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Best Clinical Practice

BEST CLINICAL PRACTICE: CONTROVERSIES IN OUTPATIENT MANAGEMENT OF ACUTE PULMONARY EMBOLISM

Brit Long, MD* and Alex Koyfman, MD†

*Department of Emergency Medicine, San Antonio Military Medical Center, Fort Sam Houston and †Department of Emergency Medicine, The University of Texas Southwestern Medical Center, Dallas, Texas

Corresponding Address: Brit Long, MD, 3841 Roger Brooke Dr, Fort Sam Houston, TX 78234

☐ **Abstract—Background: Pulmonary embolism (PE) is a common condition managed in the emergency department (ED), with a wide range of morbidity and mortality. Patients are classically admitted for treatment and monitoring of anticoagulation. Objective: We sought to evaluate the controversy concerning outpatient therapy for patients with acute PE and investigate the feasibility, safety, and efficacy of outpatient management. Discussion: Patients with venous thromboembolism have historically been admitted for treatment and monitoring for concern of worsening disease or side effects of anticoagulation (bleeding). More than 90% of EDs admit patients with PE in the United States. However, close to 50% of patients may be appropriate for discharge and outpatient therapy. The published literature suggests that outpatient treatment is safe, feasible, and efficacious, with similar rates of recurrent venous thromboembolism and all-cause mortality, especially with novel oral anticoagulants. Multiple scoring criteria can be used, including the Pulmonary Embolism Severity Index (PESI), simplified PESI, Hestia criteria, Geneva Prognostic Score, European Society of Cardiology guidelines, Global Registry of Acute Coronary Events, and Aujesky score. Simplified PESI and the European Society of Cardiology guidelines have high-quality evidence, sufficient sensitivity, and ease of use for the ED. Patients considered for outpatient therapy should possess low hemorrhage risk, adequate social situation, negative biomarkers, ability to comply, and no alternate need for admission. Conclusions: Patients with acute PE are often admitted in the United States, but a significant proportion may be appropriate for discharge. Patients with low risk for adverse events according to clinical scoring criteria, adequate follow-up, ability to comply, and no other need for admission can be discharged with novel oral anticoagulant therapy. Published by Elsevier Inc.**

☐ **Keywords—anticoagulation; novel oral anticoagulant; outpatient; pulmonary embolism; risk stratify; score**

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INTRODUCTION

Epidemiology

Pulmonary embolism (PE) is a common disease diagnosed and managed in the emergency department (ED). The incidence of PE approaches 56 per 100,000 patients, and this increases with age up to 500 per 100,000 patients in those approaching 80 years of age (1–6). Close to 1 in every 500 to 1000 ED patients has PE at any given time (4–6). This disease is associated with significant morbidity and mortality, with >100,000 deaths annually in the United States (4–6). A significant increase in diagnosis of PE has occurred with increasing use and technological advances in computed tomography (CT). However, the mortality of PE has remained the same despite increased diagnosis (7–9).

Testing

Emergency physicians manage critically ill patients daily, and patients with acute PE can present with hemodynamic instability. The increased diagnosis of PE is related to increased testing, including D-dimer and CT, and

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improved CT technology (7–9). Several strategies have been suggested for PE evaluation (10–12). Studies suggest that instead of reducing morbidity and mortality, physicians may increase patient risk in an attempt to diagnose PE (11,12). One study found that PE testing prevented 6 deaths and 24 major PE-related events, while causing 36 deaths and 37 PE-related harms, such as renal failure caused by contrast, major hemorrhage, and cancer caused by radiation from CT (13). Costs per patient for inpatient PE management ranged from $25,000 to $44,000 in 2006 (14,15). Strategies have been suggested to decrease this potential patient harm and excess cost. Evidence-based diagnostics, such as risk scores, can be used to assist providers in evaluating patients, in association with D-dimer and imaging (10–12). Another option is the use of risk stratification to determine which patients, if any, are appropriate for discharge home with treatment as opposed to inpatient admission and treatment (10–12).

History of Inpatient vs. Outpatient Management

Patients with venous thromboembolism (VTE) have historically been admitted for treatment and monitoring for concern of worsening disease or side effects of anticoagulation (bleeding). More than 90% of EDs admit patients with PE in the United States (1–6,10). Hospitalization led to intravenous unfractionated heparin and oral vitamin K antagonist (VKA) therapy, with at least a 5-day stay to ensure that the international normalized ratio threshold of 2.0 was reached (10,16–19). The advent of low–molecular weight heparins and fondaparinux ushered in an era of home treatment specifically for deep venous thrombosis (DVT) (20–22). These medications are safe and efficacious, while not requiring regular coagulation monitoring. These attributes make home treatment feasible.

Close to one-third of these patients with DVT have an associated PE, which may be asymptomatic or symptomatic (23). In Canada, studies in the early 2000s revealed the safety of outpatient treatment for PE, with a pragmatic evaluation of outpatient management released in 2008 showing that 50% of patients are safely treated at home (20,24,25). However, this is not common in the United States or in other parts of the world (26–28). A 2015 study found that even in the era of novel oral anticoagulants (NOACs), >98% of patients with PE are admitted for inpatient treatment. Less than 2% of these patients are discharged with home treatment (29). In the group selected for home treatment (13 of 746 patients), heparin and warfarin account for 69.2% of treatment, with NOACs accounting for 30.2%. Similar treatment regimens can be used in the admitted group (29). Despite this trend in the United States for inpatient management, studies suggest that close to 50% of patients are appropriate for outpatient management, specifically patients categorized as low risk for adverse outcome (10,30). The recently updated American College of Chest Physicians (ACCP) 2016 guidelines provide a grade 2B recommendation for outpatient management for patients with low-risk PE and adequate home circumstances (10).

Outpatient Treatment Barriers

The majority of centers in the United States admit patients with PE to the hospital. This is primarily because of several barriers, the first being uncertainty in identification of patients at low risk for adverse outcome appropriate for discharge (29,31). Many providers are not comfortable with the use of eligibility criteria for outpatient therapy, because initial studies detailing outpatient treatment were vague with heterogeneous populations, as well as difficulty in uniformly reproducing assessment (32–37). However, recent criteria have shown ease of use, reliability, and predictive capabilities that stratify patients to low risk for adverse events.

Outpatient Treatment Benefits

Several benefits exist for providing outpatient care of PE. Potential improvements in quality of life, increased social function, and improved physical activity are possible with outpatient care (20,29,31,36). Outpatient therapy is also associated with a decreased duration of stay and reduction in overall cost. Estimates show a potential savings of $7 million per year, assuming a $4500 difference in outpatient and inpatient treatment (37,38). Not only can outpatient treatment reduce cost, but it is safe when proper risk stratification is used.

DISCUSSION

The controversy surrounding outpatient PE therapy centers on 3 questions. First, is outpatient treatment for PE inferior to inpatient treatment? Second, is the risk of harm greater with outpatient vs. inpatient therapy? Finally, can patients be treated appropriately as an outpatient, and what tools are present for patient risk stratification?

Outpatient vs. Inpatient Therapy

The literature suggests that outpatient therapy is not inferior to inpatient therapy. A 2011 study by Aujesky et al. found that of 344 patients with acute PE, 1 patient in the outpatient group vs. no patients in the inpatient group