

Julie Vajnar, PA-C, RT, DEPARTMENT EDITOR

Using CT to diagnose pulmonary embolism

Julie Vajnar, PA-C, RT

CASE

The patient is a 60-year-old man who presents to the emergency department with shortness of breath and tachycardia. He underwent a total hip replacement 2 weeks ago. You notice he has tachypnea. You hear a prominent second heart sound on auscultation and bibasilar rales over the lungs. The chest radiography findings are normal. The results of a WBC count, clotting studies, and blood chemistry studies are normal, but the D-dimer level is elevated. The PaO₂ is also abnormal. Given the history of acute onset of shortness of breath, the tachypnea, the prominent second heart sound, and the elevated D-dimer level, as well as the history of recent surgery, pulmonary embolism (PE) is at the top of the differential diagnosis. **What is the next step in the diagnostic workup?**

DISCUSSION

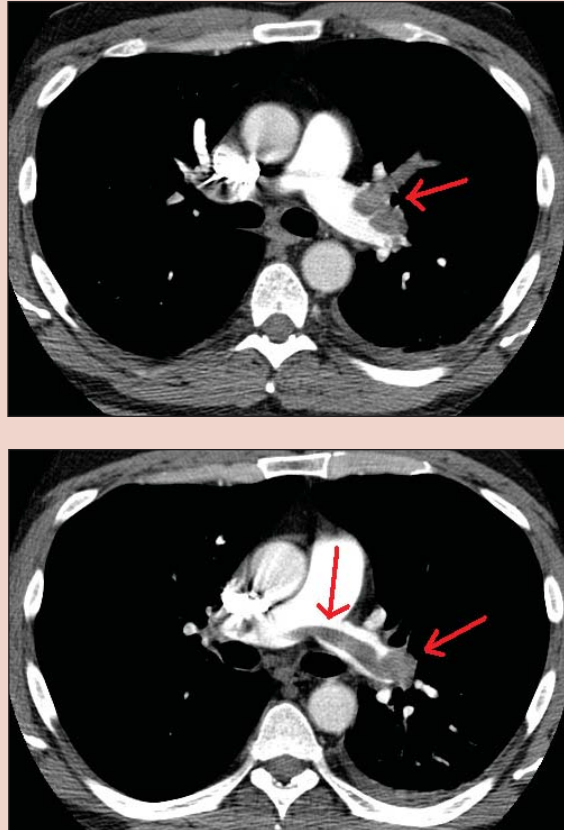
Radiology is very useful when PE is suspected, and the techniques for diagnosis have improved over the years. The modalities now used in evaluating for PE include chest radiography, nuclear medicine lung ventilation/perfusion scanning (V/Q scanning), CT of the chest (PE protocol), and pulmonary angiography. Adjunctive venous ultrasonography (US) is also used to locate a deep venous thrombosis (DVT) in the extremities. Rapid, accurate diagnosis is important since the mortality rate for PE is around 30% if the condition is left untreated. With treatment, this rate can be decreased to approximately 8%.¹

Chest radiography can be helpful. Many patients with PE have normal chest radiography findings, but the chest film can be helpful to rule out other possible causes of the symptoms, such as pneumothorax or pneumonia. Radiographic findings associated with PE may include focal atelectasis, a wedge-shaped density in the periphery of the lung that abuts the pleura (Hampton's hump), or localized peripheral oligemia with distended proximal vessels (Westermark's sign). Chest radiography can also aid the radiologist in interpreting the V/Q scan.

With V/Q scanning, a radioisotope is injected to perfuse the lungs through the bloodstream before images are taken. This is the perfusion segment of the test. For

The author practices in a radiology group at North Oaks Health System, Hammond, La. She has indicated no relationships to disclose relating to the content of this article.

FIGURE 1



These images show a large pulmonary embolus within the left main pulmonary artery and partially extending into the right main pulmonary artery.

the ventilation component, the patient inhales an aerosolized radioisotope before images are taken of the lungs. The radiologist compares the perfusion and ventilation images, looking for any defects in perfusion and whether the ventilation images reveal a matched or mismatched defect. A mismatch is suggestive of PE.

Results usually embody the criteria from the Prospective Investigation of Pulmonary Embolism Diagnosis study and are interpreted as normal or low, intermediate (or indeterminate), or high probability for thromboembolism. A normal result essentially excludes PE. A high-probability result, especially when combined with

clinical suspicion of PE, points to PE. Low- and intermediate-probability results are more uncertain indicators and usually mean that further evaluation is needed, especially when clinical suspicion for PE is high. It has been reported that 12% of patients with a low-probability V/Q scan and up to 30% of patients with an intermediate-probability scan have PE.²

CT of the chest has become increasingly popular for detecting PE. This imaging technique is fast, is relatively noninvasive (requiring IV access), and has a sensitivity and specificity approaching those of the gold standard test, pulmonary angiography. IV contrast is injected, and CT images are taken through the chest as the contrast flows through the pulmonary arteries and their branches. Emboli manifest as intraluminal filling defects or nonopacified arteries (see Figure 1, page 56). CT is very sensitive for detecting emboli in the main, lobar, and segmental pulmonary arteries but is limited in detecting subsegmental emboli (those in the smaller, more peripheral vessels). Many institutions have replaced V/Q scanning with CT as their test of choice for PE.

Pulmonary angiography has a very high sensitivity and specificity, but with the advances in CT, pulmonary angiography is not performed as often as it used to be. It is an invasive procedure involving catheterization of the pulmonary arteries, and even though the injection

of contrast media carries risks, the complication rate is low. Angiography may be especially useful when findings on CT or other imaging techniques are inconclusive but clinical suspicion of PE remains high or when the patient is being considered for catheter-directed fibrinolytic therapy or embolectomy.

Venous ultrasonography of the lower extremities does not confirm a diagnosis of PE, but sometimes this test is used because approximately 90% of PEs develop from DVT of the lower extremities.³ Because treatment for DVT and PE are the same, a positive US result may negate the need for further evaluation. A negative US result, however, does not exclude PE. If necessary, this fast and relatively inexpensive test can be done at the patient's bedside.

A number of modalities can be used to evaluate a patient with suspected PE, and the route chosen may depend on the availability of the various tests, the hospital's and supervising physician's preferred method, and the patient's condition. □

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Politics and the PA *Continued from page 22*

From planting signs in yards, to labeling envelopes, to knocking on doors and speaking to neighbors, successful campaigns require the efforts of many volunteers, and the duties don't usually require any specialized skill or political savvy. By devoting a little time to accomplishing these tasks for a chosen candidate, PAs can help shape the composition of the school board, state legislature, or other elected body that makes decisions that affect the health of those in the community. Campaigns also require money to get their messages heard in our crowded media landscape. While few of us have the means to make four-figure pledges to multiple candidates, even small contributions will be appreciated and remembered, especially by candidates for local office.

For a few special PAs, devoting a part of their time and income to campaigns is not enough. Their drive to help their communities calls them to give politics their all and run for office themselves. PAs in California, New Hampshire, and North Carolina have been successful in winning seats in their state legislatures. The same qualities that all PAs have to offer in the political realm—teamwork skills, specialized knowledge of health issues, and insight into human behavior—have allowed these

PAs to become successful lawmakers. They show by example that it is possible to combine the roles of politician and PA, but be forewarned: just like being a PA, running a successful campaign and serving in a legislature take dedication, perseverance, and a whole lot of hard work. Nonetheless, for those with the energy and motivation, it might be the best way to help their communities on a wide range of issues.

PAs help individual patients on a daily basis and, over time, can improve the health of whole communities from their clinics. But PAs also have much to offer their communities outside of the workplace. Engaging in political activity is a key way for PAs to spread their unique knowledge and their keen judgment on health care issues. By taking the time to express your support for a positive piece of legislation, plant a candidate's sign in your yard, or visit your member of Congress, you can help build the political influence of the profession and, more important, support political decisions that will improve the health of Americans. You'll find it more productive, more rewarding, and certainly more interesting than watching another of those endless political ads. □

REFERENCE

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