

Percutaneous Thrombolysis of Acute-On-Chronic Inferior Vena Cava Thrombosis After Previous Insertion of an Adams-DeWeese Clip

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Abstract

We describe the successful percutaneous treatment of acute-on-chronic IVC thrombosis 30 years following previous placement of Adams-DeWeese clip.

Keywords

Adams-DeWeese clip, angioplasty, inferior vena cava, thrombosis, venous

Introduction

Historical clinical and autopsy studies have suggested that nearly 90% of pulmonary emboli (PE) arise from sites of thrombosis in the pelvic or lower extremity veins. When anticoagulation was contraindicated or failed, early surgical procedures included ligation of the inferior vena cava (IVC), which often led to acute cardiovascular collapse, due to sudden reductions in venous return or chronic venous insufficiency (CVI). Subsequent procedures then targeted partial interruption of the IVC whereby the Adams-DeWeese clip was developed.

Case Report

A 60-year-old female nurse presented in April 2011 with a 10-day history of increasing back pain, bilateral lower extremity edema, and a significant weight gain of 30 pounds, with severely progressive symptoms of dyspnea, reduced ambulation, and increased lower extremity pain and swelling. She had known protein C deficiency and an Adams-DeWeese clip placed for multiple PE following gastric bypass surgery 30 years ago. She was initially on Coumadin for 2 years before switching to aspirin 325 mg daily. She was a nonsmoker.

On examination, she was afebrile and hemodynamically stable with a body mass index of 47. She had normal breath sounds. Her abdomen was soft, nontender with a midline laparotomy scar. There were no superficial collateral abdominal wall veins. She had significant bilateral lower limb edema.

There was no blue discoloration or evidence of skin ulceration. Capillary return and distal pulses were normal. Laboratory testing demonstrated a hemoglobin of 13.0 g/L, white blood cell count of $19.4 \times 10^9/L$, platelets of $254 \times 10^9/L$, and a serum creatinine of 1.9 mg/dL. Testing for other thrombophilic abnormalities was negative. An electrocardiogram was normal. Lower limb venous duplex revealed bilateral occlusive thrombosis in both lower extremities extending from the popliteal vein to the common femoral vein. A computed tomography (CT) venogram confirmed thrombus extending superiorly to the infrarenal IVC adjacent to the previously inserted Adams-DeWeese clip (Figure 1). There was no evidence of a PE or underlying malignant process. The patient was commenced on a continuous therapeutic heparin infusion, maintaining the activated partial thromboplastin time between 60 and 90 seconds, prior to lower limb venography due to significant lower limb symptomatology.

In the prone position, both popliteal veins were punctured using a micropuncture introducer set (Silhouette Transitionless, Cook Medical, Bloomington, Indiana) under ultrasound

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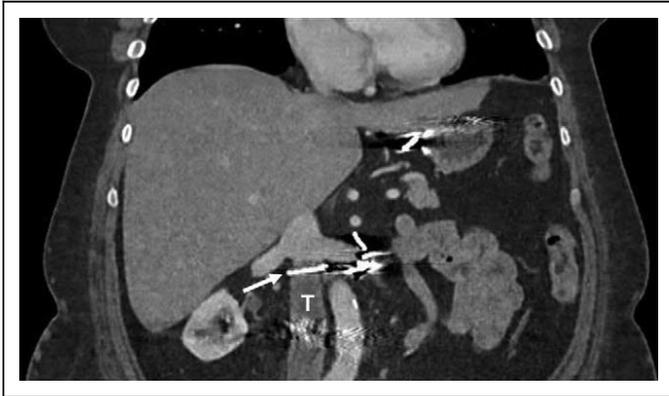


Figure 1. Coronal CT venogram confirming thrombus within the IVC extending to the level of the renal vein (T). The transverse linear opacity (white arrow) within the infrarenal IVC represents the previously inserted Adams-DeWeese clip.

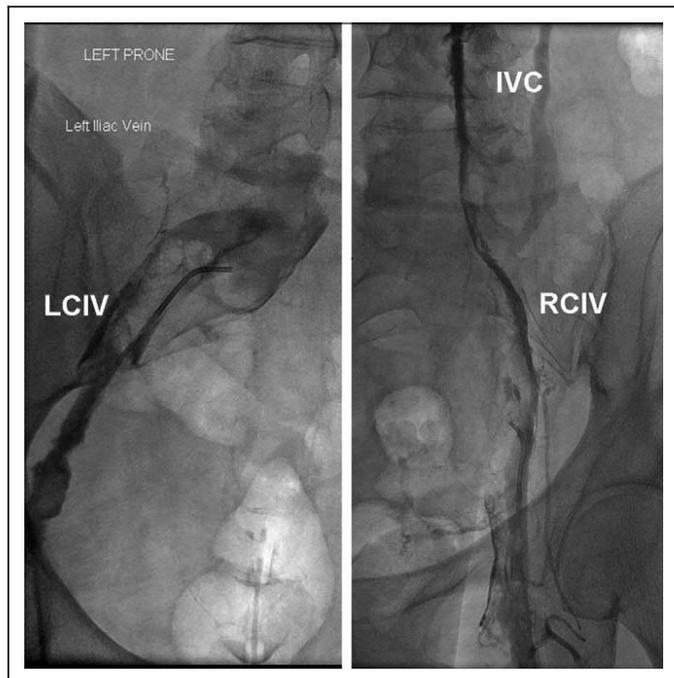


Figure 2. Bilateral venograms demonstrating partial flow through the right common iliac vein (RCIV) and occlusion of the left common iliac vein (LCIV).

guidance after the infiltration of 1% lidocaine. Following insertion of a stiff-angled Glidewire (Terumo, Phoenix, Arizona), the 5F sheath was exchanged for an 8F sheath. Bilateral venograms via Berenstein catheters identified partial flow through the right common iliac vein while the left common iliac vein was occluded (Figure 2). The left lower extremity was treated with a pulse spray of 10 mg tissue plasminogen activator (tPA) followed by percutaneous thrombectomy with the Angiojet thrombectomy system (Possis Medical, Minneapolis, Minnesota). Despite incomplete recanalization, the procedure was discontinued on the left side due to bradycardia as the improvement

in flow identified was deemed satisfactory. After 30 minutes and normalization of hemodynamics, pulse spray tPA thrombolysis followed by percutaneous thrombectomy was performed on the right lower extremity followed by 8 mm × 40 mm balloon venoplasties (Mustang PTA Balloon Catheter, Boston Scientific) to 2 high-grade right superficial femoral vein stenoses. She was anticoagulated with warfarin.

At clinic review 2 weeks postprocedure, she described some symptomatic improvement but no change in lower extremity swelling and continuing difficulty with ambulation necessitating the use of a wheelchair. Repeat CT venography confirmed persistence of her bilateral deep vein thrombosis (DVT) extending to the IVC. Further venography in the prone position via the popliteal veins facilitated the insertion of two 50-cm infusion catheters (AngioDynamics Uni-fuse Queensbury, New York) that were placed just below the Adams-DeWeese clip in the infrarenal IVC extending to both femoral veins. Following an initial 4-mg bolus of tPA, an overnight 24-hour infusion of 0.5 mg tPA and 500 units of heparin per hour was commenced. Venography the following day identified significant residual clot burden, which was treated with bilateral Angiojet thrombectomy. Partially improved flow within the IVC was now apparent, with contrast flow extending to the suprarenal IVC. A tPA and heparin infusion was deemed necessary for a further 24 hours to improve stagnated distal flow. Venography on the third day again identified reduced flow. Bilateral stiff-angled glidewires were successfully passed proximally through 2 fenestrations in the Adams-DeWeese clip into the suprarenal IVC to facilitate treatment of additional thrombus at this level. Repeat percutaneous Angiojet thrombectomies followed by sequential balloon venoplasty through the Adams-DeWeese clip fenestrations into the suprarenal IVC, with a 6 mm × 40 mm and then an 8 mm × 40 mm Mustang balloon, improved IVC flow (Figures 3 and 4).

Two weeks after the second series of procedures, the patient felt 95% better with only occasional pelvic discomfort and lower extremity ache. Her mobility was limited to 200 yards due to general fatigue. Although check ultrasound confirmed persistence of thrombus in femoral and iliac veins, flow was present, and no further treatment was considered due to symptomatic improvement. She continues on compression hosiery, lifelong oral warfarin therapy, and remains well 33 months later.

Discussion

Superior and inferior vena cava thromboses remain rare with a reported incidence between 1.3% and 1.5% in all hospitalized patients with venous thrombosis where 78% had presented with isolated vena cava thrombosis while the remaining 22% had additional venous thrombotic sites.¹ Increased age conveys a higher risk with no difference in overall prevalence between the genders.² Although IVC thrombosis is frequently associated with neoplastic disease, the prevalence still remains low occurring in only 0.07% of hospitalized patients with cancer.²

In the absence of neoplastic disease, it was presumed that our patient's initial PE was directly related to significant

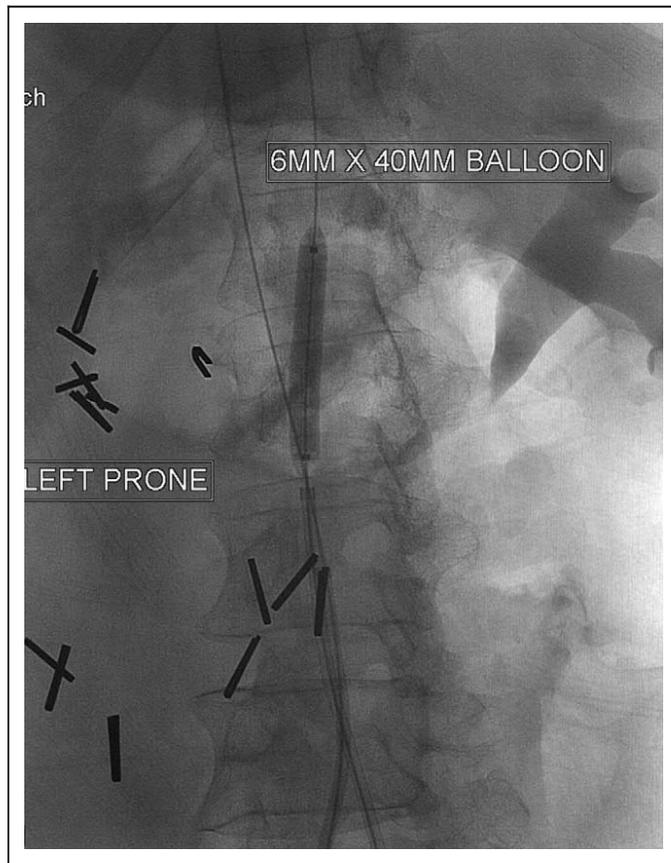


Figure 3. Balloon venoplasty through the Adams-DeWeese clip fenestrations with a 6 mm × 40 mm Mustang balloon.

intra-abdominal complications following her gastric bypass surgery. When she was acutely ill postoperatively, anticoagulation was contraindicated. Insertion of an Adams-DeWeese clip was deemed necessary instead of IVC ligation, which was a frequently performed life-saving intervention to prevent embolic dissemination since its description by John Homans in 1944.³ However, despite its effectiveness, it was not without complications including cardiogenic shock secondary to a sudden decrease in peripheral venous return and postthrombotic syndrome (PTS), which was reported to occur in 20% to 45% of these patients.³

Partial interruption of the IVC was pioneered in the 1950s as an effective modality in preventing fatal PE while minimizing lower limb thrombotic sequelae.³ Following comparative evaluation of IVC interruption techniques, Adams and DeWeese reported that extraluminal clips appeared to be superior to suturing techniques that were tedious to apply, requiring mobilization of long segments of vein with the creation of unreliable flow apertures.³ Early clip designs comprised Teflon in a U-shape configuration followed by incorporation of a V-shaped ridge to permit stable closure. Subsequent modifications included shape streamlining with a drilled hole in each end to facilitate passage of a suture tie, which was then used to guide the passage of the clip posteriorly around the IVC during operative placement.³

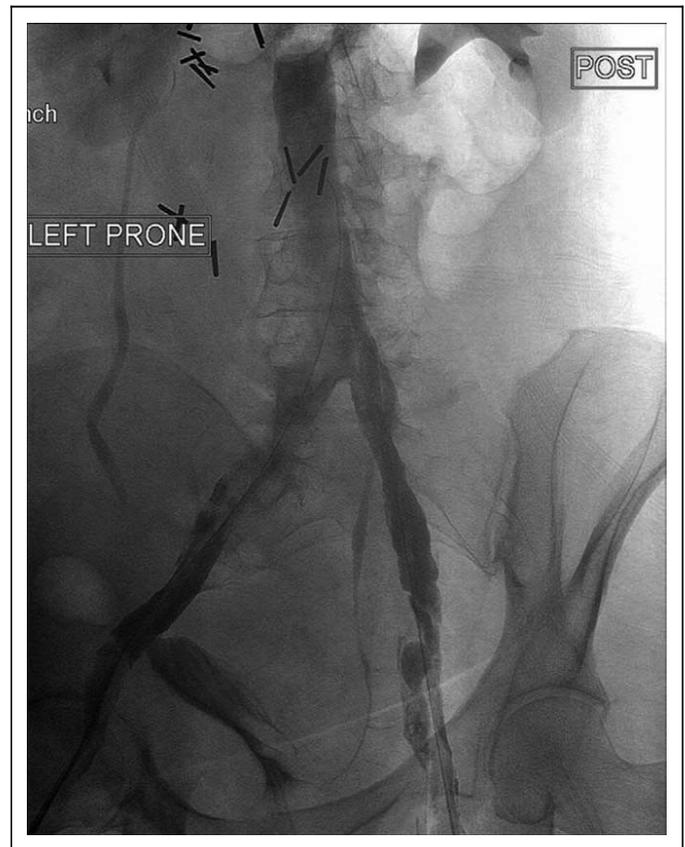


Figure 4. Improved flow through the suprarenal IVC following repeat percutaneous Angiojet thrombectomies and sequential balloon venoplasty.

When lower limb venous duplex confirms bilateral DVTs extending to the iliac veins, it is our feeling that cross-sectional imaging with CT or magnetic resonance imaging is warranted to delineate proximal extent of the thrombus. Although a heparin infusion was commenced to minimize the risk of embolization and thrombus propagation in our patient, endovenous intervention was deemed necessary in the presence of her acute lower limb and generalized clinical symptomatology. Only 6% of anticoagulated patients achieved clot lysis within 10 days of treatment while thrombus propagation may be identified in up to 40% of patients despite adequate treatment.⁴

McAree et al have previously reviewed therapeutic options for the treatment of acute idiopathic IVC thrombosis from the American College of Chest Physicians guidelines where a 3-fold strategy to minimize long-term sequelae of CVI or PTS includes thrombus removal through pharmacological, endovascular, or surgical modalities; use of anticoagulation to reduce thrombus propagation; and confinement of thrombus to the IVC to minimize PE risk. If the acute thrombosis occurs as a secondary event, treatment success was thought to depend on whether the causative pathology could be resolved.²

Although the Cochrane review by Watson et al concluded that local and systemic thrombolysis was advantageous over anticoagulation alone in the treatment of DVT, systemic thrombolysis was considered a suboptimal treatment for occlusive

IVC thrombosis.⁵ Endovascular modalities, as utilized in this case, facilitate local delivery of therapeutic agents including thrombolytics, thereby minimizing systemic effects, while permitting angioplasty, stent insertion, and deployment of proximal filters if required.⁴ Interventions during the initial presentation, ideally within 14 days of symptomatic onset, have a higher preservation rate of distal venous valvular function resulting in significantly reduced CVI rates.^{2,4}

Alesh et al reported 28% recanalization and 56% PTS rates for occluded veins following systemic thrombolysis compared to 90% and 26%, respectively, with catheter-directed thrombolysis.⁶ Pharmacomechanical thrombectomy with Angiojet or Trellis-8 (Covidien, Mansfield, Massachusetts) devices may also result in clot maceration and an increased thrombus contact area for thrombolytic activity via numerous penetrating intrathrombus injections.⁷ Angioplasty and stenting may be used to complement thrombolysis with improved medium to long-term patency rates. Residual stenosis and an ilio caval obstructive lesion in a patient with symptomatic recurrence necessitated an additional procedure whereby percutaneous canalization of the Adams-DeWeese clip fenestrations combined with angioplasty appeared to significantly improve clinical outcome.^{2,4} Stenting was not considered due to improved IVC flow following angioplasty of the suprarenal IVC through the Adams-DeWeese clip fenestrations while concerns regarding stent deployment through the small diameter clip fenestrations may actually have impeded the newly improved flow. We also hoped to avoid surgical thrombectomy, bypass, or reconstruction due to her previous significant abdominal catastrophe following her gastric bypass surgery. With our patient's previous history of protein C deficiency, lifelong warfarin therapy will be necessary. An IVC filter was not required due to the previous insertion of the Adams-DeWeese clip.

Conclusion

We have described the successful percutaneous recanalization of IVC thrombosis following the insertion of an Adams-DeWeese IVC interruption clip where our experience may

guide the treatment of similar IVC thrombosis cases secondary to filter placement, which are more commonly deployed now. Although check ultrasound confirmed residual thrombus, no further treatment was warranted in the presence of continued symptomatic improvement. We emphasize a team-based approach for the initial acute treatment, which may involve multiple procedures using a myriad of modalities in conjunction with long-term anticoagulation treatment. Inferior vena cava stenting remains an option for future therapy.

Declaration of Conflicting Interests

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