Trends in In-Hospital Deaths Among Hospitalizations With Pulmonary Embolism

Pulmonary embolism (PE) is a potentially life-threatening condition that typically occurs when a thrombus from deep veins in the leg, pelvis, arms, or heart embolizes to the lungs. Recent data linked PE to approximately 247,000 hospitalizations in the United States in 2006. To our knowledge, the case-fatality rate and estimated number of in-hospital deaths among a national representative example of hospitalizations that encompass first-listed and any-listed PE diagnoses in the United States are limited. Therefore, we report nationally representative estimates of in-hospital deaths (ie, annual number and case-fatality rate) among hospitalizations with a PE diagnosis (ie, first-listed and any-listed) in the United States by analyzing data from the 2001-2008 National Hospital Discharge Survey (NHDS).

Methods. The NHDS is conducted annually by the National Center for Health Statistics, Centers for Disease Control and Prevention, Atlanta, Georgia, to collect demographic and medical information on a sample of hospitalizations from a national probability selection of hospitals in the 50 states and the District of Columbia. All survey procedures involving human subjects and confidentiality were reviewed and approved by the Research Ethics Review Board of the National Center for Health Statistics. The NHDS assigns each sampled hospitalization a maximum of 7 diagnostic codes based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Pulmonary embolism was identified using ICD-9-CM codes 415.1x, 634.6x, 635.6x, 636.6x, 637.6x, 638.6, and 673.2x. The first-listed code is a principal diagnosis. We limited our analysis to a sample of nonnewborn hospitalizations with a first-listed (n=8990) or any-listed (n=14,721) PE diagnosis.

To assess in-hospital deaths with a first-listed or an any-listed PE diagnosis during the study period and to ensure adequate subgroup size, we calculated the annual number of deaths and case-fatality rates for the following 2-year periods: 2001-2002, 2003-2004, 2005-2006, and 2007-2008. We performed orthogonal polynomial contrasts to test linear trends in the proportions of case fatality across these periods. We accessed the data via the Research Data Center and used SPSS 19 Complex Samples for Survey Analysis (IBM Corp) and Stata 11 (StataCorp LP) to perform the data management and analyses to account for complex sample survey design.

Results. Among hospitalizations in the United States during 2001-2002, 2003-2004, 2005-2006, and 2007-2008, the estimated annual number of in-hospital deaths were 5870, 5140, 5440, and 3600, respectively, for first-listed PE and 17,920, 14,870, 17,600, and 18,560, respectively, for any-listed PE (Figure). The case-fatality rates (ie, number of deaths per 100 hospitalizations) declined linearly across the 4 defined study periods (P < .05).
for linear trend); they were 5.9%, 4.2%, 3.8%, and 2.4%, respectively, for first-listed PE and 11.4%, 7.8%, 7.8%, and 7.1%, respectively, for any-listed PE (Figure).

Comment. Because of the scope of this article, we report several overall estimates of in-hospital deaths with a first-listed and an any-listed PE diagnosis in the United States during 2001-2008 that were not available previously. The annual number of deaths ranged from 3600 to 5870 and from 14 870 to 18 560 among hospitalizations with a first-listed PE diagnosis and an any-listed PE diagnosis, respectively. Despite the decline in the overall case-fatality rate of hospitalizations with a PE diagnosis, we did not find a corresponding reduction in the numbers of in-hospital deaths, especially among those with a first-listed PE diagnosis. Although the exact reasons for the decline in case-fatality rates were unknown and may warrant further investigation, the decrease may be multifaceted and could be attributable to a combination of an increased number of PE diagnoses resulting from improved diagnostic techniques together with more effective treatment and fewer complications.7,8

Regardless of an overall decline in the case-fatality rate in hospitalizations related to PE during the study period, the annual number of in-hospital deaths remains relatively stable, especially for any-listed PE. As the US population is aging, reducing the number of in-hospital deaths from PE and improving patients’ quality of life are important clinical and public health goals and pose a formidable challenge for the health care systems. The decline in the case-fatality rate stabilized during the periods of 2005-2006 and 2007-2008 in hospitalizations with any-listed PE. Therefore, our results provide support for identifying and implementing effective preventive strategies among hospitalized patients.

Our research has some limitations. Although we evaluated in-hospital deaths with a diagnosis of PE, PE cases may be underreported because (1) asymptomatic patients with PE and other comorbid conditions might be undiagnosed and (2) a misdiagnosed PE or a PE diagnosis was not made before death occurred. Nonetheless, our study represents an important effort to characterize PE-related mortality burden in US hospitals.

In conclusion, the estimated annual number of in-hospital deaths among hospitalizations with a diagnosis of PE remained relatively stable during 2001-2008, despite the decline in the case-fatality rates for the same period. Therefore, PE remains an important clinical and public health concern in the United States. Moreover, clinicians and hospitals should be able to effectively identify and treat patients with PE and their comorbid medical conditions. Furthermore, the growing number of patients with PE in the hospital setting highlights the need for improving the diagnosis and management of PE in this setting.7,8