

MANAGEMENT OF ACUTE PULMONARY EMBOLISM

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FOREWORD

Acute pulmonary embolism causes dread among physicians and patients. The diagnosis is often difficult to establish, and the cause is often unclear. Management is controversial, because advice from specialists may be based more upon bias than upon evidence.

Pulmonary embolism is receiving more attention now than ever before. The National Quality Forum is writing guidelines to ensure “best practices” in acute care hospitals. The Joint Commission that accredits US hospitals is planning to issue directives within the next few years to optimize prevention and treatment of pulmonary embolism. In March 2006, the National Comprehensive Cancer Network issued guidelines on treatment of cancer patients with pulmonary embolism. The US Surgeon General’s Office held an unprecedented 2-day symposium in May 2006 on pulmonary embolism. New patient advocacy and self-help groups are emerging throughout the United States. Public service announcements are educating laypersons about pulmonary embolism with respect to risk factors and warning signs. A new nonprofit organization, the North American Thrombosis Forum (www.NATFonline.org) has been established to focus on research, clinical, and public policy issues related to thrombosis. The topic of “clot” has become “hot.”

Pulmonary embolism as a discipline does not “belong” to any single group. It requires collaboration among emergency medicine, internal medicine, cardiology, pulmonary, hematology, and radiology physicians as well as interventional radiologists and cardiologists and cardiac surgeons. Websites provide useful information but are not sufficiently detailed or nuanced to guide complex management decisions. Because of the disparate disciplines involved in the study of pulmonary embolism, coupled with exponentially increasing advances in our understanding of this disease, a scientifically rigorous and contemporary textbook fills an unmet need.

Stavros Konstantinides, MD, is a leader in the field of acute pulmonary embolism. As a cardiologist, he has carried out pioneering work in echocardiography, biomarker elucidation, and thrombolysis of pulmonary embolism. Through the multicenter registries and trials that he has organized, Professor Konstantinides has established a personal connection to a global network of pulmonary embolism specialists. Using his considerable persuasive skills, he has enlisted key experts to take time from their busy schedules to contribute to this outstanding textbook.

Management of Acute Pulmonary Embolism is not a book that will rest for long on the bookshelf. With its recent references, clear-cut tables, and beautiful illustrations, it will serve as a practical compendium for use in daily clinical practice. I plan to take it with me when I am summoned to the Emergency Department, Intensive Care Unit, or when I consult on outpatients with pulmonary embolism. Armed with this textbook, I will have at my fingertips all of the information I need, compiled in 19 superb chapters, to manage any aspect of this illness.

Management of Acute Pulmonary Embolism is organized in three sections: diagnosis, treatment, and special topics. The diagnosis section has up-to-date chapters on clinical evaluation; cardiac biomarkers, including troponin, BNP, and pro-BNP; and imaging,

including the latest technological developments in chest CT scanning and venous ultrasound examination. Importantly, these timely advances are synthesized in two summary chapters. Perrier “puts it all together” for clinically stable patients, and the Editor himself writes a masterpiece chapter with diagnostic algorithms for hemodynamically unstable patients.

The therapy section updates our use of heparin, low-molecular-weight heparin, fondaparinux, warfarin, and thrombolysis, but goes far beyond the usual topics to include novel approaches such as pulmonary embolectomy (now modified to achieve survival rates that exceed 90%) and new devices for suction catheter embolectomy. A controversial chapter in this section more or less advocates thrombolysis for pulmonary embolism patients undergoing cardiopulmonary resuscitation. Although we need not necessarily agree with this philosophy, the author makes his case elegantly and provides “food for thought.”

The final section on special topics will be especially useful in the outpatient setting. How extensive a thrombophilia workup should be undertaken? What are the special considerations for cancer patients who have pulmonary embolism? How should pulmonary embolism be managed during pregnancy? What should we do to prevent a patient from being the 1 in 1 million who boards a long-haul air flight and collapses and dies from pulmonary embolism upon deplaning 6–18 h later? Finally, for the 4% of patients who develop chronic thromboembolic pulmonary hypertension after acute pulmonary embolism, how can we optimize their management?

Management of Acute Pulmonary Embolism will receive magnificent reviews and become a best-seller among specialty textbooks. For the medical student or investigator, it is the starting point for future study. For the practicing physician, it is indispensable. I feel privileged to know Professor Konstantinides personally. I congratulate him and express my admiration and gratitude for the strides he has made in the field of acute pulmonary embolism by compiling and editing this important new text.

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PREFACE

Management of venous thromboembolism has long been characterized by a high degree of complexity and a disappointing lack of both efficacy and efficiency. The clinical symptoms and signs of acute pulmonary embolism (PE) are notoriously nonspecific, and ubiquitously available bedside tests such as the ECG, chest X-ray, and clinical chemistry can offer little assistance apart from strengthening or weakening the clinical suspicion. Thus, for almost 30 years, confirmation of the diagnosis relied on ventilation-perfusion lung scan and/or pulmonary angiography. However, scintigraphy frequently yields nondiagnostic findings, and pulmonary angiography is an invasive procedure that may place the patient at risk of life-threatening complications besides requiring local expertise and sophisticated logistics to be readily available on an around-the-clock basis. These risks and limitations of individual tests led to the development of complex multistep diagnostic algorithms, which were successfully tested in well-designed management studies but have proven extremely difficult to implement in clinical practice. As a result, the diagnosis of potentially life-threatening PE was frequently missed in many patients who subsequently died of the disease without receiving appropriate treatment, while other patients unnecessarily underwent a battery of potentially hazardous, time-consuming, and costly procedures because of a vague, poorly documented clinical suspicion.

Luckily, things are now beginning to look better for patients with PE, and for the physicians caring for them. The recent development of structured models for assessment of clinical pretest probability, the widespread use of D-dimer testing in the hospital and the outpatient setting, and the enormous technical advances of multidetector-row CT scan, are radically changing our approach to patients with suspected PE. These modalities form the basis for contemporary diagnostic algorithms that are not only efficient and reliable, but also simple, fast, noninvasive, and “user-friendly.” Furthermore, the prognostic importance of right ventricular (RV) dysfunction has been recognized, and a number of studies have demonstrated the value of echocardiography and laboratory biomarkers for risk stratification of PE. Simplified treatment regimens using low-molecular-weight heparins are now available for hemodynamically stable patients with PE, while early thrombolysis and technical advances in surgical and interventional treatment permit successful removal of thrombus in massive PE.

Pulmonary embolism is of interest (and importance) to physicians of almost all disciplines, being encountered across the entire spectrum of clinical medicine. In *Management of Acute Pulmonary Embolism*, traditional, novel, and evolving aspects related to the diagnosis and treatment of PE are highlighted by an international team of experts who have significantly contributed to the advances in this exciting field. The book is divided into three parts. The first part focuses on the contemporary diagnostic approach to the patient with suspected PE and begins with a critical review of currently used models for assessing clinical probability, and the utility of D-dimer testing. Next, the imaging procedures for visualizing pulmonary thromboemboli are presented, placing

emphasis on the emerging role of spiral CT as the new diagnostic gold standard, but also emphasizing the importance and practicability of an early noninvasive ultrasound evaluation of the leg veins. Risk stratification of pulmonary embolism is, as mentioned above, evolving into an important determinant of successful PE management, and three chapters are devoted to biochemical and imaging tests allowing detection of right ventricular dysfunction, and of a patent foramen ovale. Finally, in Chapters 7 and 8, our current state of knowledge is summarized in up-to-date diagnostic algorithms. These are aimed at helping the clinician walk through the individual tests and find the fastest and most efficient pathway for confirmation or exclusion of PE both in hemodynamically stable and in unstable patients, always considering the logistics and expertise available on site.

The second part provides an update of the therapeutic options for patients with PE. Contemporary regimens of anticoagulation with unfractionated and low-molecular-weight heparins are presented and discussed, as is the intensity and optimal duration of oral anticoagulation for secondary prophylaxis, the controversial topic of thrombolysis in PE, and the advantages of early surgical embolectomy provided that the appropriate setup is available. In this section, emphasis is also placed on the management of patients with fulminant PE undergoing cardiopulmonary resuscitation, explaining the scientific background favoring aggressive use of thrombolysis in this setting and the potential to save lives in a seemingly desperate situation. Furthermore, the recent technical advances in interventional (catheter-based) thrombus aspiration are presented, a therapeutic option that may yield impressive results at the hands of a skilled interventionalist.

The third part of the book deals with those specific aspects which make venous thromboembolism such a unique disease requiring multidisciplinary management strategies. A number of highly relevant and controversial topics are critically discussed, including the need for thrombophilia screening after diagnosis of PE, the association between PE and cancer, and the true magnitude of PE-related risk in “economy-class” passengers. A detailed chapter is devoted to the care of pregnant patients with acute PE and to secondary prophylaxis of PE in pregnancy, a particularly sensitive area of research and clinical practice for which little direct evidence and no formal guidelines exist. Finally, a comprehensive review focuses on the management of chronic thromboembolic pulmonary hypertension, the feared long-term complication of PE that may not be as rare and elusive as previously thought.

Writing a book on a rapidly evolving field poses a tremendous challenge, since such an effort bears the risk of providing outdated, overhauled information if the book cannot be completed within a relatively short period of time. I am therefore particularly thankful to each one of the authors who took every effort not only to present and discuss their topic in the best possible manner but also to meet the publication deadline, which makes it possible to present a really *contemporary* overview of PE management. I hope that the reader will find *Management of Acute Pulmonary Embolism* as informative and enjoyable as I did throughout this exciting process.

Stavros V. Konstantinides, MD

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