

1634 patients have nondiagnostic scans, and fewer than one-half of patients with angiographically confirmed PE have a high probability scan. As many as 40% of patients with high clinical suspicion for PE but “low-probability” scans do, in fact, have PE at angiography.

MAGNETIC RESONANCE (MR) (CONTRAST-ENHANCED) IMAGING When ultrasound is equivocal, MR venography with gadolinium contrast is an excellent imaging modality to diagnose DVT. MR pulmonary angiography may detect large proximal PE but is not reliable for smaller segmental and subsegmental PE.

ECHOCARDIOGRAPHY Echocardiography is *not* a reliable diagnostic imaging tool for acute PE because most patients with PE have normal echocardiograms. However, echocardiography is a very useful diagnostic tool for detecting conditions that may mimic PE, such as acute myocardial infarction, pericardial tamponade, and aortic dissection. Transthoracic echocardiography rarely images thrombus directly. The best-known indirect sign of PE on transthoracic echocardiography is McConnell’s sign: hypokinesis of the RV free wall with normal or hyperkinetic motion of the RV apex. One should consider transesophageal echocardiography when CT scanning facilities are not available or when a patient has renal failure or severe contrast allergy that precludes administration of contrast despite premedication with high-dose steroids. This imaging modality can identify saddle, right main, or left main PE.

Invasive Diagnostic Modalities • PULMONARY ANGIOGRAPHY Chest CT with contrast (see above) has virtually replaced invasive pulmonary angiography as a diagnostic test. Invasive catheter-based diagnostic testing is reserved for patients with technically unsatisfactory chest CTs and for those in whom an interventional procedure such as catheter-directed thrombolysis is planned. A definitive diagnosis of PE depends on visualization of an intraluminal filling defect in more than one projection. Secondary signs of PE include abrupt occlusion (“cut-off”) of vessels, segmental oligemia or avascularity, a prolonged arterial phase with slow filling, and tortuous, tapering peripheral vessels.

CONTRAST PHLEBOGRAPHY Venous ultrasonography has virtually replaced contrast phlebography as the diagnostic test for suspected DVT.

Integrated Diagnostic Approach An integrated diagnostic approach (Fig. 300-3) streamlines the workup of suspected DVT and PE (Fig. 300-6).

TREATMENT DEEP VEIN THROMBOSIS

PRIMARY THERAPY

Primary therapy consists of clot dissolution with pharmacomechanical therapy that usually includes low-dose catheter-directed thrombolysis. This approach is reserved for patients with extensive femoral, iliofemoral, or upper extremity DVT. The open vein hypothesis postulates that patients who receive primary therapy will sustain less long-term damage to venous valves, with consequent lower rates of postthrombotic syndrome. A National Heart, Lung, and Blood Institute–sponsored randomized controlled trial called ATTRACT (NCT00790335) is testing this hypothesis.

SECONDARY PREVENTION

Anticoagulation or placement of an inferior vena caval filter constitutes secondary prevention of VTE. To lessen the severity of postthrombotic syndrome of the legs, below-knee graduated compression stockings may be prescribed, 30–40 mmHg, for 2 years after the DVT episode. They should be replaced every 3 months because they lose their elasticity.

TREATMENT PULMONARY EMBOLISM

RISK STRATIFICATION

Hemodynamic instability, RV dysfunction on echocardiography, RV enlargement on chest CT, or elevation of the troponin level

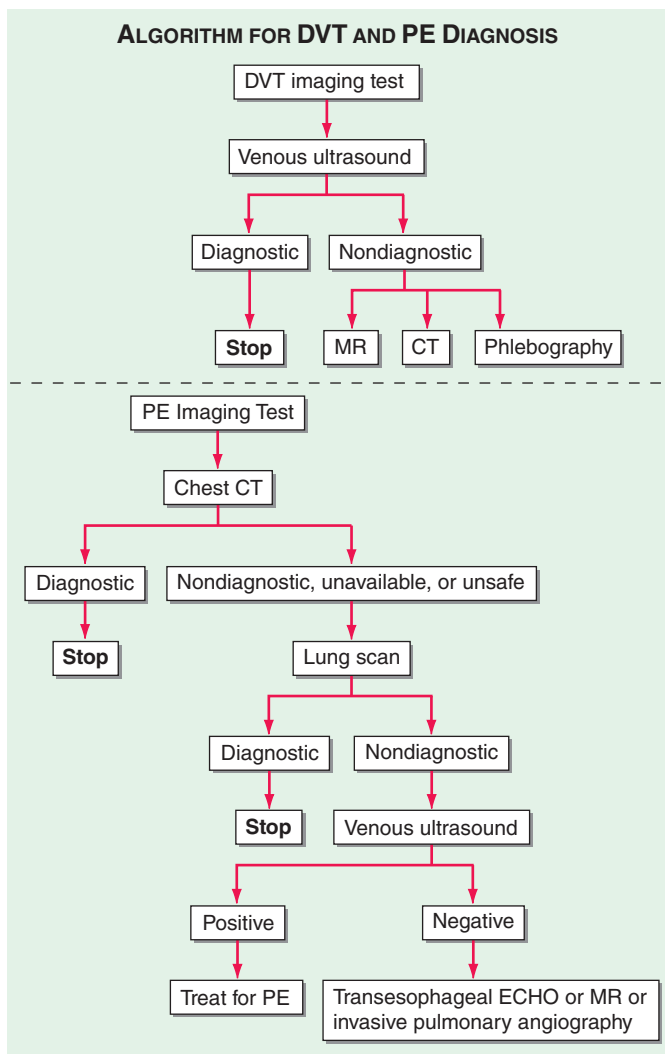


FIGURE 300-6 Imaging tests to diagnose DVT and PE. ECHO, echocardiography.

due to RV microinfarction portend a high risk of an adverse clinical outcome. When RV function remains normal in a hemodynamically stable patient, a good clinical outcome is highly likely with anticoagulation alone (Fig. 300-7).

ANTICOAGULATION

Effective anticoagulation is the foundation for successful treatment of DVT and PE. There are three options: (1) the conventional strategy

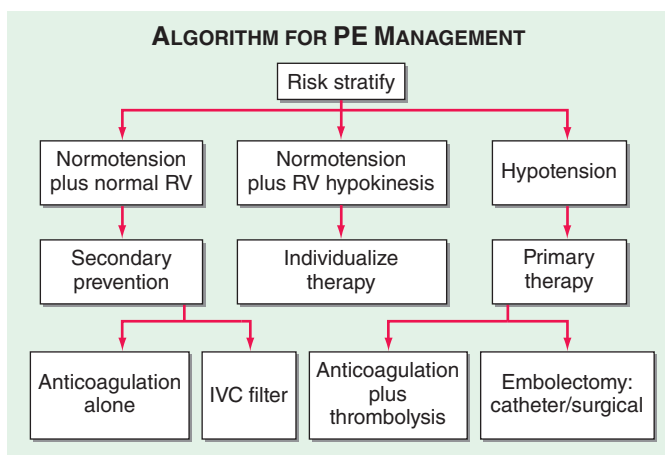


FIGURE 300-7 Acute management of pulmonary thromboembolism. RV, right ventricular; IVC, inferior vena cava.