Extending The Stent Into The IVC During Iliac Venous Reconstruction Is Frequently Needed And It Increases Thrombotic Complications

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MAYO CLINIC

No Conflict of Interest

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Factors Associated with Contralateral Deep Venous Thrombosis after Iliocaval Venous Stenting

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WHAT THIS PAPER ADDS

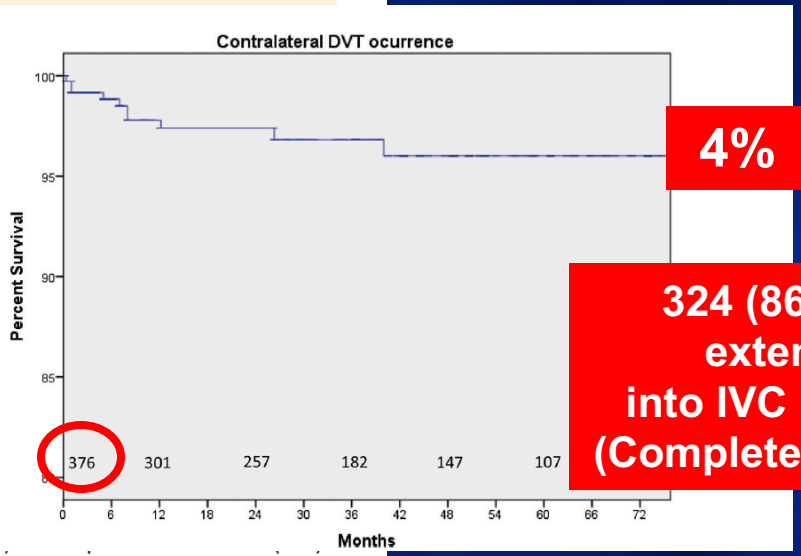
This study suggests that placement of iliac venous stents across the ilio
associated with a low incidence of contralateral iliac DVT, and if this occu
with good results. Acute DVT, pre-operative contralateral IIV thrombosis
non-compliance, and malignant compression are significant factors th
contralateral DVT.

Background: The majority of iliac venous obstructions occur on the le
become the first line treatment for this condition. A left common iliac ve
vena cava (IVC) to some extent, thereby covering the contralateral cor
increase the risk of thrombosis of the contralateral iliac vein. The aim ol
and factors associated with, contralateral lower limb venous thrombos
results of salvage revascularisation.

Methods: A total of 376 patients (102 from UCH, Galway, Ireland, 2008
France, 2000–15) with symptomatic acute or chronic left iliocaval ven
evaluated. Either duplex ultrasound scanning (DUS) or computed tomc
pre- and post-operative imaging. Data were collected from the PACS sy
Department, UCH, Galway, and from the electronic medical records of
Marseille.

Results: The median age of stented patients was 46 (range 15–86 years
left CIV stent placement, 10 patients later presented with a right (contral
resulting in a cumulative incidence of contralateral DVT of 4% according to Kaplan-Meier analysis. Acute DVT ($p = .001$), non-compliance with the prescribed 6 months anticoagulation ($p = 0.05$), pre-operative contralateral internal iliac vein (IIV) thrombosis ($p = 0.001$), and pre-existing IVC filter placement ($p = 0.003$) were all statistically significantly associated with contralateral DVT. All patients with symptomatic contralateral iliac DVT underwent clot removal in the acute phase. The primary patency of these limbs was 100% at 3 years.

Conclusion: Stent placement across the iliocaval confluence from the left CIV is associated with a low but definite rate of contralateral iliac vein thrombosis. Acute DVT, pre-operative contralateral IIV thrombosis, pre-existing IVC filters, and anticoagulation non-compliance are significant risk factors.



4%

324 (86%) had extension into IVC by >2 cm (Complete coverage)

Risk Factors

- Extension into IVC by >2 cm
- Acute DVT
- Previous contralateral DVT
- Anticoagulation non-compliance
- Pre-existing IVC filter

MAYO CLINIC

Stenting of the venous outflow in chronic venous disease: Long-term stent-related outcome, clinical, and hemodynamic result

Peter Neglén, MD, PhD,[a] Kathryn C. Hollis, BA,[a] Jake Olivier, PhD,[b] and Seshadri Raju, MD,[b]
Jackson, Miss

Background: Stenting of chronic nonmalignant obstruction in the venous outflow tract started in earnest in 1997. Data sets are now available to perform long-term analysis of stent-related outcome and clinical and hemodynamic results of this intervention.

Materials: From 1997 to 2005, 982 chronic nonmalignant obstructive lesions of the femoroiliocaval vein were stented under intravascular ultrasound guidance. Median patient age was 54 years (range, 14 to 90 years), the female/male was 2.6:1, and left/right limb symptoms, 2.4:1. Clinical score of CEAP was 2 in 7%, 3 in 47%, 4 in 24%, 5 in 5%, and 6 in 17%; primary/secondary etiology was 518:464. Stent-related outcome (morbidity, thrombotic events, patency, in-stent recurrent stenosis), clinical outcome, quality of life (QOL) as assessed by the Chronic Venous Insufficiency Quality of Life Questionnaire (CIVIQ), and hemodynamics were evaluated before and after intervention.

Result: Monitoring for 94% of patients lasted a mean 22 months (range, 1 to 107 months). Stenting was performed with no mortality (30 days) and low morbidity. Thrombotic events were rare (1.5%) during the postoperative period (<30 days) and during l up (3%). At 72 months, primary, assisted-primary, and secondary cumulative patency rates were 79%, 100%, and 1 mbotic disease and 57%, 80%, and 86% in thrombotic disease, respectively. Cumulative rate of severe in-st occurred in 5% of limbs at 72 months (10% in thrombotic limbs, 1% in nonthrombotic limbs). The ma ith stent occlusion were the presence and severity of thrombotic disease; thrombophilia by its pain score and degree of swelling decreased significantly postst present to 11% an 62% and 32%, resp categories. Mean h limbs with no con superficial reflux in

Conclusions: Venou rate of in-stent res consistently reflecte clinical outcome occurred regardless of presence of remaining reflux, adjunct saphenous procedures, or etiology of obstruction. (J Vasc Surg 2007;46:979-90.)

"Contralateral iliac vein thrombosis due to the IVC stent extension was generally benign and infrequent (1%)."

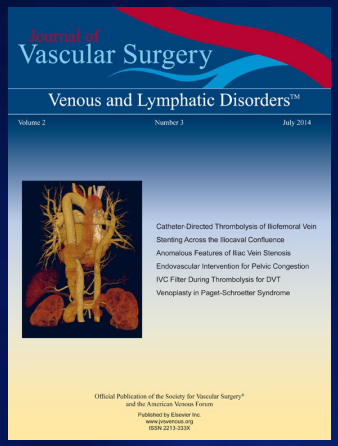
From the Society for Clinical Vascular Surgery

Journal of Vascular Surgery
Venous and Lymphatic Disorders™

The incidence of contralateral iliac venous thrombosis after stenting across the iliocaval confluence in patients with acute or chronic venous outflow obstruction

Xzabia A. Caliste, MD,[a] Amanda L. Clark, BS,[a] Adam J. Doyle, MD,[a] John P. Cullen, PhD,[a] and David L. Gillespie, MD,[b] *Rochester, NY; and Fall River/New Bedford, Mass*

Objective: Percutaneous transluminal angioplasty with stenting of the iliac veins is the method of choice to treat patients with symptomatic lower extremity venous outflow obstruction. The optimal method of performing this technique remains to be solved, however. One question in particular is that when braided stainless s
Scientific, Natick, Mass) ar
extend into the vena cava
fear of causing thrombos
lateral iliofemoral vein? It
venous stents significantly
the inferior vena cava (IV
with disease of the comm
The aim of this study wa
led to thrombosis of a n
vein.
Methods: We retrospectivel
data from 2008 to 2012
chronic iliocaval veno
neous angioplasty a
collected by use o
database variabl
contralateral
Results: In
80 years), 200 iliocaval stent
41 received ipsilateral stents that extended into the IVC and
completely across the contralateral common iliac vein orifice;
39 (95%) of these had venous outflow obstruction as a result
of thrombotic disease. In 22 patients (54%), post-thrombotic
disease involved the IVC. All patients had stents that extended
into the IVC, crossing the normal contralateral iliac vein
orifice completely. Most patients (97.5%) were maintained by
full anticoagulation with warfarin or low-molecular-weight
ment is likely to eliminate the need to cross the iliocaval
confluence and risk contralateral venous thromboses. (J Vasc
Surg: Venous and Lym Dis 2014;2:253-9.)



- **4/41 (9.7%) patients with stents extended over the contralateral iliac vein into the IVC had contralateral DVT at a mean of 10 months (0-30 months)**

From the American Venous Forum

Deep venous thrombosis associated with caval extension of iliac stents

Erin H. Murphy, MD, Blake Johns, BS, Elliot Varney, BS, William Buck, BBA, MS, Arjun Jayaraj, MD, MPH, RPVI, *and* Seshadri Raju, MD, FACS, *Jackson, Miss*

ABSTRACT

Background: It is generally difficult to place an iliac vein stent precisely at the iliocaval junction with venographic control or even with intravascular ultrasound guidance. Furthermore, mechanical properties of the Wallstent (Boston Scientific, Marlborough, Mass) can predispose precisely placed stents to distal displacement or stent collapse. Our center has thus advocated extending Wallstents 3 to 5 cm into the inferior vena cava to prevent complications of missed proximal lesions or stent migration. This technique has gradually been accepted, and concerns of jailing of contralateral flow were not initially recognized. We analyzed deep venous thrombosis (DVT) incidence following iliocaval stenting with two alternative techniques: (1) Wallstents with 3- to 5-cm extension into the inferior vena cava; and (2) a modified Z-stent (Cook Medical, Bloomington, Ind) technique, in which overlapping Wallstents end at the iliac confluence and caval extension is performed with a Z-stent placed at the top of the stack. The function of the Z-stent is to provide improved radial force at the iliocaval confluence and to prevent jailing of contralateral flow with larger stent interstices.

Methods: There were 755 limbs with consecutive Wallstent caval extensions (2006-2010) and 982 limbs with Z-stent extensions (2011-2015) analyzed for DVT incidence postoperatively.

Results: Demographics were similar for both groups. Mean age was 56 and 58 years in the Wallstent and Z-stent groups, respectively. There was a female predominance (Wallstent, 69%; Z-stent, 67%) and a higher incidence of left-sided disease (Wallstent, 66%; Z-stent, 56%) in both groups. There was a slightly higher incidence of post-thrombotic disease in the Z-stent subgroup (Wallstent, 53%; Z-stent, 68%). Cumulative freedom from contralateral DVT was 99% and 90% in the Z-stent and Wallstent groups, respectively ($P < .001$) during the 5 years following stent placement. However, all three patients with DVT contralateral to a Z-stent actually had high placement of the Wallstent across the confluence. Thus, no patients with proper Z-stent technique had a contralateral DVT. Cumulative freedom from ipsilateral DVT was 97% and 82% in the Z-stent and Wallstent groups, respectively ($P < .001$) during the 5 years following stent placement. The decrease in incidence of ipsilateral DVT appeared to be attributable to decreased missed distal lesions with increased operator experience and not attributable to the Z-stent itself.

Conclusions: Contralateral DVT incidence was significantly lower with the Z-stent modification. In addition, the Z-stent modification provides greater radial strength at the iliac-caval confluence and simplifies simultaneous or sequential bilateral stenting. Use of proper technique and intravascular ultrasound is essential to limit the incidence of ipsilateral DVT. (J Vasc Surg: Venous and Lym Dis 2017;5:8-17.)

Endovascular stenting has become the first-line treatment for patients with symptomatic iliofemoral stenosis or occlusion. Excellent clinical outcomes and patency can be achieved with adherence to the basic vascular principle of establishing adequate inflow and outflow. In most cases, the outflow component requires stenting of the proximal common iliac vein (CIV), which is a typical location of densely fibrotic venous lesions and is considered an anatomic choke point.

Proper stenting of the proximal CIV can be challenging for two primary reasons: (1) the difficulty in accurately locating the iliac vein confluence on venography; and (2) the limitations of current stent technology, which can lead to either cranial stent collapse with coning or downward stent migration when stents are positioned exactly at the confluence.

To mitigate the difficulties of landing stents at the confluence, it has been recommended to deploy Wallstents (Boston Scientific, Marlborough, Mass) 3 to 5 cm into the inferior vena cava (IVC).[1,2] Initial concerns that crossing the contralateral vein could cause contralateral deep venous thrombosis (DVT) were not immediately recognized.[3] Over time, however, we observed patients

From The RANE Center at St Dominic's Memorial Hospital.

Author conflict of interest: E.H.M. is a consultant for Medtronic. S.R. holds a U.S. patent regarding intravascular ultrasound diagnostics in chronic venous disease and has stock in Veniti.

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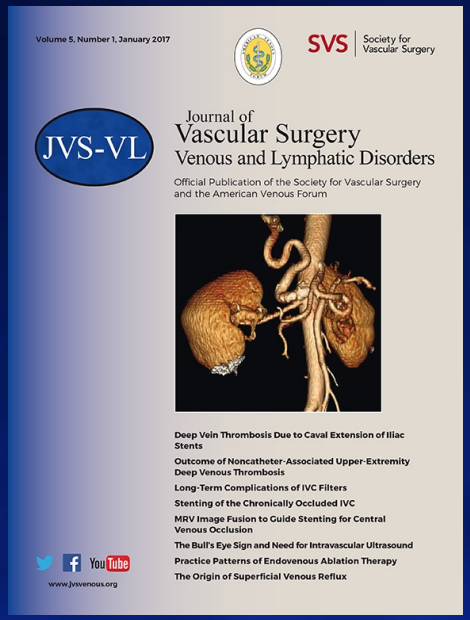
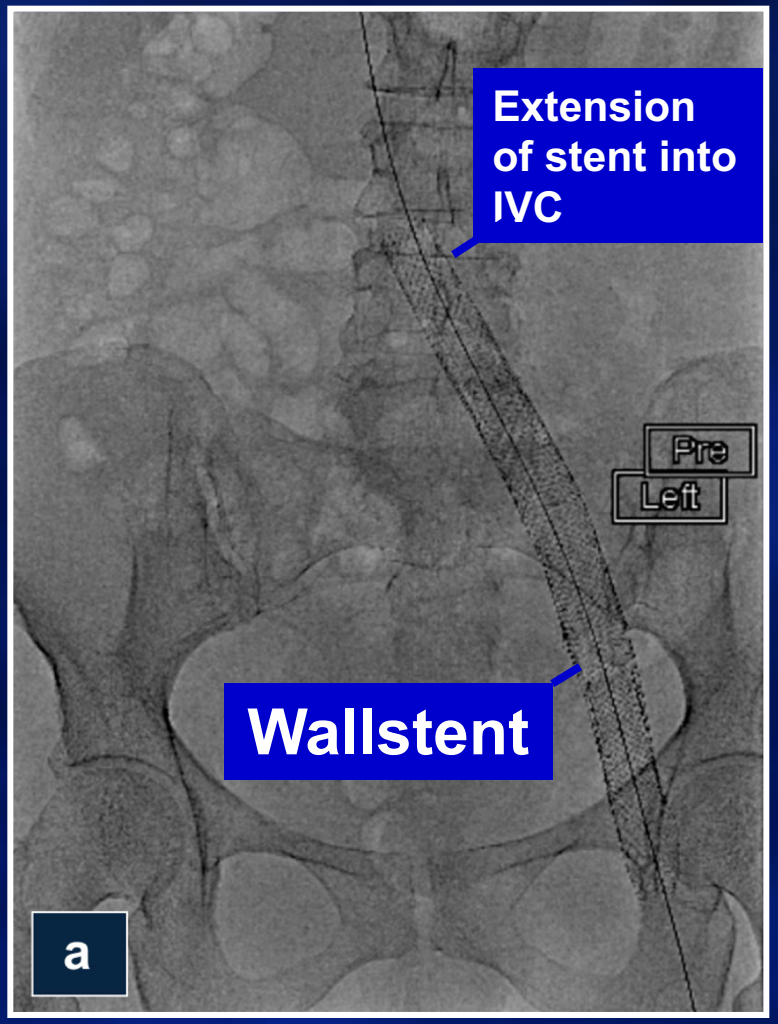
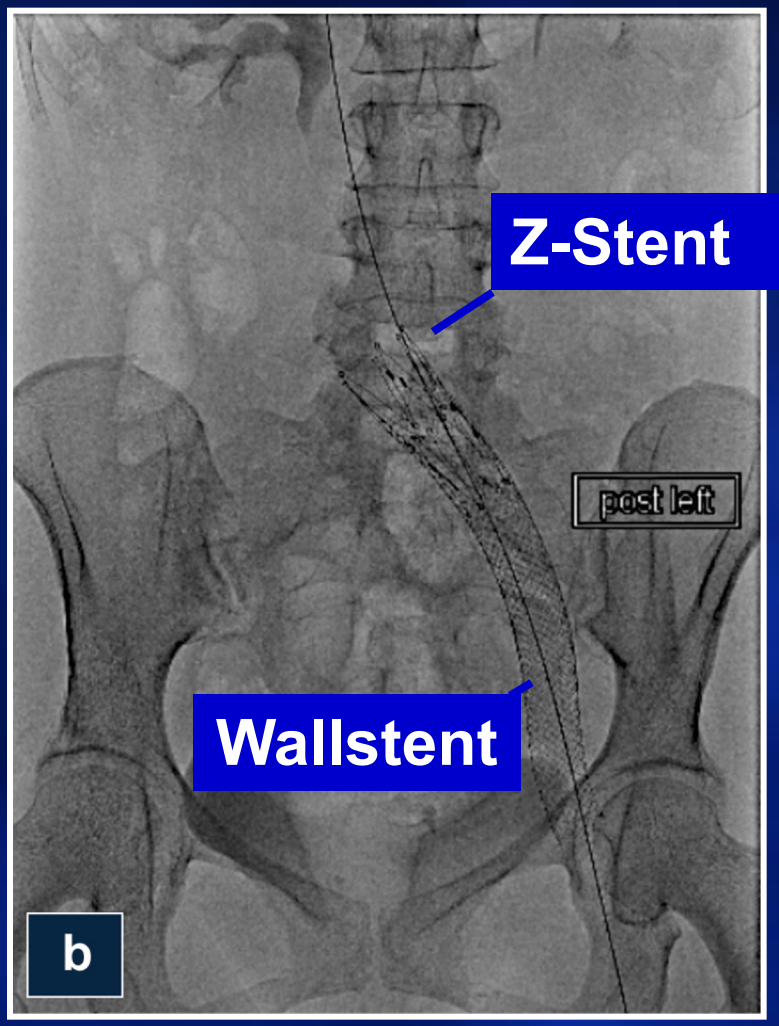


J Vasc Surg Venous and Lym Dis 2017;5:8-17

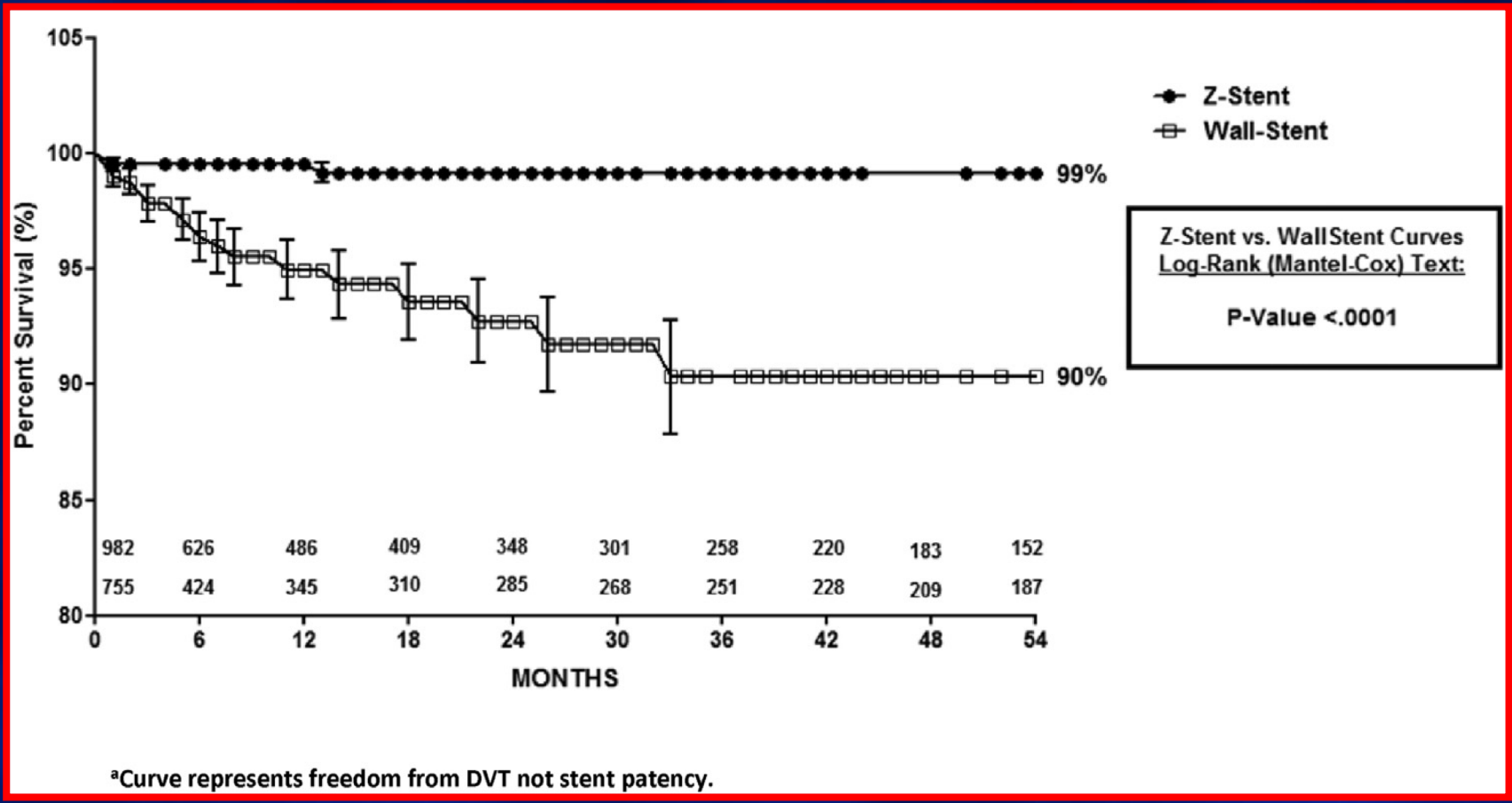
755 patients

982 patients





Freedom from Contralateral DVT



Contralateral DVT at a mean of 47.5 +/- 37.8 months
(Range: 9 days -111 months)

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Factors Associated with Contralateral Deep Venous Thrombosis after Iliocaval Venous Stenting

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[b] Department of Angiology and Vascular Surgery and Department of Biomedical Sciences, Hospital São João, EPE, Porto, Portugal
[c] Department of Vascular Surgery, CHU Nord, Marseille, France
[d] Department of Interventional Radiology, University College Hospital of Galway, National University of Ireland, Galway, Ireland

WHAT THIS PAPER ADDS

This study suggests that placement of iliac venous stents across the iliocaval confluence is a safe procedure. It is associated with a low incidence of contralateral iliac DVT, and if this occurs, early clot removal may be performed with good results. Acute DVT, pre-operative contralateral IIV thrombosis, pre-existing IVC filters, anticoagulation non-compliance, and malignant compression a
contralateral DVT.

Background: The majority of iliac venous obstr
become the first line treatment for this conditio
vena cava (IVC) to some extent, thereby coveri
increase the risk of thrombosis of the contralate
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results of salvage revascularisation.
Methods: A total of 376 patients (102 from UCH
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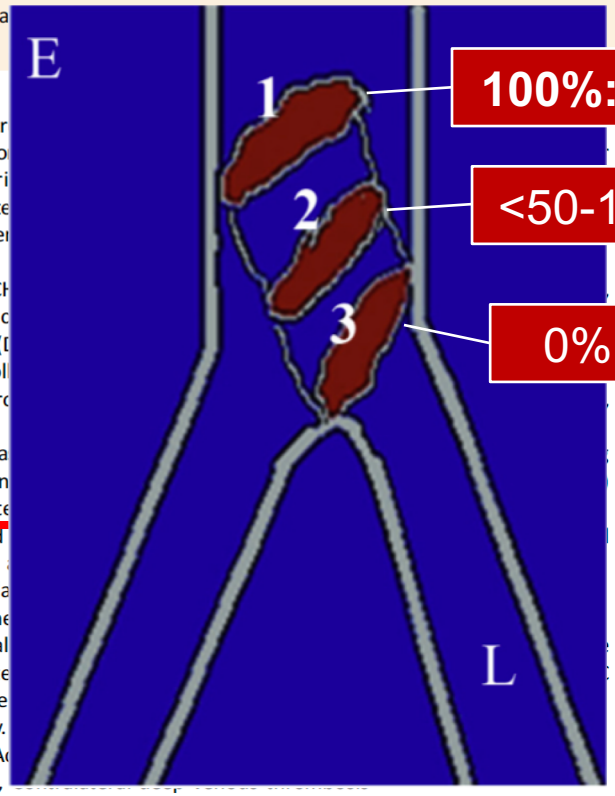
Marseille.
Results: The median age of stented patients wa
left CIV stent placement, 10 patients later presen
resulting in a cumulative incidence of contralate
($p = .001$), non-compliance with the prescribed
internal iliac vein (IIV) thrombosis ($p = 0.001$),
statistically significantly associated with contrala
underwent clot removal in the acute phase. The
Conclusion: Stent placement across the iliocaval
rate of contralateral iliac vein thrombosis. Acute
filters, and anticoagulation non-compliance are

Article history: Received 24 December 2016, A
Keywords: Post-thrombotic, Iliac venous stent,

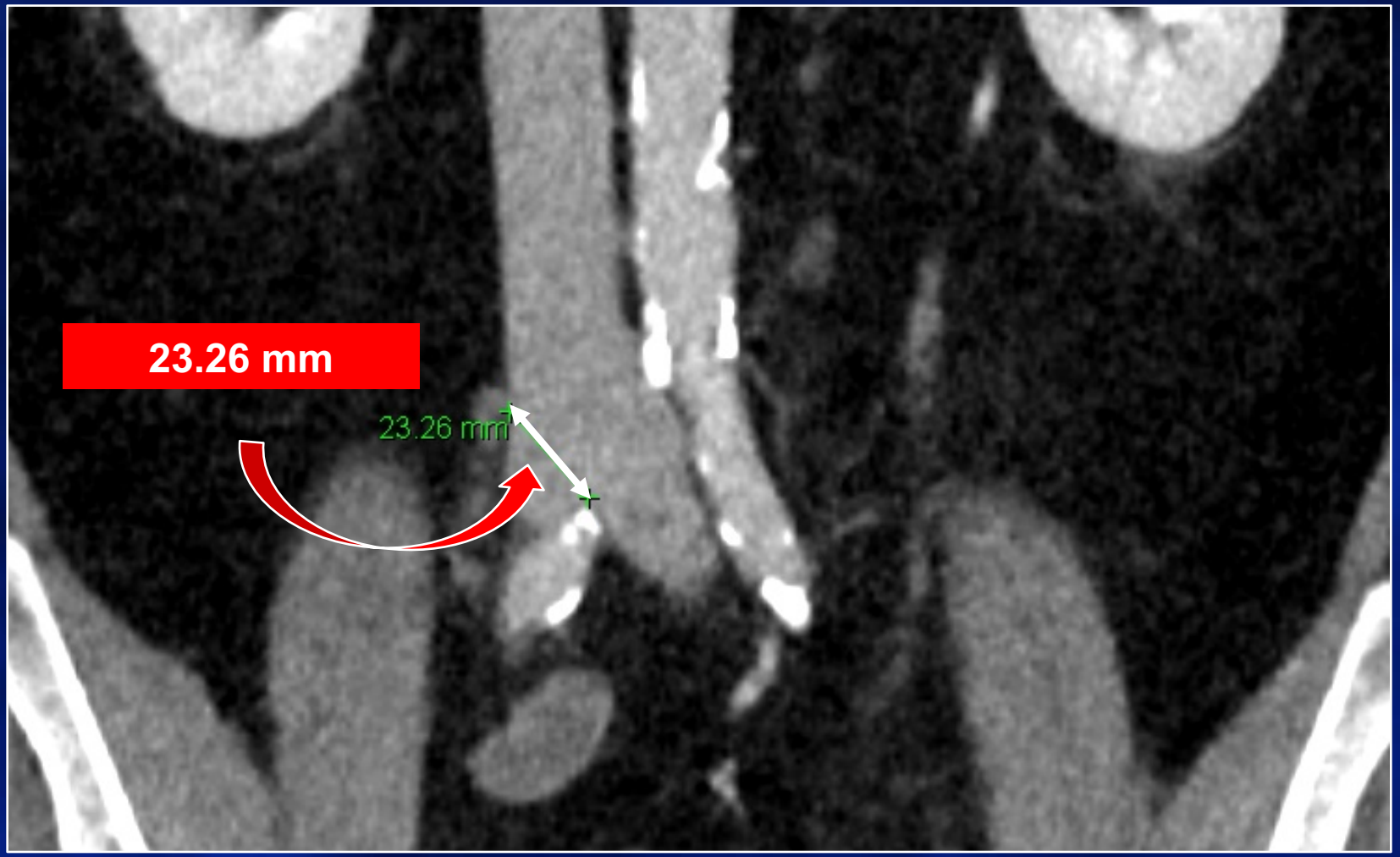


100%: >2 cm: 324 (86%)

<50-100%: 0-2 cm: 48 (13%)

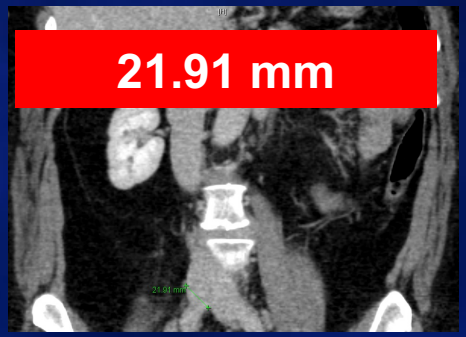
0%: 0 cm: 4 (1%)

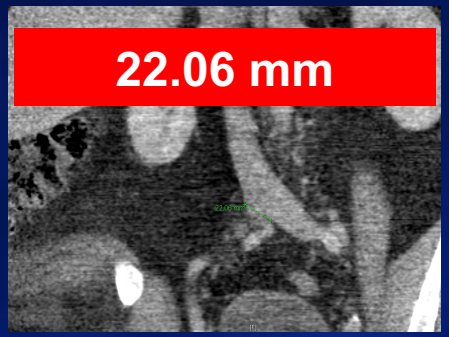
Iliac Bifurcation – IVC Distance

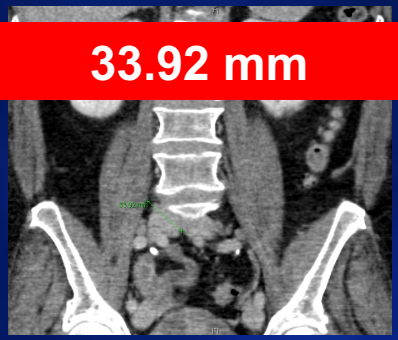


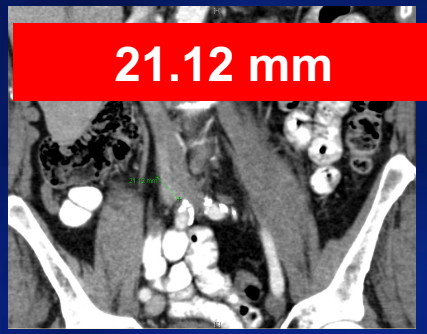
8 of 10 patients had iliac – IVC distance >2.0 cm:

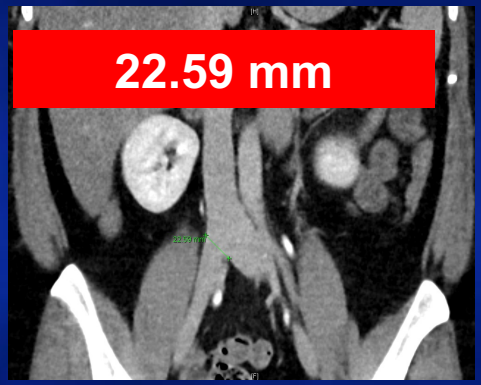
Mean: 2.45 cm, Range: 21.12 – 33.92 cm

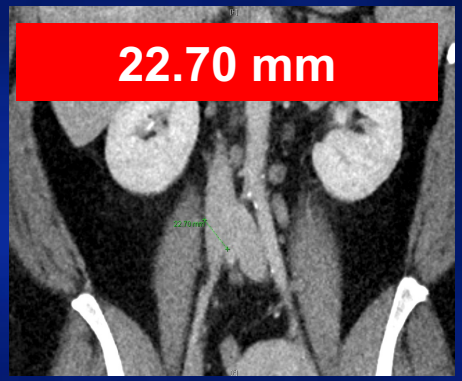


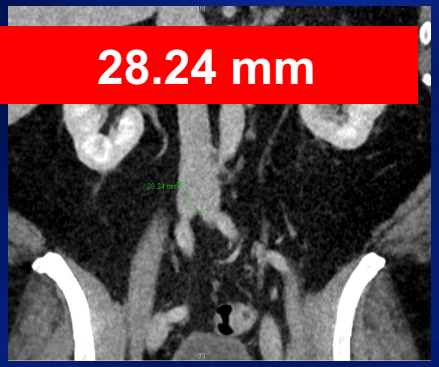


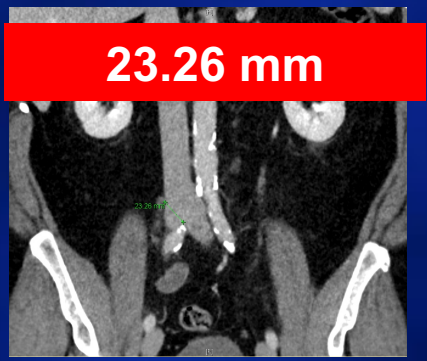












Arjun Jayaraj, MD, unpublished data

Contralateral Deep Vein Thrombosis after Iliac Vein Stent Placement in Patients with May-Thurner Syndrome

Trong Binh Le, MD, PhD, Taeg Ki Lee, MD, Keun-Myoung Park, MD, Yong Sun Jeon, MD, PhD, Kee Chun Hong, MD, PhD, and Soon Gu Cho, MD, PhD

ABSTRACT

Purpose: To investigate the incidence and potential causes of co
stent placement in patients with May-Thurner syndrome (MTS).

Materials and Methods: Data of 111 patients (women: 73%
center were retrospectively analyzed. Mean patient age was 63.1 ±
Stent location was determined by venogram and classified as e
confined to the iliac vein. Potential causes of contralateral DVT we
stent location and contralateral DVT was analyzed.

Results: Ten patients (9%, men/women: 4/6) exhibited contral
Median age was 69 years (range, 42–85 years). Median follow-
venous intimal hyperplasia (VIH) (n = 7), "jailing" (n = 2), and
overextended to the IVC. Overextension of CIV stent was associat
contralateral CIV stent was 70% at 20 months.

Conclusions: Contralateral DVT after CIV stent implantation h
Overextension of the CIV stent to the IVC is associated with
potential cause.

Iliac vein stenting/MTS (n=111)
Mean age: 63.1 ± 15.2 years
Female/male: 73%/27%
Median follow-up: 36 months (1-142 months)

Contralateral DVT (n=10)
Median age: 69 years (42-85 years)
Female/Male: 6/4
Median detection timing: 40 months (6-98 months)
Median follow-up: 73.5 months (20-134 months)

J Vasc Interv Radiol 2018; 29:774–780

Contralateral Deep Vein Thrombosis after Iliac Vein Stent Placement in Patients with May-Thurner Syndrome

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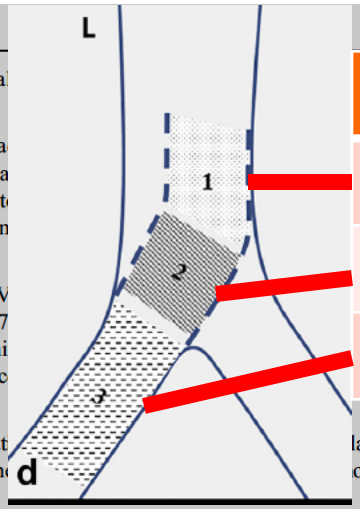
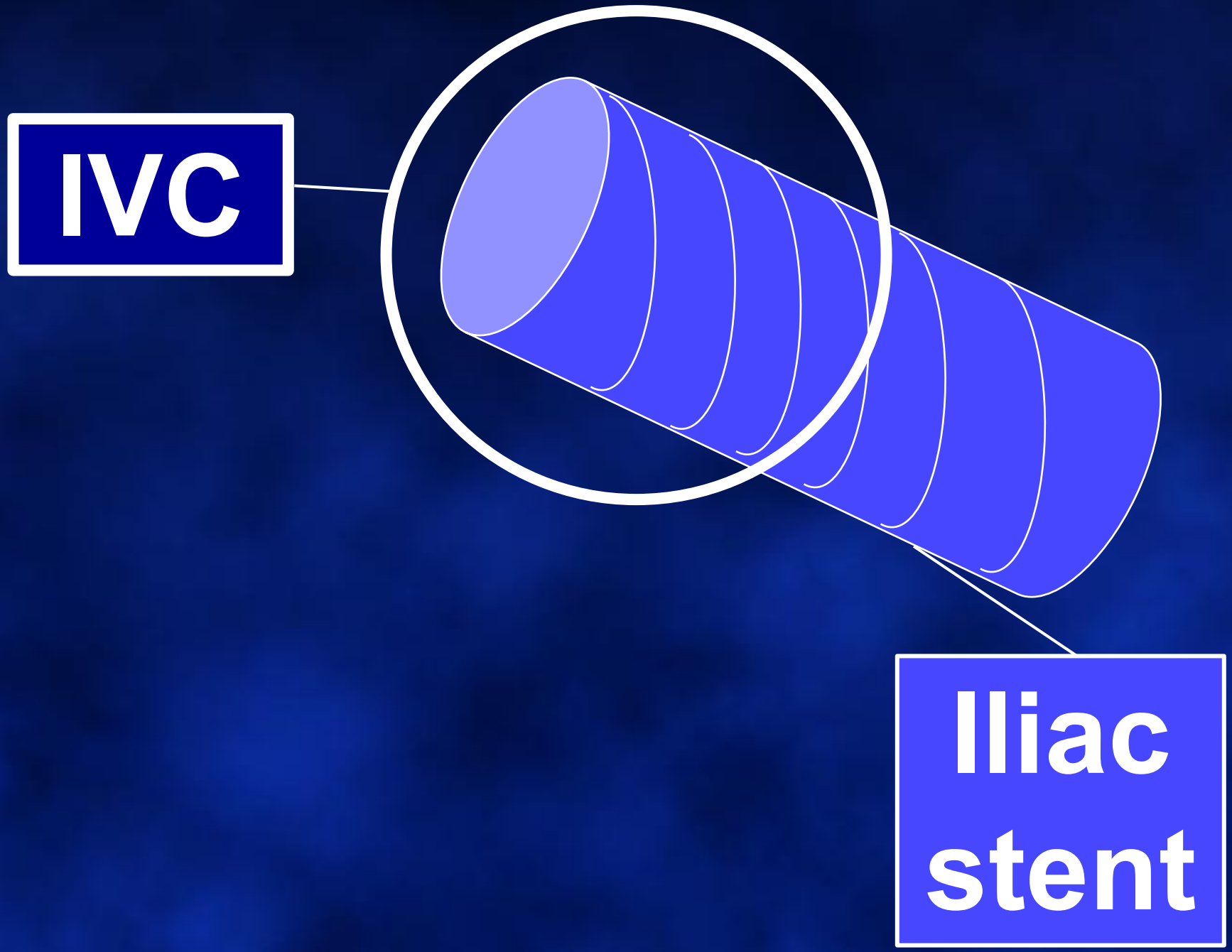
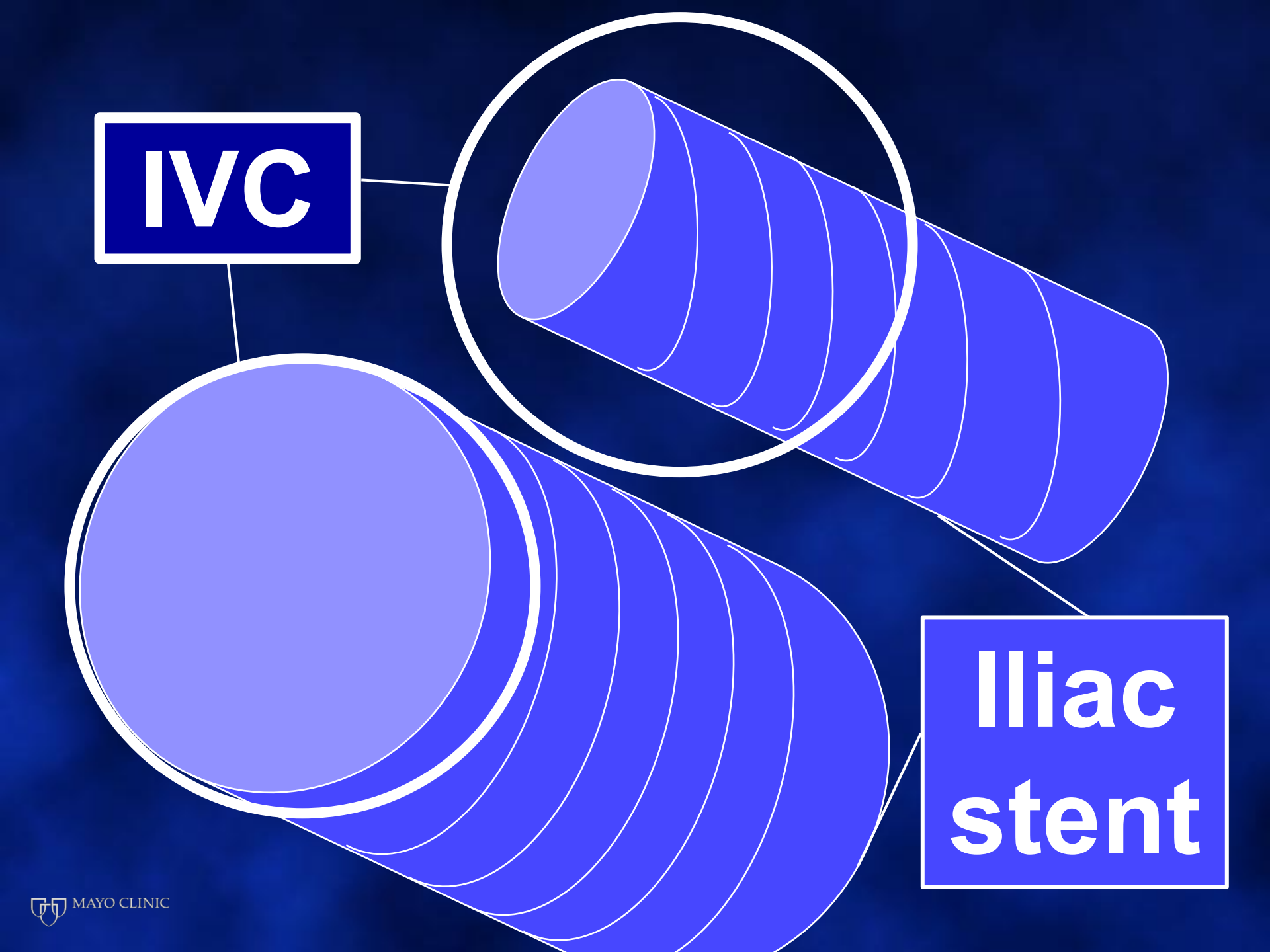
Conclusions: Contralateral DVT after CIV stent implantation has a relat late during follow-up. Overextension of the CIV stent to the IVC is associated with developm ould be considered a potential cause.



Contralateral DVT		
8/25	32%	<.01
2/39	5.1%	.29
0/47	0%	<.01

J Vasc Interv Radiol 2018; 29:774–780





From the American Venous Forum

Long-term clinical outcomes and technical factors with the Wallstent for treatment of chronic iliofemoral venous obstruction

Paul J. Gagne, MD,[a] Nicole Gagne, BA,[b] Taras Kucher, MD,[a] Michael Thompson, RN,[c] *and* Dana Bentley, BA,[d]
Darien and Norwalk, Conn; and New York, NY

ABSTRACT

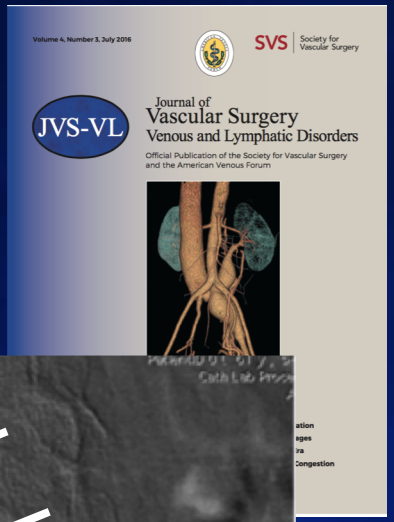
Background: Factors affecting long-term clinical outcome and stent patency afte
complex and ill-defined. Also, consensus is lacking among clinicians regarding t
(Boston Scientific, Marlborough, Mass) as dedicated nitinol-based venous stents h
study to review our long-term results using Wallstents and to evaluate the potent

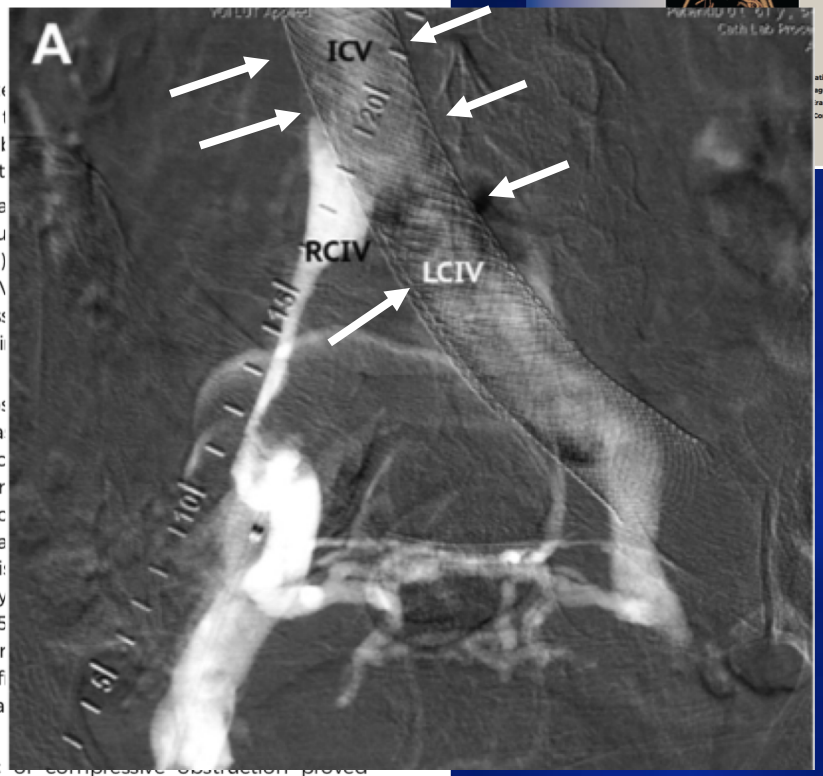
Methods: From 2007 to 2014, there were 77 limbs in 67 consecutive patients tha
femoral vein obstruction. Intravascular ultrasound (IVUS) and venography were u
Baseline clinical severity was assessed with Venous Clinical Severity Score (VCSS)
Pathophysiology (CEAP) classification. Clinical improvement was assessed with \
change ≥4 points was considered significant improvement. Patency was assess
spective review of patients' records and imaging was conducted to assess baseli
with long-term clinical outcomes.

Results: Lesions were nonthrombotic in 42 limbs (55%) and left-sided in 48 limbs
bilateral venous disease. Patients were predominantly male (55%); median age wa
baseline VCSS was 9 (range, 3-23). IVUS and venography estimated equal vessel c
IVUS estimated a longer lesion in 32 limbs (42%). Stenting correlated with venogr
more closely aligned with IVUS in 35 limbs (45%). Stents extended into the commo
and into the inferior vena cava in 6 limbs (8%). Sixty-five (97%) patients had a
50 n [redacted] the overall cohort was 87%; assis
patency were both 95%. In the nonthrombotic subset, assisted primary patency
primary patency was 97%. In the post-thrombotic subset, primary patency was 75
ondary patency were 88%. Three early failures occurred. Eight patients required r
five interventions were to maintain patency. Cox multivariate regression identif
complications. At last VCSS follow-up per patient (median, 26 months), 52 pa
improvement. None had score worsening.

Conclusions: Venous stenting with Wallstents for iliofemoral post-thrombotic or compressive obstruction proved safe and effective through long-term follow-up, with excellent patency rates. The majority of patients exhibited significant clinical improvement. CFV occlusive disease predicts increased complications. (J Vasc Surg: Venous and Lym Dis 2018;■:1-11.)

Keywords: Venous stent; Wallstent; Iliofemoral veins; Post-thrombotic; Nonthrombotic; IVUS





J Vasc Surg Venous and Lym. 2019, in press

3/6 had reintervention because of jailing of RIV

Open surgical removal of iliac vein Wallstents with excision of pseudointima obstructing the contralateral iliac vein

Animesh Rathore, MD, Peter Gloviczki, MD, *and* Haraldur Bjarnason, MD, *Rochester, Minn*

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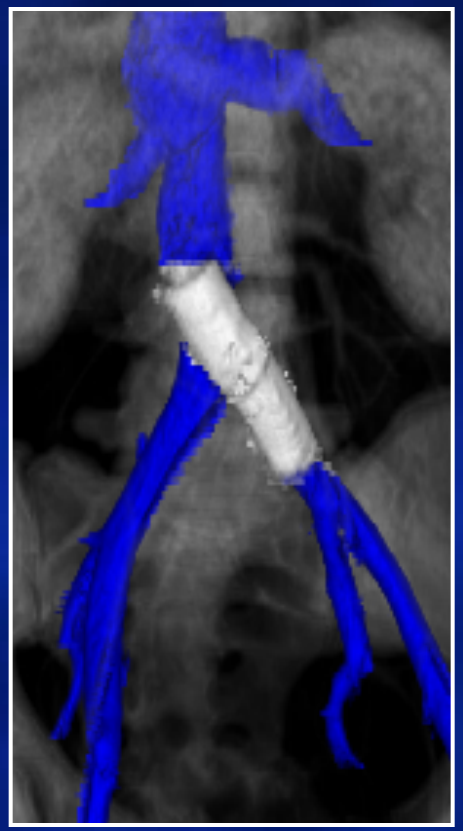

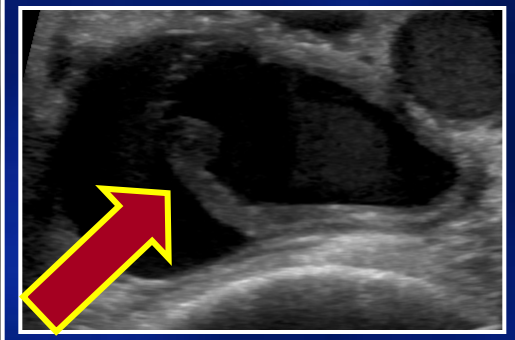

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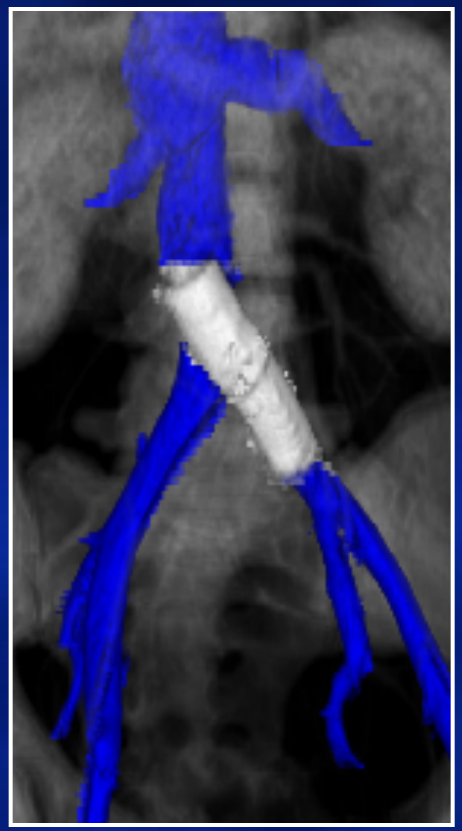

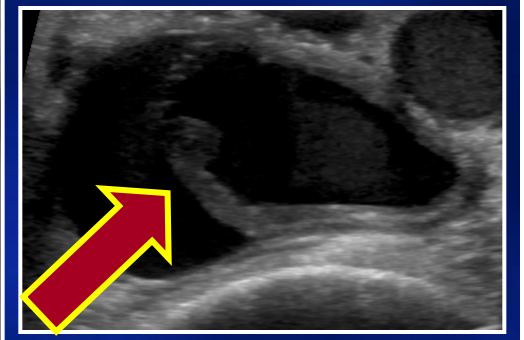

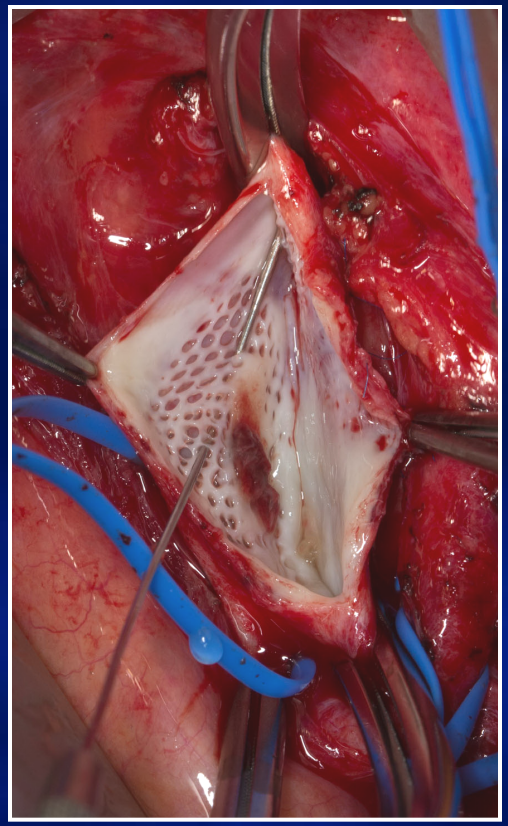

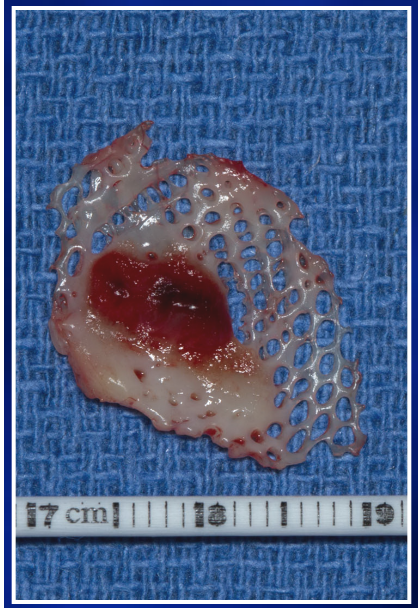

Iliac vein stenting and contralateral deep vein thrombosis

Iliac vein stenting, one of the triumphs of the endovascular revolution, has transformed the management of proximal deep venous occlusive disease. A minimally invasive percutaneous procedure, stenting of the obstructed iliac and iliofemoral veins, has been used with increasing frequency since the publication of a large retrospective cohort study of 982 patients in 2007 by Neglen et al.[1] This report confirmed primary and secondary stent patency rates of 57% and 86% for postthrombotic obstruction and 79% and 100% for symptomatic nonthrombotic iliac vein lesions, such as May-Thurner syndrome. A recent systematic review of iliac vein stenting analyzed data from 4959 patients and found that primary and secondary patency rates ranged from 32% to 98.7% and 66% to 96%, respectively, and healing of venous ulcers occurred in 56% to 100% of the limbs, often following the failure of conservative compression therapy alone. Still, because of lack of controlled prospective studies, the quality of evidence to support iliac vein stenting remains weak and results of multicenter prospective randomized studies like the ATTRACT[2] and C-TRACT[3] trials are eagerly awaited.

Stenting continues to be widely accepted as an appropriate and safe procedure that should be considered for symptomatic iliac vein obstruction, but the issue of contralateral iliac vein thrombosis or stenosis, caused by extending the iliac stent into the inferior vena cava, which partially or completely obstructs the contralateral iliac vein (often termed "jailing"), has been theorized but not commonly recognized. When contralateral deep vein thrombosis (DVT) occurs after stenting, it is often considered to be a consequence of bilateral post-thrombotic disease rather than a complication of iliac vein stenting. Consequently, reports on contralateral DVT following iliac vein stenting have been scarce, with an incidence ranging from 1.1% to 2.2%.[1,4,5]

During an open surgical procedure, where a previously placed iliac vein stent was removed for severe pelvic pain, we (P.G.) recently observed partial occlusion of the contralateral iliac vein by pseudointima, with limited flow through very small interstices of a Wallstent (Boston Scientific, Natick, Mass), which had been extended into the vena cava.[6] "Jailing" of the contralateral iliac flow by a Wallstent protruding into the inferior vena cava was previously reported by Raju et al.[7] Consequently, they modified their technique by placing a Gianturco Z-stent (Cook Medical, Bloomington, Ind), with large interstices, on top of the Wallstent, to both prevent jailing and improve the radial force at the iliocaval junction.

In the current issue of the *Journal of Vascular Surgery: Venous and Lymphatic Disorders*, Murphy et al[8] compared results of iliac vein stenting in 982 limbs when using the Gianturco Z-stent extensions (placed between 2011-2015), with results in 755 limbs treated with Wallstent alone, frequently with caval extension (placed between 2006-2010), to treat iliac vein obstruction. Five-year freedom from contralateral DVT was 99% in the Z-stent modification group and only 90% in the Wallstent extension group ($P < .001$). In addition, all three patients with contralateral DVT, who had the Z-stent, also had high placement of the Wallstent into the inferior vena cava. Therefore, no patients with a properly placed Z-stent technique had a contralateral DVT.

The technical modification of using a proximal stent extension with very large interstices seems to have an excellent likelihood of preventing the development of a contralateral iliac vein obstruction by a pseudointima mesh formed in the stent. However, it will be important for other studies to confirm the findings of Murphy et al[8] with even longer-term results since the patient population undergoing this procedure is often young, so they need excellent life-long results.

Although evidence is increasing that the use of Wallstents, which have small interstices, extending into the vena cava from the iliac vein may lead to the development of an occlusive pseudointima, which may provoke swelling or contralateral DVT, it is also likely that other balloon-expandable stents of a similar configuration with similar small interstices will also develop a pseudointima that may cause jailing of the contralateral iliac vein, with reduced iliac flow. Until better venous stents are developed, one way to avoid this problem is by using the Z-stent modification or by using stents that are cut at 45 degrees at their upper end, where available, to prevent jailing. The technique of extending a Wallstent into the inferior vena cava during iliac vein stent[ing] abandoned.

Peter Gloviczki, MD
Peter F. Lawrence, MD
Editors, Journal of Vascular Surgery Publications

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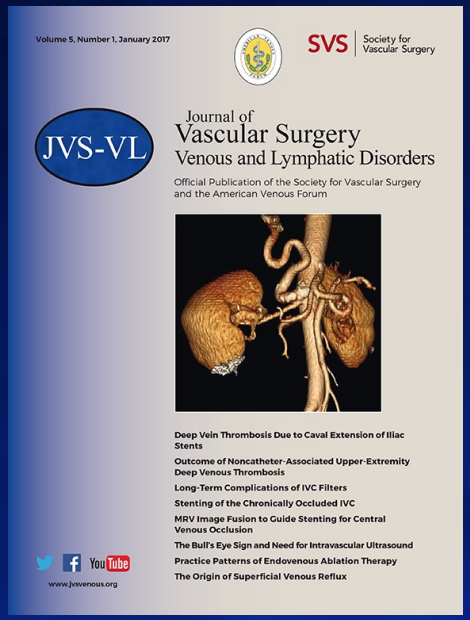

The technique of extending a Wallstent into the inferior vena cava and completely covering the inflow from the contralateral iliac vein should be abandoned

MAYO CLINIC

Eur J Vasc Endovasc Surg (2017) 54, 745–751

Factors Associated with Contralateral Deep Venous Thrombosis after Iliocaval Venous Stenting

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[c] Department of Vascular Surgery, CHU Nord, Marseille, France
[d] Department of Interventional Radiology, University College Hospital of Galway, National University of Ireland, Galway, Ireland

WHAT THIS PAPER ADDS

CONCLUSION

Stent placement across the iliocaval confluence from the left CIV is associated with a low but definite rate of contralateral iliofemoral venous thrombosis. Contralateral IIV thrombosis, pre-existing IVC filters, and anticoagulation non-compliance are significant predictors, and the malignant compression effect can be considered as an associated risk factor. Subsequent right side thrombus removal presents good long-term results. Future stent development may attempt to eliminate the need to cross into a healthy IVC and avoid the risk of secondary contralateral venous thrombosis.

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Extending Iliac Stent Into The IVC Is Frequently Needed BUT It Increases Thrombotic Complications

THANK YOU !

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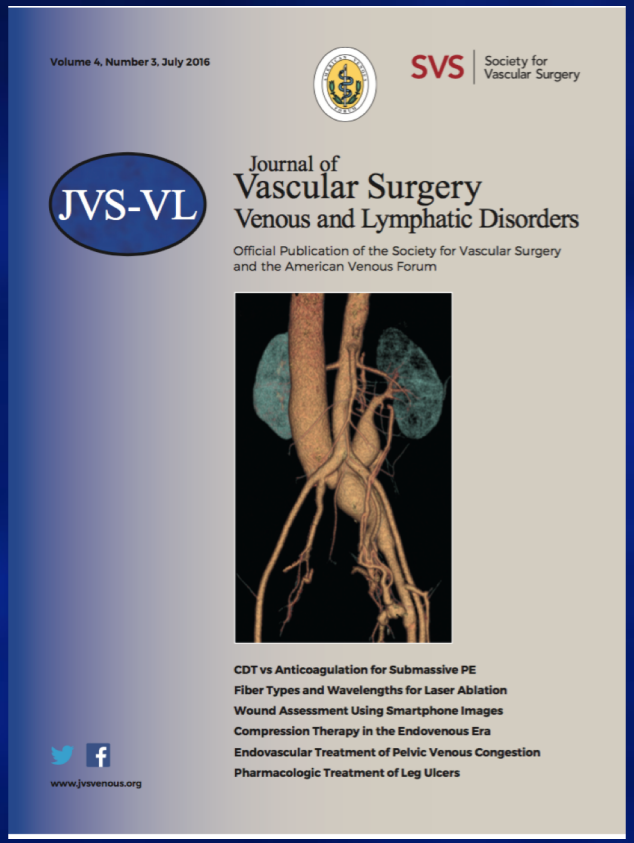
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