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Rehabilitation

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Tackling deep vein thrombosis:
Traditional treatments and newer approaches

BY MIGUEL A. COBA, JR., M.D.

EACH YEAR, approximately one in 1,000 American adults develops venous thromboembolism (VTE)—with deep vein thrombosis (DVT) accounting for about two-thirds of all cases and the balance attributed to pulmonary embolism (PE), with or without DVT. The incidence of this potentially life-threatening condition is on the rise.1

DVT is most common in patients older than 45, and is more prevalent in men. Up to 20 percent of hospitalized patients and 40 percent of surgical patients experience a thrombosis. Complications of DVT include PE, post-phlebitic or post thrombotic syndrome, and death. PE accounts for approximately 10 percent of hospital deaths. Risk factors include surgery, hospitalization, immobility, trauma, pregnancy, cancer, obesity and hereditary hypercoagulable disorders.

Patients in rehabilitation hospitals have a higher risk for DVT due to mobility issues. Studies have shown that up to 34 percent of patients in rehabilitation have DVT.

To complicate matters, DVT may be difficult to diagnose upon examination. It can be asymptomatic, or symptoms can mimic other conditions that patients in the rehabilitation setting may experience, such as swelling of the leg and leg pain. During their initial hospitalization, patients may develop DVT that remains undiagnosed upon admission to the rehabilitation facility.

At Kessler Institute for Rehabilitation, clinicians are trained to look for Virchow’s triad—blood stasis, endothelial injury and blood hypercoagulability—which predispose a patient to thrombosis. The unfortunate reality is that many patients in rehabilitation have two or all three risk factors for DVT.

Traditional Treatments

Until recently, the standard treatments for DVT were warfarin or low molecular weight heparin (LMWH). Warfarin (Coumadin or Jantoven) can be administered orally and is indicated for prophylaxis and treatment of venous thrombosis and PE. LMWH, such as Lovenox, Arixtra or Fragmin, is administered through subcutaneous injections. When an individual bleeds, the blood automatically starts a series of reactions to clot and stop the hemorrhaging. Vitamin K is an important substrate in this chain reaction, called the clotting cascade. Warfarin is a vitamin K antagonist. Since patients’ blood levels of vitamin K vary depending on diet and individual drug metabolism, (continued on page 7)
WITH THE NUMBER OF MEDICAL PUBLICATIONS doubling every five years, remaining current on the research literature is an intimidating task. Indeed, one 2004 analysis estimated that more than 7,000 articles were published each month in high-quality primary care journals alone and that reading this volume of literature would take 627 hours!\(^1\) Ten years later, this figure only will have grown.

Yet, staying current is necessary if we are to provide optimal clinical care. This challenge is even greater for rehabilitation medicine because we do not specialize in just one organ or body system, but provide care for patients with a wide range of ages, conditions and needs. We also must be knowledgeable about many other areas of science, such as genomics, robotics and even behavioral economics, because they all influence our field.

There are ways, however, to balance the amount of time you invest in staying current with the depth of information you need. Among them:

- **Limit your reading options.** Choose one or two high-impact general medicine journals, such as *The New England Journal of Medicine* and *The Journal of the American Medical Association*, as well as leading publications in our field, including *The American Journal of Physical Medicine & Rehabilitation*, *Physical Medicine and Rehabilitation* and *Archives of Physical Medicine and Rehabilitation*.
- **Subscribe to an RSS or email feed** so you can scan tables of content, then click through to the relevant abstracts. Explore tables of content in journals. JournalTocs (www.journaltocs.ac.uk) provides tables of contents from more than 24,000 journals.
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- **Get tweets.** Put a hashtag (#) in front of the journal’s name to receive Twitter alerts.
- **Attend relevant scientific and professional meetings.** And take advantage of the growing number of virtual meetings.
- **Enroll in selected continuing medical education courses.**
- **Learn from students and trainees.** Students can teach their supervisors and mentors as well as be taught by them.
- **Partner with experts.** For instance, if you have a patient with challenging kidney issues, have a “go-to” colleague in nephrology for a consultation.

Staying current with the literature doesn’t improve patient care unless you also transfer that knowledge into the clinical setting. That doesn’t necessarily mean immediately integrating new procedures or medications into your practice, but it does encourage remaining aware of them so that as the evidence becomes more compelling, you can implement them.
BY STEPHEN HAMPTON, M.D.

Wearable ‘smart’ devices empower patients with disabilities

THE INTRODUCTION of the Apple Watch in 2015 along with devices from Google, Microsoft, Fitbit and others portends expanding capabilities to record and monitor an individual’s physical activity and other health data with widely available commercial products. These innovative devices can empower individuals to better manage their health care and may provide more extensive, specific data for physicians to use in treatment.

Wearable devices offer an array of potential applications in health care. That such technology is designed to be worn makes it highly effective for behavior modification. For example, these devices can be useful in combating sedentary behavior by providing reminders to the wearer to get moving after prolonged inactivity. This is especially important for individuals with disabilities who are at an increased risk for complications resulting from immobility. They might benefit, for example, from a reminder to regularly shift their weight to protect their skin from pressure ulcers. Patients with complex medication schedules can set reminders that signal when it is time to take medicine. This addresses a well-documented gap between how medications are prescribed and how they are used. Wearers also can set goals with digital trackers, such as the number of steps they want to walk in a day or time spent exercising during the week—and they can track progress in real time.

Furthermore, these wearable devices may provide more thorough and reliable data to physicians through passive monitoring of vital signs, such as heart rate. Information obtained during clinical visits can sometimes be unreliable because patients may struggle to remember specifics about their behavior or symptoms since their last appointment. In addition, measurements such as blood pressure may not accurately represent the typical range because factors such as anxiety or caffeine consumption can affect readings. If instead physicians can access data from a device that the patient consistently wears, a more precise picture will emerge. In addition, manufacturers are now making biometric sensors (e.g., scales, glucometers, blood pressure cuffs) that connect with mobile devices to record and store data, giving patients an ongoing picture of their vitals that they can choose to share with their physicians.

To gain the full benefit of the additional health care information generated by the devices, the related software that allows for greater organization of information must be employed. Programs like Apple Health and Google Fit integrate data from health and fitness applications to provide a centralized dashboard for individuals to track. Easy access helps to empower patients to watch for patterns and discover connections between these numbers, such as what happens to their blood pressure or weight with increased activity throughout the day. These programs also allow patients to create an emergency information card that is accessible from the lock screen of their smartphone. This card allows patients to create a medical ID that shows information of their choosing, such as allergies and reactions, medical conditions, medications, an emergency contact and organ donor status.

As their capabilities grow, these tools may prove useful for a range of patients. Products currently on the market are generally not developed specifically for individuals with disabilities and may not be as accurate when used with assistive devices, such as walkers and wheelchairs.

Enhancements and new offerings all signal the interest of major electronics companies in the health arena. Demonstrations of these products and programs for individuals with disabilities could ensure that future innovations will keep the needs of this population in mind. Integrating these “smart” devices into treatment plans gives clinicians and patients powerful tools to work together to achieve successful outcomes. This is particularly important as physicians are treating the large population of aging baby boomers.

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Focus on Rehabilitation

Describe your role as program director.

Monifa Brooks, M.D.: It’s a great job! I’m a babysitter, manager, mom. Seriously, my primary responsibility is to interview and select new applicants. I also continually evaluate the curriculum to ensure that our residents receive the quality training that will provide viable options when they complete their fellowships. They can choose private practice, outpatient rehabilitation or work for the government in the Veterans Affairs (VA) system. They may start out interested in one subspecialty and completely change their minds during residency. Our students leave well trained and highly qualified to practice medicine or pursue a fellowship.

What barriers to graduate medical education do medical students face today?

Brooks: In medical school, students complete rotations. However, they have to wait until residency for the opportunity to really focus on a single area of specialization. Unfortunately, students who graduate from medical school face several barriers to advanced medical training. Federally funded residency programs have been capped since 1997, even though an increasing number of students continue to graduate from medical schools. And that number is projected to rise during the next 10 years.

There is an advantage to hospitals and institutions, including ours, in that the field of medicine has become so competitive that the quality of applicants to residency programs is very high. For example, our residency training program receives more than 300 applicants for eight residency positions each year. As a result, we have had the privilege to train the best and brightest medical students.
But because of the limited number of programs nationally, not all applicants can find placement.

**Focus:** What makes residencies in PM&R so attractive to students?

**Brooks:** PM&R is an increasingly popular field. In terms of medical specialties, the lifestyle allows for a better work-life balance than, for example, surgery, where the time demands are generally more rigorous. Another thing that draws students is the diversity of patients and their medical issues.

Our residency program in rehabilitative medicine offers students the opportunity to learn in a diverse environment, which may not be possible in a more rural medical school or health care setting. Residents are exposed to patients, young and old, who have a variety of disabilities, including spinal cord injury, traumatic brain injury, amputation and stroke. We see many combat veterans. Residents also perform outpatient and inpatient rehabilitation services and learn how to administer back injections and nerve blocks. They provide care in a number of settings, including Kessler, University Hospital (a Level 1 trauma center) and a VA center.

**Focus:** What do students typically do after their residencies?

**Brooks:** Fellowships are available that allow physicians to further subspecialize. We offer four fellowships in PM&R, and typically more than 50 percent of residents who leave our residency seek out fellowships. Areas of subspecialization that are attracting trainees include spinal cord injury medicine, traumatic brain injury, pediatric PM&R, and musculoskeletal/pain. While some residents are drawn to musculoskeletal specialization believing the work-life balance is easier in an outpatient setting, a good quality of life is also possible for PM&R physicians who choose to work in hospitals.

That is not to say that rehabilitation is an easy field. Residents come straight out of medical school and internship, where they’ve had a year of frenzied hospital rotations. They have a solid medical foundation in disease management, such as controlling diabetes and hypertension, but rehabilitation is a whole new world for them. The setting often differs from their prior experience as the emphasis is on long-term management and prevention of secondary complications in addition to resolving acute medical issues. Even the terminology is new.

**Focus:** The expectations from the Accreditation Council for Graduate Medical Education (ACGME) have increased in recent years. How has that affected your residency program?

**Brooks:** The ACGME oversees more than 9,500 residency education programs, including ours. Through accreditation, we are meeting or exceeding a nationally accepted set of education standards.

Accreditation has always been a lengthy process. The ACGME used to reaccredit every three, four or five years depending on the quality of the program. Now it has instituted ongoing rolling evaluations with greater standardization. Per ACGME standards approved in 2007, we must demonstrate that our residents are meeting the six core competencies described by the program. These are patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism and systems-based practice. Specifically, residents must provide compassionate, appropriate and effective care and must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral science and apply this knowledge to patient care.

Residents must also learn to investigate and evaluate their own care of patients and to dedicate themselves to continually improving treatment through lifelong learning. Communication is a critical skill for the residents. They should be able to exchange information not just with colleagues but also with patients, families and health care professionals. They must commit to carrying out professional responsibilities and maintaining ethical principles. Finally, they must demonstrate an awareness and responsiveness to the larger context and system of health care. This means they should work effectively in different settings and know how to coordinate patient care with others as appropriate. Our residents’ performance in these six competencies are reviewed by the Residency Review Committee that is responsible for PM&R programs.

There are some challenges that have resulted from ACGME policies. The duty hour limitation, which is well intended, occasionally results in residents missing out on unique learning opportunities or procedures. Fortunately, our residents still have ample opportunity to learn all required procedures during the three years.

**Focus:** Would you like to see any changes to the residency program that would benefit patients?

**Brooks:** We are fortunate at Kessler in that the needs of all patients are being met; however, the field would benefit if the cap on residencies were expanded to meet the expected need for our services as the population ages.

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LEGISLATIVE ISSUES and economic forces dramatically influence everything in our world. Federal, state and local governments pass laws and agencies issue regulations that directly affect our facilities and our patients. If you don’t remain aware of what’s happening on the legislative side, the changes will blindside you.

At the federal/Medicare level, the Centers for Medicare and Medicaid Services (CMS) is one of the major agencies to watch. It proposes and then finalizes regulations for Medicare that directly affect rehabilitation hospital and physician payments, operational practices and reporting requirements. For instance, in 2014 those changes touched on presumptive compliance determination methodology for the 60 percent rule, new therapy mode reporting requirements, and quality measure reporting obligations. Vigilance from our professional organizations enabled us to respond to those proposed modifications and contribute to several changes in the final adopted rule.

This year, we can expect CMS to issue regulations to implement the Improving Medicare Post-Acute Care Transformation (IMPACT) Act of 2014, which is designed to standardize data used throughout post-acute care facilities so payments and outcomes can be compared across settings. President Barack Obama signed the act in October, but regulations for its implementation will take time to emerge.

At the state level, legislative and regulatory actions that affect Medicaid, as well as licensing and construction requirements, also impact rehabilitation facilities. Given that every state’s Medicaid system is different, this can make managing the plethora of rules and regulations challenging for organizations with facilities in more than one state.

Finally, local governments may issue regulations and ordinances that affect building codes and other operational factors.

Tracking Legislation and Regulations
Keeping up with the agencies and governing bodies that influence us is a daunting task, yet one that rehabilitation facility leadership must pursue. There are ways to manage the flood of information. The key is to focus on a few major sources, and to rely judiciously on the services of trusted organizations and individuals.

While you could intently read the Federal Register (federalregister.gov), the primary source for regulations and bills, few individuals or even organizations can allocate the time and resources to keep up with this daily publication.

As an alternative, most rely on professional and trade associations to inform them of impending concerns. In the rehabilitation hospital world, the American Medical Rehabilitation Providers Association, which I currently chair, is a primary source. Other highly regarded organizations include the American Hospital Association, state hospital associations and the American Academy of Physical Medicine and Rehabilitation. They use staff and lobbyists at the state and national levels to track legislation and regulations and support their members’ needs. Membership is required to access these services.

In addition, the national media, such as The Washington Post, The New York Times and The Wall Street Journal, cover major health care policy initiatives and provide email alerts by topic. Trade magazines, including Modern Healthcare, frequently cover relevant legislation and regulations.

Medical news junkies can monitor the Congressional Record (gpo.gov/fdsys/browse/collection.action?collectionCode=CREC), which tracks all legislation passed or pending, and provides edited transcripts of activities on the floor of the House and the Senate.

Many agencies like CMS also produce emails, blogs and other social media resources to keep the public informed. Most are free.

Larger health care systems frequently have their own public policy professionals tracking regulations and legislation. They may be focused primarily on the acute care setting; however, it may be necessary to capture their attention so they follow issues relevant to physical medicine and rehabilitation.

Remaining vigilant about public policy changes that can affect us requires diligence and reliance on others. But it is critical if we are to advocate for change and to operate successfully in the highly regulated world of health care.
Tackling deep vein thrombosis
(continued from page 1)

the degree of anticoagulation, or a person’s ability to clot, must be regularly checked with blood tests while the individual is on warfarin. Therefore, prescribing warfarin can be tricky. It has a narrow therapeutic index, and the dosage varies greatly among patients partly due to diet and metabolism. It also has the potential for interactions with other drugs that inhibit or induce the enzymes CYP2C9, CYP1A2 and CYP3A4. Warfarin also may interact with antibiotics and antifungals. Caution should be used when prescribing warfarin with other medications that also have anticoagulant or blood thinning properties, as this may increase the risk of bleeding. These medications include anticoagulants, antiplatelet agents, nonsteroidal anti-inflammatory drugs, and serotonin reuptake inhibitors. Concomitant medication use must be monitored carefully.

Patients who cannot tolerate anticoagulation because of bleeding risk or recent bleeding in the brain or gastrointestinal system sometimes undergo inferior vena cava (IVC) filter placement to prevent blood clots from reaching the lungs. The filter does not prevent the formation of new blood clots. This approach may not be advisable for some patients who may be inappropriate candidates for the procedure or who are unwilling to have an object implanted.

Newer Treatment Options
The Food and Drug Administration (FDA) approved new classes of medications for treating DVT. These include Xarelto (rivaroxaban; approved in 2011) and Pradaxa (dabigatran etexilate mesylate; 2010). Rivaroxaban is a factor Xa inhibitor. The drug has no direct effect on platelet aggregation. Instead, it indirectly inhibits platelet aggregation induced by thrombin. Dabigatran has a different mechanism of action: It inhibits thrombin, which is the final effector in blood coagulation. Neither drug requires continuous blood monitoring. These medications also have the desirable qualities of oral administration through fixed dose with a rapid onset of action, a wide therapeutic window and a minimal drug-interaction profile.

Rivaroxaban and dabigatran have been FDA approved primarily to treat atrial fibrillation. Rivaroxaban is also approved for treatment of DVT and PE, for reduction of the risk of recurrent DVT and PE, and for prophylaxis of DVT in patients who undergo knee or hip replacement surgery. Rivaroxaban is one of the therapies recommended for the treatment of acute DVT in the guidelines published by the American College of Chest Physicians in 2012. Dabigatran is approved to treat DVT and PE in patients who have been administered a parenteral anticoagulant for five to 10 days and to reduce the risk of recurrent DVT and PE in previously treated individuals.

Unlike warfarin, dosing for both compounds is standardized. The level of rivaroxaban differs, however, when it is given to treat DVT and reduce risk of recurrence versus its use as prophylaxis after knee or hip surgery. While warfarin takes one to two days to achieve a peak effect, the effects of rivaroxaban and dabigatran are generally seen in two to four hours.

Rivaroxaban has the potential to interact with drugs that inhibit or induce CYP450 3A4. The combination of P-glycoprotein (P-gp) and CYP3A4 inhibitors can increase the exposure range of rivaroxaban from 30 percent to 160 percent, which may increase bleeding risk. Dabigatran should not be used in patients with creatinine clearance <50 mL/min who are on P-gp inhibitors.

The risk of bleeding events is increased for patients taking a factor Xa or thrombin inhibitor. Patients should be encouraged to report any bleeding, vomiting, headaches, dizziness or weakness or pain, swelling, or drainage at the site of an injury or wound.

Warnings and Risks
Rivaroxaban and dabigatran have black box warnings for premature discontinuation, which increases the risk of thrombotic events and for a spinal or epidural hematoma. Patients who discontinue these drugs for any reason other than pathological bleeding or completion of therapy should be given an alternative anticoagulant. Epidural or spinal hematomas, which may cause long-term and permanent paralysis, have been reported in patients treated with rivaroxaban and dabigatran who received neuraxial anesthesia or who underwent spinal puncture.

One disadvantage of these new drugs is that there are no antibodies against factor Xa and thrombin inhibitors. During mild and moderate bleeding events, rivaroxaban or dabigatran should be stopped, and mechanical compression, surgery, interventional therapy, and hemodynamic stabilization should be undertaken as necessary.

The therapy choice depends on factors such as the individual’s health and condition, insurance coverage, drug cost and the individual’s compliance with monitoring. For example, a patient at Kessler was recently switched from warfarin to rivaroxaban because of transportation issues that prevented regular blood draws. She reported that this reduced her stress and improved her quality of life; she has been clinically stable for approximately six months after treatment. Fortunately, with several options available, patients with DVT can be treated effectively in the rehabilitation setting.

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