Tips and Tricks in Venous Stenting

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Iliac venous obstruction- who cares?

- Landmark study by O’Donnell/Browse 1977
- Purely IF DVT
- At 5 years most could not walk properly
- At 10 years
  - 50% had ulcers
  - 11 of 12 men were disabled and unable to maintain a steady job because of their leg symptoms
  - “7 of 9 women were unable to perform household duties”

O’Donnell TF, Jr, Browse NL, Burnand KG.
How common is this problem:

- Incidence 1/1000
- 300,000 new DVTs per annum in Europe
- Say 1/3 Ilio-femoral = 100,000 IF DVTs p.a.
- Recanalisation with AC alone 24-36% - say 1/3
- So 66,000 new iliac stenoses or occlusions per annum
- After 10 years 660,000 iliac venous occlusions
- Not trivial, hugely under-treated
• Most of us learned arterial intervention-angiograms/angioplasty/stents/EVAR
• Central venous access was the start of my venous exposure
• Graduated to dialysis intervention
• Venous stent placement in outflow of AVF
• IVC filters
• Eventually preformed catheter directed thrombolysis for acute IF DVT
• Learned that veins don’t stay open without stents!!

Gradual increased exposure to venous disease
My tips and tricks…….

- Thorough history and examination
- Good pre-op imaging
- Anesthesia- general/local/spinal?
- Access Site?
- DETERMINE WHICH INFLOW VEIN IS DOMINANT AND WORK THROUGH THIS e.g. PFV, access thru collateral from popliteal vein
- URINARY CATHETER!!!!
- “The kit”
- Oblique angles to find true path
- Full anticoagulation- before, during and after
- Pneumatic compression boots overnight
- Color Doppler US Day 1
- CTV 6/52
- If you make a mistake have a plan B
- Sometimes it is better to retreat and live to fight another day
Good pre-op imaging

• All patients should have an US pre op- looking specifically at:
  – R IJV
  – R and L Common Femoral Veins
  – R and L popliteal vein
• Would you do an EVAR without a CTA or MRA????
• Don’t do an iliac vein occlusion without either a CTV or MRV
• If shortness of breath consider CTPA or Echo to assess Pulmonary Artery Pressure
  • 49% of UCH Galway patients with iliac vein thrombus have a positive CTPA
  • Prove to yourself that Shortness of Breath is NOT due to Right Ventricular Strain FIRST
• Direct CTV provides much better images
• Direct CTV is difficult if limb swollen
• Indirect CTV more generally applicable, can be done as a follow on to standard CTPA; 150cc at 150s
• More idiot proof
• No matter how inept your colleagues are indirect CTV is hard to screw this up...
• Most MRVs sent to me are poor quality

• Therefore:
  DIRECT CTV for chronic and INDIRECT for acute
  MRV for either IF you are expert

Direct CTV v Indirect CTV v MRV
INDIRECT CTV - Thrombus within L CIV
DIRECT CTV
Perfect delineation of iliac vein compression
MRV- tends to overcall stenosis, but is Radiation free and getting much faster

Easier to miss calcification on MR
IVUS is the MOST precise method of stent delivery
• ALWAYS US guided
• Do NOT puncture vein unless it is completely normal on Ultrasound
• Otherwise you may need to stent down to where you puncture—better to have some running room
• My preferences for a common & external iliac occlusion:
  – Ispilateral CFV but only if totally NORMAL on US
    • (calculate inferior landing zone BEFORE puncturing)
  – Popliteal prone
  – FV in mid thigh
  – Contralateral CFV
  – Right internal jugular

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Access Site
- Support sheath-braided
- 8/10F
- CTO catheters
- Torqueable wires, hydrophilic, stiff hydrophilic
- CTO wires- Asahi Astato
- IVUS
- Small balloons to support CTO wires
- Big balloons- high pressure- 14mm MINIMUM from IVC to groin
- Big stents 14mm MINIMUM-self expanding
  - Cook ZV
  - Optimed
  - Veniti
  - Wallstent

“The kit”
Extra tricks:

- Use braided sheath to advance and make progress over a stiff hydrophilic wire
- Use inflated balloon in occlusion to support wire for extra pushability
- Above and below access or from both groins
- Snare from contra-lateral side
- If wires are approaching each other but you cannot get in same plane, inflate 3mm balloons with nose cones touching and wires retracted into balloons; then re-advance wires- balloons will have got you back in correct plane- then snare
Stent from “flow to flow”

• If this means stenting from right atrium to upper PFV- go for it!
Stent Implantation across the Ostia of the Renal Veins Does Not Necessarily Cause Renal Impairment when Treating Inferior Vena Cava Occlusion


The effect of inferior vena cava (IVC) stents crossing the ostia of the renal veins on renal function has not been reported. The purpose of this study is to report a single-institution experience with four cases of IVC stent implantation for malignant compression and/or invasion of the IVC causing severe lower-extremity edema. The patients' symptoms were successfully relieved, and follow-up imaging and serum creatinine measurements for the remainder of their lives revealed no evidence of renal impairment or renal vein thrombosis.

J Vasc Interv Radiol 2007; 18:685-694
Abbreviation: IVC - inferior vena cava

SEVERE lower-extremity swelling caused by compression or invasion of the inferior vena cava (IVC) by tumor, although not as well recognized as superior vena cava obstruction, is a complication of intraabdominal malignancy. Previously, the focus of investigations for causes of swollen legs was aimed at more diffuse processes such as congestive cardiac failure or third spacing from low albumin levels caused by anasarca. However, physicians are becoming increasingly aware of mechanical causes of IVC compression (1). In addition, the increased availability of high-quality cross-sectional imaging has lead to an increased awareness of processes that may compress or occlude the IVC. In addition, clinicians were not aware of the therapeutic options available to their patients; so interventional radiologists were not referred these patients until very late in their disease trajectory (2-3).

Although the techniques we describe are familiar to most interventionalists, there has been a certain degree of reluctance (in our practice at least) to place stents in the IVC across the renal veins for fear of compromising renal function. Our limited experience in patients with a limited life expectancy would suggest that this may be an unnecessary concern, and that these stents may be safe in this clinical situation, although long-term follow-up is not available.

MATERIALS AND METHODS
Four patients with intraabdominal malignancy presented with severe lower-extremity edema (Fig 1). Cross-sectional imaging (contrast medium-enhanced computed tomography [CT] or gadolinium-enhanced magnetic resonance [MR] imaging) revealed compression of the IVC by surrounding nodes or tumor.

The site of puncture was determined by the presence or absence of venous thrombosis on color Doppler ultrasonography (US), so the procedure was performed with the patient in a supine (common femoral vein [n = 1] or right internal jugular vein puncture [n = 2]) or prone (popliteal vein puncture, n = 1) position. In our limited experience, the supine position is preferable in patients with severe abdominal and lower-extremity swelling because the prone position tends to compromise respiratory function.

With standard techniques, US guidance, micropuncture access (Angiodynamics, Queensbury, NY), a 0.035-inch angled Glidewire (Toronto, Tokyo, Japan), and a 65-cm Kumpe catheter (Angiodynamics), contrast venography was then performed with use of a graduated marker catheter (Omniflush; Angiodynamics), and based on this, the lesion was crossed. An appropriate stent was then chosen to treat the occlusion. Patients underwent anticoagulation with 5000 IU heparin intravenously through the access sheath.
Post op-every patient

- Thigh high Class 2 compression stockings
- Pneumatic compression boots overnight
- Colour Doppler US next day
- IF CDUS is OK, then pneumatic compression boots off
- Full anticoagulation before, during and after procedure
- CTV at 6/52; MRV not adequate
Almost all of my patients have an underlying causative stenosis

- 40-50% of patients have cancer
- Most also have a stenosis-
  - May Thurner
  - Lymph node
  - Post Radiotherapy
Evidence for stenting?

• The patients who fare worst following DVT have a combination of obstruction and reflux
• There is good evidence that relief of obstruction diminishes post thrombotic syndrome (PTS)
Do stents stay open long term?

- Good patency in long term series
- Biggest risk factor for re-occlusion is extent of prior thrombosis and poor inflow
- Active cancer does not seem to be a risk factor for re-occlusion

Neglen JVS 2008 (48), 5: 1255-1261
OSullivan JVIR 2000
Kolbel EJVES 2007
Figure 3. Life-table analysis of patients with acute (-) and chronic (•) symptoms treated by endovascular stent placement.
Stents: Does the inguinal ligament matter? (Neglen)

- 177 limbs stents terminating below Ing. ligament v 316 limbs terminating above
- 54 month follow up: assessment patency by US and venography
- Cumulative secondary patency (CSP) 95% in those which terminated above v 86% below

Slight drop in patency more likely related to poor inflow
What is your ideal stent?

• Big
• Consistent radial hoop strength \textit{from end to end}
• Flexible
• Trackability
• No foreshortening
• ?? Radio-opaque/sheath size/Radio-opacity?
16mm self expanding stents
VENOUS indication (CE)

- Cook Zilver Vena
- Optimed Sinus Venous
- Veniti Vici
- Boston Wallstent
- Bard Venovo
Radial Hoop Strength -importance?

- Veins are different to arteries
- Arterial stents need low radial force ONCE the plaque has been cracked
- Veins have a MUCH higher recoil
- Venous stents need life long strength
- High pressure balloons
Cook Zilver Vena

- Longer
- Bigger

- Maintains radial expansile force over its whole length
• About 1-2 patients per week
• 120 stents per annum
• 30% have cancer
• Post radiotherapy/Malignant lymph node compression
Case 1

• 23 y old lady
• Left ilio-femoral DVT at 37 weeks gestation
• Treated conservatively
• Seen at 3/12 post partum with persistent symptoms- leg swelling, venous claudication, weight gain; no ulcers
• CTV at 4 months as follows:
Tiny L External Iliac Vein; HUGE Left Obdurator vein
Pre operative US

- Check RIJV
- L popliteal
- R popliteal
- L FV
- L CFV
- L EIV
- L CIV
Initial steps:

- No need of IVC filter in chronic setting
- Prone
- Popliteal venous puncture using US
- 5F sheath
- Ascending venography
- Multiple oblique views of occlusion
- Cross it
- Confirm position in IVC
Then:

• Upsize to 9F sheath
• 5000u IV Heparin
• Sequential dilatation L CIV EIV CFV
• Balloon from 4 to 14mm
• DEEP CONSCIOUS SEDATION OR GENERAL ANAESTHETIC- this is really painful
• Big Long Cook ZV stents
• POST DILATATION TO 14 OR 16mm
• Post op- Pneumatic boots, Class 2 comp stockings, Colour Doppler US day 1
Angio
At 7 months
Post DVT

PRONE

< Popliteal

Iliac>>

Popliteal

Left

Oblique Iliac
36 month Ultrasound

IVC  CIV  CFV
Case 2

- 18 y old girl
- On low dose OCP for acne
- Studying 10 h per day for exams
- Abd pain x 3/7
- Dysuria
- Admitted St Elsewhere March 11 2014
- L leg swells
- CTV
Plan

- Filter- Cook Celect
- Trellis to R/L CIV
- CDT to left leg
- Cook ZV to whatever is left- probably kissing iliac stents
Posterior tibial vein access
Left ankle- start CDT
Post 14mm PTA

Little improvement

Note narrow L CFV

I had planed to puncture L CFV and do kissing stents

What now?
Stiff Glide wire
Cook ZV 14/140
Superb Tracking
Zero

Fore-shortening
Extreme accuracy
In delivery
Post 14/140mm
Cook ZV stent to L CFV EIV
And 14mm PTA to both areas

What to do with IVC?
Change from stiff to floppy glidewire
Deliberately pull wire back……
While simultaneously deploying 14/140 Cook ZV stent....
“The flick trick”
Incredible flexibility and accuracy
Minor IVC stenosis persists, but overall very satisfactory

**Clinically**

Leg swelling gone
CDUS day 1 open both sides
Went home
Normal activity now
Galway 4 year Cook ZV patency
Patency by US and CTV

- 174 stents
- 91 patients
- 88/91 stented segments patent at 30 days
- 63/68 segments patent at 180 days
- 33/38 segments patent at 1150 days
Common mistakes

• Not performing adequate pre operative imaging - CTV/MRV essential
• Not anti-coagulating before, during and after
• Not using purpose designed stents
• Not ballooning aggressively enough
• Treating between 6/52 and 6/12 – active phlebitis - avoid
• POST OP-
  – Pneumatic compression boots x 24h
  – Color Doppler US day 1; if clear, boots come off
  – Class 2 thigh high compression stockings x 3/12
Venous Stenting is going to grow

- We need stents that are
  - Purpose designed
  - Large diameter
  - Longer
  - Enhanced radial force
  - Good flexibility
We have had “venous stents” for 5 years now

• Has my stenting pattern changed - INFLOW
• Has my stent preference changed - FLEXIBILITY
• Have I grown more or less aggressive with balloon dilatation – MUCH MORE
• Have I had a rupture - ZERO
Thank you

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All doctors interested in venous disease are welcome to visit!!
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