Initiating and Building a DVT Practice

How to educate physicians and use a single-setting treatment to advance therapy for DVT patients.

BY FRANK R. ARKO, MD

With an estimated incidence of one in 1,000 individuals per year, deep venous thrombosis (DVT) is a highly prevalent clinical problem, ranking as the third most common cardiovascular disease in the US.[1] The incidence of morbidity and mortality associated with DVT carries a tremendous economic impact, with more than 600,000 hospitalizations or outpatient treatments per year, and accounting for approximately 100,000 deaths.[2] For severe DVT, hospitalizations can last 1 to 2 weeks.[3]

Current treatment alternatives include anticoagulation therapy alone, designed to address acute symptoms and prevent clot propagation and pulmonary embolus; thrombolytic therapy to lyse the thrombus plus anticoagulation; surgical thrombectomy plus anticoagulation; and finally, nonsurgical mechanical thrombectomy using devices that are designed to mechanically macerate and remove flow-obstructing thrombus that can be combined with thrombolytics. Thrombus removal strategies promote early restoration of vein patency with improved venous return, while potentially decreasing the risk of the late complication of postthrombotic syndrome.[4,5] Currently, the majority of patients are treated with anticoagulants and compression stockings only. In the past, catheter-directed thrombolysis (CDT) and surgical thrombectomy were the only tools available to physicians either to lyse the thrombus or remove the thrombus, respectively. Although both CDT and surgical thrombectomy are often effective, CDT is often associated with long intensive care unit stays, as well as hemorrhagic complications, and surgical thrombectomy is rarely performed.

In recent years, many technologies have been introduced for percutaneous thrombus removal. Although CDT is effective at clot lysis, newer technologies have focused on treating the thrombus at a single setting while using smaller doses of lytics. These technologies have allowed for the evolution and development of DVT practices for many endovascular interventionists, including cardiologists, vascular surgeons, and interventional radiologists.

THE NECESSARY TOOLS

To build a DVT practice, one must start by attaining the appropriate tools to treat this disease process and developing a familiarity with catheter-directed thrombolysis. Currently, the most commonly used devices to treat DVT are the AngioJet rheolytic thrombectomy system (Possis Medical, Minneapolis, MN) and the Trellis-8 Peripheral Infusion System (Bacchus Vascular, Inc., Santa Clara, CA), which are the two devices that I use to treat my patients. One or both of these devices are necessary to treat patients at a single setting. Other exciting technologies currently available utilizing ultrasound will also be briefly discussed.

AngioJet Rheolytic Thrombectomy System

The AngioJet rheolytic thrombectomy system is designed to produce an area of extremely low pressure at the catheter tip by controlled high-velocity saline jets. Via this mechanism, thrombus surrounding the catheter tip is macerated and rapidly evacuated via an effluent lumen into a collection chamber. The AngioJet rheolytic thrombectomy catheter may be used in combination with adjunctive

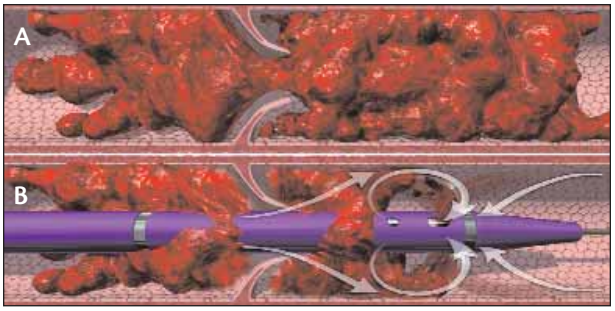

Figure 1. Clot within the vein and around the venous valve. The DVX catheter after power-pulse spray is then used to remove the thrombus.

thrombolytic agents (power-pulse technique) for more complete and rapid thrombus removal with lower mean lytic infusion doses and durations than standard CDT. The AngioJet thrombectomy device has no direct contact with the vessel wall, causing only minimal endothelial denudation. Typically, either 10 mg of tenecteplase or tissue plasminogen activator is placed in a 50-mL normal saline bag; with the outflow lumen occluded, the lytics are directly infused into the clot and allowed to work for 15 to 30 minutes, based on physician preference. Once this is complete, the catheter is then used in the standard fashion with the outflow lumen opened to remove the thrombus (Figure 1).

Trellis-8 Peripheral Infusion System

The Trellis-8 Peripheral Infusion System is an advanced isolated thrombolysis catheter with two occluding balloons, drug infusion holes between the balloons, and mechanical drug dispersion capabilities. This pharmacomechanical combination enables focused treatment of thrombus within a targeted vessel (Figure 2).

EndoWave Peripheral Infusion System

Another device that is being used in the treatment of DVT is the Ekos EndoWave Peripheral Infusion System (Ekos Corporation, Bothell, WA), which has been demonstrated to improve the effectiveness of drug delivery, such as thrombolytic agents, over traditional catheters in patients with peripheral arterial occlusions and DVT. The peripheral catheter technology combines the use of a multisideport drug-infusion catheter with treatment zones up to 50 cm and a matched ultrasound core wire that uses a series of tiny ultrasound transducers placed evenly along the length of the infusion area to deliver high-frequency, low-power ultrasound. The ultrasound helps temporarily loosen and separate the fibrin for more blood clot permeability.

OmniWave Endovascular System

Finally, another device that has recently been approved for the treatment of DVT is the OmniWave Endovascular System (OES, Omnisonics Medical Technologies, Inc., Wilmington, MA). The OES is intended for use in the infusion of physician-specified fluids, including thrombolytics, into the peripheral vasculature and for the removal of thrombus in the peripheral vasculature. It uses transverse ultrasonic energy to create cavitational streaming that rapidly resolves thrombus and quickly restores flow without adversely affecting surrounding structures (Figure 3).

It must be noted that when starting to treat DVT, adjuvant procedures are often required with all of these single-setting devices. This would include standard percutaneous transluminal angioplasty, percutaneous transluminal angioplasty and stenting within the iliac system (especially for May-Thurner syndrome), and a familiarity with standard CDT because it is sometimes required after an attempt at single-setting interventions.

CHALLENGES

There are multiple issues that make it initially difficult to develop a DVT practice. Fortunately, these can be overcome with some effort. The three biggest challenges are identifying the referring physician, educating the referring physician on treatment options for DVT, and changing the attitudes of the referring physicians.

Identifying Referring Physicians

One of the most difficult issues when developing a DVT practice is identifying potential referring physicians. Referrals can come from both medical and surgical specialists. Medical specialists within the hospital include pulmonologists, cardiologists, internists, hematologists, and emergency department physicians. I have received consultation requests from surgical specialists including general surgeons, plastic surgeons, urologists, obstetricians, and orthopedic

Figure 2. The Trellis-8 infusion catheter with proximal and distal balloons for localized thrombolysis. It allows for mechanical dispersion of the infused thrombolytic agent.

Figure 3. The OmniWave Endovascular System uses transverse ultrasonic energy to create cavitational streaming that rapidly resolves thrombus and quickly restores flow without adversely affecting surrounding structures. Longitudinal ultrasonic motion is converted to transverse motion along the treatment zone. Transverse micromotion creates stress waves to stimulate cavitation and streaming within the region of ultrasonic activation.

surgeons. All of these physicians are well aware of the gold standard of anticoagulation in treating patients with DVT and the prolonged hospital admissions and risk of bleeding with CDT. However, single-setting treatment with power-pulse spray with the AngioJet or isolated thrombolysis with the Trellis-8 are both relatively new therapies, and these physicians may not be familiar with the body of literature that supports intervention.

Educating Referring Physicians

Physicians within the hospital who are managing DVT must be identified and then educated on single-setting treatment of DVT. Educational venues include lectures at grand rounds for each of the disciplines and on a personal level. The real challenge is to convince referring physicians that not every DVT case should be treated solely with anticoagulation. Certainly, young, fit patients with iliofemoral or femoropopliteal DVT should be considered for endovascular therapy. One of the strongest referral lines that I have established has been with the pediatric hematologist. I have treated several teenage women who developed left-sided DVT following the initiation of oral contraceptive pills for a variety of reasons. All had iliofemoral DVT with significant swelling with underlying May-Thurner syndrome. Each patient was successfully treated at a single setting (Figure 4). The physician, family, and patients have all been delighted with the outcome, establishing a strong referral line.

Furthermore, education and collaboration with the emergency department is necessary. A significant number of patients with DVT are treated with an enoxaparin sodium injection as outpatients without being admitted to the hospital in the emergency department. Brochures offering alternative treatment options in addition to anticoagulation are available to the patients if they wish to seek further therapy. We have found that those patients who remain symptomatic often follow through with further consultation.

As a vascular surgeon, I have used personal interactions with other surgeons within the hospital to demonstrate my interest in DVT management. I have treated several postoperative patients in the acute setting without lytics using the AngioJet with excellent results. This completely avoids the potential risk of bleeding immediately after the operation and results in a happy referring physician and patient.

Changing Attitudes

With some investigation, you will find that there are a large number of patients being treated for DVT within the hospital. The greatest challenge is to educate the treating physicians that you can offer a safe and effective strategy to remove the thrombus. Physicians are accustomed to treating patients with anticoagulation that is successful in preventing clot propagation and pulmonary embolism. However, many of them are unaware that postthrombotic syndrome occurs in 30% to 80% of patients within the first 2 years after DVT. Furthermore, they are often unaware of the substantial negative impact that postthrombotic syndrome can have on a patient's quality of life.

Whether communicating at grand rounds or in a personal interaction, our message is the same. We can treat the patients acutely in a single setting to remove the thrombus, restore vessel patency, and potentially decrease the long-term morbidity associated with the postthrombotic syndrome. Too often, we are referred to the patient years after he or she has developed postthrombotic syndrome. Often, compression stockings are our only remaining treatment option, which can be frustrating for the treating physician as well as the patient. Our best opportunity to treat postthrombotic syndrome is to prevent it by intervening early with acute DVT.

Finally, it is important to continue your communication with the referring physician after the intervention. It is important to discuss the procedure, its success, and the appropriate follow-up of the patient and anticoagulation regimen. Successful results will lead to more direct referrals in the future.

THE VASCULAR LAB

One of the most important elements toward developing a successful DVT practice is to build a vascular lab. We operate the vascular lab in three hospitals. When we read a vascular lab study and a patient with DVT is diagnosed, we have the opportunity to discuss the available treatment

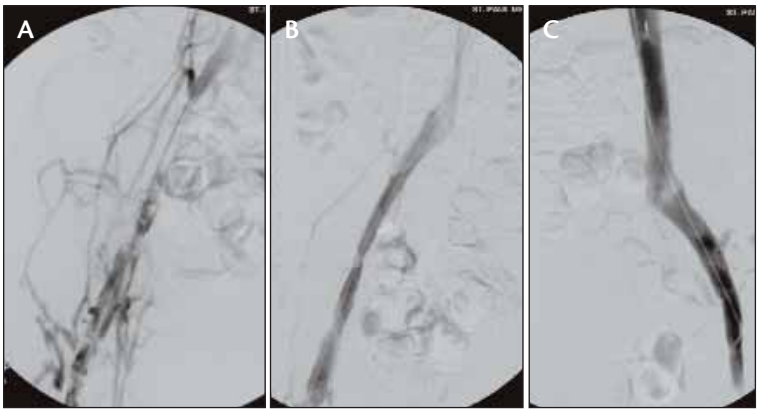

Figure 4. Example of a 16-year-old woman who developed DVT and a pulmonary embolism after starting oral contraceptive pills. She was treated with the AngioJet, utilizing the power-pulse spray technique. The preintervention venogram demonstrating significant DVT (A). Imaging after single-setting endovascular therapy (B). Both A and B show the patient in the prone position. As a result of May-Thurner syndrome, the iliac vein was stented. Imaging of the left common iliac vein 3 months after the procedure when the optional inferior vena cava filter was removed from the right internal jugular approach (C).

options with the referring physician as well as the patient. If the patient has significant symptoms, he or she usually elects to undergo intervention. We explain the procedure as being a single-setting intervention using a small dose of thrombolytics with either the AngioJet or the Trellis-8. For inpatients being evaluated for DVT, perhaps the easiest approach is to speak with the hospital ultrasonographers. They can alert you to any patients they see with DVT. The clinician taking care of the patient can be called, and if clinically appropriate, the patient may be treated with endovascular therapy.

PATIENT SELECTION

Appropriate patient selection is the key to building a successful DVT practice. With approximately 500,000 to 800,000 cases of DVT and 30% to 80% of these patients who later develop postthrombotic syndrome, I advise my referral base that there is the potential to decrease this debilitating long-term problem if we can treat young patients with DVT and recanalize the vein. By convincing the primary care physicians of this fact, I can usually get them to refer their younger patients.

With regard to the location of the DVT, those with iliofemoral DVT usually are very symptomatic with a swollen leg. These patients are often referred even for CDT. By offering a single-setting treatment, both the physician and the patient are impressed with the ease of the intervention and the rapid improvement of their symptoms. By starting with this group of patients, we were able to convince the referring physician to send those patients with more distal occlusions and less advanced stages of thrombosis using the rationales that endovascular therapy of DVT with the AngioJet or Trellis-8 is an effective treatment for immediate symptomatic relief for the patient, and it may decrease the risk of venous incompetence and postthrombotic syndrome.

Another group of patients experiencing successful results are those with upper-extremity DVT. These patients are often younger and have a symptomatic swollen arm. Successful removal of the thrombus at a single setting with rapid improvement of swelling and pain relief is typical. Follow-up with the referring physician allows you to report on the outcome and convey that similar safe and effective outcomes can be obtained in treating lower-extremity DVT.

Furthermore, it is important not to ignore the symptom relief of patients who often follow-up with the referring physician. These patients often have subjective symptoms that are difficult to quantify. They feel as if their legs are heavy, tired, and ache when compared to the contralateral limb. However, I have been extremely impressed by the amount of symptomatic relief that the patients experience after treatment.

CONCLUSION

A group of undertreated patients with symptomatic DVT exists because their treating physicians are often simply unaware of the endovascular options available to the patients. With the availability of devices that allow for single-setting treatments, such as the AngioJet or Trellis-8, with smaller doses of lytics and excellent early results, we may be able to alter the paradigm of therapy for most patients with symptomatic DVT in the future. ■

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