

Treating DVT Quickly and Cost-Effectively

Keys to efficient time and resource management while providing quality deep vein thrombosis care.

TIPS ON HOW TO KEEP COSTS AND RESOURCE BURDENS DOWN WHEN TREATING DVT



LAWRENCE "RUSTY" HOFMANN, MD

I think the single most important variable in managing resources in treating acute and chronic deep vein thrombosis (DVT) is to understand what you're walking into when you start a case. In the early 2000s, most

patients would end up on the angiography table with only an ultrasound from the groin down, meaning you really had no idea what was going on above the inguinal ligament. Due to frustrations and significant time spent on venography to map out what was clotted, what was acute, and what was chronic, I began performing CT venography. I find that a CT venogram that goes from the diaphragm to the ankles provides an overview of the venous system that is invaluable for knowing the most appropriate place(s) to access the patient, how long the case is going to take (which also determines whether general anesthesia is needed), and the likelihood for long-term success. All of this information can then be shared with the patient prior to the procedure.

Another important determinant for keeping costs and resources down, particularly in the acute DVT setting, is to know what you can get done on the table and what needs to be dripped overnight. Over the past 15 years, it has been my experience that if the clot is < 10 days old based on the patient's symptoms and that the CT venogram supports that it is an acute clot,

I can treat the patient in a single session on the table. I have found that when a clot is older than that, time is often spent attempting to debulk the clot, which consumes in-room resources, and the patient ultimately ends up with a catheter and thrombolysis overnight. For that reason, when a clot is older than 10 days, in our institution, we place a catheter for infusion and get the patient off of the table. Another important aspect to know is when to bring the patient back after catheter-directed thrombolysis. A number of studies by our institution and others have shown that the mean time for lysis is around 24 hours. For that reason, we do not bring the patient back until 24 hours after the infusion has started.

Finally, another important variable in keeping resources down is to keep the stents open after they've been implanted. Typically, my protocol is to start the patient on enoxaparin (1 mg/kg, twice daily), with a goal anti-Xa level of 0.7 to 0.9 IU/mL that I check 2 days after the initiation of treatment. After the 1-month follow-up in my clinic, I transition the patient to either warfarin or an oral anti-Xa agent. I am still unclear on the efficacy of the oral anti-Xa agents at this time, as we've had some thrombotic complications when switching patients to these agents; however, that is anecdotal at this point. Another important variable is the use of antiplatelet agents, which I do not routinely use. In a very small subset of patients in the past couple of years, I have started them on low-dose aspirin. There are no data that any patient should be on clopidogrel, which is an incredibly expensive drug with no evidence to support its efficacy.

Over the past 2 decades, we have advanced techniques and devices to treat DVT. However, there is much still to learn on the most cost-effective way to workup, treat, and manage patients with this disease.

AMBULATORY VENOUS THROMBECTOMY



JEFFREY WANG, MD

I use a two-session technique to treat DVT in an ambulatory fashion, without requiring an overnight hospital stay. I have found this technique to be very effective in treating acute DVT. I have become confident enough in its safety and effectiveness that I have adopted

the procedure for use in our office-based angiosuite.

First, the patient is placed in a prone position. Under ultrasound guidance, the ipsilateral popliteal vein is cannulated, provided that it is patent. If the popliteal vein is not patent, then the cannulation site is moved more distally to a patent tibial vein or a small saphenous vein, if continuous. Once access is achieved, a wire and catheter of the operator's choosing is used to cross the DVT from the distal access site to the inferior vena cava. Once the thrombus is crossed, an Angiojet catheter (Boston Scientific Corporation) in power-pulse mode is used to power-pulse lytic into the DVT. Typically, this is a solution of 10 mg of lytic in 50 mL of saline for a unilateral DVT or 15 mg of lytic in 75 mL of saline for a bilateral DVT or inferior vena cava occlusion.

Once this is done, a lytic catheter is placed from the distal access site to the proximal end of the DVT. The patient is then taken out to the holding area for lytic infusion for at least 1.5 hours or, more commonly, the time it takes to perform one or two additional cases in the interim. After this time, the patient is brought back to the cath lab, and the lytic catheter is removed after the working wire is placed again. All patients receive ondansetron, famotidine, and prednisone prior to the second procedure.

The Angiojet catheter is then used in thrombectomy mode to perform venous thrombectomy. Once this procedure has been performed and the acute clot is removed, secondary intervention is performed with ballooning and stenting as needed. The wires and sheaths are then removed, and the patient's leg is wrapped in an elastic bandage wrap from the foot to mid-thigh. Anticoagulation, typically low-molecular-weight heparin, is continued with a conversion to an oral agent in approximately 2 weeks. If a stent has been placed or balloon angioplasty has been performed, the patient will be placed on 75 mg of clopidogrel for 2 weeks and 81 mg of aspirin long-term while continuing the anticoagulation regimen. The patient is discharged 2 hours after completion of the procedure.

...it is of the utmost importance for patients to receive education about the disease process, procedure, post-operative care, postoperative expectations, and medication regimen...

Patients are educated prior to discharge on the importance of hydration, the presence of hemoglobinuria, possible side effects, and their medication regimen. This education is highlighted in addition to the standard postangiography patient education. All patients receive a follow-up call 24 hours after the procedure. If there are any concerns, additional follow-up calls at 24-hour intervals are made until they are either resolved or the patient is asked to see the physician.

When I first started performing interventional treatment for DVT, I used the standard power-pulse technique. I found when I performed this technique, there were some cases in which there was residual thrombus within the deep venous system after performing thrombectomy; this would then require additional lytic infusions, typically an overnight lytic drip. The unplanned additional lysis would create difficulties in scheduling, increase the length of hospital stay, and expose the patient to additional risk as the duration of lytics is increased. I believed it was important to try to eliminate, or at least significantly reduce, the times that an unplanned lytic infusion would be necessary, while still keeping the procedure ambulatory.

The components of this procedure boil down to the thrombus management and the secondary intervention. When thinking about the thrombus management component and looking into the 20-minute dwell time of the power-pulse technique, I thought that this was too short; however, I did believe that the concept of using power-pulse spray to infuse the tissue plasminogen activator was effective in distributing the lytic. Logistically, for me, it was not possible to keep the patient in the cath lab on the table for 1.5 hours or more, just waiting for the lytic to work, so I opted to move the patient to the holding area for lytic infusion to allow the power-pulsed lytic time to work.

The injected lytic will have a better chance to penetrate the thrombus when it is in direct contact with the thrombus; therefore, I do not perform thrombectomy prior the power-pulse lytic infusion. If you perform thrombectomy, make a flow channel through

the thrombus, and then subsequently decide to power-pulse the lytic, some of that lytic will be washed away by the flow in the channel and will not penetrate into the thrombus.

I also think that it is important to give the lytic the appropriate amount of time to work by keeping the patient in the holding area for some time prior to performing thrombectomy. Once I adopted this technique, I saw that the acute thrombus was adequately removed, and then I could move on to the secondary intervention. During the secondary intervention portion of the procedure, the potential anatomic lesion is treated, and aggressive ballooning can be utilized to help open any areas of chronic scarring and to macerate any potential intermediate-age thrombus, if present. Stenting above the common femoral vein is also necessary in many of these cases.

When performing these types of procedures in an ambulatory hospital setting or office-based lab, it is of the utmost importance for patients to receive education about the disease process, procedure, postoperative care, postoperative expectations, and medication regimen, which should all be carefully discussed prior to discharge. As previously stated, frequent commu-

nication with the patient after the procedure is also extremely important, as this will significantly reduce preventable postoperative complications. ■

Lawrence “Rusty” Hofmann, MD

Professor and Chief
Interventional Radiology
Stanford University Medical Center
Stanford, California
lhofmann@stanfordhealthcare.org
Disclosures: Consultant to and royalties from Cook Medical; shareholder in Nitinol Devices & Components, Inc.

Jeffrey Wang, MD

Director of Vascular Research
Shady Grove Adventist Hospital
Horizon Vascular Specialists
Rockville, Maryland
jeffrey.y.wang@gmail.com
Disclosures: Consultant to Boston Scientific Corporation.
