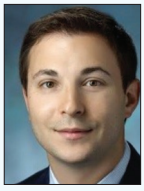
PANEL DISCUSSION

Streamlining DVT/CVO Management

A discourse on the varied treatment algorithms at centers in the United States.

With Steven Abramowitz, MD; Mona Ranade, MD; Wendy Nelson, NP; and S. Jay Mathews, MD, MS, FACC, FSCAI



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When it comes to patient flow, what are the common logjams in your everyday deep vein thrombosis (DVT) practice?

Dr. Abramowitz: For both inpatient and outpatient DVT-related care, we openly share our program's care algorithm. However, identification of discharged patients from urgent care or emergency department (ED) settings remains our biggest barrier in providing care for those patients with iliofemoral or high Villalta classification femoropopliteal DVTs. Many of these patients can be appropriately managed in the outpatient environment. However, discharged individuals often experience barriers or delays in arranging outpatient specialty appointments, receive conflicting information from trusted primary care providers regarding treatment strategies, or are lost to follow-up. This also applies to those patients who are diagnosed and managed solely in the outpatient setting by concerned primary care physicians, rehabilitation facilities, and skilled nursing facilities.

Dr. Ranade and Ms. Nelson: In a busy tertiary care academic institution, several common logjams can arise in everyday interventional radiology (IR) practice. Here are some potential challenges:

1. **Scheduling and patient triage.** Most of the consultations we obtain for treatment of DVT occur during inpatient hospitalization, and a handful of them are from referring physicians caring for patients in an outpatient

setting. We prioritize patients based on the severity of their condition, comorbid conditions, and history of previous interventions. Depending on the complexity of the case, appropriate anesthesia support and operating time need to be allocated to the cases. There are also patients who may not be candidates for intervention at the time of evaluation but may require further follow-up and assessment for effectiveness of conservative management and/or postthrombotic symptoms.

Our inpatient nurse practitioners (NPs) may be able to coordinate care with referring teams and patients while in house, but a number of these patients are lost to follow-up after discharge, secondary to several factors including miscommunication with primary team, access to care, or insurance issues.

2. **Resource allocation.** Limited resources such as procedure rooms, anesthesia support, equipment, and staff availability can lead to bottlenecks in accommodating cases in a timely manner.

3. **Multidisciplinary coordination.** In some cases, such as tumor thrombus or lead or catheter-associated thrombus, DVT management involves collaboration with other specialists such as vascular surgery, hematology, oncology, and cardiology. Coordinating care plans and obtaining consultations efficiently can be challenging at times.

4. **Imaging and diagnosis.** Diagnosis and assessment of severity of the DVT may require imaging studies such as ultrasound, CT venography, or MR venography. Delays in obtaining and interpreting imaging studies can impede patient flow and prolong the time to intervention.

Dr. Mathews: Many physicians agree that DVT that is present for > 2 weeks can become significantly organized, making interventional and medical therapies more challenging. This remodeling is characterized by vein retraction and high collagen content within wall-adherent thrombus. Whenever a patient presents to either the office or hospital with significant postthrombotic syndrome, often the clot age is older than the onset of symptoms.

Getting patients in for timely treatment once identification has occurred can be a problem. DVT is being increasingly identified in many sites of service: primary care offices, imaging centers, urgent care centers, freestanding EDs, and hospitals. Streamlining referrals and navigating insurance authorizations can be a challenge.

How has your group learned to identify these scenarios in advance and avoid/minimize their impact?

Dr. Ranade and Ms. Nelson: All consultations to our department are divided into inpatient versus outpatient categories. For hospitalized patients, our inpatient NP team or consult resident assesses the imaging, clinical presentation, hypercoagulability workup, and comorbid conditions and determines when a procedural intervention may be appropriate. Our outpatient clinic NP team and IR physicians evaluate all outpatient consultations for the same. In general, patients with acute infrainguinal disease are treated conservatively unless they have signs or symptoms of ischemia or have significant morbidity from their DVT. Procedural plans along with anesthesia needs, procedure duration, and postoperative patient disposition are all determined with an algorithm.

We have implemented quality improvement initiatives aimed at identifying and addressing inefficiencies in the workflow. For example, we ensure that there is a proceduralist with subspecialization in DVT management available daily and that we are able to accommodate add-on inpatient cases within the rooms in a reasonable manner. The consult team establishes clear communication channels and protocols for consultation and referral when the patient is referred as an outpatient. We provide ongoing training and education for IR team members to ensure they are equipped with the necessary knowledge and skills to effectively manage DVT cases. This includes training on new procedures, technologies, and protocols, as well as communication and teamwork skills.

Dr. Mathews: Consults for DVT to our office are considered urgent. Early in our venous thromboembolism (VTE) pathway, I had taken to putting my direct contact to help triage care for affected patients. However, this is not a sustainable option given the potential massive call volume. A dedicated VTE coordinator/hotline is our goal, but this remains a work in progress.

Dr. Abramowitz: For patients diagnosed within our health system, we have created an electronic referral process by which ED providers can place a high-priority follow-up request. These orders are reviewed daily, and patients are contacted within 24 hours to arrange specialty appointments. Because our associated urgent care centers are on a separate electronic medical record, we have implemented a virtual consultation protocol in which a video telehealth visit is performed at the time of diagnosis by the on-call specialist. For patients outside of our health system, we encourage referring facilities to utilize our on-call physician to aid in the triage and management of diagnosed patients. The physician will then help arrange appropriate outpatient management.

How does efficiency vary by whether the case will be outpatient or inpatient? What are some notable differences in these cases?

Dr. Mathews: Unfortunately, in the era of managed care, getting patients in for consultation rapidly and getting authorization for procedures can be problematic. As time does matter, sometimes I will send patients directly through the ED to expedite getting them into the catheterization lab before interventional outcomes become poor.

Inpatient cases also occur daily and will be booked based on complexity of the case and lab availability. We have a vascular interventionalist scheduled daily who will manage the VTE cases that are admitted.

Dr. Abramowitz: Admittedly, we are far more efficient in providing streamlined and expedient care to inpatients. The difference is the ability to be involved in inpatient care at a very early stage of the patient's encounter. This is due to the ownership our DVT providers have over the disease state. With rare exception, admission and inpatient management falls under the auspices of the treating practitioner. In being the attending of record as opposed to the consultant service, we have reduced ED throughput times and inpatient length of stay.

Dr. Ranade and Ms. Nelson: Outpatient cases tend to be more efficient in comparison to inpatient add-on cases secondary to many factors, such as ensuring availability of anesthesia/sedation nurses, room time, and a skilled proceduralist to perform the procedure.

Are there any notable variances by time of day?

Dr. Abramowitz: Sadly, yes. Even after implementing some of the programs previously mentioned, patients seen and discharged after hours or over the weekend are prone to higher rates of noncompliance with our care protocol. For patients diagnosed during these periods at unaffiliated sites, we also find that the decision to contact our group during daytime or weekday hours is lost in handoff.

Dr. Ranade and Ms. Nelson: There are no notable variances by time of day. However, in general, we tend to perform these procedures during the daytime and not overnight in an emergent manner, with the exception of clot-in-transit cases or those involving extensive pulmonary embolism.

Dr. Mathews: Complicated thrombectomy/reconstruction cases should be scheduled during the day to utilize anesthesia if needed and ensure appropriate staff support. However, most DVT thrombectomy cases are relatively straightforward from a procedural equipment standpoint and lower risk. We will see these patients toward the end of the day as they are less taxing for the staff and are fairly predictable.

How do you ensure the room is prepped and ready with all possible device needs available? What kinds of devices are on hand for all DVT cases?

Dr. Ranade and Ms. Nelson: We always perform a morning procedure review with the charge nurse, IR technologist, consult NPs, and trainees to ascertain that we have all patient and procedural needs addressed before the patient is brought to the IR suite. For any case involving patients with DVTs, we assess ability to anticoagulate, have heparin and tissue plasminogen activator present barring any allergies, and typically inform the patient of patient positioning based on whether aspiration, mechanical thrombectomy, or lysis is planned for the patient. Intravascular ultrasound (IVUS) is commonly utilized in cases where imaging is equivocal or stenting is necessary.

Dr. Mathews: Ease of thrombus removal is based on several factors, including age/organization of thrombus, location of thrombus, patient body habitus, and comorbidities. I use multiple devices for thrombectomy: catheter-directed thrombolysis, aspiration devices for acute/subacute clot, extraction tools for wall-adherent thrombus, rheolytic tools/rotational tools for clot maceration, and coring devices/laser ablation/sharp recanalization tools for chronic cases. In addition, I am a strong proponent of imaging, so we use IVUS to identify the cause of DVT (ie, venous compression, webs, prior thrombus). We also have dedicated venous stents available when needed. If possible, I will also have tools available to remove filters (ie, snares, forceps, laser) but may pursue this in a staged fashion depending on the complexity of the procedure. I tend to approach patients with a large body habitus from a supine approach. In patients at risk for respiratory compromise, I will use anesthesia if a prone approach is needed. Patients with submassive pulmonary embolism, clot in transit, or iliocaval thrombus will need these addressed prior to a lower extremity DVT procedure to avoid VTE and decompensation.

Dr. Abramowitz: We are lucky to have institutional support for our comprehensive VTE program. Our operating rooms and procedural suites are stocked with myriad catheter-based tools, allowing providers easy access to lytic-based, mechanical, and aspiration technologies.

Regular meetings with our Value Analysis Committee ensure that we are stewards of cost and also have access to endovascular tools in each interventional category.

What is your follow-up plan with these patients? Do you have a dedicated clinic or coordinator? How are follow-up plans conveyed to the patient, and how do you ensure good compliance?

Dr. Mathews: Funding for a dedicated DVT/VTE coordinator remains challenging at an institutional level. However, our discharge coordinators will help facilitate education and follow-up. One of the most common issues patients face is the cost of anticoagulation, especially with the direct thrombin inhibitors. We try to make sure that a 30-day sample card is available, and our local "Meds to Beds" program can make sure that the patients have their prescriptions prior to leaving the hospital.

Moreover, most patients are seen typically in our outpatient clinic within 2 weeks postpresentation. These patients will also have repeat periodic venous duplex to document clot resolution, valve function, or other pathology like rethrombosis. Identifying patient-specific factors is also essential to ensure optimal outcomes.

Dr. Abramowitz: Our treatment protocol extends beyond the decision for intervention in DVT patients. We outline recommended follow-up protocols for both interventional and noninterventional DVT management. Although we do not have a dedicated DVT clinic, quarterly quality and safety reviews of DVT patient care help ensure standardization. Additionally, we provide patients with institutionally created information regarding what they can and should expect in their care journey.

Dr. Ranade and Ms. Nelson: We have established standardized follow-up protocols for patients. Follow-up for patients is every 3 months for the first year and then annually. This is typically accompanied with duplex venous ultrasound for patients who may have residual thrombus postprocedure or presence of stents. We have recently created an NP role dedicated to keeping a database of and ensuring follow-up with patients with inferior vena cava filters and VTE. ■

Disclosures
Dr. Abramowitz: Consultant to Boston Scientific Corporation, Gore & Associates, Inari Medical, and Philips.
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Ms. Nelson: None.
Dr. Mathews: Consultant to and research support from Penumbra, Inc., Innova Vascular, Akura Medical, Philips, and Boston Scientific Corporation.