



TROMBOSI VENOSA DEGLI ARTI SUPERIORI E INTRADDOMINALE

La diagnostica per immagini

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Unità Operativa Semplice di Radiologia Vascolare e d Interventistica





TIPS FOR SUCCESSFUL VENOUS OCCLUSION INTERVENTION

Haraldur Bjarnason, MD

Interventional Radiology

Department of Radiology

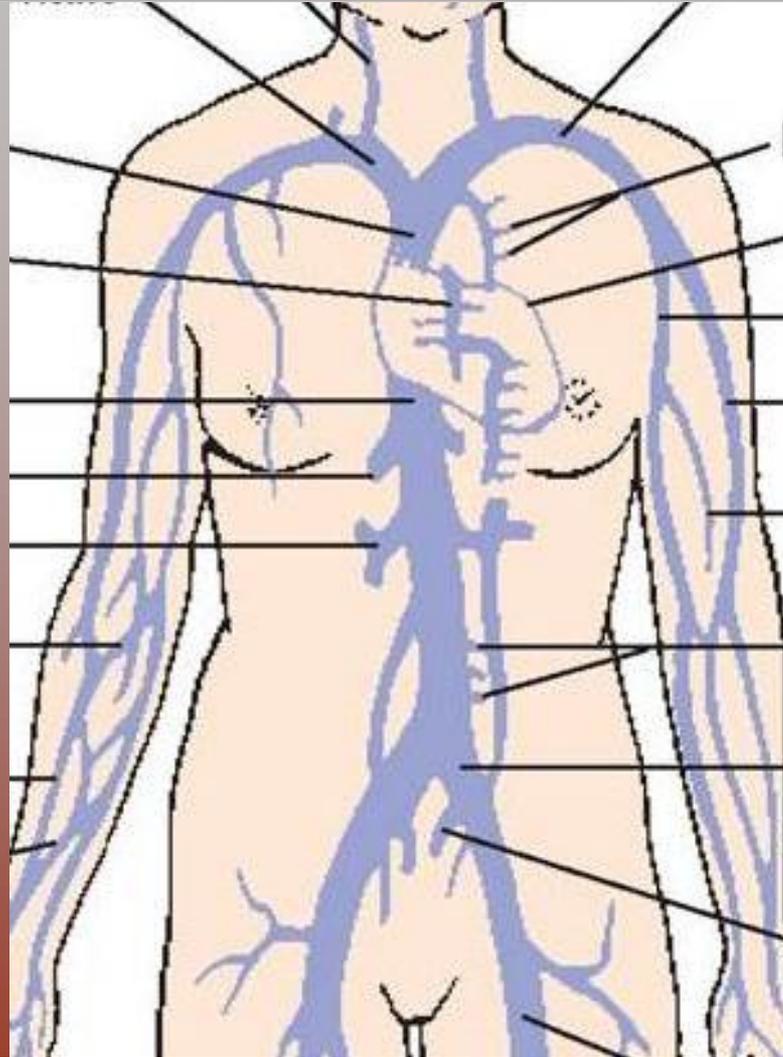
Mayo School of Graduate Medical Education

VOL. 15, NO. 7 JULY 2016 ENDOVASCULAR TODAY

- The key to successful vein recanalization is to **understand the anatomy**.
- One must take into account the **overall anatomic situation, inflow and outflow**, as well as the **cephalic extension** of the obstruction.
- It is therefore crucial to have **good cross-sectional imaging** for planning purposes



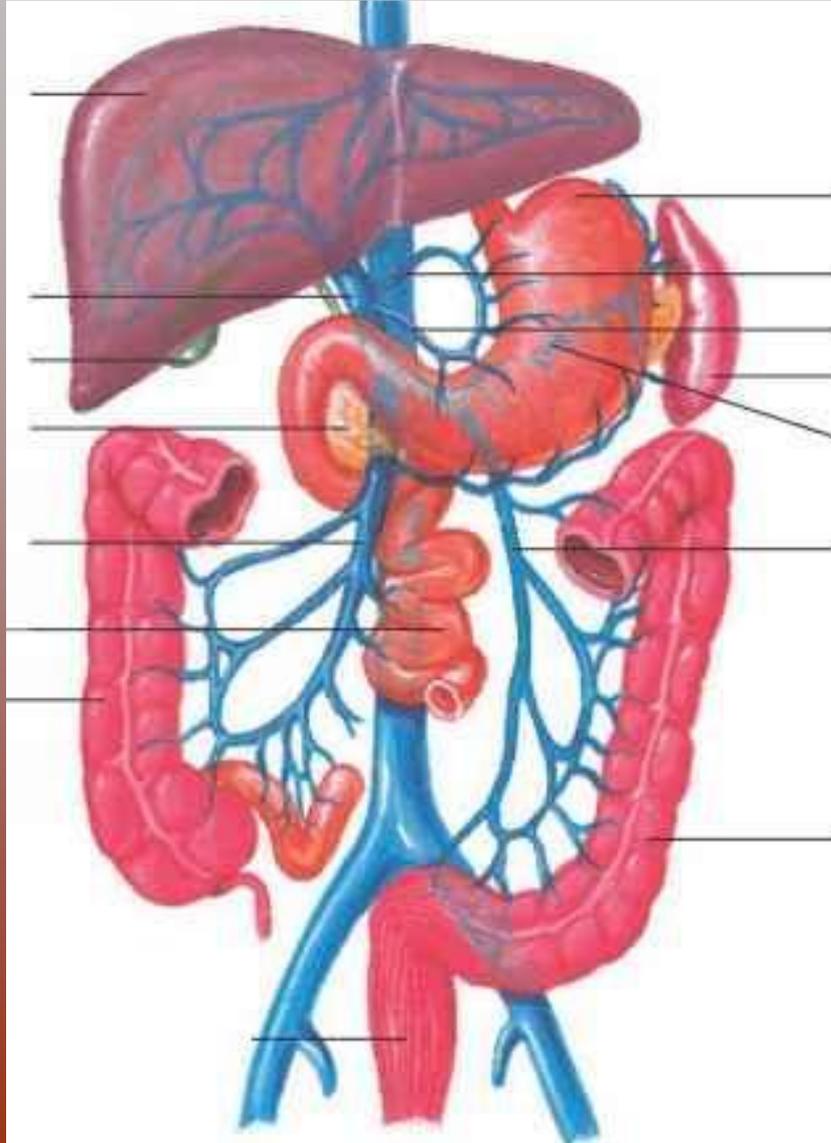
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TROMBOSI VENOSA ILIACO-CAVALE

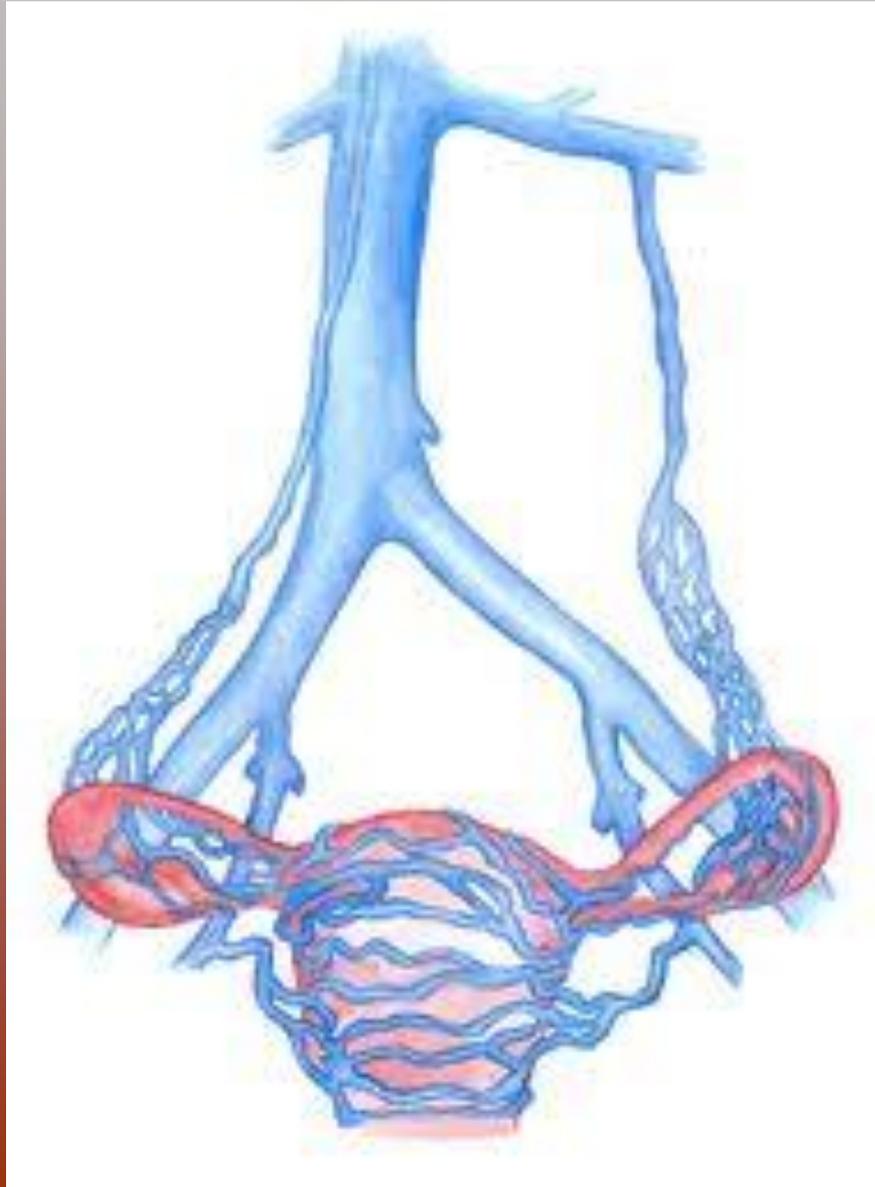


TROMBOSI VENOSA MESENTERICO-PORTALE





TROMBOSI VENOSA GONADICO-RENALE





DIAGNOSTICA PER IMMAGINI

SEDE
ESTENSIONE
RAPPORTI
NATURA
CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE
FOLLOW UP

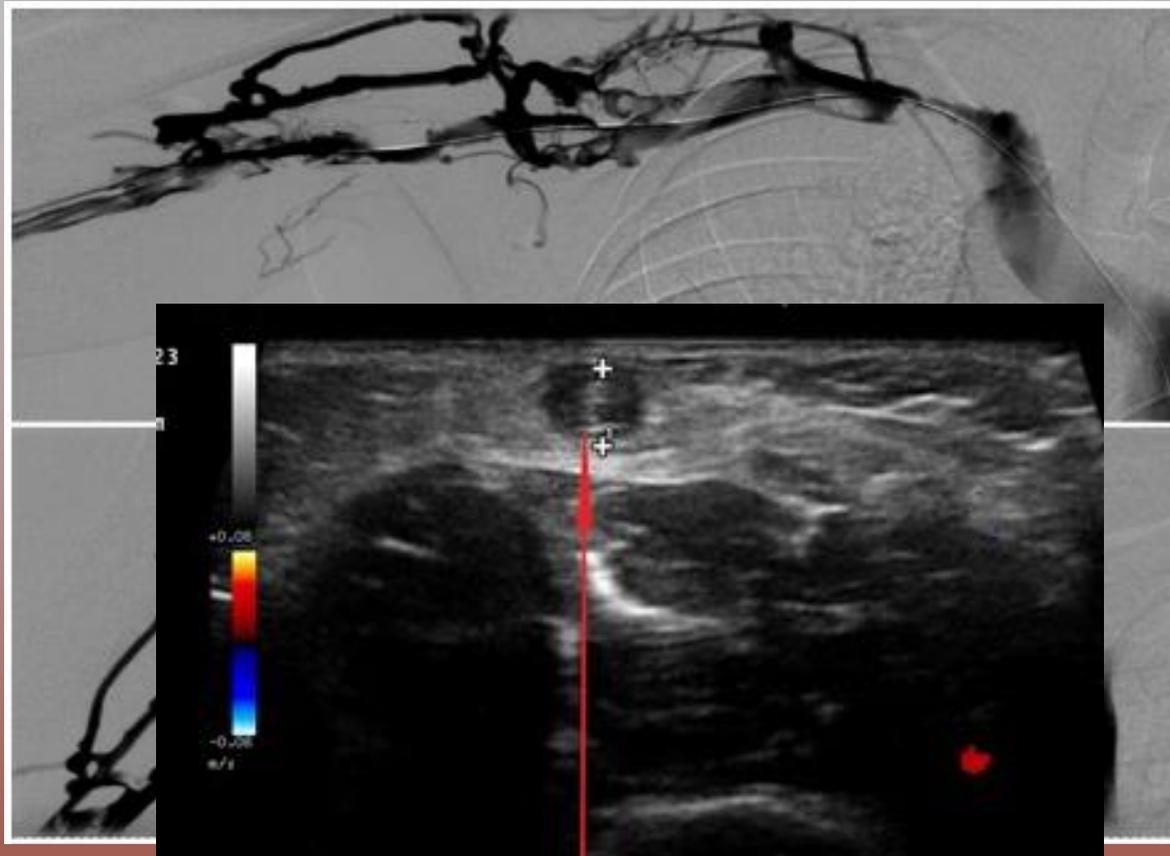


DIAGNOSTICA PER IMMAGINI

**SEDE
ESTENSIONE
RAPPORTI**



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SEDE
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RAPPORTI

Whereas **venography** remains the **gold standard** for diagnosing UEDVT, it has been **largely replaced by ultrasonography** as the initial diagnostic modality.

Management of Deep Vein Thrombosis of the Upper Extremity

Rolf P. Engelberger, MD; Nils Kucher, MD

(*Circulation*. 2012;126:768-773.)



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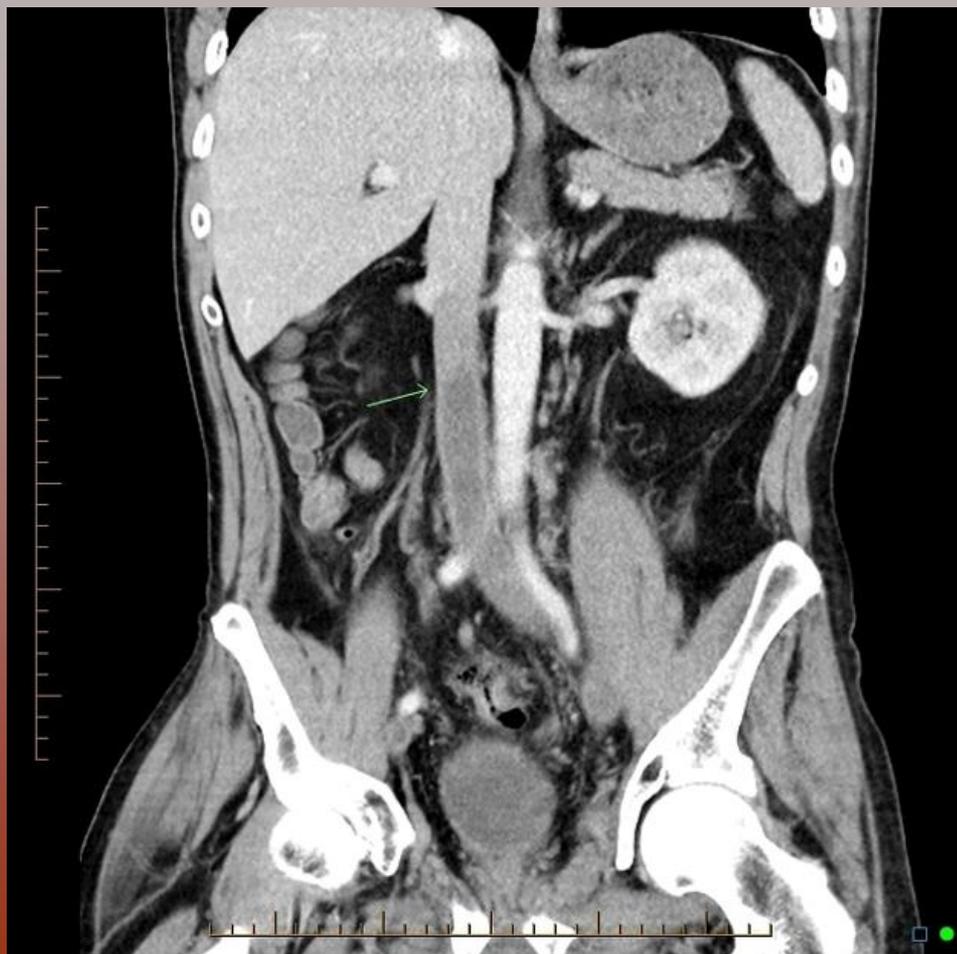
Douglas S. Katz, MD, FACR, Kristen Fruauff, MD, Anca-Oana Kranz, MD, and Man Hon, MD

**Imaging of deep venous thrombosis:
A multimodality overview**



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Because **CT** is used to evaluate a wide variety of abdominal symptoms, it is likely to be the **most common imaging modality** for initial detection of IVC variants and pathologic findings



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*Richard P. Smillie, MD
Monisha Shetty, MD
Andrew C. Boyer, MD
Beatrice Madrazo, MD, RVT
Syed Zafar Jafri, MD*

**Imaging Evaluation of the
Inferior Vena Cava¹**

RadioGraphics 2015; 35:578-592



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MR imaging, specifically with breath-hold contrast material–enhanced three-dimensional T1-weighted imaging and balanced steady-state free-precession techniques, is more reliable than CT for evaluation of IVC **tumor thrombus**



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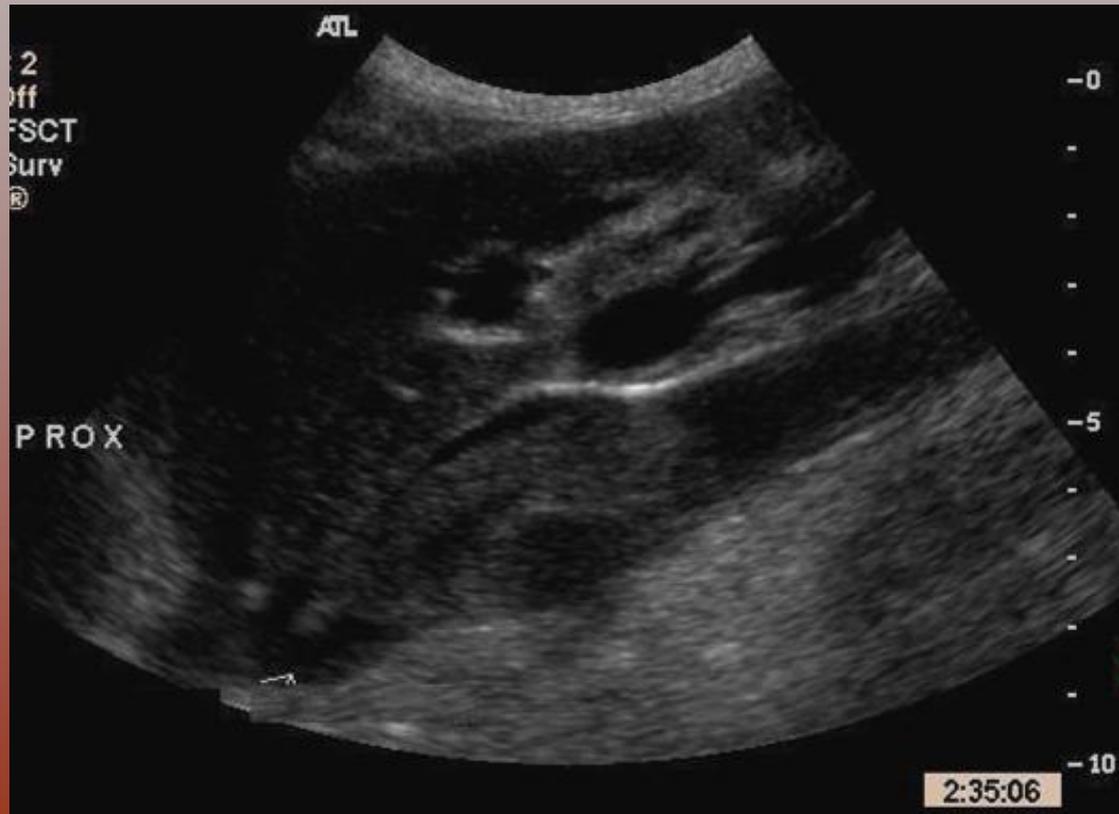
**Imaging Evaluation of the
Inferior Vena Cava¹**

RadioGraphics 2015; 35:578–592



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US is also useful for **initial evaluation** when an IVC pathologic condition is suspected, although US is subject to operator dependence and evaluation of the infrahepatic IVC may be limited because of artifact resulting from overlying bowel gas and body habitus



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**Imaging Evaluation of the
Inferior Vena Cava¹**



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Thomas de Perrot, MD,¹ Marc Righini, MD,² Henri Bounameaux,² Pierre-Alexandre Poletti, MD¹

**Contrast-Enhanced Sonographic Diagnosis of
Unsuspected Internal Iliac Vein Thrombosis**

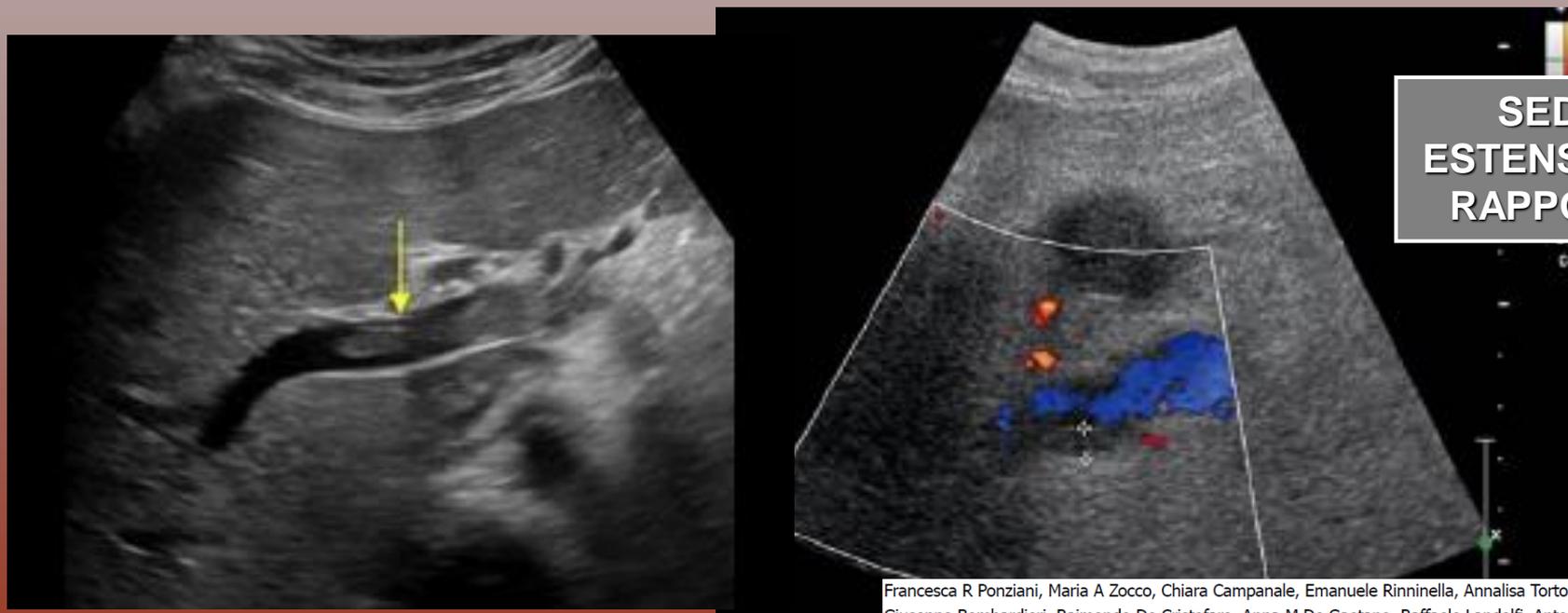
J Clin Ultrasound **39**:553–555, 2011;



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Ultrasonography (US) is usually the **investigation of choice**, with a sensitivity and specificity ranging between 60% and 100%[

Doppler imaging can confirm the absence of flow in part or all the **vasal lumen**



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Francesca R Ponziani, Maria A Zocco, Chiara Campanale, Emanuele Rinninella, Annalisa Tortora, Luca Di Maurizio, Giuseppe Bombardieri, Raimondo De Cristofaro, Anna M De Gaetano, Raffaele Landolfi, Antonio Gasbarrini

Portal vein thrombosis: Insight into physiopathology, diagnosis, and treatment

Gastroenterol 2010; 16(2): 143-155



TROMBOSI VENOSA MESENTERICO-PORTALE

CT scanning is able to demonstrate hyperattenuating material in the portal vein lumen and the **absence of enhancement** after contrast injection

MRI might also confirm the vascular occlusion; at spin-echo MR, the clot appears isointense on T1- weighted images, or **hyperintense if recent**, and usually has a more intense signal on T2 images

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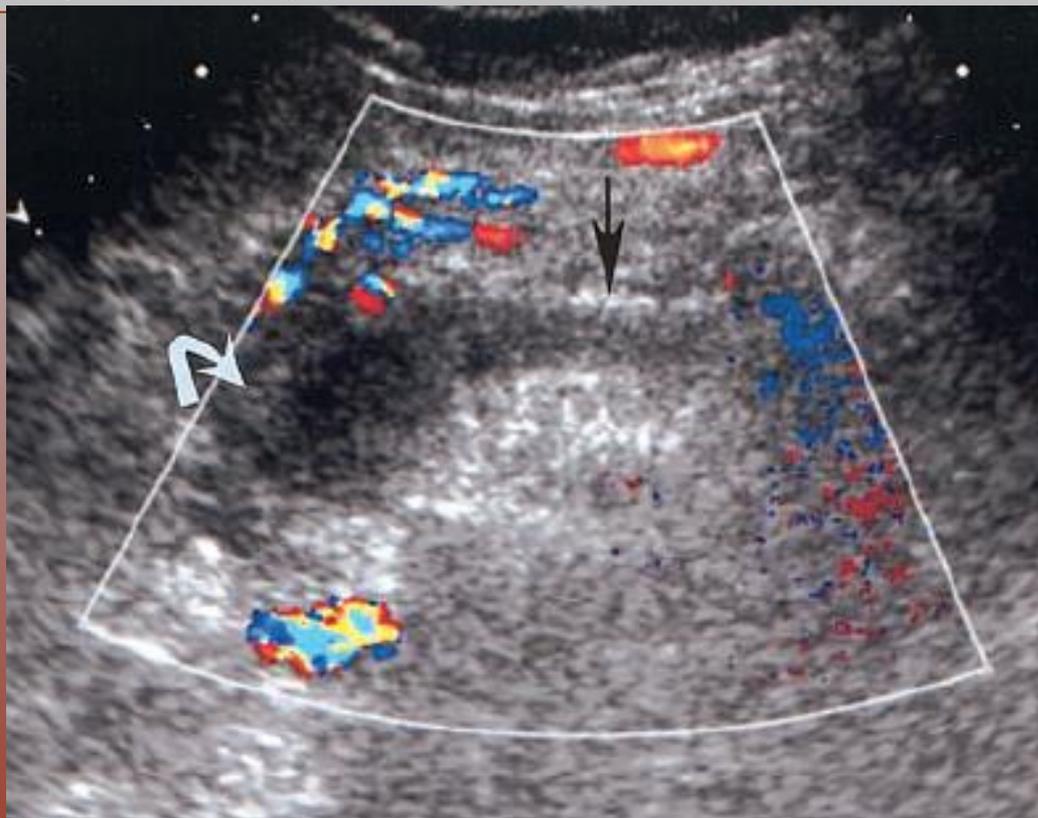
Portal vein thrombosis: Insight into physiopathology, diagnosis, and treatment

Gastroenterol 2010; 16(2): 143-155



TROMBOSI VENOSA MESENTERICO-PORTALE

US is less reliable in determining the **extension of the thrombus to the mesenteric circulation**. Instead, **CT** scanning and magnetic resonance imaging (**MRI**) can easily obtain this information



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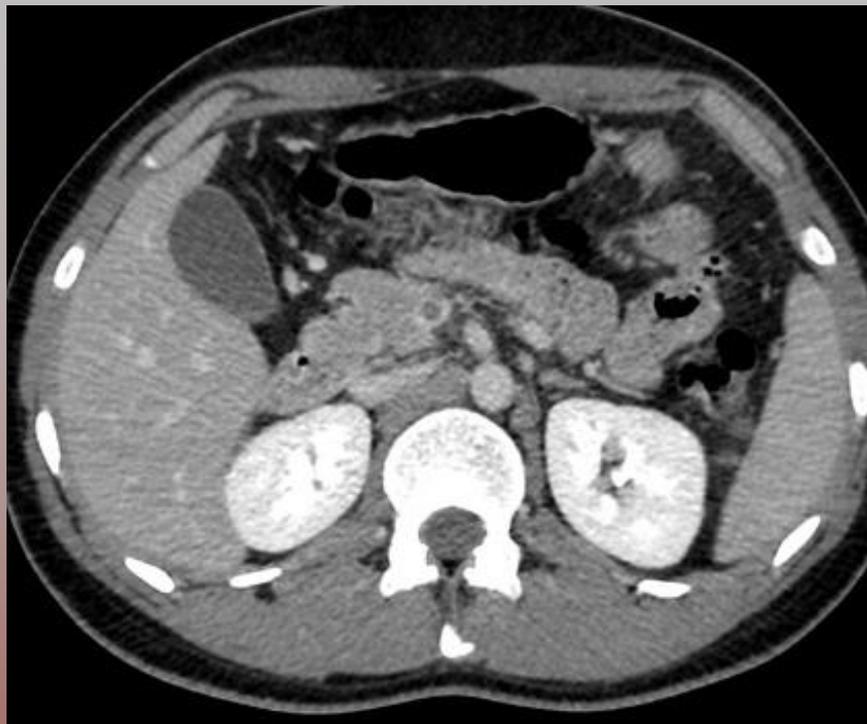
Francesca R Ponziani, Maria A Zocco, Chiara Campanale, Emanuele Rinninella, Annalisa Tortora, Luca Di Maurizio, Giuseppe Bombardieri, Raimondo De Cristofaro, Anna M De Gaetano, Raffaele Landolfi, Antonio Gasbarrini

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Helical CT angiography and three-dimensional gadolinium-enhanced **MR angiography** should be considered the **primary diagnostic modalities** for patients with a high clinical suspicion of **mesenteric venous thrombosis**.

Michelle S. Bradbury, MD, PhD • Peter V. Kavanagh, MD • Robert E. Bechtold, MD • Michael Y. Chen, MD • David J. Ott, MD • John D. Regan, MD • Therese M. Weber, MD

Mesenteric Venous
Thrombosis: Diagnosis
and Noninvasive
Imaging¹



TROMBOSI VENOSA MESENTERICO-PORTALE

SEDE
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Helical CT angiography and three-dimensional gadolinium-enhanced **MR angiography** should be considered the **primary diagnostic modalities** for patients with a high clinical suspicion of **mesenteric venous thrombosis**.



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CT, sonographic, and MR imaging findings of this pathology have been well described, and these methods have been shown to be reliable and sensitive for detecting OVT



Mehmet Bilgin,¹ Osman Sevket,² Seyma Yildiz,¹ Rasul Sharifov,¹ and Ercan Kocakoc¹

Imaging of Postpartum Ovarian Vein Thrombosis

Obstetrics and Gynecology Volume 2012,



TROMBOSI VENOSA GONADICO-RENALE

The **sensitivity** of contrast enhanced **CT** to detect OVT approaches **100%** although may be **overlooked by the inexperienced radiologist** given infrequent presentation



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RAPPORTI

Kassem Harris, Suchita Mehta, Edward Iskhakov, Michel Chalhoub, Theodore Maniatis, Frank Forte and Homam Alkaied

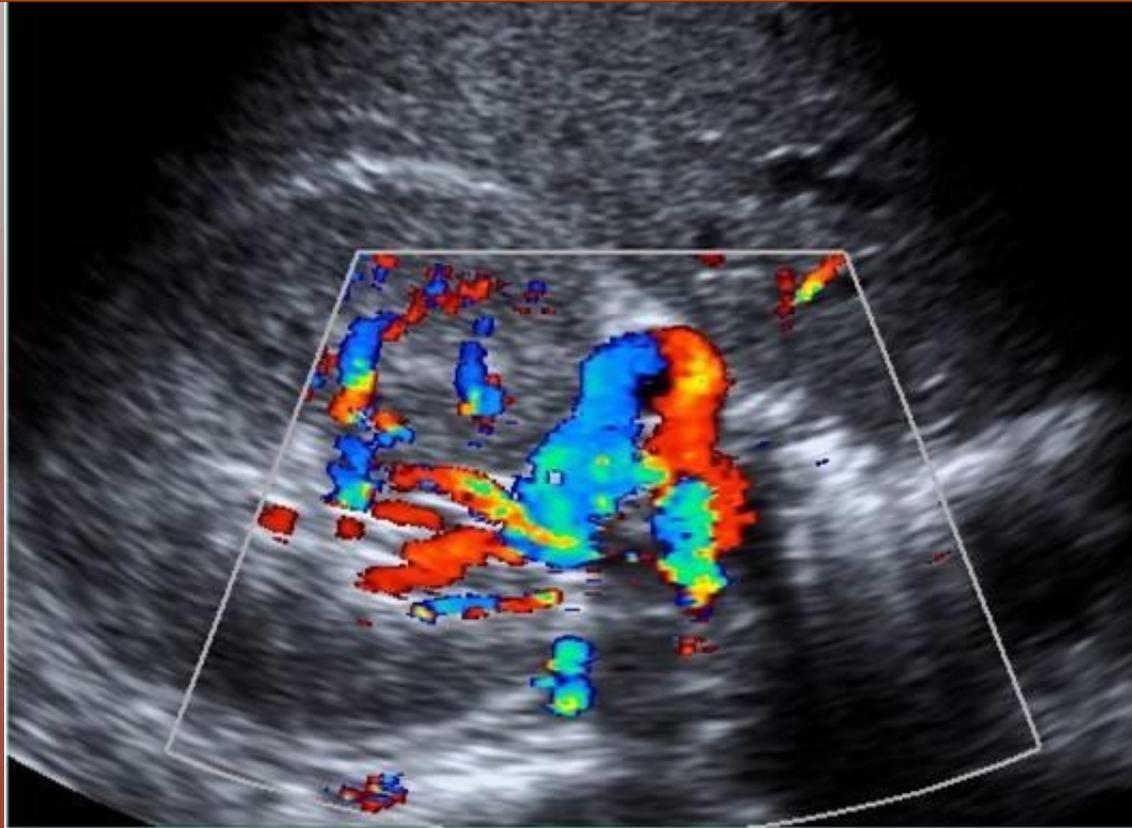
Ovarian vein thrombosis in the nonpregnant woman: an overlooked diagnosis



TROMBOSI VENOSA GONADICO-RENALE

- **Ultrasound (Duplex) of kidney and renal vein.**

This should be the initial investigation of choice. An increase in renal size accompanied by a decrease in echogenicity (due to interstitial edema) can be seen during the acute phase of obstruction



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Misha Witz MD¹ and Zeev Korzets

Renal Vein Occlusion: Diagnosis and Treatment

IMAJ 2007;9:402-405



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Conventional CT or CT angiography is useful , particularly when vein occlusion is thought to have been caused by renal or retroperitoneal tumor or aortic aneurysm

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Misha Witz MD¹ and Zeev Korzets

Renal Vein Occlusion: Diagnosis and Treatment

IMAJ 2007;9:402-405



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MRI is reported to be comparable or superior to CT angiography but is not freely available



Misha Witz MD¹ and Zeev Korzets

Renal Vein Occlusion: Diagnosis and Treatment

IMAJ 2007;9:402-405



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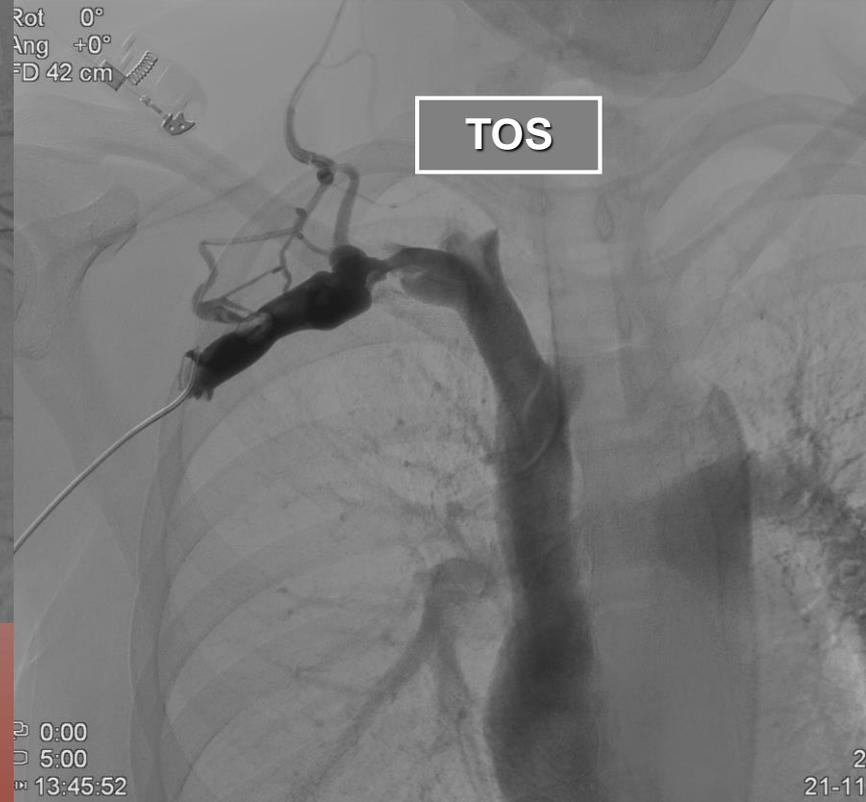
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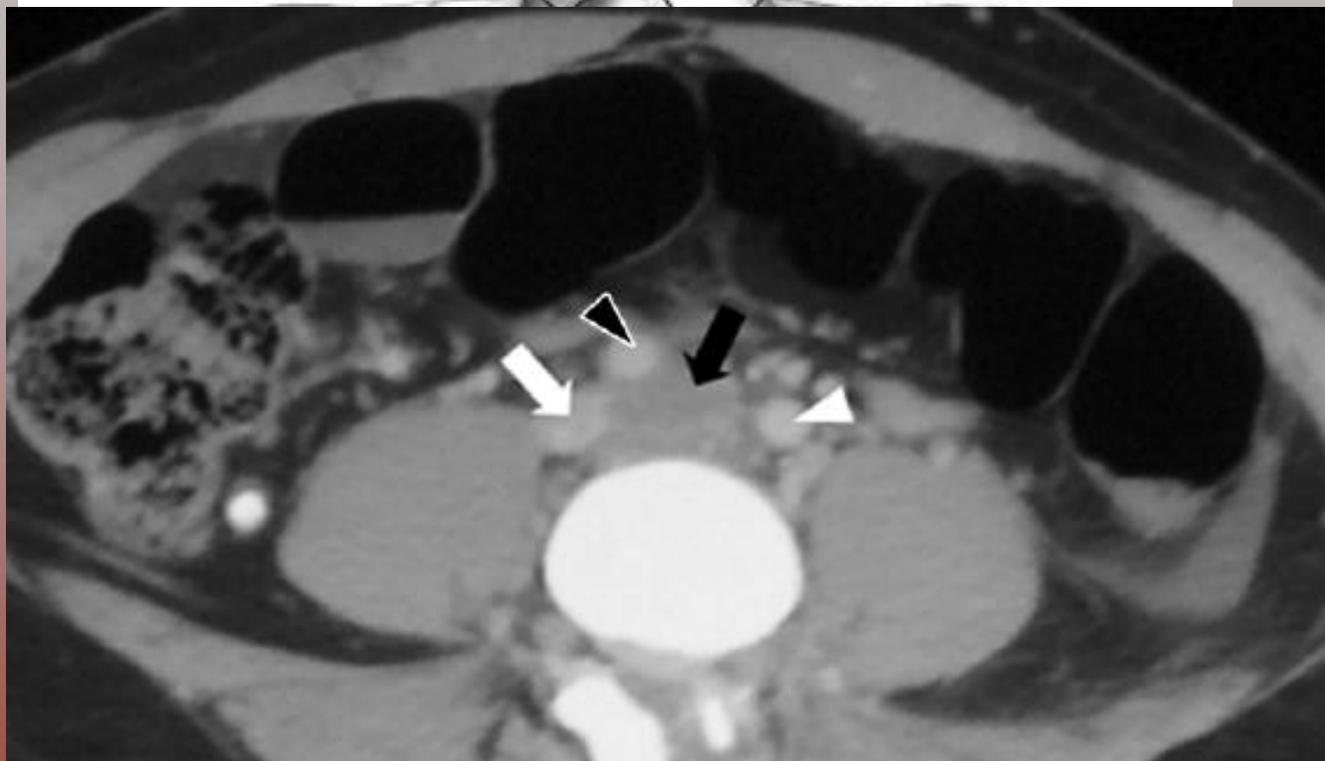




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**Endovascular Management of
May-Thurner Syndrome**

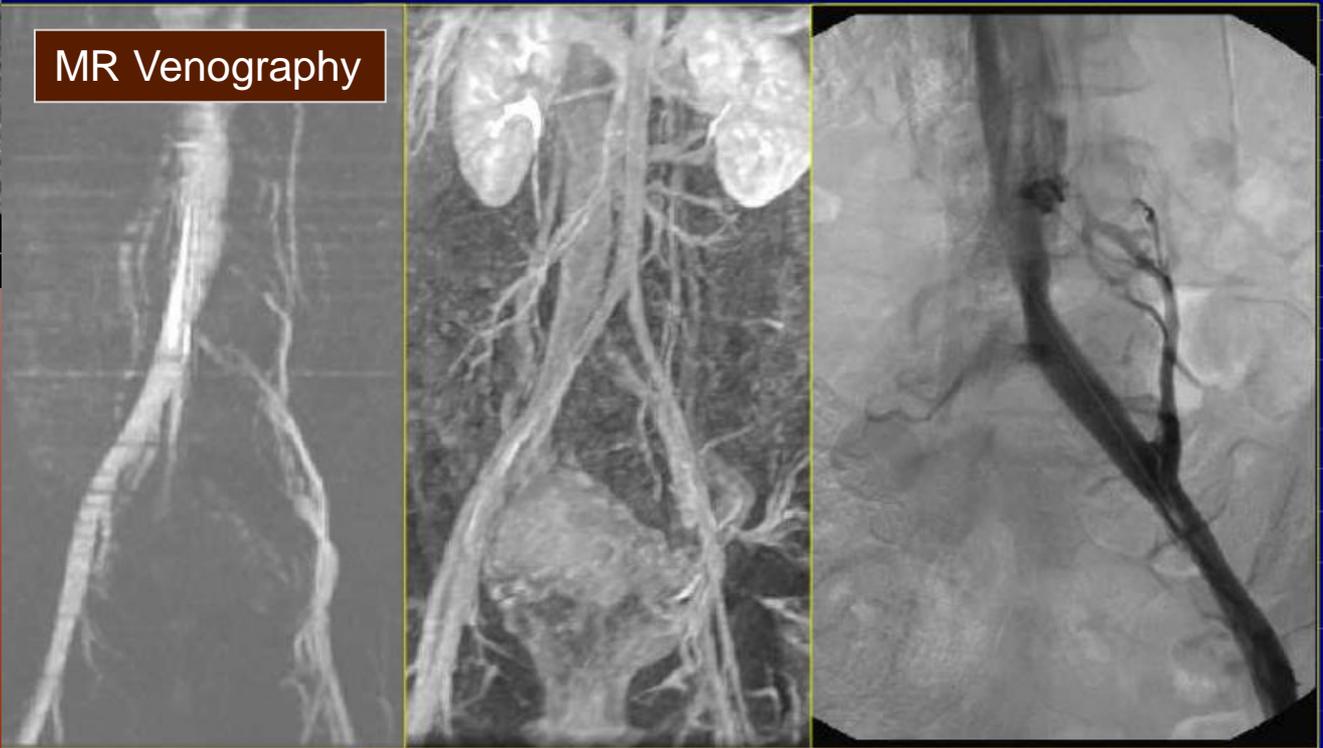
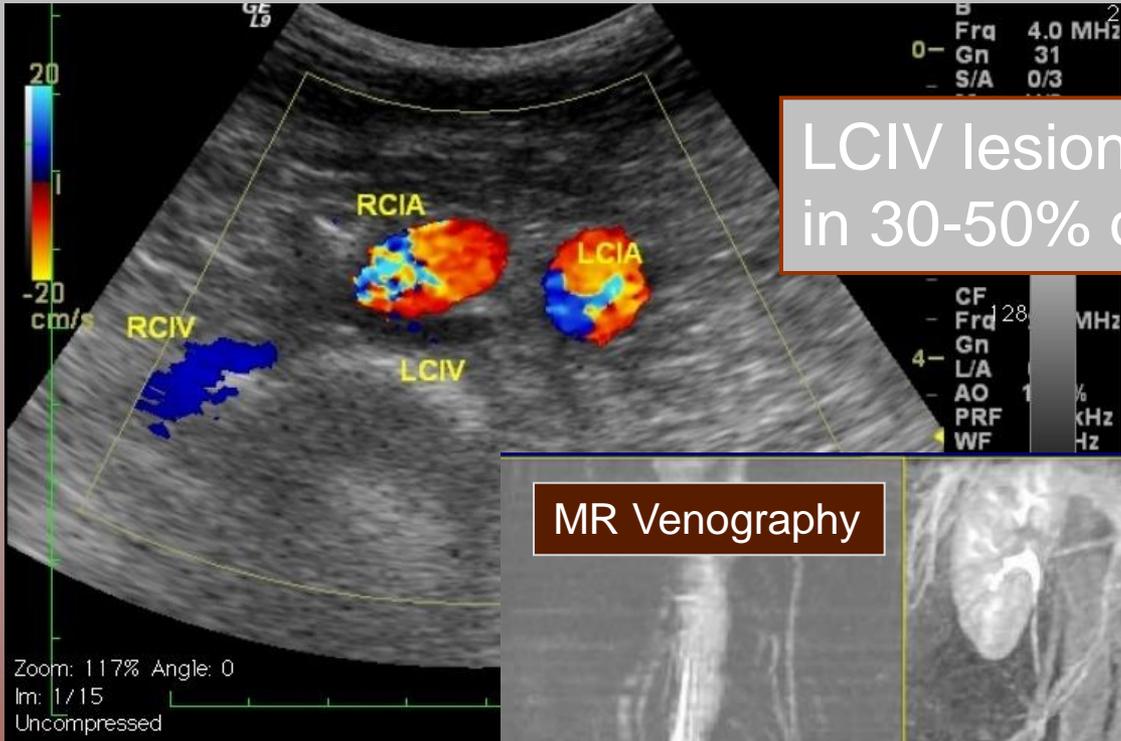
M. R. Grunwald
M. J. Goldberg
L. V. Hofmann



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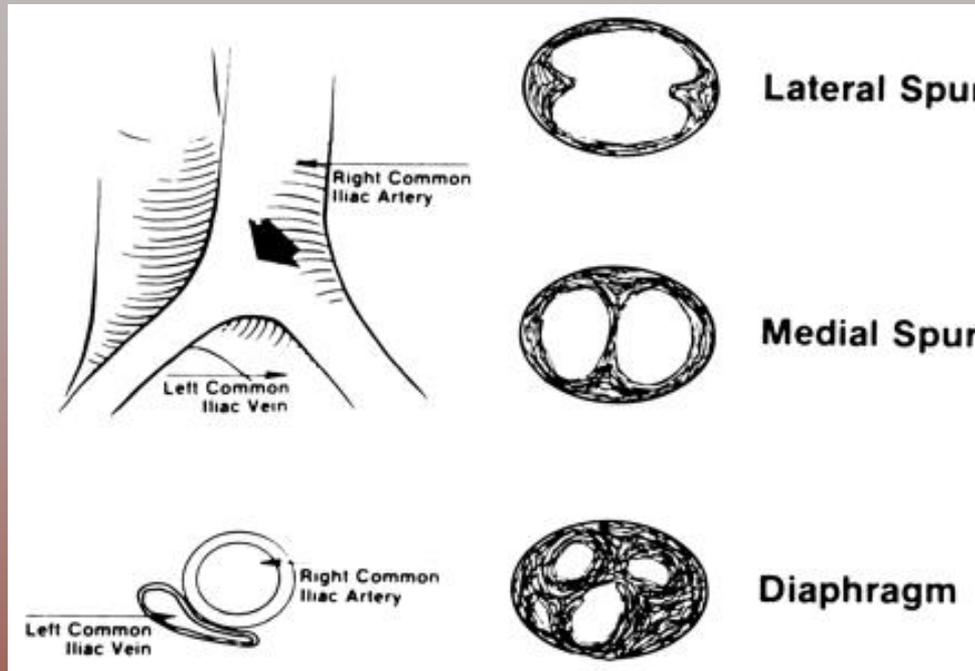
LCIV lesions present in silent form in 30-50% of the general population





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bands of fibrous tissue or webs were found in the left CIV at the point where it was crossed by the right CIA ,which consisted of fibrocytes, collagen, and capillaries



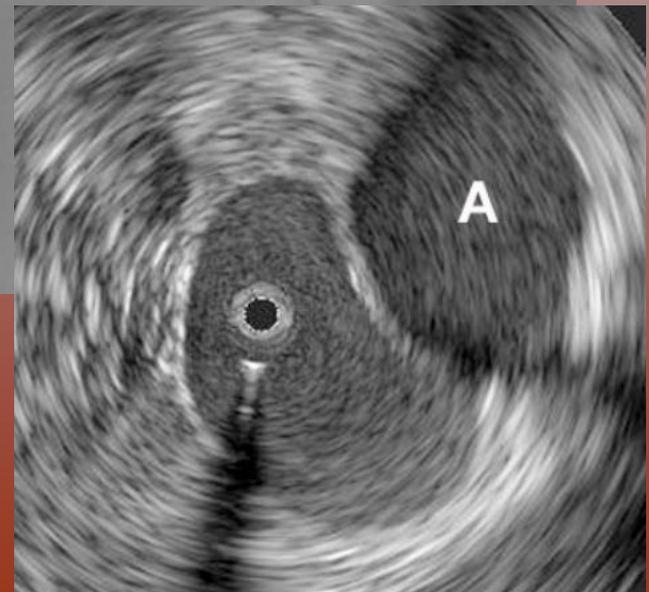
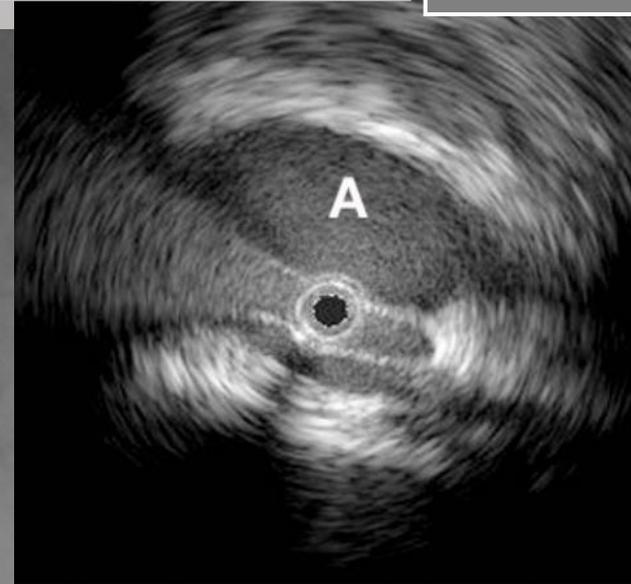
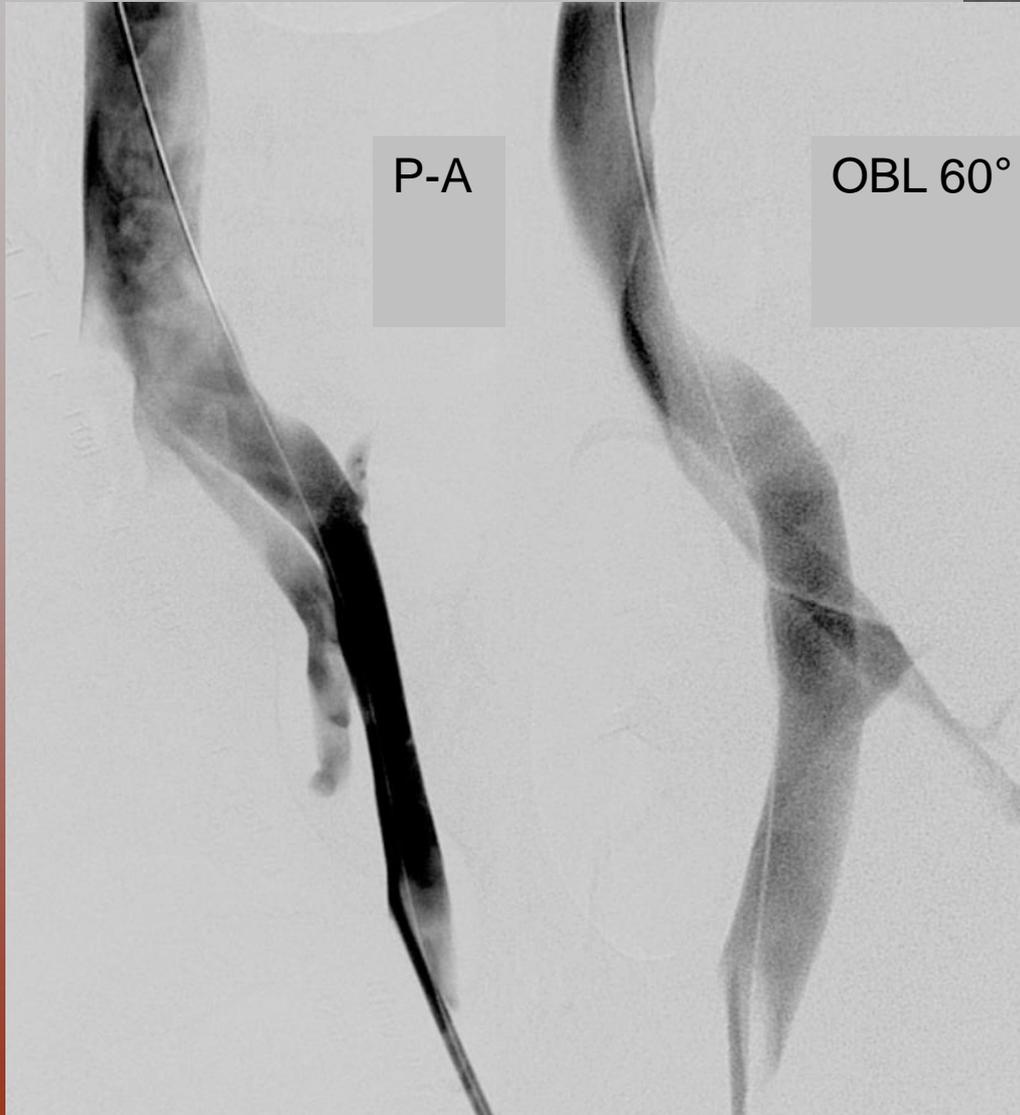
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normal intima and media were replaced by wellorganized connective tissue covered with endothelium, further confirming May and Thurner's hypothesis that the synechiae were caused by wall **compression and irritation from chronic, pulsatile trauma**



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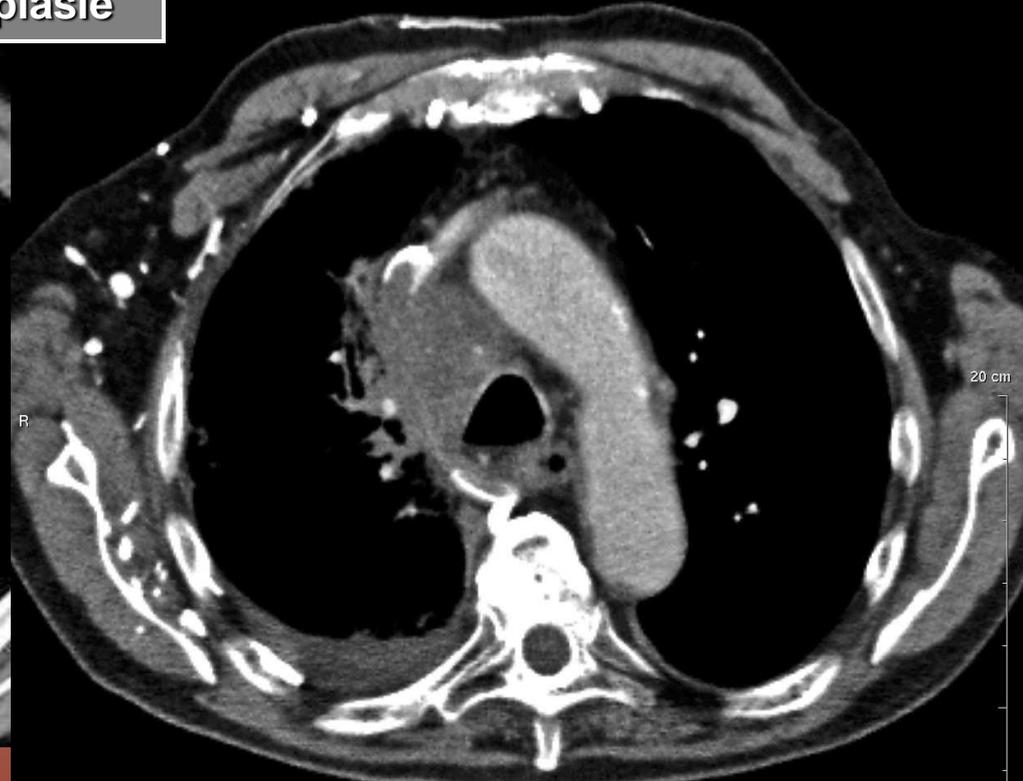




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Neoplasie

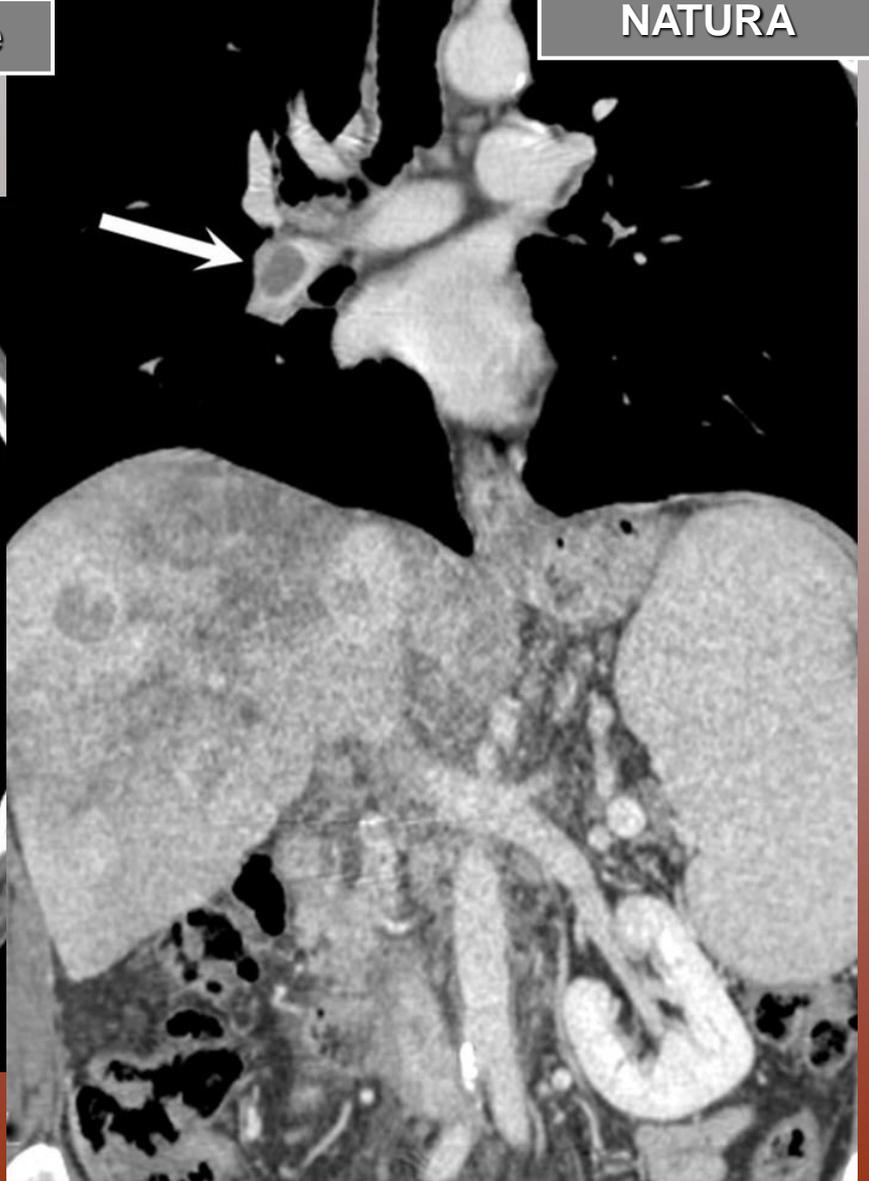




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Neoplasie

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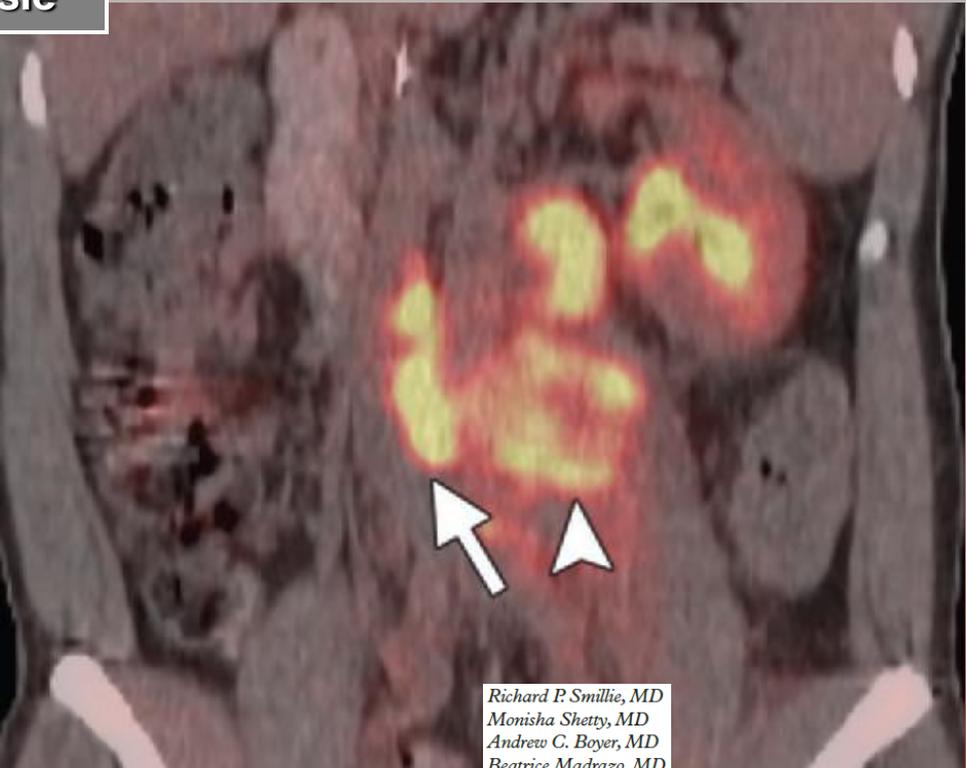
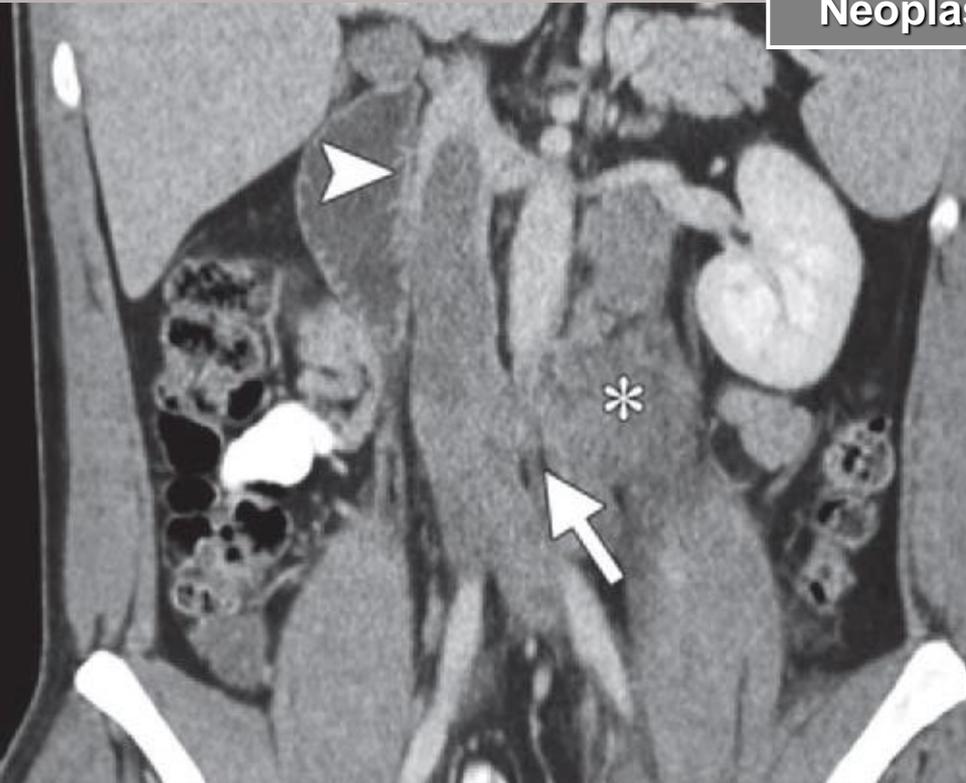




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Neoplasie



Richard P. Smillie, MD
Monisha Shetty, MD
Andrew C. Boyer, MD
Beatrice Madrazo, MD,
Syed Zafar Jafri, MD

Imaging Evaluation of the Inferior Vena Cava¹

RadioGraphics 2015; 35:578-592



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Membrane

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**Imaging Evaluation of the
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RadioGraphics 2015; 35:578–592



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Budd-Chiari

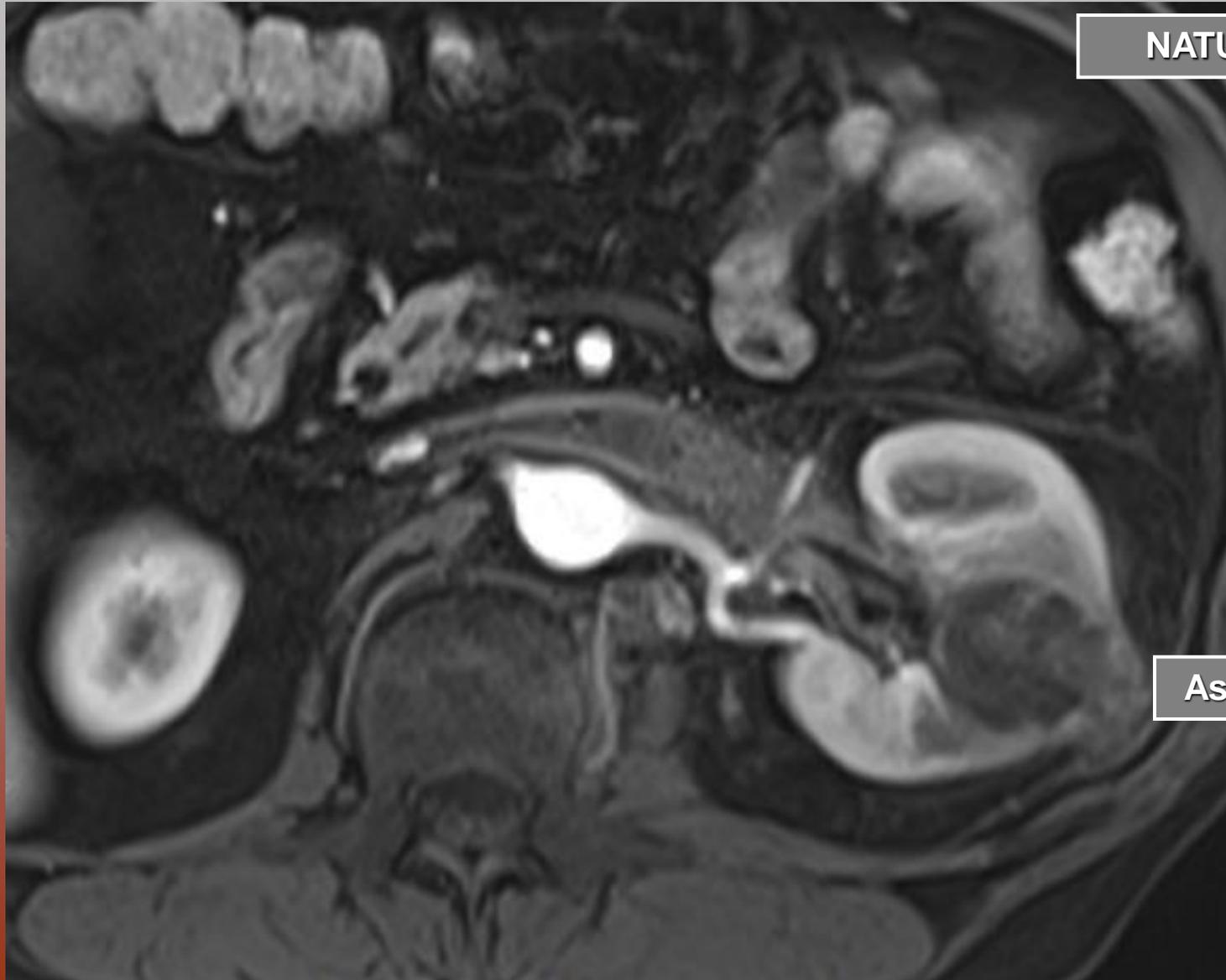


Hepatic vein stenting for recurrent ascites in polycystic liver and kidney disease

David W. Mudge¹, James Taylor² and Kym M. Bannister¹



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Ascesso



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Carcinoma



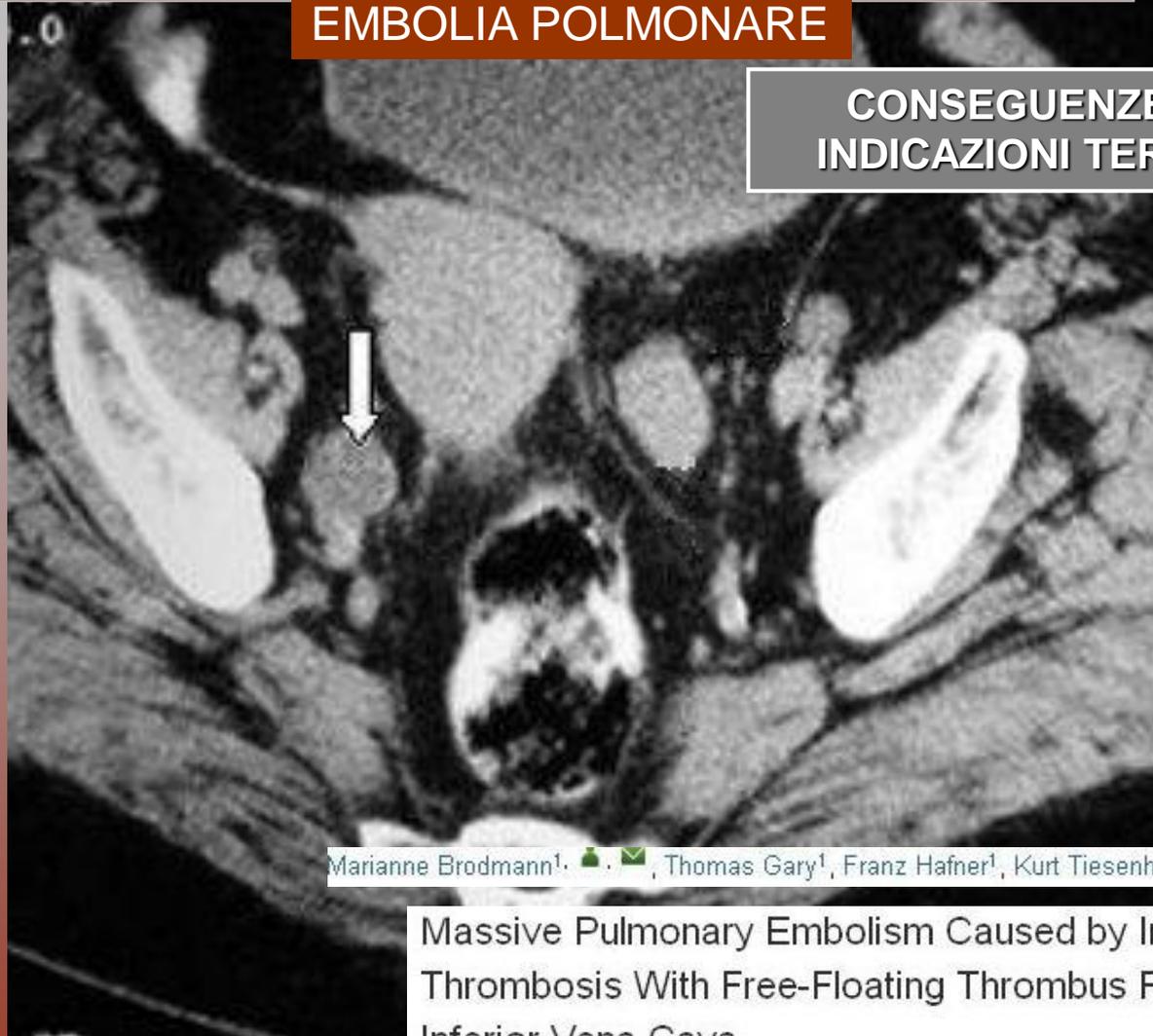
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EMBOLIA POLMONARE

CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE



Marianne Brodmann¹, Thomas Gary¹, Franz Hafner¹, Kurt Tiesenhausen², Hannes Deutschmann³

Massive Pulmonary Embolism Caused by Internal Iliac Vein Thrombosis With Free-Floating Thrombus Formation in the Inferior Vena Cava

Annals of Vascular Surgery

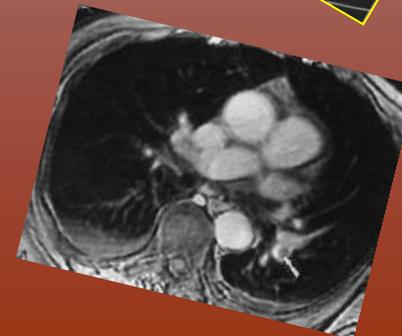
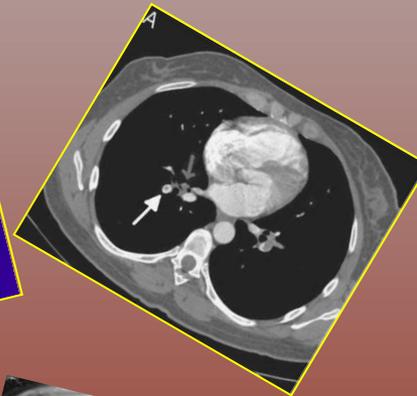
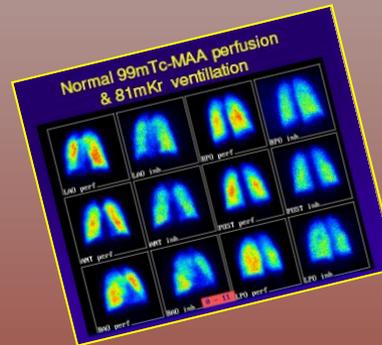
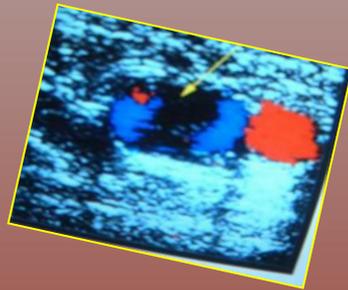
Volume 26, Issue 3, April 2012, Pages 420.e5–420.e7



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EMBOLIA POLMONARE





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Computed tomographic (CT) pulmonary angiography has been evaluated with meta-analysis and has demonstrated **sensitivities** of 53%–100% and **specificities** of 83%–100%

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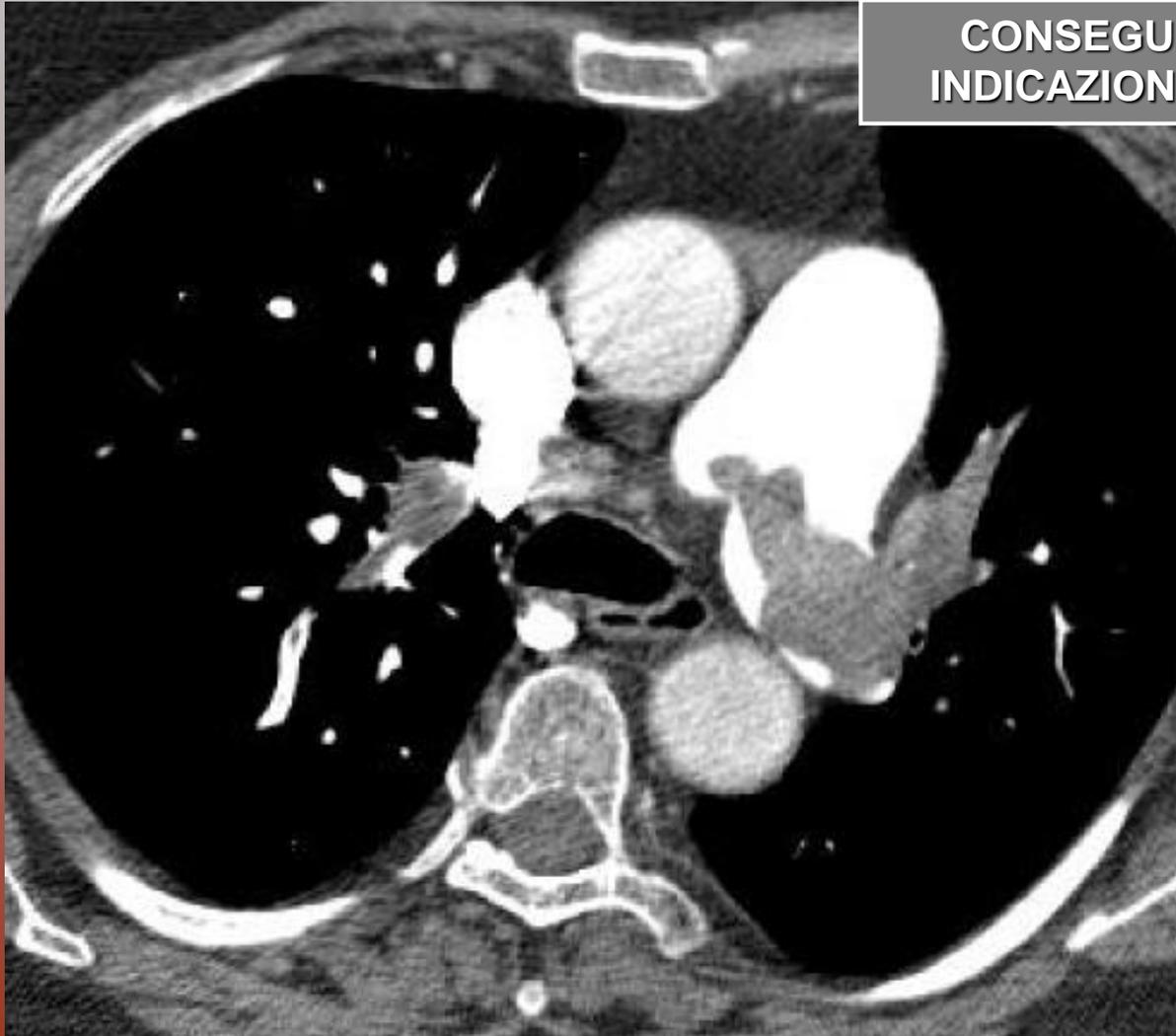
*Conrad Witttram, MB, ChB • Michael M. Maher, MD • Albert J. Yoo, MD
Mannudeep K. Kalra, MD • Jo-Anne O. Shepard, MD
Theresa C. McLoud, MD*

CT Angiography of Pulmonary Embolism: Diagnostic Criteria and Causes of Misdiagnosis¹



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EMBOLIA POLMONARE



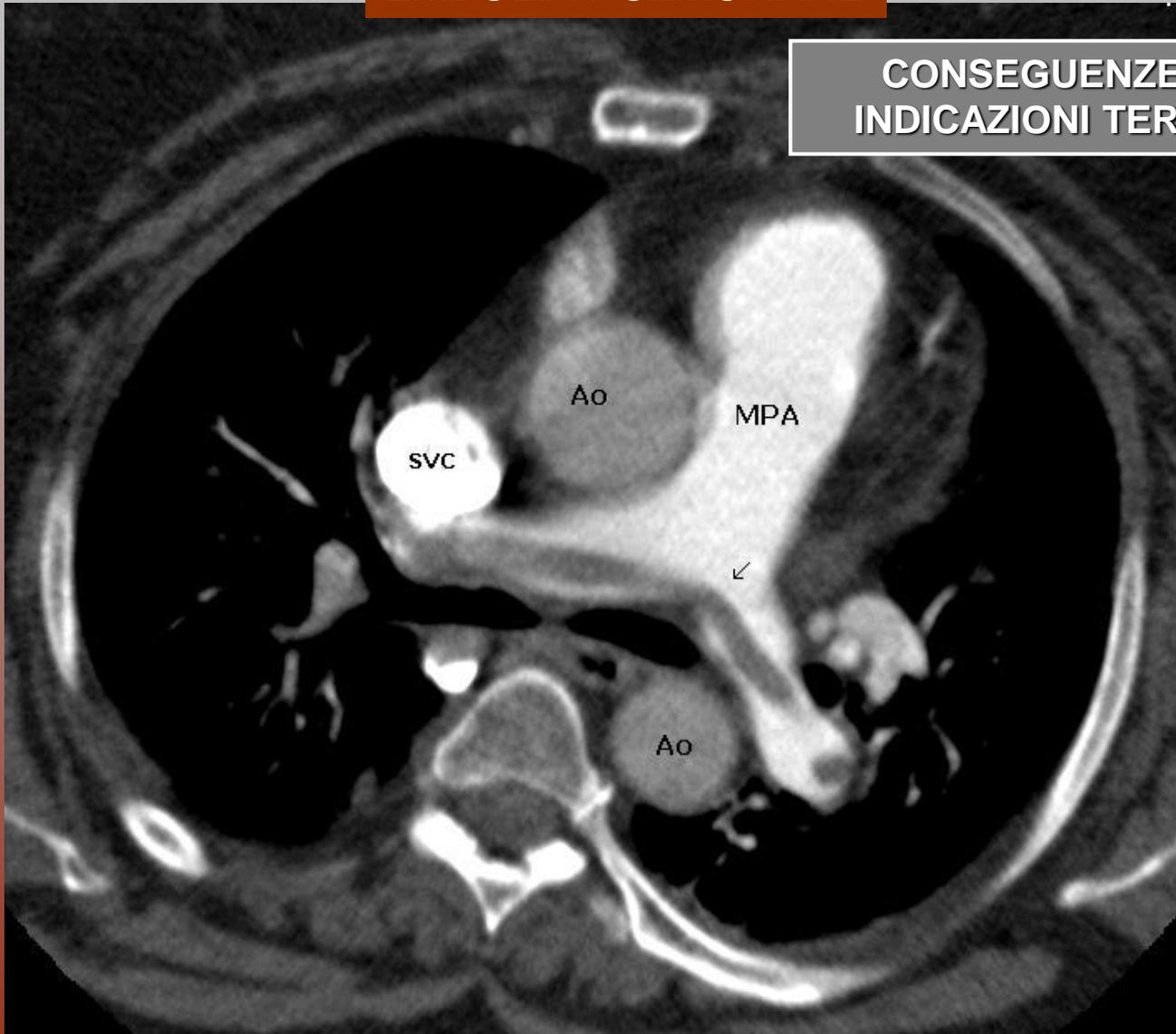
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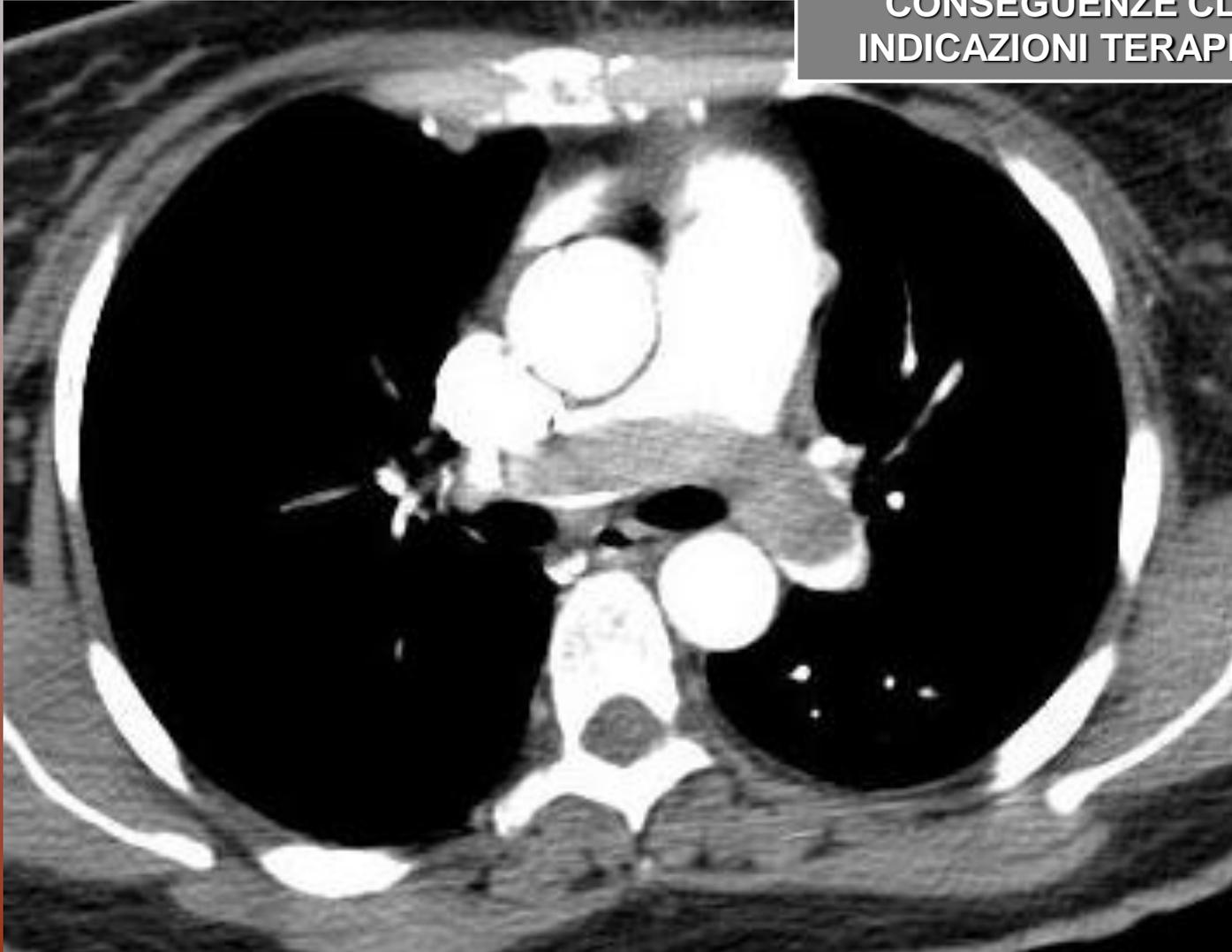




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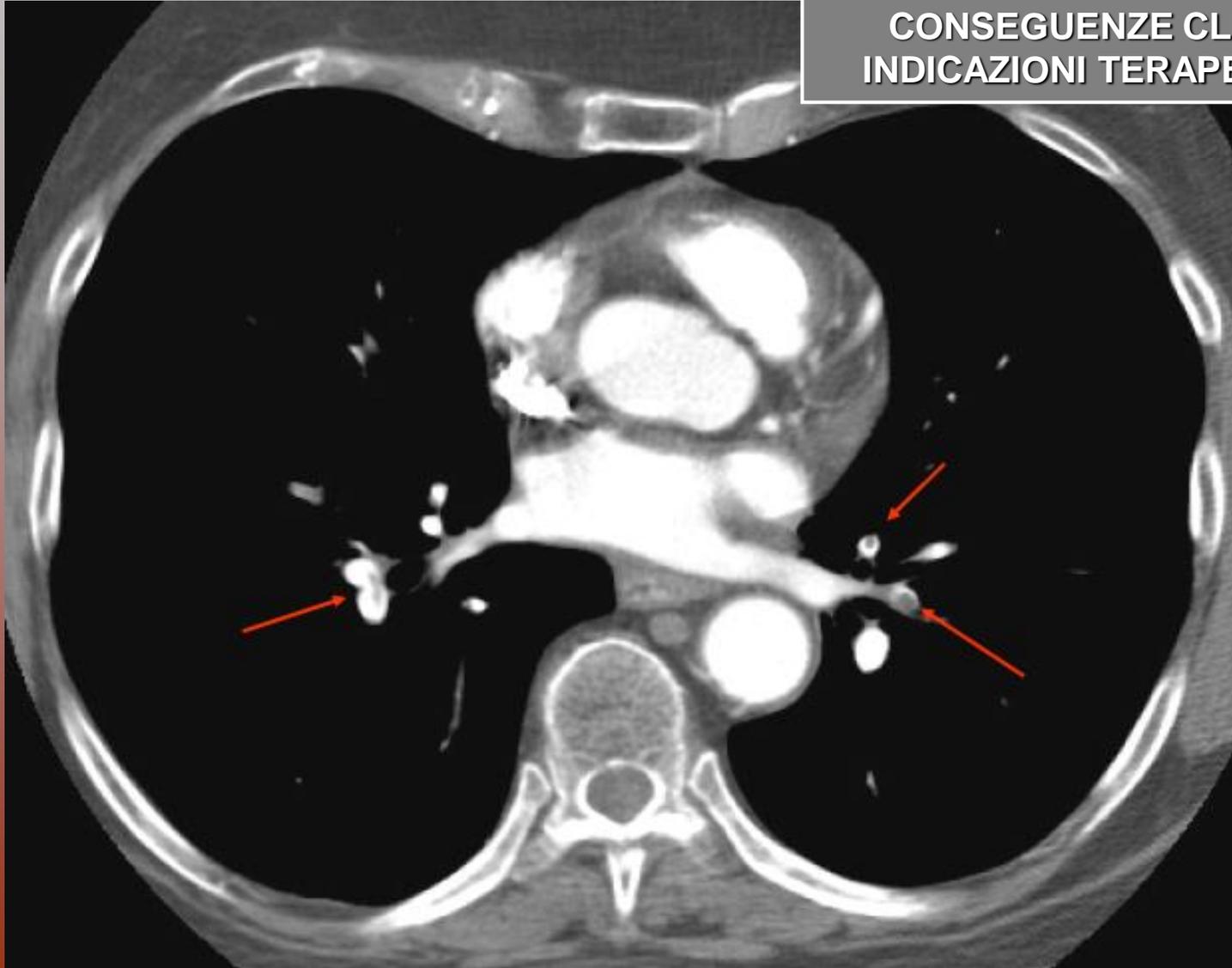




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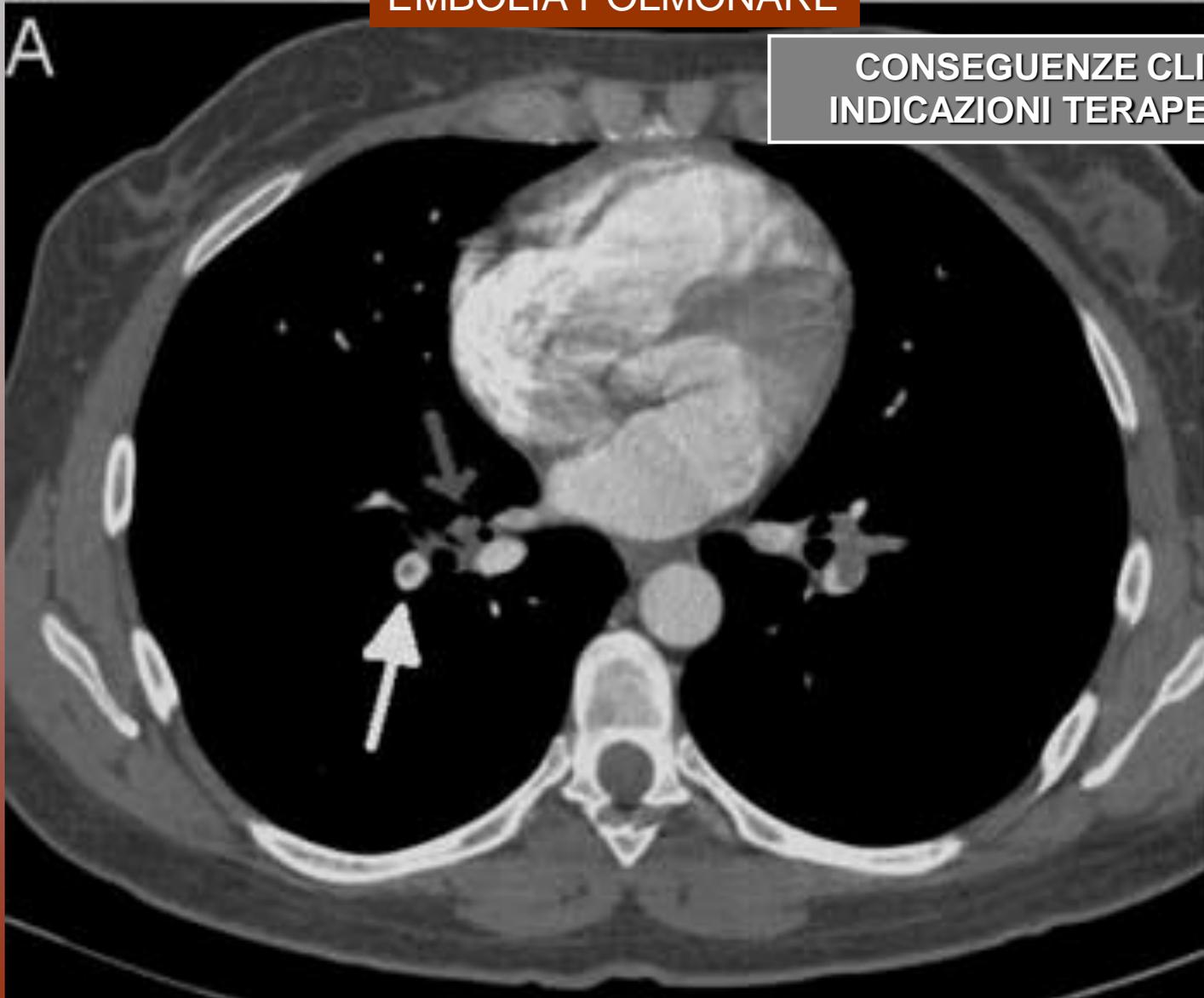
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EMBOLIA POLMONARE

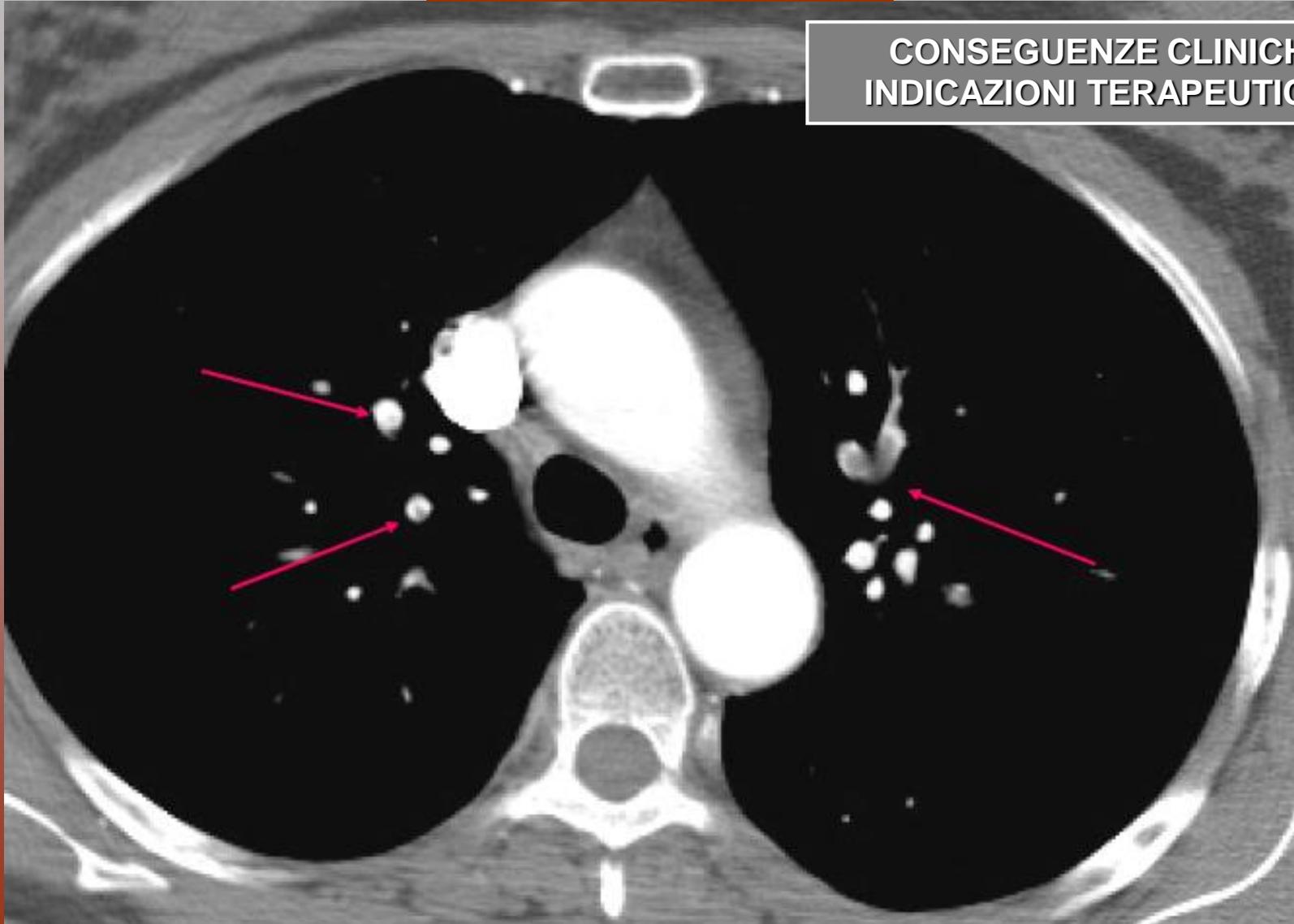




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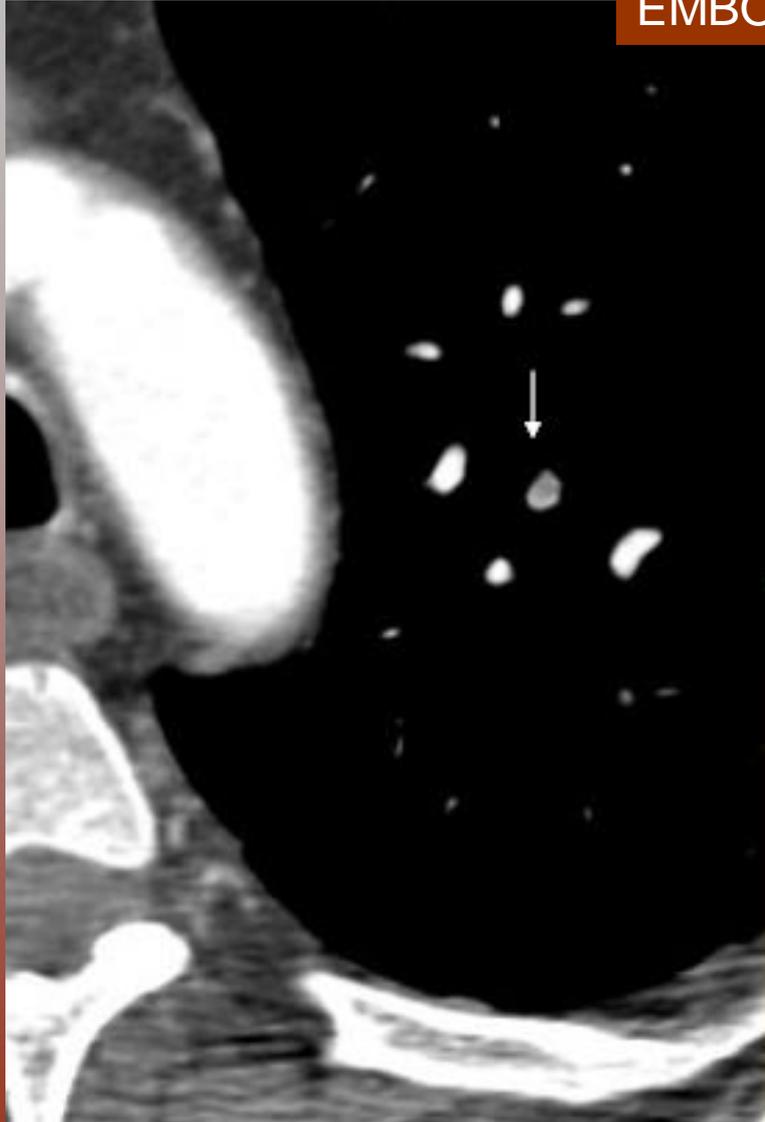
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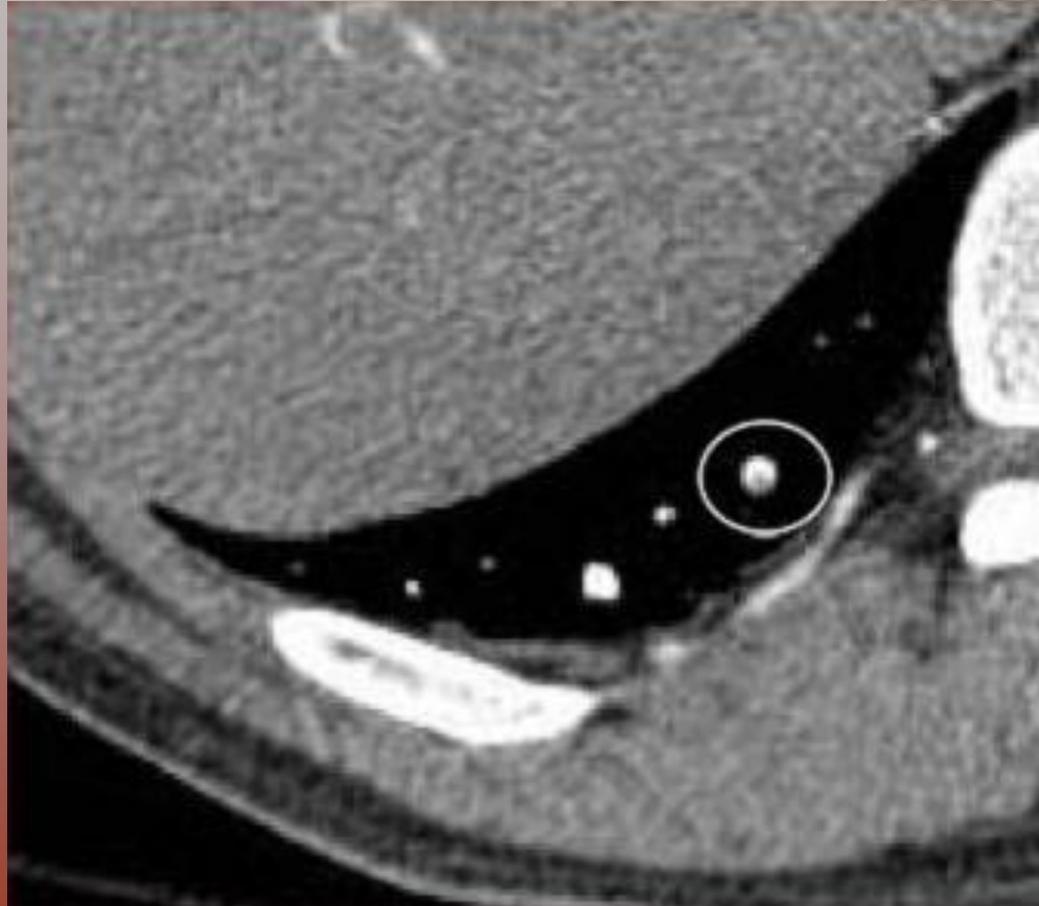




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TROMBOSI VENOSA ILIACA EMBOLIA POLMONARE

CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE

Lawrence R. Goodman, MD

Small Pulmonary Emboli: What Do We Know?¹

Radiology 2005; 234:654-658

- **1995 - “ CT is insensitive; it misses too many pulmonary emboli.”**
- **2005 - “ CT is too sensitive; it detects too many pulmonary emboli.”**



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Lawrence R. Goodman, MD

Small Pulmonary Emboli: What Do We Know?¹

Radiology 2005; 234:654–658

In daily practice, the clinical importance of **small PE** is also called into question when small emboli are detected in **asymptomatic patients who have undergone CT scanning for other reasons**. Incidental PE have been detected in **2%–5%** of all patients scanned.

The majority of patients with small PE are never suspected clinically and are never evaluated. **Autopsy studies** show evidence of **old or recent PE in 51%–90%** of patients **when there is careful examination of the pulmonary vessels**



TROMBOSI VENOSA ILIACA EMBOLIA POLMONARE

CONSEGUENZE CLINICHE
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Lawrence R. Goodman, MD

Small Pulmonary Emboli: What Do We Know?¹

Radiology 2005; 234:654–658

How frequent are **Isolated Subsegmental Pulmonary Emboli (ISSPE)** ?

- 4-slice MDCT : **4.2%** of pts (Coche, Radiology, 2003)
- 16-slice MDCT : **5.4%** of pts (Eyer, AJR, 2005)



TROMBOSI VENOSA ILIACA EMBOLIA POLMONARE

CONSEGUENZE CLINICHE
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Lawrence R. Goodman, MD

Small Pulmonary Emboli: What Do We Know?¹

Radiology 2005; 234:654-658

Do All Patients with PE Need to Receive Anticoagulation Therapy?

ISSPE : May Not Need Anticoagulation

- SSPE, good CP reserve, no DVT
- Incidental SSPE, good CP reserve, no DVT
- Contraind to anticoag, no DVT

ISSPE : Need Anticoagulation

- Inadequate CP reserve
- DVT
- Recurrent PE



TROMBOSI VENOSA ILIACA EMBOLIA POLMONARE

CONSEGUENZE CLINICHE
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Right Ventricular (RV) Failure

- **Leftward Septal Bowing**
- **Dilated RV and normal or small LV**
RV/LV short axes ratio > 1
RV/LV short axes ratio > 1.5 indicate a
severe episode of PE

Rene Quiroz, MD, MPH*; Nils Kucher, MD*; U. Joseph Schoepf, MD; Florian Kipfmuller, BS;
Scott D. Solomon, MD; Philip Costello, MD; Samuel Z. Goldhaber, MD

**Right Ventricular Enlargement on Chest
Computed Tomography**

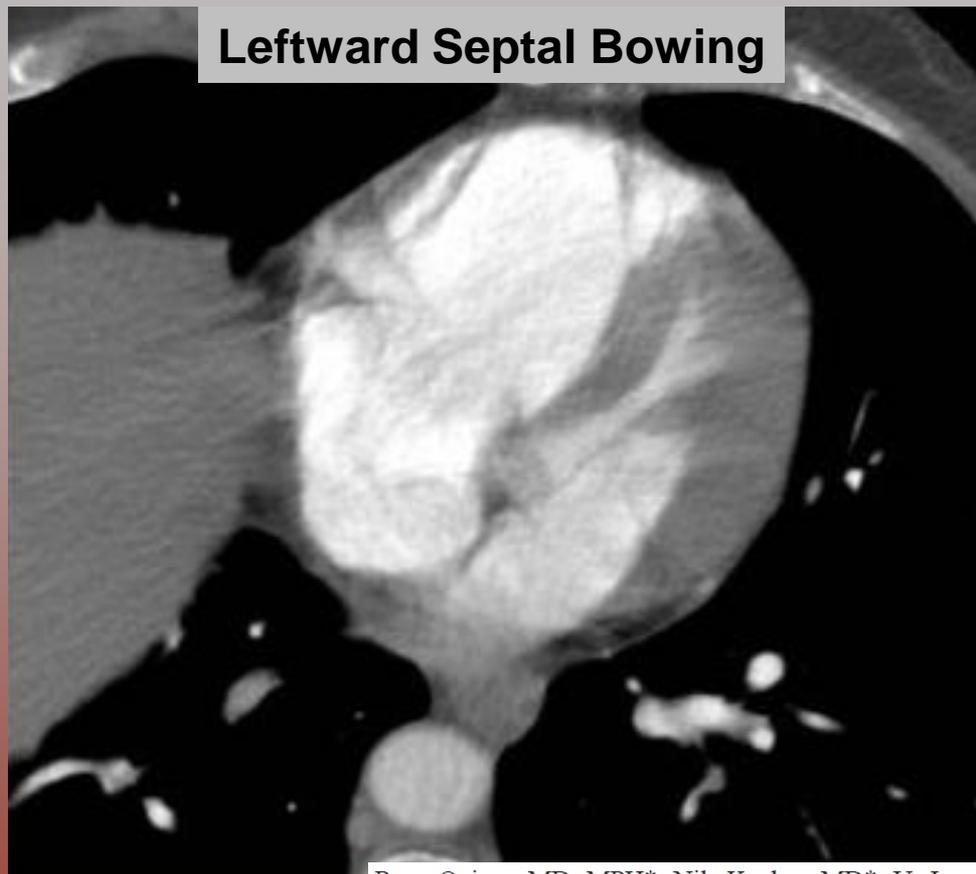
Prognostic Role in Acute Pulmonary Embolism

(*Circulation*. 2004;109:2401-2404.)



TROMBOSI VENOSA ILIACA EMBOLIA POLMONARE

CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE



Rene Quiroz, MD, MPH*; Nils Kucher, MD*; U. Joseph Schoepf, MD; Florian Kipfmuller, BS;
Scott D. Solomon, MD; Philip Costello, MD; Samuel Z. Goldhaber, MD

**Right Ventricular Enlargement on Chest
Computed Tomography**

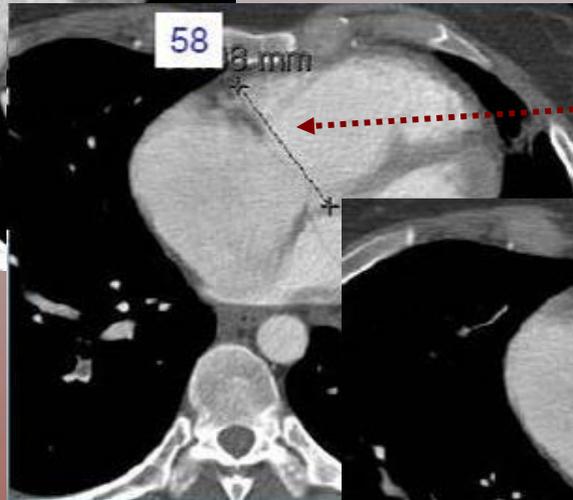
Prognostic Role in Acute Pulmonary Embolism

(*Circulation*. 2004;109:2401-2404.)



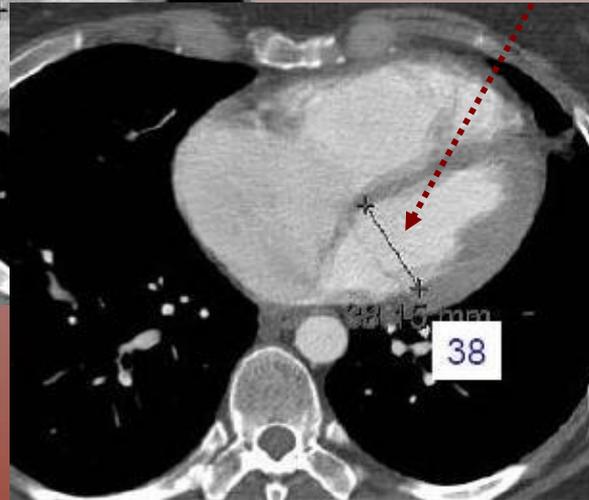
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Measurement of the short axes of the RV and LV on axial CT pulmonary angiogram

$$RV/LV = 58/38 = 1,5$$



Rene Quiroz, MD, MPH*; Nils Kucher, MD*; U. Joseph Schoepf, MD; Florian Kipfmuller, BS;
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Threshold Values of Quantitative Measurements as Predictive Indices of Death

Measurement	Probability of Death					
	5%	10%	20%	30%	40%	50%
PA obstruction (%)						
Qanadli et al (17)	27	43	60	72	81	90
Mastora et al (18)	5	30	57	75	90	100
RV/LV ratio	1.0	1.3	1.7	1.9	2.1	2.3
RV short axis (mm)	40	48	57	61	65	69
Superior vena cava diameter (mm)	16	19	23	25	27	29
Azygos vein diameter (mm)	7	9	12	13	14	15

Benoit Ghaye, MD
Alexandre Ghuysen, MD
Valerie Willems, MD
Bernard Lambermont, MD, PhD
Paul Gerard, PhD
Vincent D'Orio, MD, PhD
Pierre Alain Gevenois, MD, PhD
Robert F. Dondelinger, MD

Severe Pulmonary Embolism:

Pulmonary Artery Clot Load Scores
and Cardiovascular Parameters as
Predictors of Mortality¹

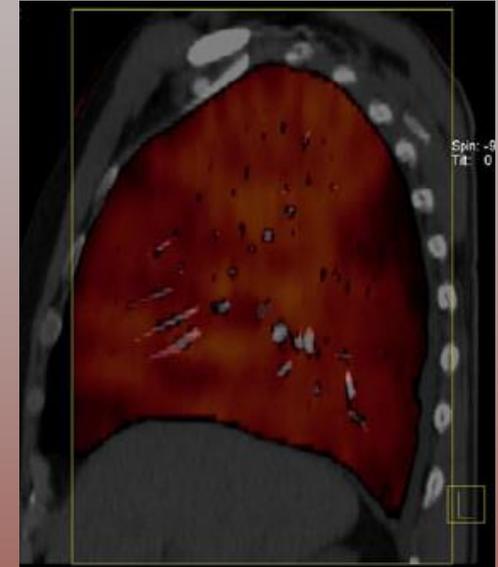
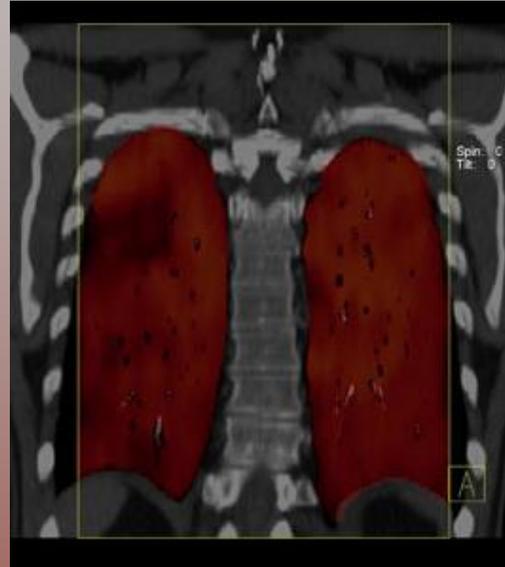
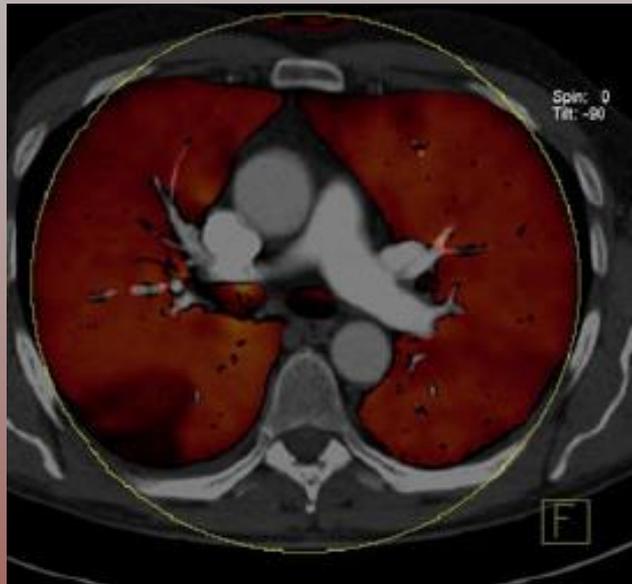


TROMBOSI VENOSA ILIACA

EMBOLIA POLMONARE

CT perfusion

CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE



Sven F. Thieme • Nima Ashoori • Fabian Bamberg • Wieland H. Sommer •
Thorsten R. C. Johnson • Hanno Leuchte • Alexander Becker • Daniel Maxien
Andreas D. Helck • Jürgen Behr • Maximilian F. Reiser • Konstantin Nikolaou

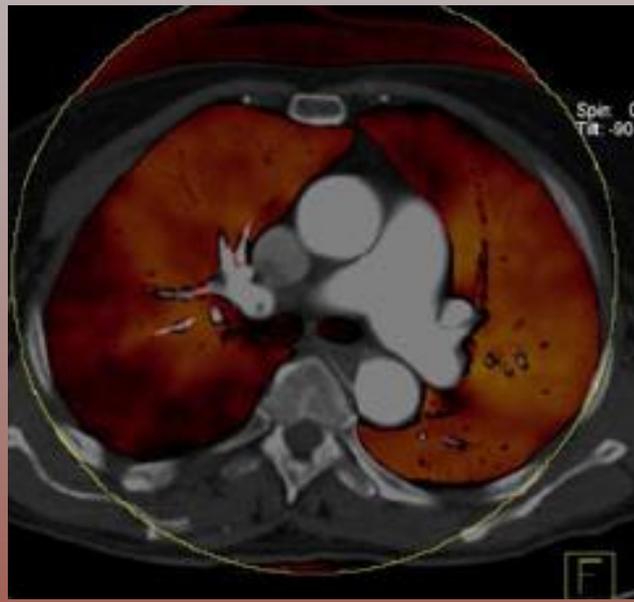
Severity assessment of pulmonary embolism using dual energy CT – correlation of a pulmonary perfusion defect score with clinical and morphological parameters of blood oxygenation and right ventricular failure



TROMBOSI VENOSA ILIACA EMBOLIA POLMONARE

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CT perfusion



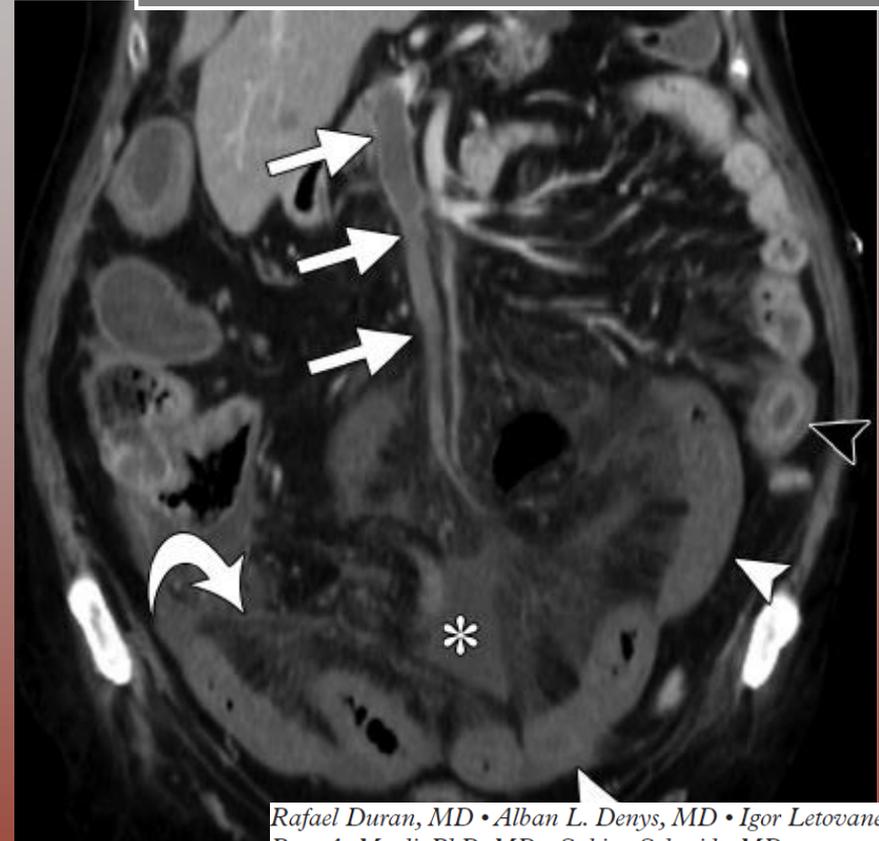
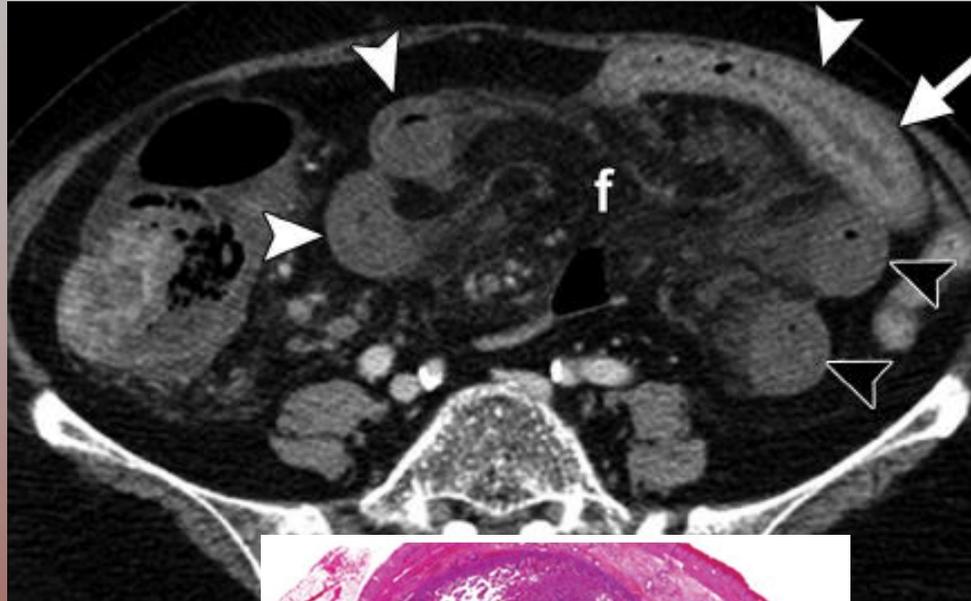
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Thorsten R. C. Johnson • Hanno Leuchte • Alexander Becker • Daniel Maxien
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Severity assessment of pulmonary embolism using dual energy CT – correlation of a pulmonary perfusion defect score with clinical and morphological parameters of blood oxygenation and right ventricular failure



TROMBOSI VENOSA MESENTERICO-PORTALE

CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE



Rafael Duran, MD • Alban L. Denys, MD • Igor Letovanec,
Reto A. Meuli, PhD, MD • Sabine Schmidt, MD

Multidetector CT Features of Mesenteric Vein Thrombosis¹

RadioGraphics 2012; 32:1503–1522



TROMBOSI VENOSA GONADICO-RENALE

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INDICAZIONI TERAPEUTICHE



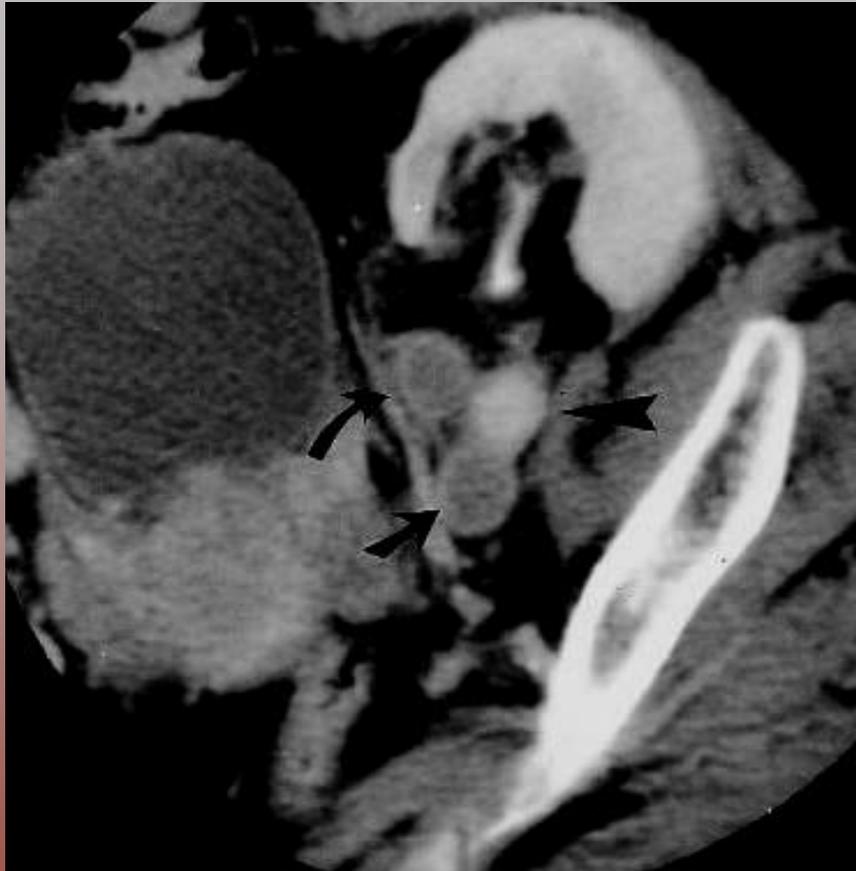
*Akira Kawashima, MD • Carl M. Sandler, MD • Randy D. Ernst, MD
Eric P. Tamm, MD • Stanford M. Goldman, MD • Elliot K. Fishman,*

CT Evaluation of Renovascular Disease¹

RadioGraphics 2000; 20:1321-1340



TROMBOSI VENOSA GONADICO-RENALE



Pier Luigi Bedani¹, Roberto Galeotti²,

Successful local arterial urokinase infusion to reverse late postoperative venous thrombosis of a renal graft

Nephrol Dial Transplant (1999) 14: 2225–2227



TROMBOSI VENOSA GONADICO-RENALE

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INDICAZIONI TERAPEUTICHE



JAMES L. GUZZO, MD, AND HEITHAM T. HASSOUN, MD

**Renal Vein Stenting for
Nutcracker Syndrome**

ENDOVASCULAR TODAY | APRIL 2010



TROMBOSI VENOSA GONADICO-RENALE

CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE

Franco Verde^{1*}, Pamela T. Johnson¹

One Not to Miss: Ovarian Vein Thrombosis Causing Pulmonary Embolism with Literature Review



Ovarian vein thrombosis is a rare, yet highly important, entity to recognize, due to possibility of causing **pulmonary embolism**.

Inspection of ovarian veins should be part of every CT interpretation, particularly in the setting of **pregnancy, malignancy, pelvic infection** and **surgery**, as a small clot may be overlooked.



TROMBOSI VENOSA GONADICO-RENALE

CONSEGUENZE CLINICHE
INDICAZIONI TERAPEUTICHE



Daniela Fratti¹, Roberto Galeotti², Enrico Ricci¹, Stefano Moratelli³, Antonietta Vanini⁴

Early Resolution of a Life-threatening Caval Thrombus Through Percutaneous Radiological Approach☆

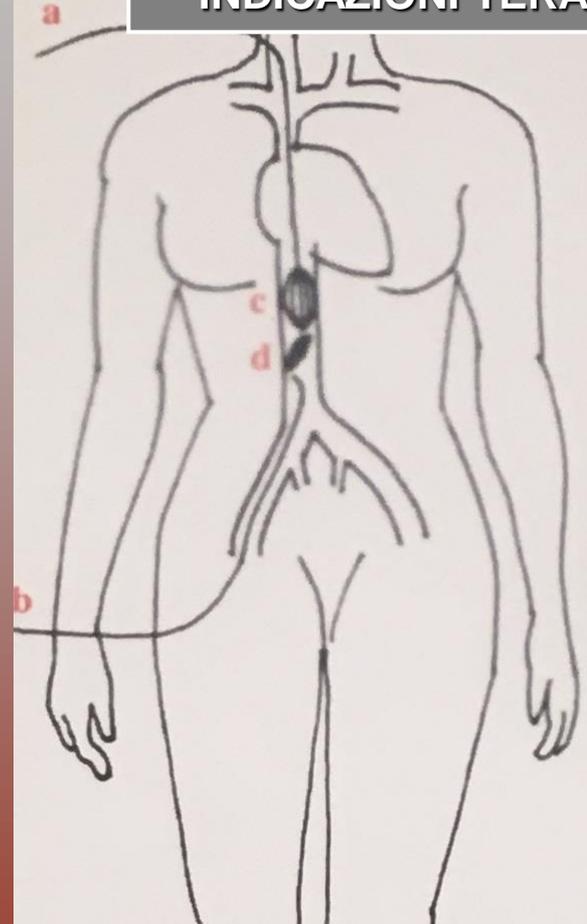
Thrombosis Research 101 (2001) 441-444



TROMBOSI VENOSA GONADICO-RENALE



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INDICAZIONI TERAPEUTICHE



Daniela Fratti¹, Roberto Galeotti², Enrico Ricci¹, Stefano Moratelli³, Antonietta Vanini⁴

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Daniela Fratti¹, Roberto Galeotti², Enrico Ricci¹, Stefano Moratelli³, Antonietta Vanini⁴

**Early Resolution of a Life-threatening Caval Thrombus
Through Percutaneous Radiological Approach[☆]**



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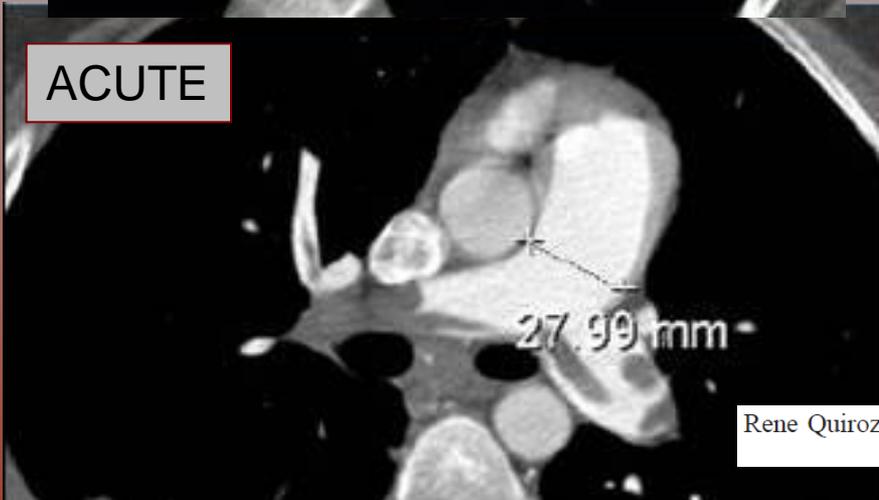
TROMBOSI VENOSA ILIACO-CAVALE

EMBOLIA POLMONARE

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Rene Quiroz, MD, MPH*; Nils Kucher, MD*; U. Joseph Schoepf, MD; Florian Kipfmuller, BS; Scott D. Solomon, MD; Philip Costello, MD; Samuel Z. Goldhaber, MD

Right Ventricular Enlargement on Chest Computed Tomography

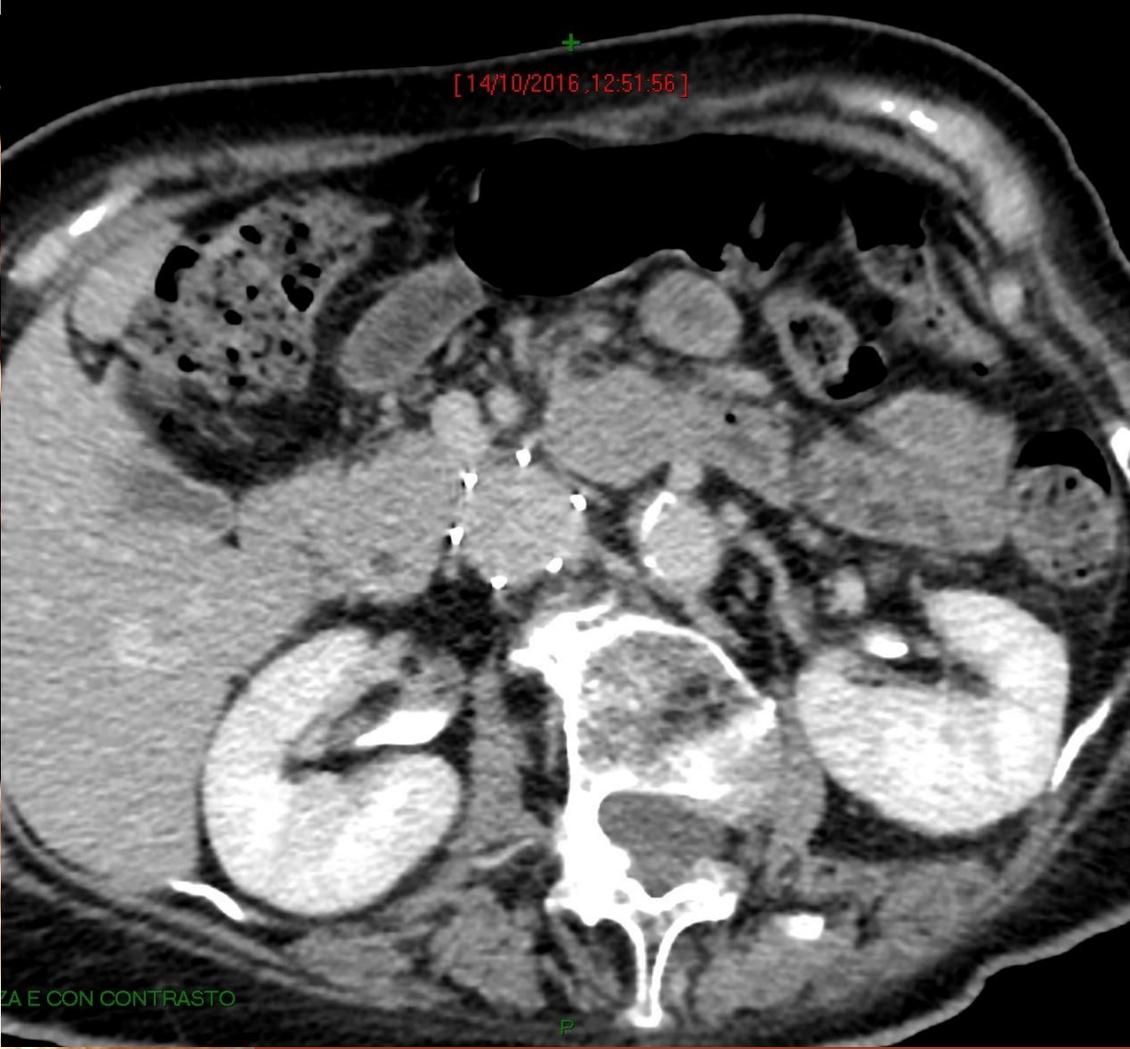
Prognostic Role in Acute Pulmonary Embolism

(*Circulation*. 2004;109:2401-2404.)



TROMBOSI VENOSA ILIACO-CAVALE

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TROMBOSI VENOSA ILIACO-CAVALE



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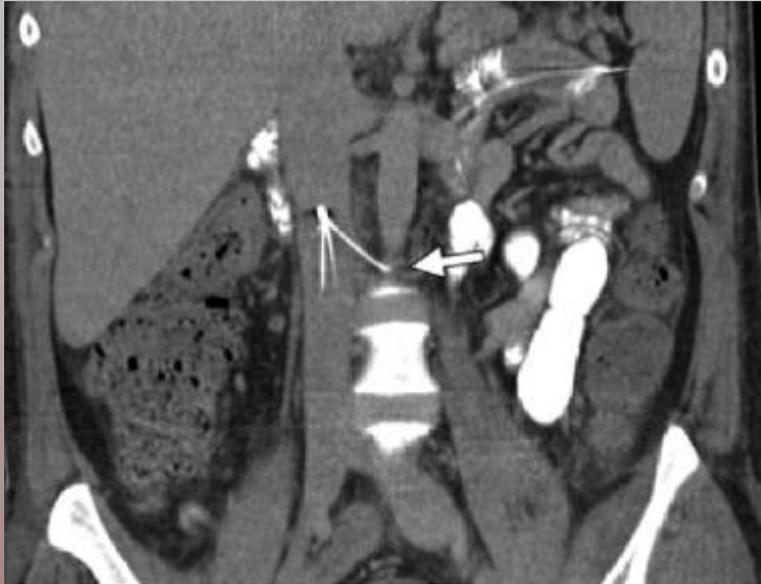
BJ McAree¹, ME O'Donnell^{1,2}, GJ Fitzmaurice¹, JA Reid¹,
RAJ Spence^{2,3} and B Lee¹

Inferior vena cava thrombosis: A review of current practice

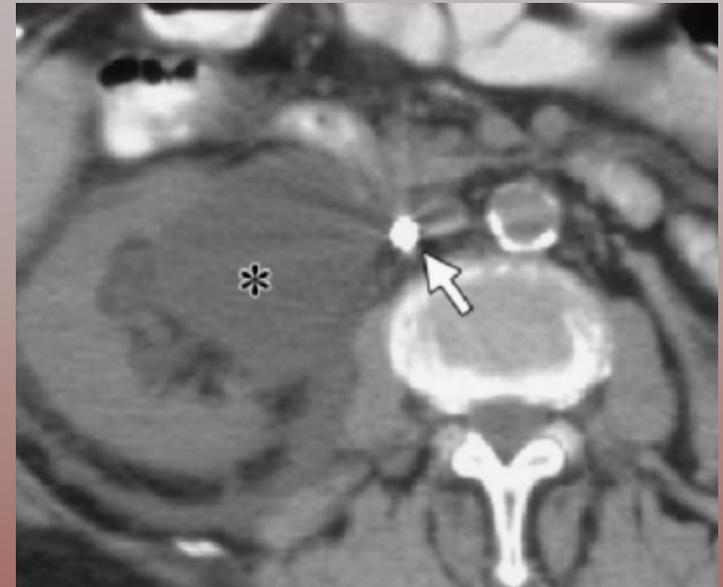
Vascular Medicine
18(1) 32-43
The Author(s) 2013



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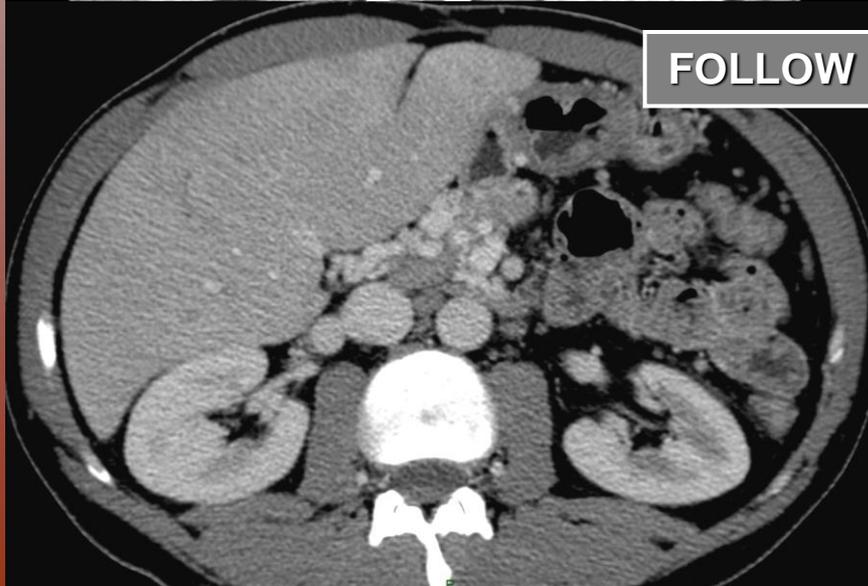
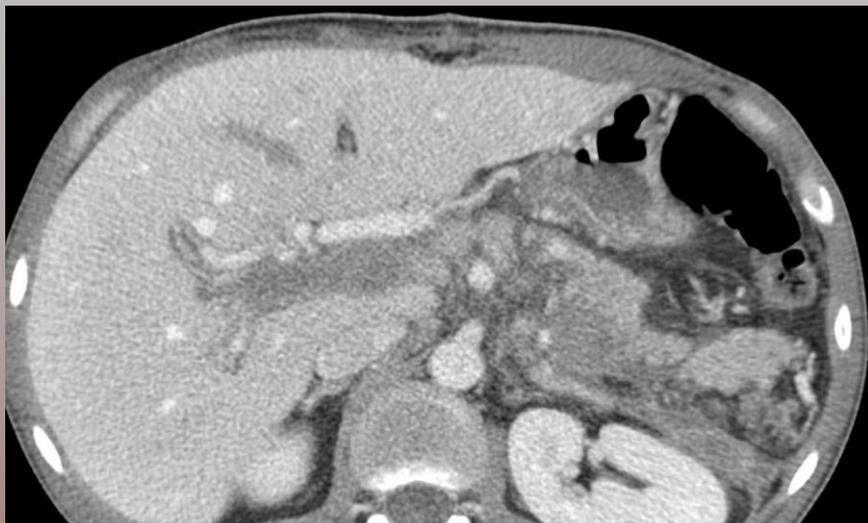
Richard P. Smillie, MD
Momisha Shetty, MD
Andrew C. Boyer, MD
Beatrice Madrazo, MD,
Syed Zafar Jafri, MD

Imaging Evaluation of the
Inferior Vena Cava¹

RadioGraphics 2015; 35:578–592



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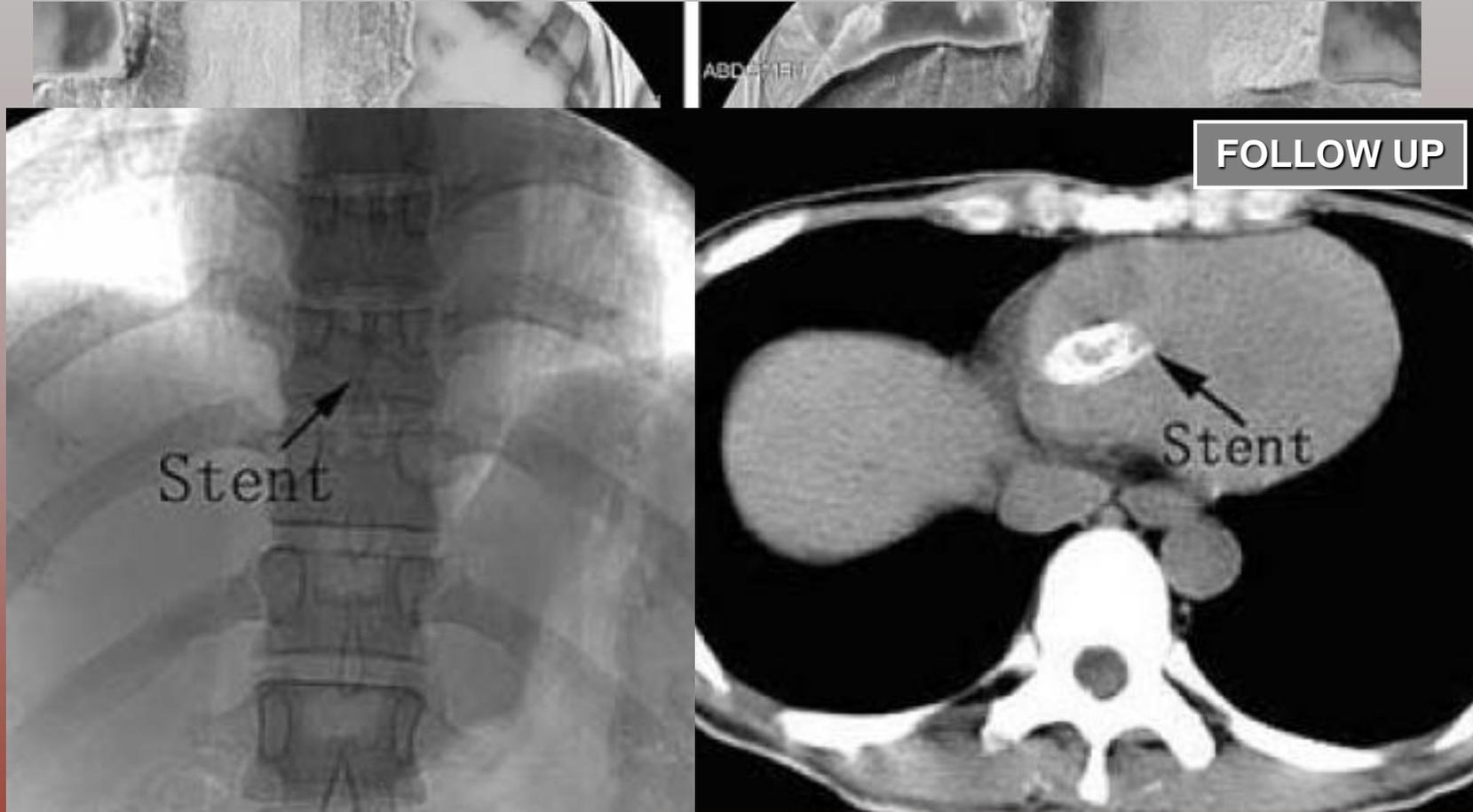
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A stranger in the heart: LRV stent migration

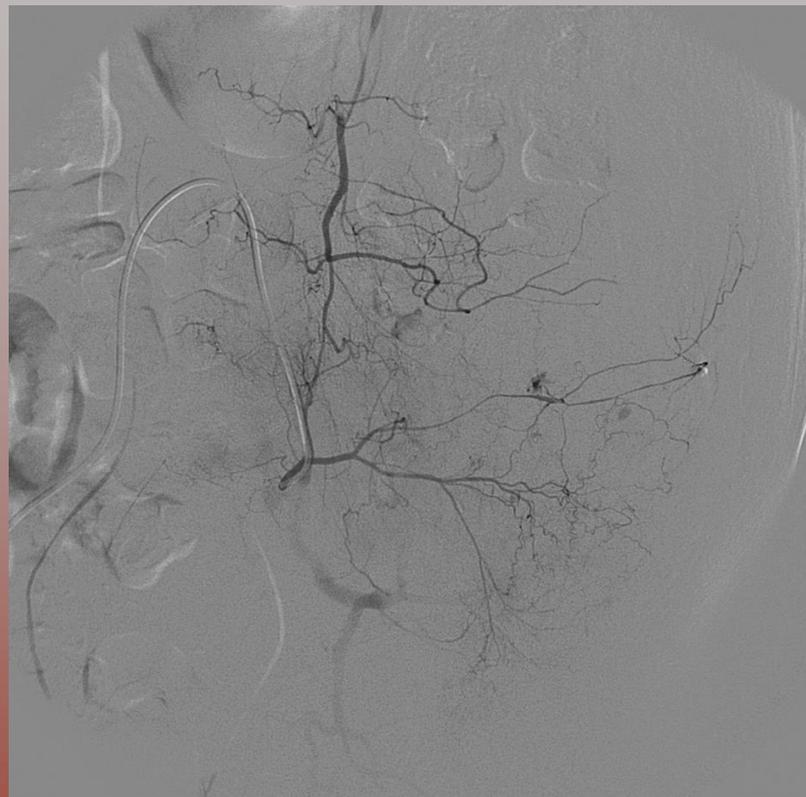
Shanwen Chen · Hongkun Zhang · Lu Tian
Ming Li · Min Zhou · Zhonggao Wang

Int Urol Nephrol (2009) 41:427–430



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A. Spina, V. Pollastri, C. Albieri, A. Clarizia, E. Salviato, R. Galeotti

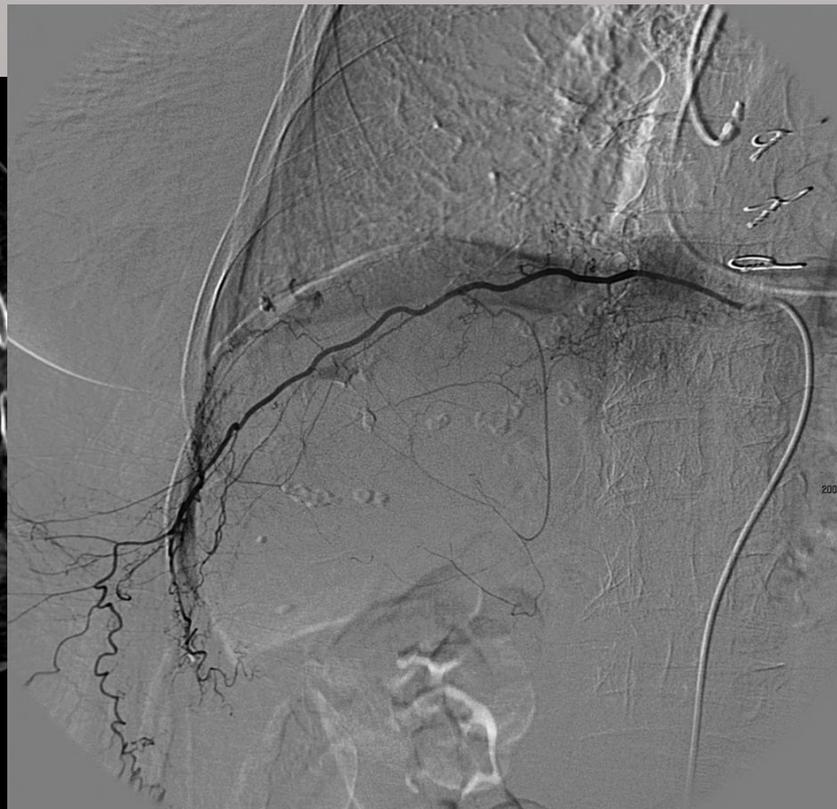
Trans-catheter arterial embolization in the management of spontaneous thoraco-abdominal hemorrhages secondary to anticoagulant therapy

ECR 2013



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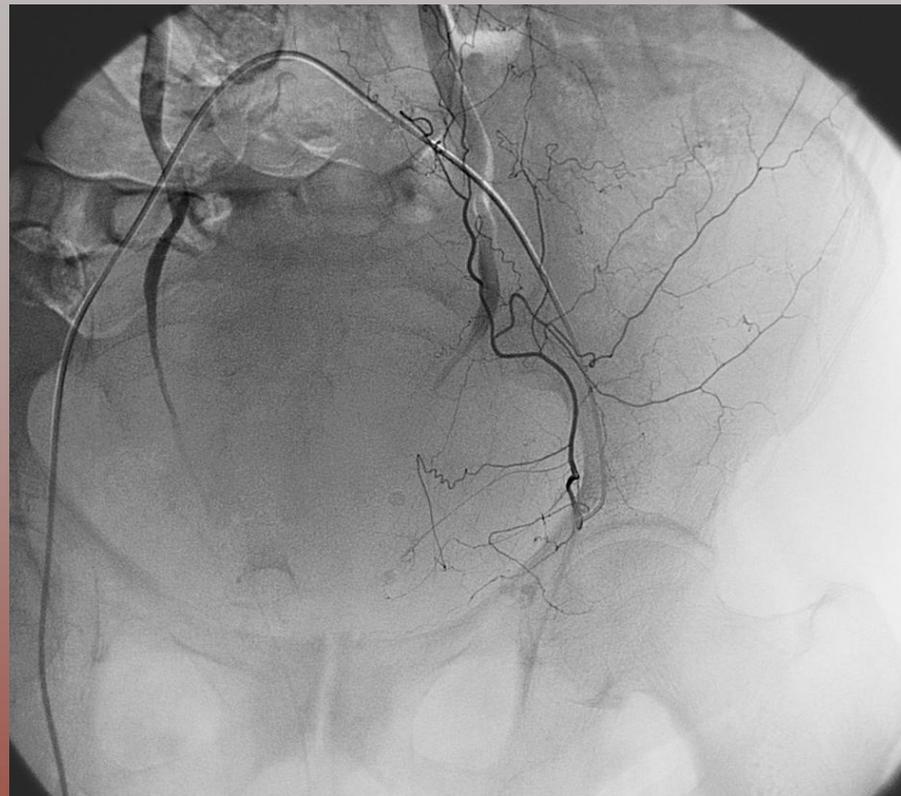
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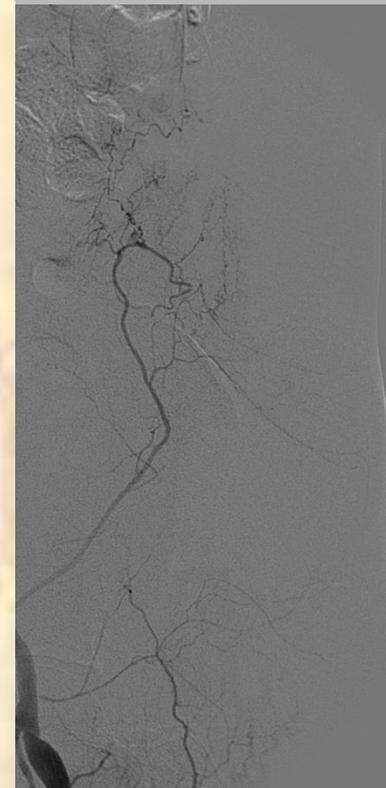
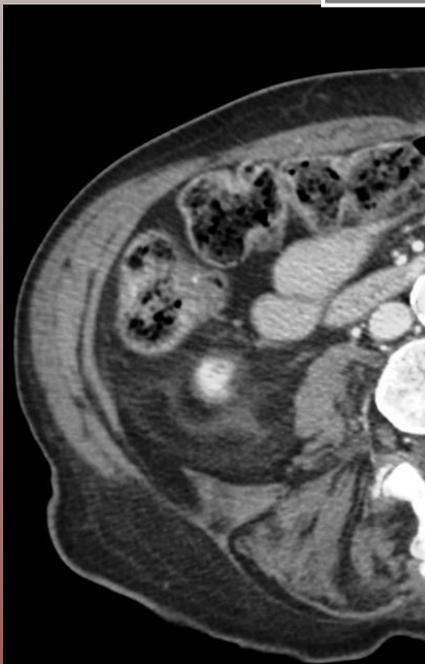
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Trans-catheter arterial embolization in the management of spontaneous thoraco-abdominal hemorrhages secondary to anticoagulant therapy



TROMBOSI VENOSA

FOL



riato, R. Galeotti

Management of spontaneous thoraco-abdominal hemorrhages secondary to anticoagulant therapy



Roberto Galeotti
Elisabetta Salviato
Clorinda Montalto

Debora Chiarini
Luca Maietti
Caterina Caselli
Ilaria Rondin
Brunetta Borsetti
Sara Vezzelli

Patrizia Busi
Mara Simoni
Mirco Piva
Nicoletta Grandi



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CONGRESSO NAZIONALE DEL TRENTENNALE

GRAZIE PER LA TUA PRESENZA

FERRARA
Palazzo della Facchetti
20 - 21 - 22 ottobre 2016