

Venous Thromboembolism After Fibula Fracture

A Patient's Perspective

Carol V. Harvey ▼ Megan Runner

Venous Thromboembolism (VTE) is a significant healthcare issue in the United States. This article presents information on the scope of the problem of VTE through a case study demonstrating the physical and psychosocial experiences of a 24-year-old woman with a fibula fracture treated in a short leg cast who developed a deep vein thrombosis that went on to become a pulmonary embolism. The patient experience is evaluated and supported by literature review in terms of risk factors as well as diagnostic, prophylaxis, medical treatment, and nursing implications. Analysis of a patient experience with VTE is valuable to add to the nursing body of knowledge for improvement of evidence-based practice.

It seemed like a simple fibula fracture, treated by immobilization in a short leg cast. However, a week later, the patient started to complain of increasing pain in the upper calf. A week after that, she developed shortness of breath. Within hours, she was in critical care diagnosed by a computed tomographic (CT) scan with a saddle PE (pulmonary embolism). Fortunately after a week in the hospital, heparinization, treatment with low-molecular-weight heparin (LMWH), followed by 6 months of warfarin (Coumadin), she is healed and healthy. But, she realizes that her risk for venous thromboembolic disease (VTE) will continue for the rest of her life.

Scope of the Problem

The United States Surgeon General estimates that between 300,000 and 650,000 Americans experience a deep vein thrombosis (DVT) and/or a PE every year of which there are 100,000 deaths (U.S. Department of Health and Human Services, 2008). The National Institutes of Health suggests "that these conditions cause more deaths each year than breast cancer, AIDS, or motor vehicle incidents" (U.S. Department of Health and Human Services, 2008, p. 5). The problem is that 50%–80% of DVTs are asymptomatic, and unfortunately it is often not until an autopsy is performed that PE is detected (Nutescu, 2007). The American Heart Association (2008) notes that in about 12% of PE cases, death occurs. They report that in one fifth of cases, patients suffer sudden

death from PE and 30% will die within 30 days. "Roughly 30 percent of those who have a DVT in a given year will suffer from a recurrent episode sometime in the next 10 years, with the risk being greatest in the first two years" (American Heart Association, 2008; U.S. Department of Health and Human Services, 2008, p. 10). In addition, patients can develop postthrombotic syndrome with chronic pain, persistent edema, dermatitis, cellulitis, and ulcerations due to "venous hypertension caused by venous valvular incompetence and persistent obstruction" (Nutescu, 2007, p. 2075).

The Joint Commission (Amin & Deitelzweig, 2009) reports that more than 12 million hospitalized patients are classified as being at risk for a VTE, but that VTE is "the most common preventable cause of hospital-related death in the United States" (p. 558). Geerts et al. (2008) state that "almost all hospitalized patients have at least one risk factor for VTE, and approximately 40% have three or more risk factors" (p. 388s). These risk factors include unchangeable factors such as increasing age and inherited thrombophilia. Pregnancy, the postpartum period, and the use of estrogen-containing oral contraceptives or hormone replacement therapy increase the risk of VTE. Acute medical illness such as cancer, inflammatory bowel disease, nephrotic syndrome, myeloproliferative disorders, and related therapies such as chemotherapy, hormonal and radiation therapies, central venous catheterization, and the use of erythropoietic agents or selective estrogen receptor modulators impact the risk. Also very significant risks are surgery, trauma, obesity, and immobility (Geerts et al., 2008). In the extensive review of the literature by Geerts et al. (2008, p. 388s), they determine that the incidence of VTE is "10% to 40% among medical or general surgical patients and 40% to 60% following major orthopedic

Carol V. Harvey, MSN, RN, ACNS-BC, ONC, Professor of Nursing, Orthopaedic Clinical Nurse Specialist, Cypress College, Department of Registered Nursing, Cypress, CA.

Megan Runner, Nursing Student—Second Year, Cypress College, Department of Registered Nursing, Cypress, CA.

The authors have disclosed that they have no financial interests to any commercial company related to this educational activity.

DOI: 10.1097/NOR.0b013e318219ae94

surgery.” Stannard et al. (2006) state that “the prevalence is particularly high in association with skeletal trauma, with pelvic (61%), tibial (77%), and femoral (80%) fractures being the most frequently associated with venous thromboembolic disease” (p. 261). The literature also notes that “among 7 million patients discharged from 944 American acute care hospitals, postoperative VTE was the second-most-common medical complication, the second-most-common cause of excess length of stay, and the third-most common cause of excess mortality and excess charges” (Geerts et al., 2008, p. 388s).

Venous thromboembolism and PE are conditions that are poorly understood by the public, which has led to lack of understanding of the risk factors and prevention techniques. The Joint Commission also reports that many at-risk patients do not receive or are given incorrect thromboprophylaxis (Amin & Deitelzweig, 2009), and the benefits of mechanical prophylaxis remain controversial. Therefore, these conditions require more analysis and research to impact evidence-based practice to improve knowledge for better prevention and patient care.

Events Following the Fibula Fracture

The patient in this case was a 24-year-old Caucasian woman who was out on a Friday evening, wearing flat shoes, and was running to catch up with the group of friends when she tripped. She rolled her left ankle into extreme inversion. She felt a lot of pain and reported that it swelled immediately. She had trouble trying to drive home as she had difficulty depressing the clutch on her manual transmission car. She spent all of Saturday elevating her left leg and icing it. The swelling got worse and she had lots of bruising. She had a friend drive her to an urgent care, but she learned that her insurance would be applicable only in her hometown over an hour way. She returned to her apartment and continued to elevate and ice her ankle. After another painful night, she decided to drive herself to her parent’s house and finally got into an urgent care in her home community on Sunday.

The patient is a busy nursing student who was thinking, “oh no, I have clinical practicum at the hospital this week and what am I going to do if I can’t walk.” She had homework due and a care plan to finish, plus an examination the following week, but was hurting and having trouble trying to study. And, her apartment was on the second floor of a building with stairs, and she was thinking, “how am I going to manage getting up and down.” She knew that the swelling, pain, and bruising were “not good” and knew that driving was also going to be a problem. She did not think her ankle was broken, but feared the worst and was thinking, “what if my ankle is broken, or worse, and what if I cannot stay in the nursing program?”

On Sunday, she drove herself to the urgent care near her parent’s home. There she had radiographs taken (see Figures 1 and 2) and they noted a nondisplaced fracture of her left lateral fibula. As soon as she heard the bad news, she was thinking, “great what am I supposed to do now? This is the worst thing that could have happened to me!” She knew now that she would not be



FIGURE 1. Anterior-Posterior x-ray in Urgent Care. Left Ankle.

able to return to the nursing program. She was placed in a short-leg plaster cast and was instructed to remain nonweight bearing. They told her that her family physician would provide a referral to an orthopaedic surgeon. The nurse explained and demonstrated the correct way to use the crutches and the patient was given a prescription for hydrocodone. The patient drove to her parent’s home, her father got the prescription filled, and before taking any of the medication, she drove herself back to her apartment. She knew that she should not be trying to drive, but said that she just wanted to try to “handle this” on her own, and knowing that it was an hour drive, she



FIGURE 2. Lateral x-ray in Urgent Care Left Ankle in Cast.



FIGURE 3. Below the Knee Cast.

did not want to inconvenience her family. So, on Tuesday, she went back to her parent's home.

On Monday morning, she received the referral to the orthopaedic surgeon and called the office but could not get an appointment until Wednesday. She realized that she was going to have a very difficult time managing the stairs, so she asked her father to come and pick her up to take her to her parent's home because it had no stairs. So, on Tuesday she went to her parent's home. She was missing school, made phone calls to her instructors, and was still overwhelmed at what the consequences of this injury could mean to her progression in the nursing program. She did not understand why something like this had to happen to her and was feeling very angry about the whole situation. She was "frustrated" at having to "come home" but at the same time was relieved and thankful that her parents could help.

On Wednesday she went to the orthopaedic surgeon and he confirmed the fracture and replaced the plaster cast with a fiberglass cast (see Figures 3 and 4). She was instructed not to put any weight on her left leg. She was instructed to return in 2 weeks for follow-up radiography and a check-up. Trying to stay positive and optimistic, she thought, "at least the cast was lighter and could be decorated by her little brother," but the results



FIGURE 4. Below the Knee Cast.

were definitive, this meant withdrawing from the nursing program for the rest of the semester. She would not graduate with her friends and worried about keeping up with the knowledge and skills she had gained earlier in the semester, as it would be 6 months at the earliest before she could reenter the program. The director of the nursing program assured her that she would be able to reenter the program in the Spring semester, but she was wondering, "how am I going to do then?" She was still in pain but was managing the crutches. However, it was exhausting to get around. She felt grateful to be able to stay with her parents.

In evaluating this patient, there are several things to consider. She was 5 feet 4 inches tall and weighed 200 lb. This gave her a body mass index (BMI) of 34. She had been on Ortho-Tri-Cyclen oral contraceptive since she was 16 years old and was switched to Luteru at the age of 20. She was a nonsmoker but had been fairly sedentary especially since being in the nursing program. She had been using the elliptical and weight machines in the physical education gymnasium at the college for about 6 hr/week.

Eight days later, the patient thought that she should have been doing much better, but she started to have localized pain in the upper part of her left calf. She described the pain as "sharp and throbbing" and gradually it got worse and became constant. The pain was worse when she would lift her leg or dangle it. The pain became so bad that she said, "I just broke down and cried because nothing I did would relieve the pain." She had not needed much of the hydrocodone, but she took some as she could not get comfortable. It did not help. There did not seem to be any swelling, and she said she "was able to fit 4 fingers down my cast and actually pin point with my finger where the pain was coming from." She said she actually checked the capillary refill in her toes and it was less than 2 seconds her toes were pink and not swollen. She says that she wondered what was wrong, as she did not think her leg should be hurting like this, and thought, "this is not normal pain, maybe this is a blood clot?" This thought really "scared" her. She said that she had not had an experience of a patient with a DVT but knew about this from class. She stopped taking her birth control pills and she began to "worry."

Four days later, she went to the scheduled follow-up visit with the orthopaedic surgeon. She had a repeat x-ray (see Figure 5) and told the staff about the pain in her calf. The response was "OK" and that the doctor would see her soon. This really bothered her because she felt that the staff seemed "not to care." When the surgeon came in, he said that the radiograph looked good. When the patient told him about the pain in her calf, he quickly palpated behind her knee and told her that he had seen only one patient in his many years of practice that developed a DVT while in a cast. Being a nursing student, she said she was shocked that the doctor did not ask how bad the pain was, what type of pain it was, and how long she had felt the pain. She was feeling "like nobody was listening to her and that she didn't matter." She was advised by the physician to take 325 mg of aspirin every day, and she started this regimen immediately. She hoped that this would take care of the pain and hopefully "the clot, if it was there?"



FIGURE 5. Follow-up x-ray in cast.

On Friday evening, a friend picked her up at about 8:30 p.m. to go out to dinner. She returned home at 11:00 p.m. and when she got in the house, she said, “I had a hard time catching my breath.” This seemed very unusual and made her worry. She changed clothes and lay down on her bed and worked to control her breathing. She said that she was starting to become more scared since she knew that this was not normal and she had never had a problem with breathing. The symptoms subsided and she said that she fell asleep around midnight. At about 1:30 a.m., she woke up and said that her “heart was pounding out of her chest.” Every breath she took “felt like a thousand knives stabbing me in the upper chest.” She said that the pain radiated bilaterally around her chest and through her back into the thoracic region. By now, she knew something serious was wrong. She said, “I knew it had to be either a myocardial infarction or a pulmonary embolism.” “But, I was leaning more toward a PE because of the pain in my calf; so a clot made more sense.” She realized that she was taking short shallow breaths and that her chest hurt more when she laid flat on her back. She remembered about the orthopedic position to aid breathing and tried that, but nothing worked. She said that “in the nursing program that we are taught that patients with dyspnea feel an impending sense of doom.” She said that “this could not more correct.” She said she felt “panicked and knew that something really bad was happening.” She said, “Not being able to breathe is the scariest thing I’ve ever been through; I had no control over what was happening to me and that is not a good feeling to have.” She did not want to wake up her parents, as she stated she already felt like a “bother.” So, she waited until 6:00 a.m. when her step-mother was up and getting ready for work and told her that she “could not breathe.” Her step-mother immediately called 911. When the paramedics arrived, they told her that her heart rate was 146/min and her O₂ saturation was 98%. The patient told them about the pain in her calf, and they told her that it was probably just a “cramp from her cast.” She said this made her very angry. She felt like “no one was listening to me.” She said that she “wanted to scream that she knew something was wrong.” She said, “You know your own body, and when people

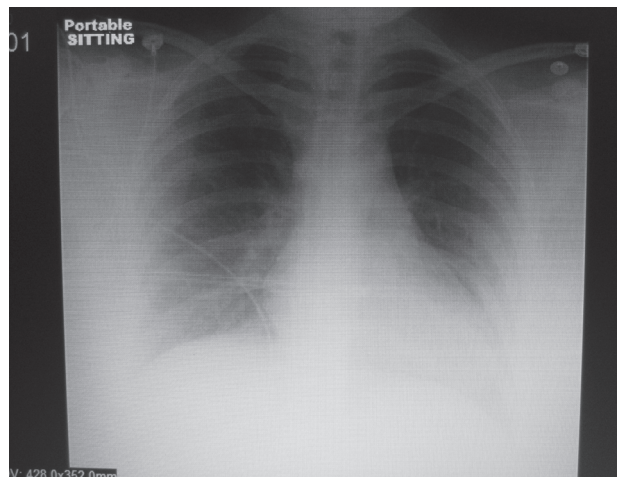


FIGURE 6. Chest x-ray.

dismiss your concerns about your own body, it’s very frustrating and saddening.”

The paramedics took her to the hospital, and when she got into the emergency room, the nurse put her on O₂ (Oxygen) 2L via nasal cannula, inserted an intravenous (IV) catheter into her right arm, and they drew blood. When the physician came in, he told her that he thought it was a PE, and he ordered a STAT (immediate) chest radiography and CT scan with contrast. The patient reported that the radiology technician told her that she would experience the feeling of the need to urinate when they injected the IV contrast. She said that this is indeed what she felt, a “weird warm feeling throughout her perineum.” The results of the chest radiography (see Figure 6) and the CT scan (see Figure 7) showed a large saddle PE. As soon as the physician told her the results, she said that she had a “complete emotional breakdown.” Her worst fears were confirmed. Her first thought was “Oh my gosh, I’m going to die” and subsequent thoughts of “I don’t want to die.” They gave her a bolus dose of 80 mg enoxaparin (Lovenox) subcutaneously, 5 mg of warfarin (Coumadin) orally, and 1.5 mg of hydromorphone (Dilaudid) IV push for the pain.

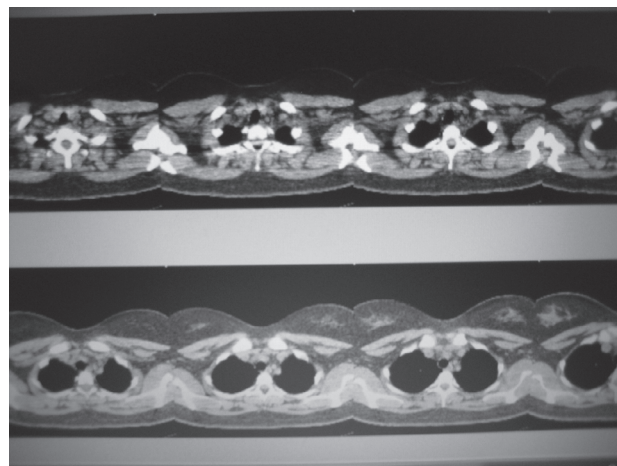


FIGURE 7. CT scan images.

They ran a continuous IV of normal saline at 125 ml/hr. The entire time in the emergency room, the patient said that she “felt scared as well as frustrated.” She said, “I had reported my calf pain earlier in the week and now I could barely breathe.” It took them 5 hr to transfer her to the ICU (intensive care unit). There they swabbed her nose for methicillin-resistant *Staphylococcus aureus*. She reported this as feeling “embarrassing.” But, what was even more embarrassing was that she had to use a bedpan, as she was on bed rest. She said that she had another “emotional breakdown” in the ICU, and when the nurse asked her what was wrong, and she said that she “was scared.” The ICU nurse comforted her, and she said that this helped her “pull myself together.” They started her on a heparin IV continuous drip and ordered 30 mg of ketorolac (Toradol) every 6 hr (see Figure 8). The patient reported that she took two doses of hydromorphone that first day in the ICU, but she felt it made her “nauseous.” By the third dose the next day, she felt very “sick” and told them “no more” hydromorphone. They changed the orders to 2.5 mg oxycodone/325 mg of acetaminophen (Percocet) for pain, but she reported needing only one dose of this over the remainder of her hospitalization. That first day in the ICU they did a Doppler ultrasound of both legs and found the blood clot in her left calf. She remained on bedrest, and the staff instructed her to keep her leg very still, even while in bed. Her breathing became easier but she remembered still feeling “scared that she would get worse.”

The patient remained in the ICU for 2 days and then was transferred to the Progressive Care Unit on Sunday.



FIGURE 8. Two IV's.

They allowed her to get up to the bedside commode. She described this as “embarrassing,” but she was weak, still had the cast and her heparin IV. She realized that she could not have made it to the bathroom. And, they still did not want her to move her leg around very much. They kept her IV infusion going for another 24 hours and then discontinued it. After 2 days in the PCU, they transferred her to the telemetry unit. She continued to have blood drawn daily to check her coagulation factors, and they continued to adjust her warfarin. Finally, 6 days after admission, they discharged her at 9:00 p.m. on Thursday. They told her that she would need to stay on warfarin for 6 months and would need to have her blood drawn every week. They wanted her international normalized ratio (INR) to be between 2 and 3.

Her parents were supportive the entire time. Her father brought her a book to read and a portable movie player so she could watch movies. Friends came to visit her in the hospital, which really made her “feel better,” but she began to worry about the future. She expressed, “Could this happen again, was her insurance going to cover all of this time in the hospital, the ICU is expensive, and what about the ongoing blood draws and Coumadin, and can I get back to the nursing program in the Spring?” She reported feeling overwhelmed, but so glad that she could stay with her parents.

Finally, 6 weeks after the initial fracture, she returned to the orthopaedic surgeon's office. The follow-up radiographs showed that the fracture had healed and the cast was removed. When she asked the physician about the blood clot, she reported that “he didn't say much,” but he did tell her that she should “get tested for a hypercoagulability problem.” This made her feel “angry” since she felt like he “blamed her” and was not recognizing that she had complained about her calf pain earlier, and that he did not “pay attention” to her symptoms. She felt that he ignored her. She said, “I hope that he will listen to his patients in the future so something like this does not happen to someone else.”

She stated that her leg felt “weak and hairy.” She continued to use crutches for another 2 weeks. The warfarin dosing was like a “roller coaster” going back and forth from 2.5 to 5 mg as it was difficult to keep her INR levels within therapeutic range. She reported getting very tired of going back and forth to the laboratory for blood draws and the multiple phone calls to the physician's office for warfarin dose adjustments.

For the next 3–4 months she complained of continued feelings of pressure, tightness, and aching in her left calf. She said that stretching and walking helped to relieve these symptoms. Her ankle continued to feel weak and she was instructed to do exercises standing on only her left foot to regain lateral stabilization.

Analysis of Risk Factors

Clearly this was an unusual event, the patient did have risk factors, but a DVT is rare in a fibula fracture treated in a cast. In searching recent literature, there was only one article that discussed VTE and below the knee casts. This author cited several older studies that showed an incidence of DVT following long bone fractures with cast immobilization ranging from 4.3% to 19%. It was

also noted that the increasing incidence may be related to the fact that the technology to recognize a DVT is improving; therefore, there is better detection (Parsonage, 2009, p. 33).

This patient had several risk factors for VTE; however, no thromboprophylaxis was implemented in her case. The literature discusses that there is not one universally effective risk-scoring system (Parsonage, 2009, p. 35). Geerts et al. state that “unfortunately, despite the hundreds of randomized trials demonstrating the benefit of thromboprophylaxis and >20 practice guidelines recommending the use of thromboprophylaxis since 1986, low adherence with evidence-based thromboprophylaxis compromises the optimal benefits of this key patient safety practice” (2008, p. 389s).

It is well accepted that endothelial/vascular injury, circulatory/venous stasis, and blood hypercoagulability (see Figure 9), as identified by Rudolf Virchow in 1855, are the chief mechanisms for the development of VTE (Ignatavicius & Workman, 2010, p. 817). The American College of Chest Physicians (ACCP; Geerts et al., 2008) identifies three levels of risk (see Table 1)—low, moderate, and high—based on the amount of injury, the amount of immobilization, and the VTE risk factors versus the bleeding risk. As supported by Geerts et al. (2008), in this case, the patient’s obesity, the use of an oral contraceptive, and a fairly sedentary lifestyle combined with the event of the fracture and immobilization in a cast certainly contributed to an increased risk for VTE.

Obesity

It is well established that obesity increases the risk for VTE and the need for adjustment in anticoagulant dosing. The patient in this case was 5 feet 4 inches/1.63 m tall with a weight of 200 lb/91 kg and which equals a BMI of 34.2 kg/m². The National Institutes of Health (2000), in Taylor, Lillis, LeMone, and Lynn (2011), lists a BMI greater than 30 kg/m² as obesity, Class I. Sharma et al. (2007) listed obesity as a significant underlying risk factor for VTE in their study of 507 trauma patients. Davidson et al. (2007) discussed the implications of obesity in determination of dosage for anticoagulants. They evaluated a major study of more than 20,000 patients who had been treated with fondaparinux, low-molecular-weight-LMWH, or unfractionated heparin of which 55% had a BMI over 30 kg/m². The results indicated that more frequent dosing of the LMWH or unfractionated heparin had better efficacy than single daily dosing.

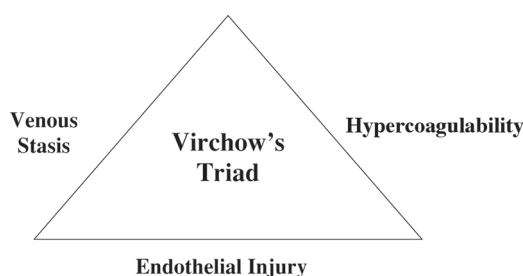


FIGURE 9. Virchow's Triad.

Nutescu (2007, p. S11) also noted a study of 807 non-obese and obese patients, classified as greater than 32 kg/m². In this study, the “incidence of VTE was significantly higher (32%) in obese patients than non-obese patients (17%).” These findings suggest the need for larger LMWH doses in obese patients. Tick, Kramer, Rosendaal, Faber, and Doggen (2008) also reported that an increased BMI and recurrent ipsilateral DVT increase the risk of postthrombotic syndrome. Therefore, clearly obesity impacts the risk for VTE and associated complications.

Oral Contraceptives

There is also an association between increased risks for VTE with the use of oral contraceptives. The patient in this study had been on Ortho-Tri-Cyclen and then Lutera for 8 years prior to her DVT and PE. Pearce, Layton, Wilton, and Shakir (2005) discuss an increased risk with the use of estrogen-containing oral contraceptives as well as with those containing progestin. Geerts et al. (2008) also list estrogen-containing oral contraceptives as a risk factor for VTE.

Diagnostic Implications

Early recognition of VTE is often difficult, especially in a cast, as expressed in this case presentation. Diagnostic identification based on signs and symptoms is also sometimes a challenge as many DVTs are asymptomatic. It is important that healthcare providers know to observe for “calf or groin tenderness and pain and sudden onset of unilateral swelling of the leg” (Ignatavicius & Workman, 2010, p. 817). Along the affected blood vessel, induration (hardening) may be palpable. This is often described as a positive cord. Redness, edema, and warmth may also be present. Homan’s sign is not a reliable sign as it occurs only in a small percentage of patients with a DVT. Ignatavicius and Workman (2010) report that “false-positive findings are common. Therefore, checking a Homan’s sign is not advised” (p. 817). The challenge is that DVT can be “clinically silent in 10 to 50 percent of patients” (Sharma et al., 2007, p. 1173) or the signs and symptoms may be difficult to assess, such as with a cast in place.

Venous Doppler ultrasonography (DUS) is one widely available tool used to identify a venous clot. This is also termed venous duplex ultrasonography or Doppler flow studies (Ignatavicius & Workman, 2010). However, even though this test is repeatable and noninvasive, Geerts et al (2008, p. 391s) report that “the accuracy of DUS is reduced for the calf veins.” Impedance plethysmography is effective for detecting DVT located above the popliteal vein by looking at venous outflow. However, this test is “not helpful in locating clots in the calf and is less sensitive than Doppler studies” (Ignatavicius & Workman, 2010, p. 818). These authors also discuss other noninvasive studies such as magnetic resonance imaging to look at direct thrombus imaging and a D-dimer (fibrin degradation fragment test) to measure clot formation and breakdown markers as part of coagulation activation. Sharma et al. (2007) also recommend magnetic resonance imaging to detect chronic or acute DVT when venous duplex scan is not available or

TABLE 1. 2008 AMERICAN COLLEGE OF CHEST PHYSICIANS (ACCP) EVIDENCE-BASED CLINICAL PRACTICE GUIDELINES (8TH EDITION) FOR PREVENTION OF VENOUS THROMBOEMBOLISM

ACCP Levels of Risk for Thromboembolism	Patient Characteristics	ACCP Recommendations (No Recommendation for Aspirin Alone for Any Patient Group)
High risk	1. Arthroplasty: hip or knee 2. Fracture of the hip 3. Major TRAUMA or spinal cord injury 4. High VTE Risk 5. High bleeding risk	LMWH or fondaparinux or Oral VKA or LDUH (hip fracture only) INR 2–3 (target of 2.5) Minimum of 10 days up to 35 days Mechanical prophylaxis
Moderate risk	1. General surgery, open gynecologic or urologic surgery 2. Bedrest or very sick medical patients 3. Moderate VTE risk 4. Moderate bleeding risk	LMWH or LDUH twice or 3 times per day or fondaparinux (Arixtra) Mechanical prophylaxis
Low risk	1. Mobile patient with minor surgery 2. Fully mobile medical patient	Ambulation—early and aggressive

Note. INR = international normalized ratio; LMWH = low-molecular-weight heparin; LDUH, low-dose unfractionated heparin; mechanical prophylaxis = intermittent pneumatic compression: stockings or foot pumps and/or graduated compression stockings; VKA = vitamin K antagonist (warfarin); VTE = Venous Thromboembolism. Adapted from “Prevention of Venous Thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines” (8th ed.), by W. H. Geerts, D. Bergqvist, G. F. Pineo, J. A. Heit, C. M. Samama, M. R. Lassen, et al., 2008, *Chest*, 133(6, Suppl), pp. 381S–453S.

in severe trauma. A more definitive test is contrast venography. It is “sensitive for detecting DVT and can be adjudicated centrally in a blinded manner; however, venography is invasive, 20 to 40% of venograms are considered nondiagnostic, and the clinical relevance of small thrombi is uncertain” (Geerts, 2008, p. 391s).

Prophylaxis/Treatment Implications

In this case of a fibula fracture, aspirin was prescribed. In clinical practice, aspirin is often prescribed for prophylaxis and sometimes treatment of VTE. The ACCP, in its *Clinical Practice Guidelines* 8th edition (2008), developed very specific patient risk levels, target patient characteristics, and recommendations for the prevention of venous thromboembolism (see Table 1). One clear recommendation is that aspirin alone as a prophylactic or treatment measure is not recommended by the ACCP. In their standard 3.7.1 they also make the following recommendation applicable for this patient: “for patients with isolated lower-extremity injuries distal to the knee, we suggest that clinicians not routinely use thromboprophylaxis” (Geerts et al., 2008, p. 386s). In contrast, the American Academy of Orthopaedic Surgeons, in its *Clinical Practice Guidelines* for Prevention of Pulmonary Embolism, recommends aspirin for patients who are at standard risk for PE (see Table 2; Johanson et al., 2009, pp. 183–196). They emphasize in Guideline 1.1 that orthopaedic patients be assessed for elevated risk for PE, which includes a hypercoagulable state or previously documented PE. Both of these guidelines (ACCP and AAOS) are well respected as they are based on systematic extensive review of published studies that provide current evidence for

best practices. They have similarities and differences but are both important to improve prophylaxis and treatment for venous thromboembolism.

Nursing Implications

Multiple nursing diagnoses are applicable in this case presentation. Certainly ineffective tissue perfusion (peripheral) and acute pain are appropriate in terms of the thrombus formation. Impaired physical mobility, as well as risk for peripheral neurovascular dysfunction, also applies in terms of the fracture itself. However, after the development of the PE, impaired gas exchange, activity intolerance, and anxiety are also significant in terms of the hypoxemia and the life-threatening nature of the event (Ignatavicius & Workman, 2010, pp. 679, 680, 818, 1185). In terms of the psychosocial implications in this case, the nursing diagnoses of self-care deficit, powerlessness, and even ineffective role performance also are important as the patient struggled with trying to maintain her independence and her worry about being able to continue in the nursing program (Carpenito, 2008).

Prevention and treatment for VTE is usually a combination of rest, mechanical compression devices, pharmacologic anticoagulation, and possibly an inferior vena cava filter if anticoagulants are contraindicated (Datta, Ball, Rudmik, Hameed, & Kortbeek, 2010). Rest includes elevation of the extremity even while sitting in a chair. Sometimes warm moist compresses can be effective to reduce discomfort. However, this is not possible with a cast in place, as in this case. Massage is definitely contraindicated to “prevent the thrombus from dislodging and becoming an embolus” (Ignatavicius & Workman, 2010, p. 818).

TABLE 2. 2007 AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS (AAOS) CLINICAL PRACTICE GUIDELINES FOR PREVENTION OF PULMONARY EMBOLISM (PE)

AAOS Recommendations

- | | |
|---|---|
| <p>1.1 Assess preoperatively for elevated risk for pulmonary embolism (PE): hypercoagulable states, previous documented PE</p> <p>1.2 Assess preoperatively for elevated risk for bleeding: history of bleeding disorder, recent gastrointestinal bleed, recent hemorrhagic stroke</p>
<p>1.3 Consider vena cava filter placement for patients with known contraindications to anticoagulants</p>
<p>2.1 Consider mechanical prophylaxis intraoperative and/or immediately postoperative</p> <p>2.2 Collaborate with anesthesiologist regarding consideration for regional anesthesia</p> <p>3.1 Consider postoperatively continued mechanical prophylaxis until discharge</p> <p>3.2 Mobilize patients as soon as feasible postoperatively to the full extent of comfort and medical safety</p> | <p>3.3 Chemoprophylaxis for patients undergoing hip or knee replacement—postoperative/inpatient care:</p> <p>3.3.1 For patients who are at standard risk for PE or major bleeding, consider (in alphabetical order): Aspirin, 325 mg twice a day starting the day of surgery for 6 weeks (reduce to 81 mg once a day if gastrointestinal symptoms develop), low-molecular-weight heparin/enoxaparin or Synthetic Pentasaccharide/Arixtra – start 12–24 hr postoperation (or after an indwelling epidural catheter has been removed) for 7–12 days, or Warfarin with an international normalized ratio < 2.0 starting the night before or the night after surgery for 2–6 weeks.</p> <p>3.3.2 For patients with elevated risk for PE and a standard risk for bleeding, consider (in alphabetical order): low-molecular-weight heparin or synthetic pentasaccharide (as above), or warfarin (as above)</p> <p>3.3.3 For patients with standard risk for PE and an elevated risk for major bleeding, consider (in alphabetical order): aspirin (as above), warfarin (as above)</p> <p>3.3.4 For patients with elevated risk for both PE and major bleeding, consider (in alphabetical order): aspirin (as above), warfarin (as above)</p> <p>3.4 Screening postoperatively on a routine basis for deep vein thrombosis or PE in asymptomatic patients is not recommended</p> <p>4.1 Encourage patients to progressively increase mobility after discharge to home</p> <p>4.2 Educate patients about the common symptoms for deep vein thrombosis and PE</p> |
|---|---|

Note. Adapted from “American academy of Orthopaedic Surgeons clinical practice guideline: Prevention of symptomatic pulmonary embolism in patients undergoing total hip or knee arthroplasty,” by N. A. Johanson, P. F. Lachiewicz, J. R. Lieberman, P. A. Lotke, J. Parvizi, V. Pellegrini, et al., 2009, *Journal of the American Academy of Orthopaedic Surgeons*, 17(3), pp. 183–196.

Mechanical devices can include knee or thigh high elastic compression stockings, sometimes called antiembolism stockings. These may also be indicated in chronic venous insufficiency to promote venous outflow (Ignatavicius & Workman, 2010, p. 818). These promote increased velocity of the venous blood flow and improve the function of the valves. The stockings provide static compression, but there may be skin integrity concerns, especially if the stockings are not removed at least twice per day (Taylor et al., 2011). Intermittent pneumatic compression devices may include leg or foot wraps/sleeves/boots that provide intermittent or sequential pressure/compression from a distal to proximal direction up the leg. They “enhance blood flow and venous return by simulating the normal muscle pumping action in the legs” (Taylor et al., 2011, p. 1033). The ACCP and AAOS guidelines support the use of these devices. However, in a patient with a below-knee cast, this method of prophylaxis is not possible (Parsonage, 2009).

Overwhelmingly, the literature supports pharmacologic intervention with anticoagulants as the primary effective DVT prophylaxis as expressed in the ACCP and AAOS guidelines (Datta et al., 2010; Geerts et al., 2008;

Ignatavicius & Workman, 2010; Johanson et al., 2009; Parsonage, 2009; Stannard et al., 2006). The decisions about which medications to use are based on patient risk for PE as well as risk for bleeding, and the dosage is based on patient weight.

Details of the anticoagulation pharmacologic dosing and administration of these medications are beyond the intended scope of this article; however, nursing implications must include adequate patient assessment and teaching. Patients must be taught regarding bleeding-prevention techniques, such as avoiding shaving with a blade razor, and avoiding activities such as working with sharp tools where accidents could occur. Patients must be evaluated for signs of bleeding such as from the nose or gums, “hematuria, frank or occult blood in the stool, ecchymosis, petechiae, an altered level of consciousness, and pain” (Ignatavicius & Workman, 2010, p. 818).

Patient assessment must also include monitoring of laboratory values. The complete blood cell count with hematocrit and platelet levels should be evaluated prior to initiation of therapy. Baseline clotting factors of an activated partial thromboplastin time (aPTT), a prothrombin time, and an INR must also be evaluated and

are usually drawn on a daily basis with initiation of therapy. The complete blood cell count can indicate bleeding/anemia as well as heparin-induced thrombocytopenia. Low-molecular-weight heparins are recommended to be discontinued when a platelet count is less than 100,000 (Deglin, Vallerand, & Sanoski, 2011, p. 659). To monitor therapeutic drug levels, the clotting factors must continue to be evaluated. For therapeutic unfractionated heparin therapy, the aPTT must be 1.5 to 2 times the control. If the aPTT is greater than 70 s, this is considered a critical value and the physician should be notified immediately because of the significant risk for bleeding (Ignatavicius & Workman, 2010, p. 818).

For LMWHs, patients are often taught to self-administer the medication. The platelet level, as mentioned earlier, as well as the creatinine level must be monitored. This level should not be greater than 2 mg/dl as this could indicate renal insufficiency. The INR level target is 2.5 but should not be higher than 3 (Geerts et al., 2008; Ignatavicius & Workman, 2010, p. 819).

Warfarin may be added after 5 days of unfractionated heparin therapy or after the first dose of LMWH. The advantage of warfarin is that it is an oral anticoagulant. However, managing the therapeutic range/dosage is often challenging. The therapeutic level of the prothrombin time should be 1.3–1.5 times greater than the control and the INR should be about 2.5–3 (Deglin et al., 2011, p. 1296).

For patients who cannot tolerate anticoagulation, or who have recurrent DVT or PE, an inferior vena cava filter may be placed. This device is like a porous “umbrella” that allows blood to pass but traps emboli to prevent them from progressing to the lungs. It is inserted through the femoral vein and is often done in the catheterization laboratory/suite (Ignatavicius & Workman, 2010, p. 820). The ACCP guidelines list a vena cava filter as a consideration for patients with known contraindications to anticoagulants and are shown to reduce the rates of fatal PE in high-risk groups (Geerts et al., 2008; Parsonage, 2009). Nurses must be observant of the insertion site and monitor patients for signs of bleeding or clot formation by doing frequent neurovascular assessments.

Strategies for Improvement

The incidence and ramifications of VTE are a challenge to the public, patients, and the healthcare system. In 2008, the United States Surgeon General released a Call to Action to Prevent Deep Vein Thrombosis and Pulmonary Embolism. The goal of this report was to define the problem and explore methods to reduce the risk of DVT and PE by increasing awareness for a better public health response. The report envisions a future where the “public at large is knowledgeable about the risk factors, triggering events, and symptoms of these diseases, and individuals feel empowered to talk with their clinicians about them whenever appropriate.” The report calls for more “evidence based practices for the screening, prevention, diagnosis, and treatment of DVT/PE.” In addition, the Call to Action supports more scientific research for better knowledge about these diseases for “dissemination to the public, and put into

practice by health professionals” (U.S. Department of Health and Human Services, 2008, p. 35).

The JCAHO (Amin and Deitelzweig, 2009, p. 558) states that “it remains the responsibility of individual hospitals to identify specific areas in which they can improve their VTE prophylaxis rates to obtain positive results.” They state that positive performance measures will be evaluated in terms of “early risk assessment, appropriate prophylaxis, prescribing, monitoring, and follow-up.” This can be supported by better staff education, audit and feedback mechanisms, improved risk assessment tools, and electronic alert systems for therapeutic regimen decision making.

Certainly nurses are a large part of these initiatives. Nurses are excellent teachers, both of the public and their patients, and can have a great impact to educate them on the risk factors for VTE, limiting events that can trigger this disease and recognition of signs and symptoms. Nurses are on the front lines in terms of delivery of therapeutic regimens for both prevention and treatment of VTE. They must follow standards of care with these high-risk interventions at all times. In addition, nurses are often the primary educators for prevention of complications from VTE and risk reduction for future events.

Patient Outcomes

At the beginning of the following semester, though still noticeably limping, the patient in this presented case returned to the college and enrolled in the Health Science Open Skills Lab so that at least she could interact with students, review materials, and practice her skills. Fortunately she was readmitted to the nursing program at mid-semester and continued on in the course progression. She managed her clinical days well but noted that her leg felt weak and tired by the end of the day. She remained on the warfarin for the ordered 6 months and is now off all anticoagulants. She reports that she will never take oral contraceptives or hormone replacement therapy, but does worry that she might have another VTE event in the future. She states she realizes that she needs to lose weight and is working on this, although it is hard during the semester as she needs to study so much. Fortunately she has not had symptoms of postthrombotic syndrome, but she states that her leg still feels weak and achy at times.

Patient experiences, such as those presented in this case, add to the body of knowledge that leads to improved evidence-based practice. Clearly, nurses must be knowledgeable of VTE and be vigilant with patients in their care. In addition, nurses must also be sensitive to the psychosocial ramifications of a VTE event. Patients are fearful and angry and the consequences impact multiple aspects of their lives. The Surgeon General's Call to Action (U.S. Department of Health and Human Services, 2008, p. 35) states, “we need the energy and commitment of individuals, families and the health care system, private sector organizations, and government at all levels to work together to build solutions that will bring better health to Americans.” Nurses are excellent promoters of these initiatives to improve patient care.

REFERENCES

- American Heart Association. (2008). *Venous thromboembolism & pulmonary embolism: Statistics*. Dallas, TX: Author. <http://www.americanheart.org/downloadable/heart/1200598191688FS29VTE08.pdf>
- Amin, A. N., & Deitelzweig, S. B. (2009). Optimizing the prevention of venous thromboembolism: Recent quality initiatives and strategies to drive improvement. *The Joint Commission Journal on Quality and Patient Safety*, 35(11), 558–564. <http://www.ncbi.nlm.nih.gov/pubmed/19947332>
- Carpenito, L. J. (2008). *Handbook of nursing diagnosis* (12th ed.). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins.
- Datta, I., Ball, C. G., Rudmik, L., Hameed, S. M., & Kortbeek, J. B. (2010). Complications related to deep venous thrombosis prophylaxis in trauma: A systematic review of the literature. *Journal of Trauma Management & Outcomes*, 4(1), 1–11. doi: 10.1186/1752-2897-4-1
- Davidson, B. L., Büller, H. R., Decousus, H., Gallus, A., Gent, M., Piovela, F., et al. (2007). Effect of obesity on outcomes after fondaparinux, enoxaparin, or heparin treatment for acute venous thromboembolism in the Matisse trials. *Journal of Thrombosis and Haemostasis*, 5(6), 1191–1194. doi: 10.1111/j.1538-7836.2007.02565.x
- Deglin, J. H., Vallerand, A. H., & Sanoski, C. A. (2011). *Davis's drug guide for nurses* (12th ed.). Philadelphia: FA Davis.
- Geerts, W. H., Bergqvist, D., Pineo, G. F., Heit, J. A., Samama, C. M., Lassen, M. R., et al. (2008). Prevention of venous thromboembolism: American College of Chest Physicians evidence-based clinical practice guidelines (8th ed.). *Chest*, 133(6, Suppl), 381S–453S. doi: 10.1378/chest.08-0656
- Johanson, N. A., Lachiewicz, P. F., Lieberman, J. R., Lotke, P. A., Parvizi, J., Pellegrini, V., et al. (2009). American Academy of Orthopaedic Surgeons clinical practice guideline: Prevention of symptomatic pulmonary embolism in patients undergoing total hip or knee arthroplasty. *Journal of the American Academy of Orthopaedic Surgeons*, 17(3), 183–196.
- Ignatavicius, D. D., & Workman, M. L. (2010). *Medical-surgical nursing: Patient-centered collaborative care* (6th ed.). St. Louis, MO: Saunders Elsevier.
- Nutescu, E. A. (2007). Assessing, preventing, and treating venous thromboembolism: Evidence-based approaches. *American Journal of Health-System Pharmacy: Official Journal of the American Society of Health-System Pharmacists*, 64(11, Suppl 7), S5–S13. http://www.ashpadvantage.com/website_images/pdf/ajhp_05152010.pdf
- Parsonage, I. (2009). Venous thromboembolism in patients with below-knee plaster casts. *Emergency Nurse: The Journal of the RCN Accident and Emergency Nursing Association*, 16(10), 32–35. <http://www.ncbi.nlm.nih.gov/pubmed/19361091>
- Sharma, O. P., Oswanski, M. F., Joseph, R. J., Tonui, P., Westrick, L., Raj, S. S., et al. (2007). Venous thromboembolism in trauma patients. *The American Surgeon*, 73(11), 1173–1180. <http://www.ncbi.nlm.nih.gov/pubmed/18092658>
- Stannard, J. P., Lopez-Ben, R. R., Volgas, D. A., Anderson, E. R., Busbee, M., Karr, D. K., et al. (2006). Prophylaxis against deep-vein thrombosis following trauma: A prospective, randomized comparison of mechanical and pharmacologic prophylaxis. *The Journal of Bone and Joint Surgery. American Volume*, 88(2), 261–266. <http://www.ncbi.nlm.nih.gov/pubmed/16452735>
- Taylor, C. R., Lillis, C., LeMone, P., & Lynn, P. (2011). *Fundamentals of nursing: The art and science of nursing care* (7th ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.
- Tick, L. W., Kramer, M. H. H., Rosendaal, F. R., Faber, W. R., & Doggen, C. J. M. (2008). Risk factors for post-thrombotic syndrome in patients with a first deep venous thrombosis. *Journal of Thrombosis and Haemostasis*, 6(12), 2075–2081. doi: 10.1111/j.1538-7836.2008.03180
- U.S. Department of Health and Human Services. (2008). *The Surgeon General's call to action to prevent deep vein thrombosis and pulmonary embolism*. <http://www.surgeongeneral.gov/topics/deepvein/calltoaction/call-to-action-on-dvt-2008.pdf>

For more than 31 additional continuing nursing education articles on orthopaedic topics, go to nursingcenter.com/ce.