further testing with D-dimer, serial duplex ultrasound, or venography is advocated (Grade 2C) [71].

Special article

Catheter-related thrombosis: A practical approach

Caroline Wall¹, John Moore² and Jecko Thachil¹



Journal of the Intensive Care Society

2016, Vol. 17(2) 160–167

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DOI: 10.1177/1751143715618683

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Diagnostic approach

A 'linogram' (contrast study) may theoretically be used to confirm internal line kinking or the presence of an intraluminal occlusion, but it is not commonly performed. In practice, trial of a thrombolytic agent empirically may be used which is particularly useful in 'precious' lines that cannot be easily replaced.¹⁴

Duplex ultrasound is the initial imaging modality of choice if a CRT is suspected clinically or if lumen patency is not restored with simple measures.²⁰ It is non-invasive and particularly reliable for assessing thrombi in anatomically accessible veins including the jugular, axillary, distal subclavian and arm veins. In the more proximal veins, sited inside the thorax, clearly duplex ultrasound is less sensitive.

If clinical suspicion of CRT is high despite a negative Duplex scan, then contrast venography may be considered as it is the 'gold standard' investigation but does confer risks associated with contrast and radiation exposure.^{14,21}

It is worth noting that the use of the D-dimer assay has not been validated for use in patients with suspected CRT and is therefore not recommended for use in this context.^{18,22}

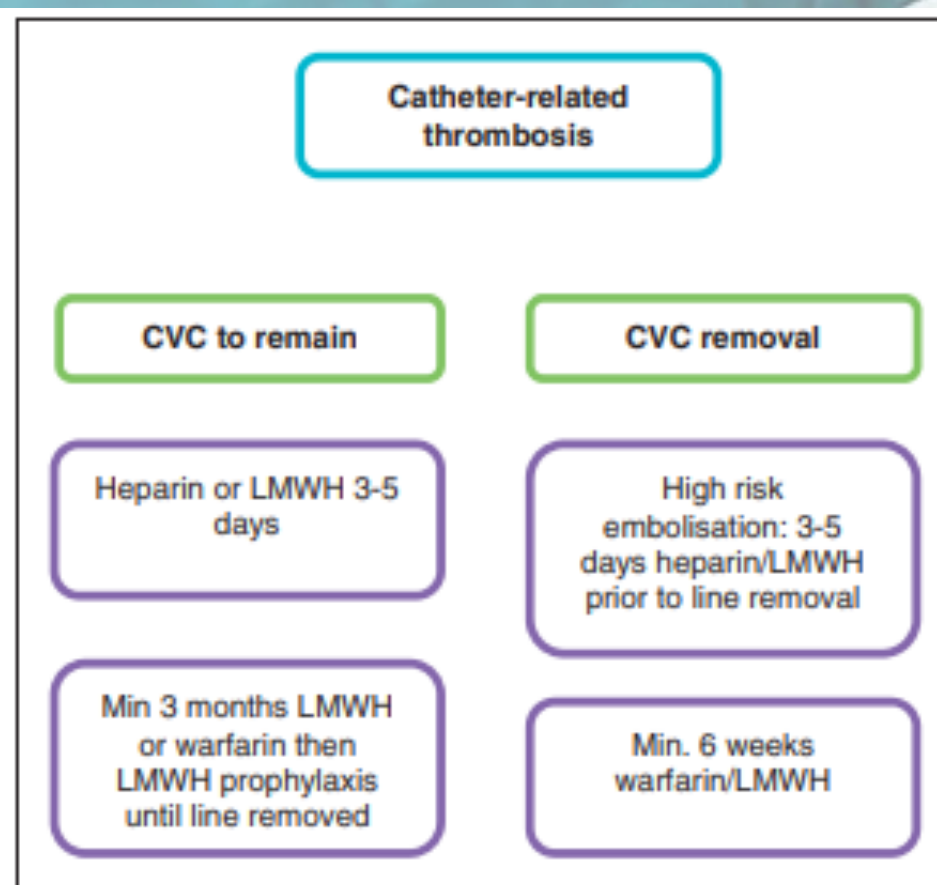


Figure 3. Proposed treatment algorithm for patients with confirmed CRT.

CVC: central venous catheter; LMWH: low-molecular weight heparin.

Line removal

The current recommendations^{3,23} state that if the CVC is still required and functioning well, it does not have to be removed provided it

- is well positioned
- is non-infected
- demonstrates good resolution of symptoms on surveillance.

The line should be removed if not all the criteria are met, if anticoagulation is contraindicated, if the thrombosis is life or limb threatening or if symptoms are not resolving.



Table 4. Treatment options in patients with CRT based on degree of thrombocytopenia.

Platelet count	Treatment options	
$>50 \times 10^9$	Full dose therapeutic anticoagulation taking into account additional bleeding risk factors e.g. renal failure	Bishop et al. ²⁸ , Baglin et al. ²⁶
$25-50 \times 10^9$	50% dose LMWH Regular monitoring	Murray et al. ¹⁸
$<25 \times 10^9$	No anticoagulation	Watson et al. ²⁷

LMWH: low-molecular weight heparin.

Journal of Thrombosis and Haemostasis, **14**: 1696–1710

DOI: 10.1111/j

REVIEW ARTICLE

Current and future perspectives in imaging of venous thromboembolism

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To cite this article: Dronkers CEA, Klok FA, Huisman MV. Current and future perspectives in imaging of venous thromboembolism. *J Thromb Haemost* 2016; **14**: 1696–710.



Table 1 Overview of available imaging techniques for different locations of venous thrombosis

Thrombus location	Available techniques						Future perspectives
	CUS	CT	SPECT	MRI	PET	Test of choice	
Deep veins of the leg [3,59,76,93]	Se: 94% (93–95) Sp: 94% (93–94) L: Detection of recurrent DVT	Se: 96% (93–98) Sp: 95% (94–97) L: radiation dose		Se: 92% (88–95) Sp: 95% (93–97) L: low availability, long imaging time	Se: 88% Sp: 100%† L: technique has to be further developed	CUS (2-point or whole-leg)	MRDTI for recurrent ipsilateral DVT
Deep veins of the arm [32,87]	Se: 82% (70–93) Sp: 82% (72–92) L: compression not possible due to overlying bone	Se: unknown Sp: unknown L: insufficient evidence		Se: 71% (29–96) Sp: 89% (52–100) L: poor accuracy		CUS	MRDTI for inaccessible vein segments
Pulmonary artery (acute PE) [37,84,100]	Se: 87% (79–92) Sp: 82% (71–89) L: small amount of accessible lung area	Se: 83% (76–92) Sp: 96% (93–97) L: contrast allergy – CI-AKI, radiation dose	Se: 83% (61–95) Sp: 98% (92–100) L: not validated in a prospective management study	Se: 78% (67–86) Sp: 99% (96–100) L: high proportion of inconclusive scans	Se: unknown Sp: unknown L: technique has to be further developed	CTPA	MR-PA, Molecular MRI with target specific- contrast agents for reduction of radiation MR techniques for reduction of radiation
Pulmonary artery (CTEPH)[52,86]		Se: 76% (69–82) Sp: 96% (93–98) L: not diagnostic for CTEPH as single test		Se: 83% (77–85) Sp: 99% (89–99)* L: low accuracy from segmental arteries		VQ lung scanning/ DSA	
Abdominal/ pelvic veins [36,88]	Se: 89% (55–99) Sp: 92% (88–94)* L: low accuracy due to overlying bowel gas	Se: unknown Sp: unknown L: radiation dose		Se: 100% (93–100) Sp: 98% (93–98)* L: low evidence		CTV	MRDTI for more accurate diagnosis
Cerebral veins [69]		Se: 75–100% Sp: 82–100% L: low sensitivity		Se: unknown Sp: unknown L: false positives due to artefacts		MRV	MRBTI for direct visualisation of the thrombus

Se, sensitivity; Sp, specificity; L, limitations; CUS, compression ultrasonography; CTV, computed tomography venography; SPECT, single-photon emission computed tomography; MRI, magnetic resonance imaging; PET, positron emission tomography; MRDTI, magnetic resonance direct thrombus imaging; DSA, digital subtraction angiography; MRV, magnetic resonance venography; MRBTI, magnetic resonance black-blood thrombus imaging; PE, pulmonary embolism; DVT, deep vein thrombosis; CTEPH, chronic thromboembolic pulmonary hypertension.
*Confidence intervals derived from original article. †Confidence interval not derivable from original article.

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. Blans³, Manfred Petjak⁴, Peter M. Van de Ven⁵ and Pieter R. Tuinman^{1,2}



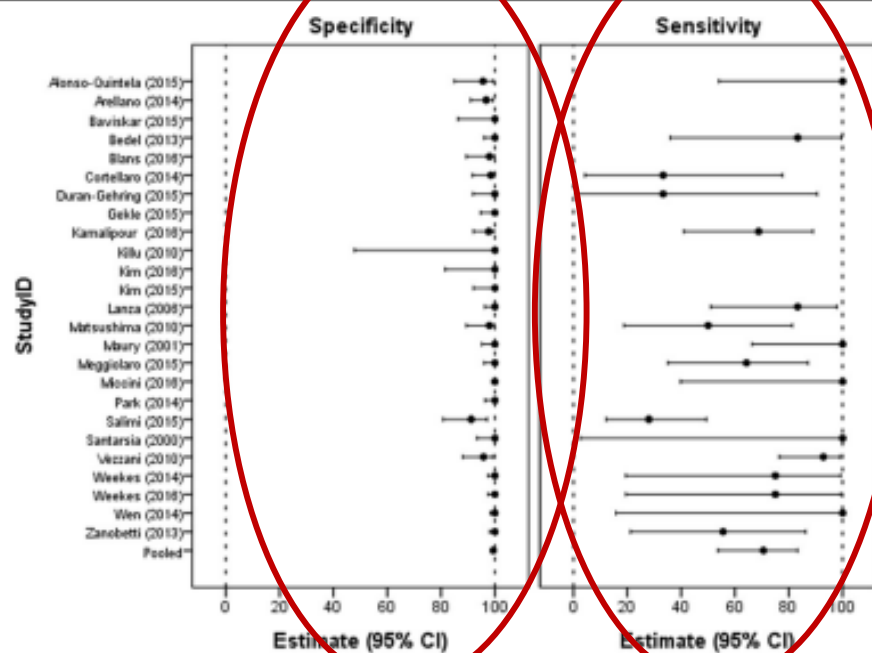


Fig. 4 Forest plot of the specificity and sensitivity of ultrasound for detection of CVC-related complications. The pooled specificity and sensitivity as well as the specificity and sensitivity for each study individually with their respective confidence interval (CI). Studies showed significant statistical heterogeneity; for specificity, $I^2 = 83.3$ (95% CI: 64.6–86.7) and, for sensitivity, $I^2 = 75.5$ (95% CI: 77.1–90.4)

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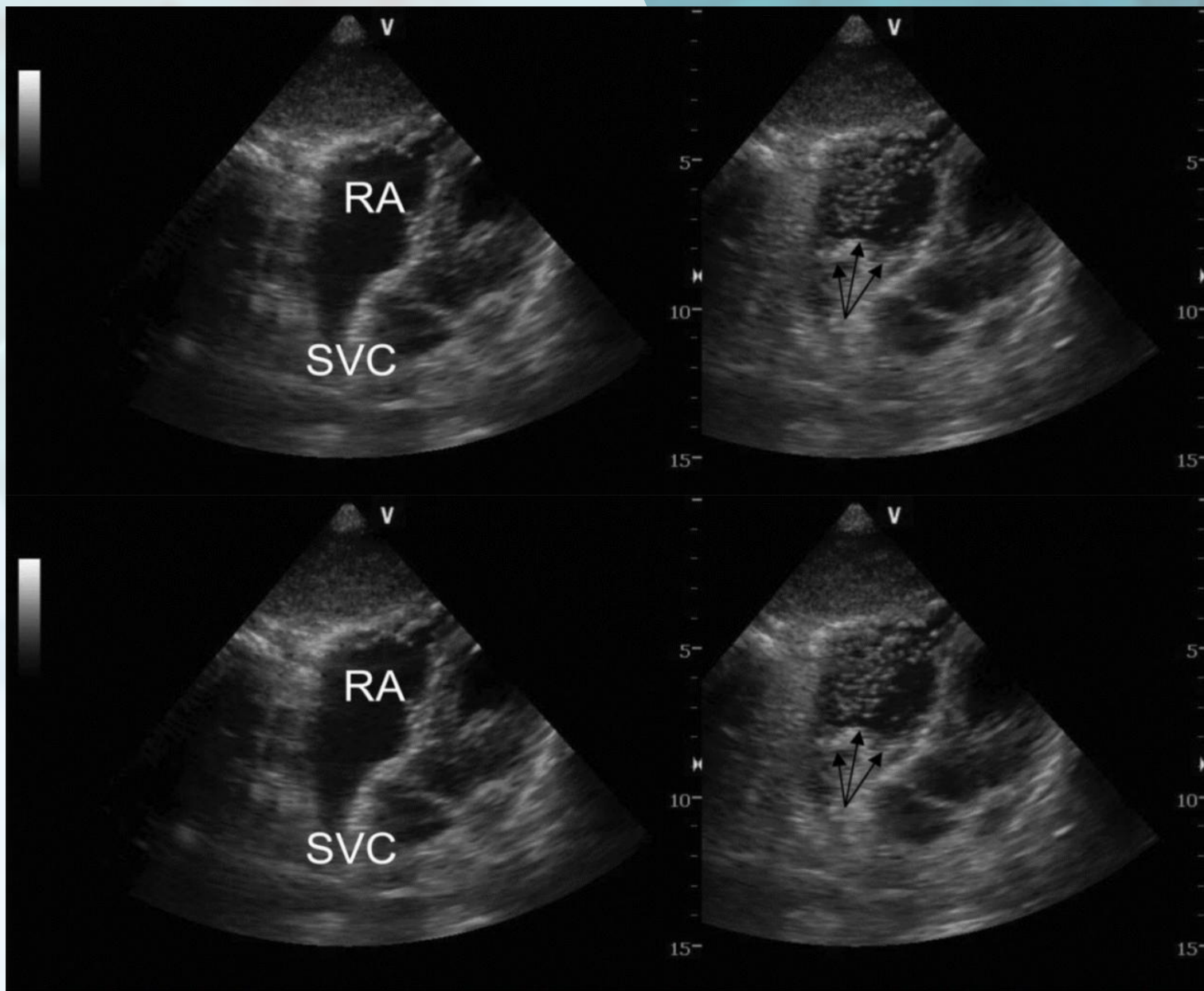


The major findings of this systematic review and meta-analysis on the diagnostic accuracy of US to detect CVC malposition are a pooled specificity and sensitivity of 98.9 (95% CI: 97.8–99.5) and 68.2 (95% CI: 54.4–79.4), respectively. Therefore, US is an accurate and feasible diagnostic modality to detect CVC malposition and iatrogenic pneumothorax. Advantages of US over CXR are that it is performed faster and does not subject patients to radiation. Vascular US combined with trans-thoracic echocardiography is advised. However, results need to be interpreted with caution since included studies were often underpowered and had methodological limitations. A large multicenter study investigating optimal US protocol, among others, is needed.



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Pictorial Review

Imaging and management of complications of central venous catheters

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^b Department of Vascular Surgery, City General Hospital, University Hospital of North Staffordshire NHS Trust, Stoke-On-Trent, UK



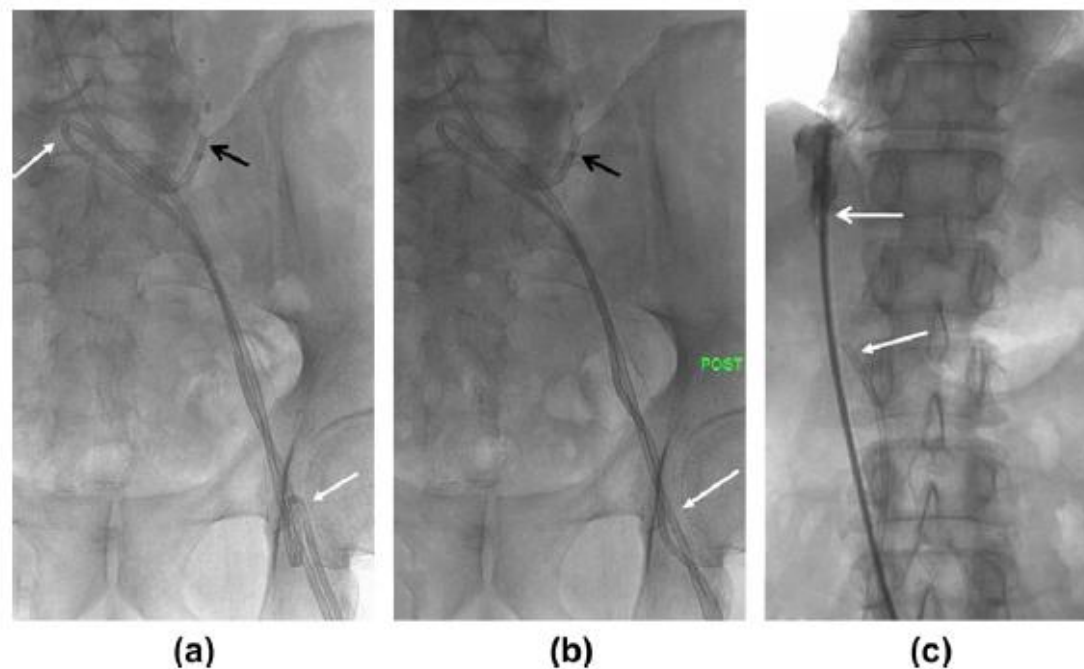
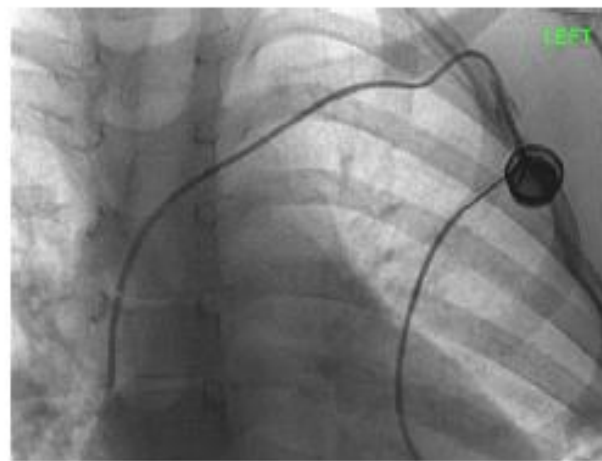
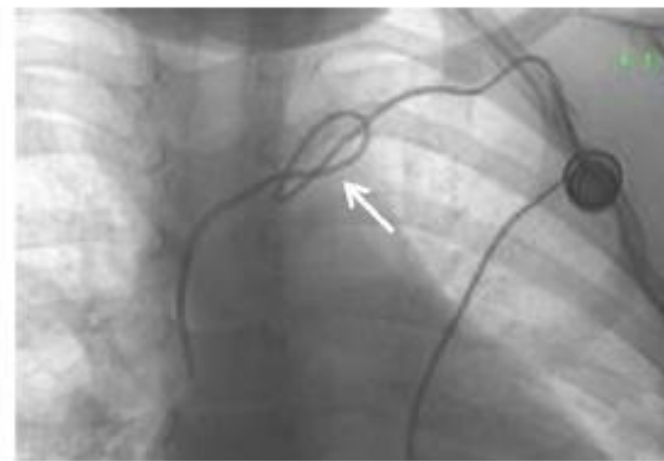


Figure 9 Primary malposition and kinking of a left femoral dialysis line. Abdominal radiograph (a) showed two kinks (white arrows) in a malfunctioning left femoral dialysis line after blind insertion. The tip of one of the lines was malpositioned into the ascending lumbar vein (black arrows). Abdominal radiographs (b and c) showed successful straightening of the kinks using a stiff guide wire. The tips of the line (white arrows) were satisfactorily repositioned to lie within the IVC.



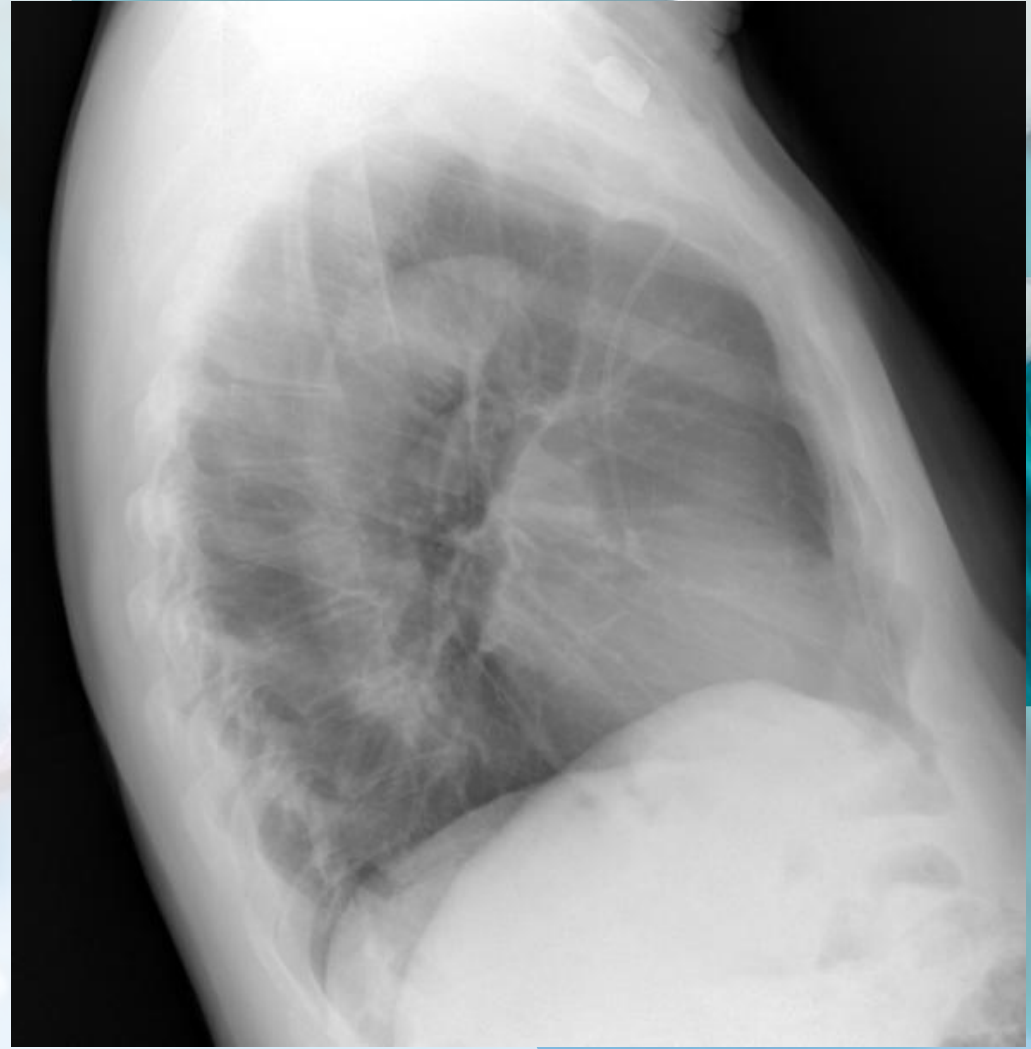
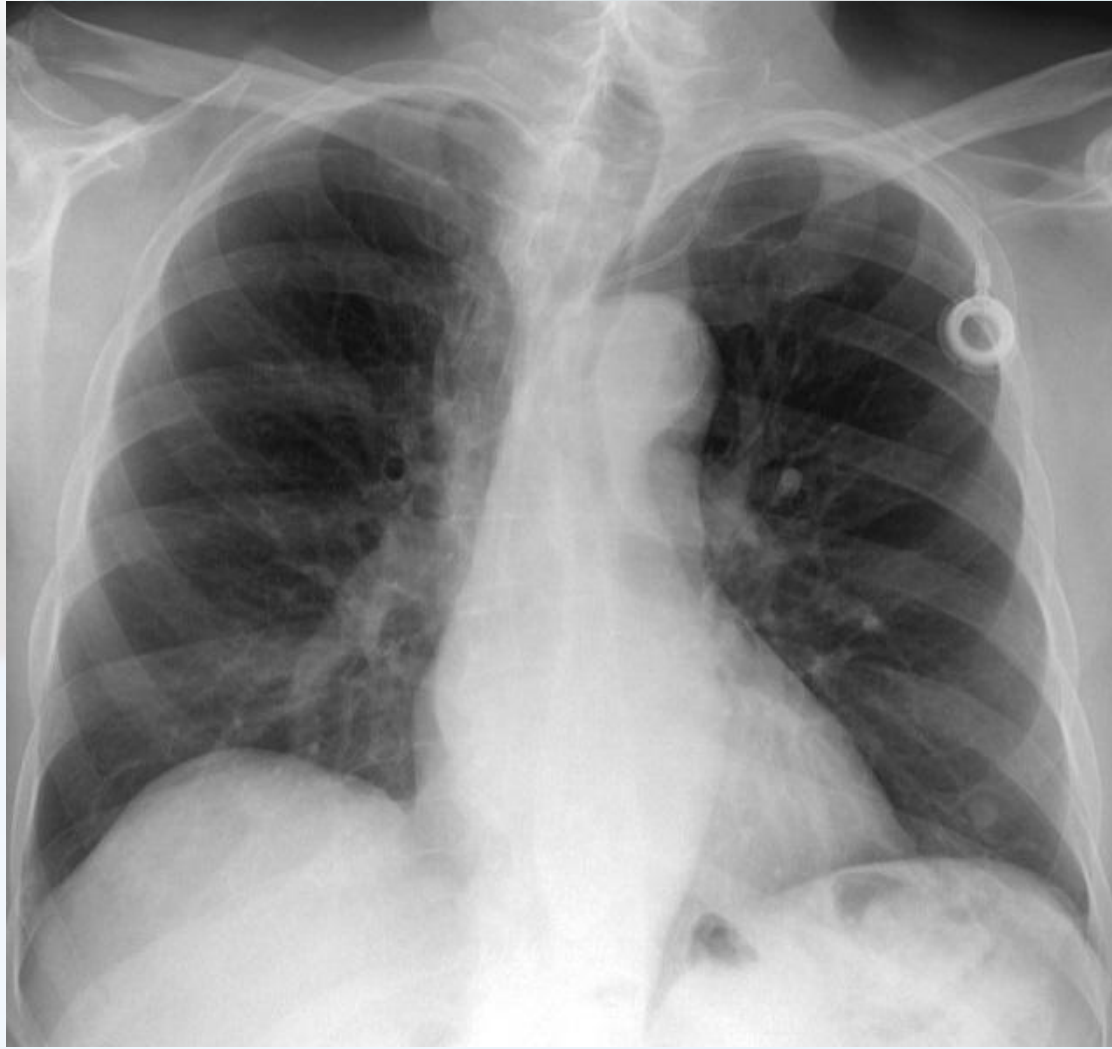


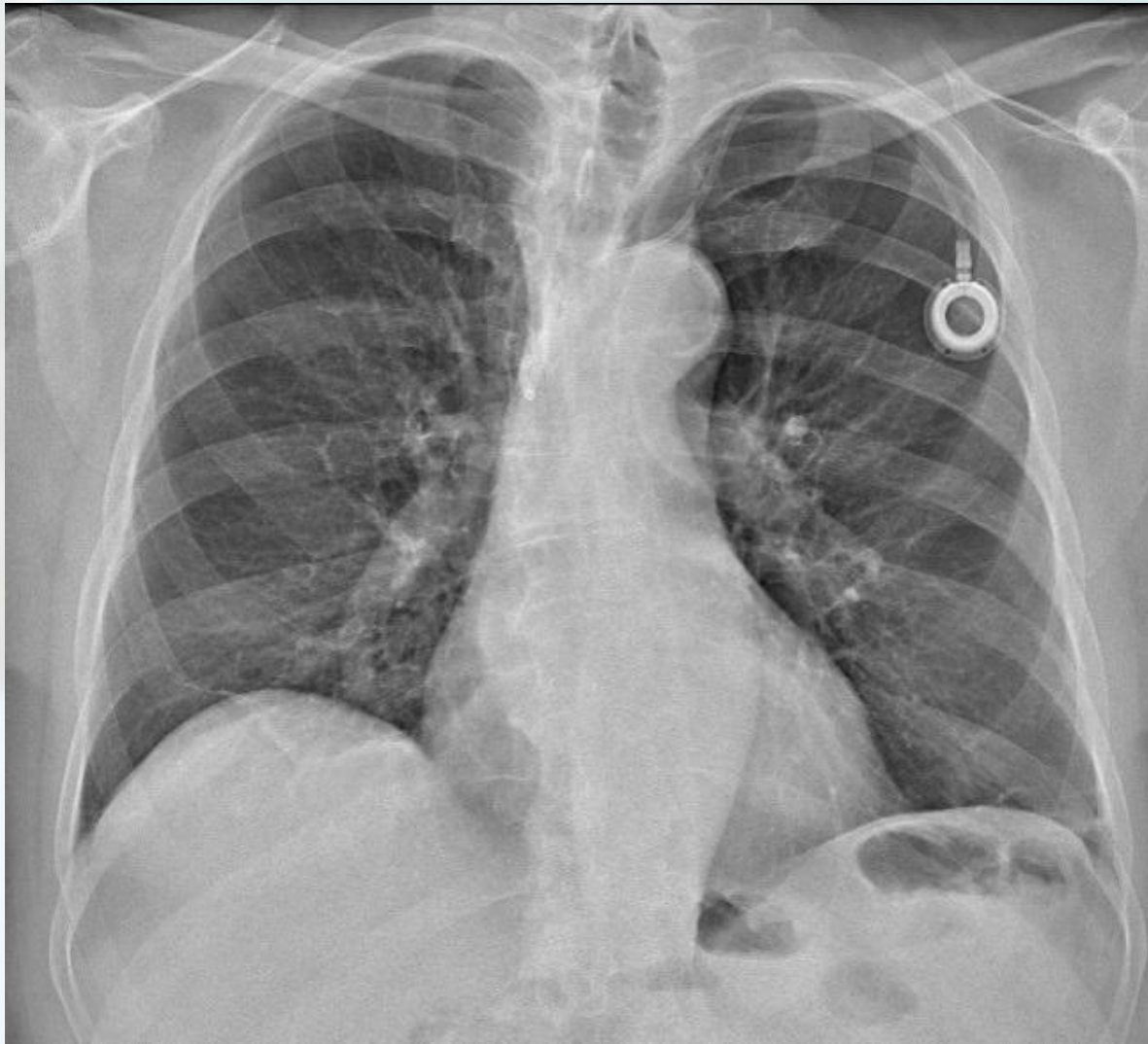
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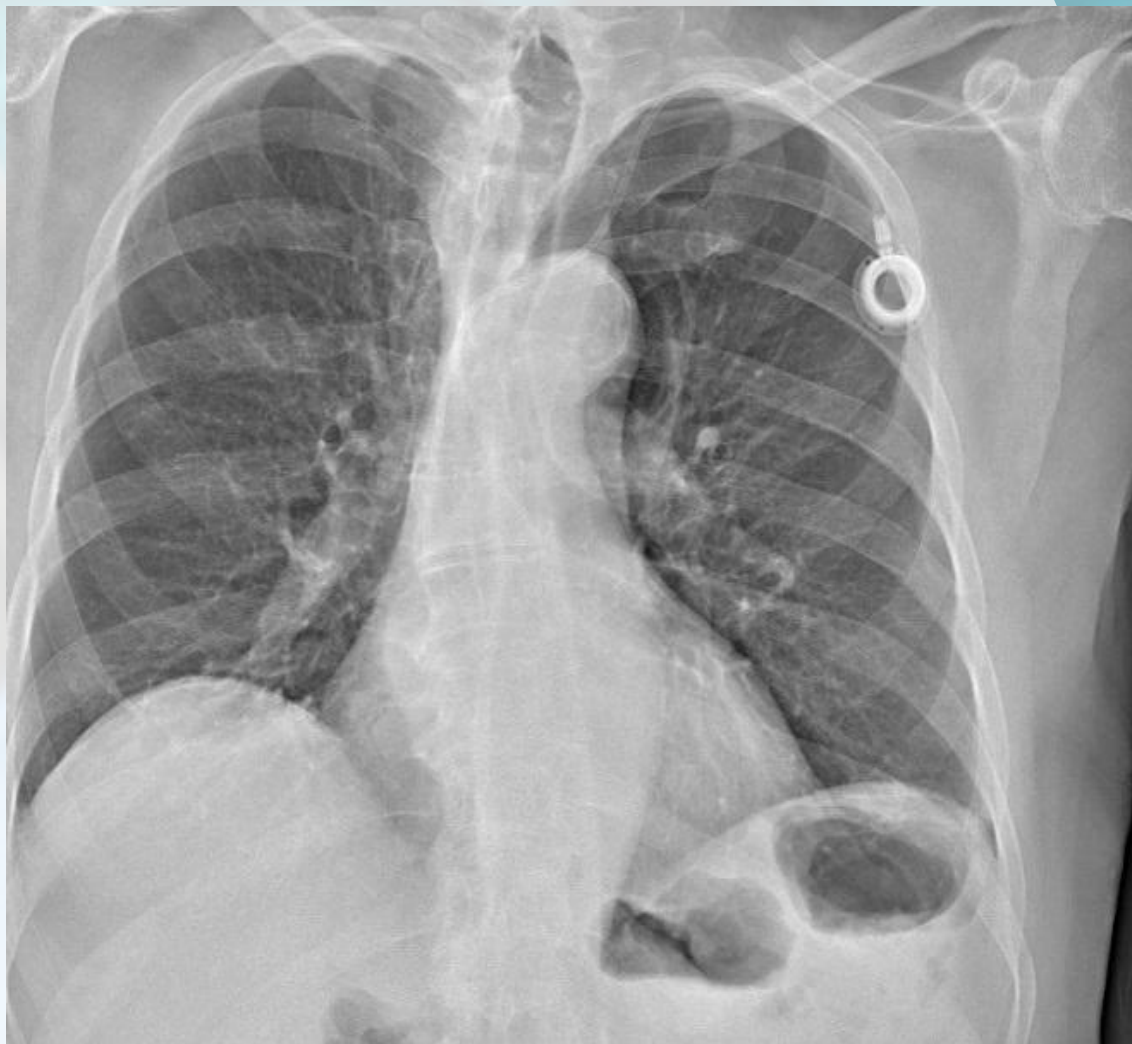


(b)

Figure 14 Intermittent looping of Portacath in a 4-year-old boy with cystic fibrosis and periodic malfunctioning of the port. Fluoroscopy (a–b) during linogram demonstrated intermittent looping (arrow) of the Portacath within the left brachio-cephalic vein. The looping of the line was induced by injection through the line. This was managed by inserting a new port on the right side.





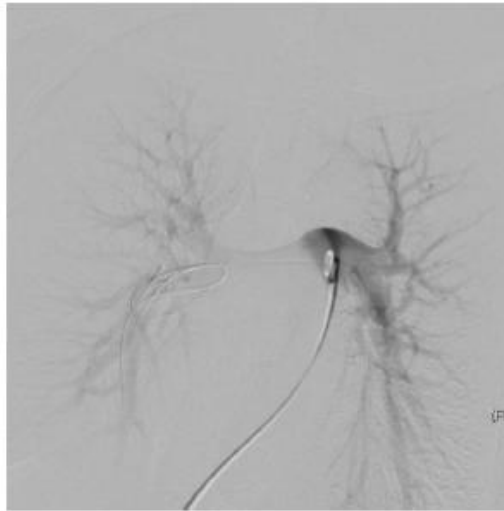


Hindawi Publishing Corporation
BioMed Research International
Volume 2016, Article ID 7814529, 5 pages
<http://dx.doi.org/10.1155/2016/7814529>

Research Article

A Novel Two-Step Technique for Retrieving Fractured Peripherally Inserted Central Catheter Segments Migrating into the Heart or the Pulmonary Artery





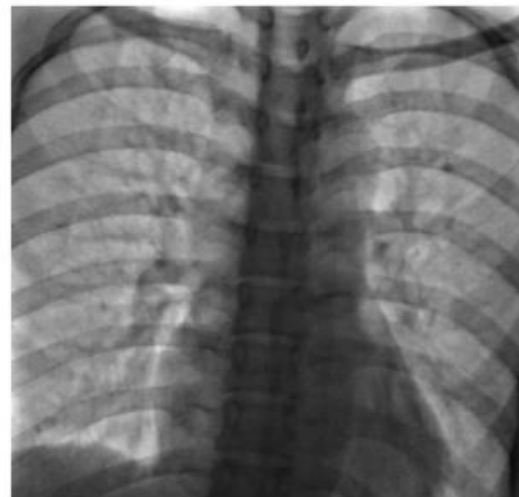
(a)



(b)



(c)



(d)





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Pictorial Review

Imaging and management of complications of central venous catheters

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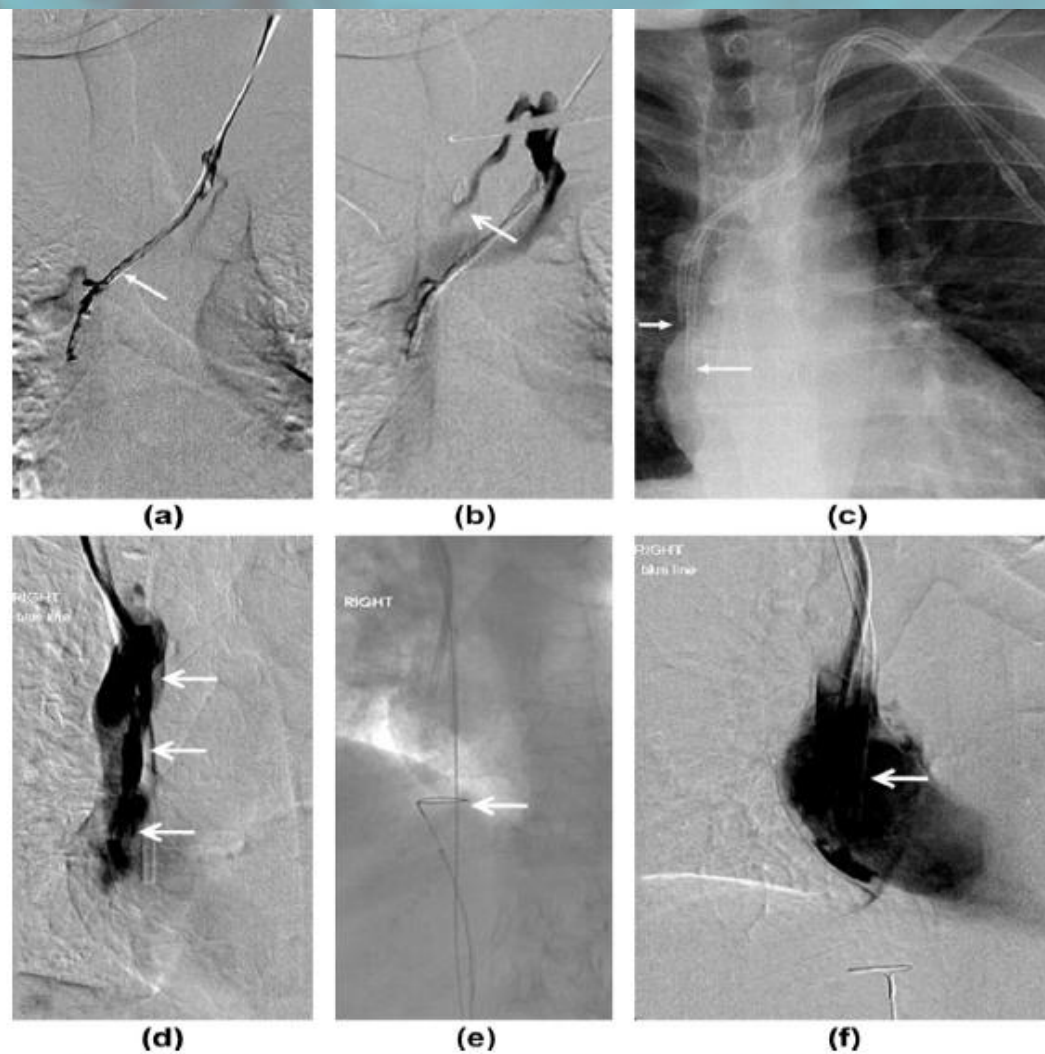


Figure 16 (a–c) Fibrin cast formation in a 34-year-old man who previously had a left IJV tunnelled line, which was removed due to malfunction. Left IJV venogram (a–b) during line exchange showed fibrin cast (arrow) formation within the left brachiocephalic vein. Chest radiograph (c) demonstrated successful line exchange (arrows) after balloon angioplasty of the pre-existing fibrin sheath. (d–f) Fibrin sheath stripping. Linogram (d) confirmed the presence of a fibrin sheath around the haemodialysis lines. The fibrin sheath prevents contrast medium flowing forwards away from the catheter tip, but instead it backtracks (arrows) around the catheter. Fluoroscopy image (e) demonstrates a goose-neck snare (arrow) inserted via a femoral venous approach. The snare is repeatedly tightened and pulled down over the lines to strip them. Post-stripping linogram (f) confirmed satisfactory clearance (arrow) of the fibrin sheath and restoration of normal forward flow of contrast

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TECHNICAL NOTE

TuLIP (Tunnelled Line Intraluminal Plasty): An Alternative Technique for Salvaging Haemodialysis Catheter Patency in Fibrin Sheath Formation

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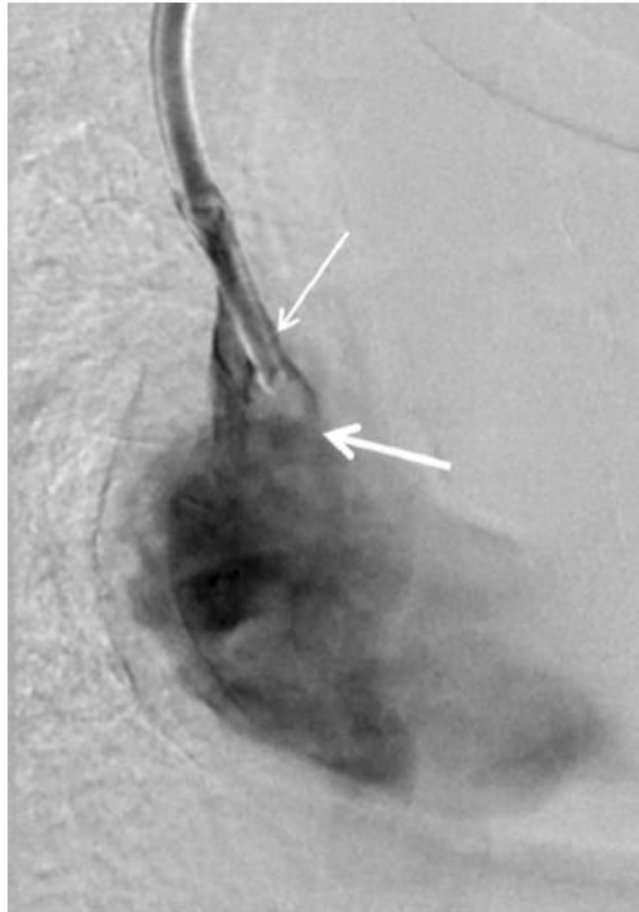


Fig. 1 Contrast injection through a haemodialysis catheter in a patient with fibrin sheath formation. A filling defect is seen at the distal tip of the catheter compatible with a small associated thrombus (thick arrow). Contrast is also seen tracking cranially alongside the catheter deep to the fibrin sheath (thin arrow)

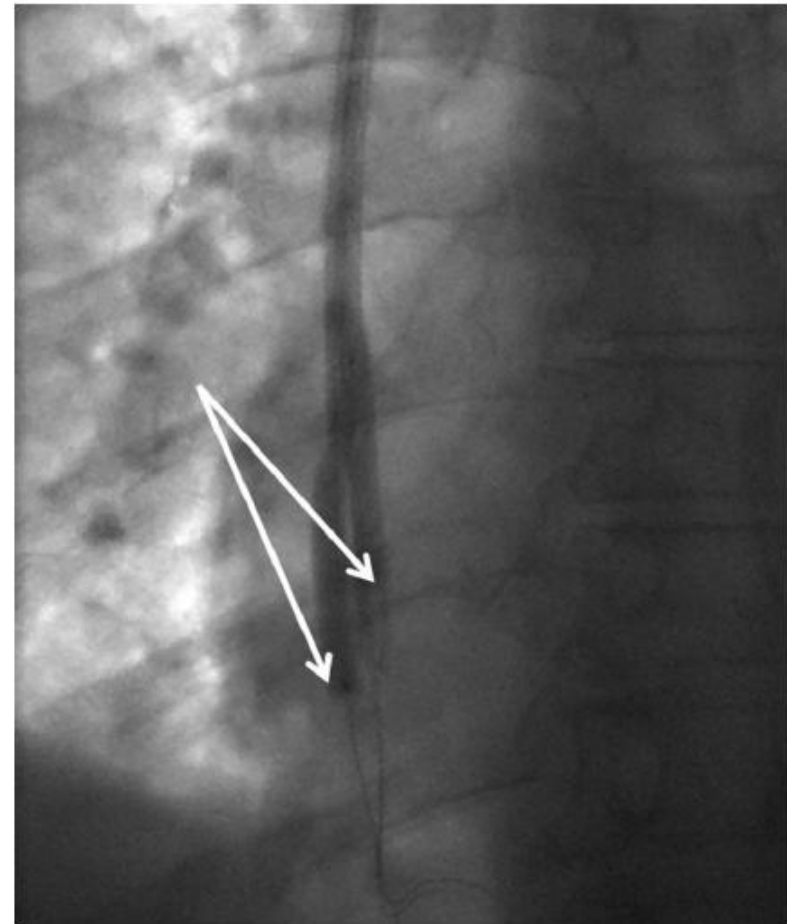


Fig. 2 Fluoroscopic image demonstrating over the wire 0.018" platform standard angioplasty balloons inflated in a 'kissing' fashion. Note the balloons are aligned with the offset positions of the distal tips of the venous (distal) and arterial (proximal) lumens (arrows)



Fig. 3 Post-treatment contrast injection demonstrating significant improvement in flow with only a residual filling defect (arrow) alongside the distal tip of the catheter





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Pictorial Review

Imaging and management of complications of central venous catheters

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