FILTER-BEARING IVC AND BILATERAL ILIOFEMORAL THROMBOSIS

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Chief Complaint and/or reason for consultation

- 36 year old male presents with chest pain, back pain and massively swollen painful bilateral lower extremities for 1 week.

History of Present Illness

- A 36 year old man was referred to our practice in August 2014 with the above mentioned symptoms due to bilateral iliofemoral DVT as diagnosed in referring facility. The patient’s history dates back to 2003 when he was involved in a pedestrian vs motor vehicle accident which was complicated with multiple episodes of extensive bilateral lower extremity DVT and pulmonary embolism significantly limiting lifestyle. A summary of the pertinent medical events and treatments over the past 11 years is described next in the past medical and surgical history.
During the past three months prior to presentation, the patient was unable to walk. 1 week prior to presentation the patient had progressive bilateral lower extremity pain and swelling more prominent on the right associated with back and chest pain and worsening lower extremity paresthesia and weakness. At that point immediate attention was turned to his extensive venous pathology history and indeed he was found to have massive bilateral iliofemoral DVT.
RELEVANT HISTORY

- Past Medical and Surgical History
  - 2003 - 1st episode of bilateral lower extremities DVT largely attributed to the trauma. This was treated with anticoagulation.
  - 2005 - 2nd episode of DVT while within the therapeutic range of Coumadin leading to placement of a permeant TRAPEASE® IVC filter.
  - 2005 to 2014 - multiple episodes of lower extremity DVT managed with anticoagulation.
  - May 2014 - Extensive bilateral lower extremity DVT managed with direct catheter thrombolysis and placement of bilateral iliac stents.
  - July 2014 - Extensive bilateral lower extremity DVT managed with direct catheter thrombolysis and anticoagulation complicated with possible heparin induced thrombocytopenia.

- Family & Social History
  - Smoker with family history only significant for hypertension and hyperlipidemia

- Medications
  - Argatroban

- Allergies
  - NKDA
DIAGNOSTIC WORKUP

- Physical Exam
  - Examination of bilateral lower extremities:
    - tenderness to palpation with extensive edema and blanching extending from the thighs to the ankles.
    - motor weakness (2/5).
    - decreased sensation.
    - thigh varicose veins.
    - Palpable peripheral arterial pulses.
  - Laboratory workup for autoimmune heparin induced thrombocytopenia was negative.
1) Concerning Heparin-induced thrombocytopenia (HIT) which statement is TRUE?

A: HIT Type I is more dangerous than HIT Type II.
B: LMWH has been shown to be 100% cross-reactive to HIT antibodies.
C: Lepirudin is the mainstay of treatment in patients with renal failure.
D: HIT Type II usually presents with arterial thrombosis.
1) Concerning Heparin-induced thrombocytopenia (HIT) which statement is TRUE?

A: HIT Type I is more dangerous than HIT Type II. Type I is a nonimmune disorder that results from the direct effect of heparin on platelet activation. This form of HIT is benign and self limiting.

B: LMWH has been shown to be 100% cross-reactive to HIT antibodies. Even though LMWH is much less likely to cause or worsen HIT than unfractionated heparin, it has been shown to be 100% cross-reactive with HIT antibodies and therefore should never be used in the treatment of HIT.

C: Lepirudin is the mainstay of treatment in patients with renal failure. Even though Lepirudin is a potent direct thrombin inhibitor which is actually recommended in the treatment of autoimmune HIT, it is metabolized and excreted by the kidneys which makes it less than ideal in patients with renal failure. Argatroban on the other hand is another potent direct thrombin inhibitor which is completely metabolized in the liver making it a better option for treatment in patients with renal failure.

D: HIT Type II usually presents with arterial thrombosis. Venous thromboembolism is the most frequent complication in HIT Type II.
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DIAGNOSTIC WORKUP

• Non-Invasive imaging
  • Grey scale and Doppler sonography of the bilateral lower extremity veins was performed to assess extent of proximal disease. This showed thrombosis of bilateral common femoral veins, right femoral and popliteal veins. Patent left popliteal and proximal femoral veins are noted.
  • CT of the abdomen and pelvis with IV contrast was performed to assess the extent of central clot burden, degree of occlusion, and possible filter-IVC-thrombus relationship.
  • CTA of the chest was performed to assess for possible pulmonary embolism.
Scene 1: Coronal reformatted CT better demonstrating the thrombosis extending beyond the IVC filter but not into the renal veins (arrow).
Axial CTA of the chest image shows multiple small sub-segmental pulmonary emboli on the right (arrows).
DIAGNOSIS

- Left sided IVC
- Thrombosis of the right popliteal, right femoral, bilateral common femoral, iliac veins/stents, and IVC with extension of the thrombus beyond the existing filter causing a picture of Phlegmasia Alba Dolans in bilateral lower extremities “edema, pain, and blanching without cyanosis”. The IVC at the level of the renal veins and distal to that is patent.
- Small sub-segmental pulmonary emboli
2) Regarding Phlegmasia Alba and Cerulea Dolens, which statement is TRUE?

A: In Phlegmasia Alba Dolens the thrombosis involves the deep and superficial veins of the extremity.

B: Phlegmasia Cerulea Dolens is preceded by Phlegmasia Alba Dolens in 50-60% of cases.

C: Cyanosis progressing from proximal to distal areas is the pathognomonic finding in Phlegmasia Cerulea Dolens.

D: Surgical thrombectomy is the best treatment option for venous gangrene and Phlegmasia Cerulea Dolens.
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“In Phlegmasia Alba Dolens the thrombosis only involves the deep veins sparing the superficial veins and collateral veins causing a decrease in venous drainage of the extremity but not completely occluding it. In Phlegmasia Cerulea Dolens the thrombosis extends to the collateral and superficial veins resulting in venous congestion and ultimately leading to cyanosis and gangrene which progresses from distal to proximal areas.

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TREATMENT PLAN

- Compression dressing was applied to bilateral lower extremities with leg elevation.

- Even though the patient was diagnosed with Type I HIT we elected to resume Argatroban drip given the high risk.

- Echocardiography showed no evidence of right heart strain and normal heart function.

- In collaboration with the vascular surgery service we decided to proceed with doing bilateral venograms through popliteal veins access with the intent of performing direct catheter thrombolysis and possible further intervention. Discussion with the patient about the risks and benefits was performed and an informed consent was obtained.
INTERVENTION

- Catheter venogram was performed through ultrasound guided popliteal vein access showing*:

- The occluded left common femoral and external iliac veins were catheterized using a 5 french sheath via a long 6 french sheath.

- The occluded right popliteal, femoral and external iliac veins were catheterized using a stiff glidewire and a kumpe catheter (I).

- Bilateral transpopliteal multi-side hole infusion catheters were placed into the IVC across the filter, external iliac and femoral veins (J), then following pulse spray of a total of 4 mg of TPA, TPA infusion was initiated at 1 mg/hour. PT/INR, aPTT and Fibrinogen levels were monitored.

*Images on next slide
Intervention – Initial venogram

- Acute on chronic thrombosis of the IVC, bilateral iliac and common femoral veins, right popliteal and femoral veins (white arrows in B-H).
- Patent left popliteal and proximal femoral veins (yellow arrows in A).
- Non-occlusive thrombus in the distal left femoral vein (red arrows in A and B).
After 16 hours of TPA initiation:
- Fibrinogen level dropped to 119 mg/dL.
- Platlet count dropped to 160 x 10^9/L from 230 x 10^9/L.
- Hence the TPA infusion rate was decreased to 0.5 mg/hour per our protocol due to high risk for developing DIC.
- After 24 hours cavogram and bilateral iliac venograms were performed to check progress.
Restoration of flow in the IVC with narrowing at the level of the filter (B). Restoration of flow in the bilateral external iliac veins with narrowing through the stents which is worse on the right side (C and D). There was sluggish flow in the right iliac vein (D) and good flow in the left iliac vein (C).
Intravascular ultrasound was introduced via each popliteal sheath, and evaluation of bilateral iliac veins, bilateral common femoral veins, and IVC was performed which revealed multifocal stenosis within the IVC and external iliac veins; therefore, over a Rosen wire, angioplasty of the IVC was performed using 14 followed by 16 mm balloons. Angioplasty of the bilateral iliac veins was performed using a 12 x 60 mm balloon. Repeat venogram and intravascular ultrasound revealed a slightly improved flow, but persistent bilateral iliac vein, right femoral vein and IVC stenosis.

At this point we discussed the case with the vascular surgeon and we decided to reconstruct the IVC and iliac veins with stents. Therefore, 2 overlapping 18-40 mm Wallstents were deployed in the IVC and the IVC filter was excluded. 12 mm Wallstents were deployed in a kissing fashion across the IVC bifurcation in bilateral common iliac veins. 12 mm Wallstents and Nitinnol stents (E-Luminexx) were also placed in bilateral external iliac and common femoral veins.

Repeat venogram revealed excellent non-interrupted flow from the common femoral veins into the IVC.

Repeat intravascular ultrasound revealed no residual stenosis in the iliac veins or IVC.

*Images to follow*
Intervention – Scene 3: angioplasty
INTERVENTION – scene4: Stenting
INTERVENTION

- AP view of the pelvis showing stents in the IVC, bilateral common iliac, external iliac and common femoral veins with a crushed excluded IVC filter (arrow).
QUESTION SLIDE

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B: Nitinol Stent.

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Wallstent

Nitinol stent

Z-stent
**CLINICAL FOLLOW UP**

- The patient after the procedure improved significantly. On discharge, no swelling in either lower extremity was appreciated and he was walking. We decided to discharge him on long term Fondaparinux.

- One month later he came back with severe sharp pain and swelling in his bilateral lower extremities and a Doppler ultrasound was obtained which showed recurrent bilateral femoral DVT.

- Venogram was performed which showed acute thrombosis of all the previously placed stents, non occlusive thrombosis of the left femoral vein and acute on top of chronic thrombosis in the right femoral and popliteal veins.

- Direct catheter thrombolysis was initiated again however this time 50 mg of TPA were pulse sprayed into the stents and right femoral veins followed by mechanical thrombectomy using Possis AngioJet device after a dwell time of about 2 hours. Flow was restored however with residual disease. TPA was continued at a rate of 1mg/ hour for 24 hours without complications and complete flow restoration was achieved with minimal residual clots and chronic changes in the right femoral and popliteal veins which were addressed again with mechanical thrombectomy and balloon angioplasty.

*Images to follow*
2\textsuperscript{ND} INTERVENTION

- Image showing stents in the IVC and bilateral iliac veins and crushed excluded IVC filter. Multi side-hole catheters are also seen across the stents.
2nd Intervention Outcome - Scene 7
Give the high risk for recurrence specially with the proximal chronic disease on the right, we discussed with the vascular surgeon and small bilateral AV fistulas were created to maintain high flow state through the stents.

Fistulas were created bilaterally between the superficial femoral artery and saphenous vein 10 cm before it joins the femoral vein.

Scene 8: Post fistula creation venogram showing excellent flow on the right side.
The patient recovered without complications from previous interventions and he was discharged home in an excellent condition however this time we elected the use of reveroxiban for anticoagulation given the failure of previous regimens.

It has been 2 months now since discharge and the patient has been seen twice for monthly follow up and he is doing great clinically (image).

Doppler ultrasound was negative in the last follow up this December.
IVC filter thrombosis is a complex problem and published experience in its management is limited due to small sample size.

Thrombus burden within an IVC filter may range from an asymptomatic small thrombus to complete IVC occlusion that affects both lower extremities.

When the IVC filter thrombus burden is small, most patients are asymptomatic, and the diagnosis is made incidentally by cross-sectional imaging. In this situation, the optimal management is unclear. In contrast, if the patient has a thrombosed filter-bearing IVC with total venous occlusion, significant lower extremity edema and pain are often present, and severe complications such as sensory deficits, venous stasis, ulceration and ischemia may also be present.

Endovascular management of thrombosed filter-bearing IVC utilizing direct catheter thrombolysis, mechanical thrombectomy, pulse spray thrombolysis, angioplasty, and stenting might not be a successful solution solely in select cases, however combined with surgical creation of AV fistula to maintain high flow state might be a more reliable and successful alternative in these cases.

Intravascular ultrasound has a potential value and diagnostic advantage over conventional venography for detection of residual venous disease after thrombolysis as seen in our case mandating further intervention (angioplasty and stenting).

The Wallstent, nitinol stents and the Gianturco Z stents are preferred for endovascular reconstruction of the IVC, iliac and even femoral veins due to their high radial force and the full range of sizes and lengths. The major disadvantage of the Gianturco Z stents is the need of a larger introduction sheath however they are the only ones that have larger interstices, which makes them suitable for placement across major draining veins.

A multi-disciplinary approach is optimal for management of patients of thrombosed filter-bearing IVC and an active clinical and imaging follow up with concurrent life long anticoagulation is necessary as this patient population is at increased risk for recurrence of DVT.


