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Vena Caval Filter Utilization and Outcomes in Pulmonary Embolism

Medicare Hospitalizations From 1999 to 2010

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ABSTRACT

BACKGROUND Inferior vena caval filters (IVCFs) may prevent recurrent pulmonary embolism (PE). Despite uncertainty about their net benefit, patterns of use and outcomes of these devices in contemporary practice are unknown.

OBJECTIVES The authors determined the trends in utilization rates and outcomes of IVCF placement in patients with PE and explored regional variations in use in the United States.

METHODS In a national cohort study of all Medicare fee-for-service beneficiaries ≥65 years of age with principal discharge diagnoses of PE between 1999 and 2010, rates of IVCF placement per 100,000 beneficiary-years and per 1,000 patients with PE were determined. The 30-day and 1-year mortality rates after IVCF placement were also investigated.

RESULTS Among 556,658 patients hospitalized with PE, 94,427 underwent IVCF placement. Between 1999 and 2010, the number of PE hospitalizations with IVCF placement increased from 5,003 to 8,928, representing an increase in the rate per 100,000 beneficiary-years from 19.0 to 32.5 ($p < 0.001$ for both). As the total number of PE hospitalizations increased (from 31,746 in 1999 to 54,392 in 2010), the rate of IVCF placement per 1,000 PE hospitalizations did not change significantly (from 157.6 to 164.1, $p = 0.11$). Results were consistent across demographic subgroups, although IVCF use was higher in blacks and patients ≥85 years of age. IVCF utilization varied widely across regions, with the highest rate in the South Atlantic region and the lowest rate in the Mountain region.

CONCLUSIONS In a period of increasing PE hospitalizations among Medicare fee-for-service beneficiaries, IVCF placement increased as utilization rates in patients with PE remained greater than 15%. Mortality associated with PE hospitalizations is declining, regardless of IVCF use. (J Am Coll Cardiol 2016;67:1027–35)

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ABBREVIATIONS AND ACRONYMS

FFS = fee-for-service

ICD-9-CM = International Classification of Diseases-Ninth Revision-Clinical Modification

IVCF = inferior vena caval filter

PE = pulmonary embolism

Inferior vena caval filters (IVCFs) are an advanced therapy for pulmonary embolism (PE) with uncertain net benefit. IVCFs can prevent recurrent PE (1), but this benefit might be offset by procedural and longer term device-related complications such as recurrent deep vein thrombosis and post-thrombotic syndrome. The available randomized controlled trials have not shown a mortality benefit associated with the use of IVCFs (1–4). Expert guidelines recommend the use of IVCFs for cases with contraindications to anticoagulation or with recurrent PE despite receiving anticoagulation (5–7). Given the equivocal data for risks and benefits, clinical equipoise for use of IVCFs has persisted (8–11).

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Older adults may represent a population in which IVCF utilization is common despite the uncertainties surrounding clinical benefit. Age and medical comorbidities place older adults at higher risk for the development of PE, as well as its complications, including right ventricular dysfunction (12) and death (12–15). Meanwhile, older adults are less likely to receive alternative therapies such as thrombolytic therapy (12,16,17), because of concerns for hemorrhagic complications, or surgical thrombectomy because of a high prevalence of multiple comorbidities. These factors, as well as recent technological advances in IVCF design (18) may have increased the use of IVCFs over time. Accordingly, we assessed the utilization rates and outcomes of IVCF placement among all Medicare fee-for-service (FFS) beneficiaries ≥65 years of age in the United States from 1999 to 2010 and also examined regional variations in IVCF use.

METHODS

DATA SOURCE. We used the 100% Medicare enrollment file from the Centers for Medicare & Medicaid Services to identify all Medicare FFS beneficiaries ≥65 years of age from 1999 through 2010 with at least 1 month of enrollment who resided in and were hospitalized in the United States. For each year, we counted the total number of beneficiaries and calculated person-years for beneficiaries to account for new enrollment, disenrollment, or death during the study period. We then linked the person-years beneficiary data with the inpatient claims data to identify all FFS beneficiaries with principal discharge diagnoses of PE who underwent IVCF placement from January 1, 1999, through December 31, 2010. The Medicare inpatient claims data encompass procedural and diagnostic information for hospitalizations based on the International Classification of Diseases-Ninth Revision-Clinical Modification (ICD-9-CM), as well as demographics and dates of hospital admission and discharge. Death was determined through the Medicare enrollment file, which includes information on out-of-hospital mortality.

PATIENTS. We included patients with principal ICD-9-CM discharge diagnoses of PE using the following codes: 415.1X (pulmonary embolism and infarction), 415.11 (iatrogenic pulmonary embolism and infarction), 415.13 (saddle embolus of pulmonary artery), and 415.19 (other pulmonary embolism and infarction). We excluded patients with principal discharge diagnoses of septic pulmonary embolism (415.12). For patients with multiple hospitalizations (5.7% in 1999 and 2.5% in 2010) for PE in each given year, we randomly selected 1 hospitalization. Among patients with principal ICD-9-CM discharge diagnoses of PE, we used ICD-9-CM procedure codes to identify those who received IVCFs (38.7) during the index PE hospitalization.

OUTCOME MEASURES. We determined the number of hospitalized patients with PE who received IVCFs in each year during the study period and reported the rates of PE hospitalizations with IVCF placement per 100,000 person-years of Medicare FFS beneficiaries. Furthermore, to provide a clinically meaningful denominator for the use of IVCFs, we determined the number of patients with principal discharge diagnoses of PE in each year. Using the PE hospitalizations with IVCF placement as the numerator, we calculated the rate of IVCF use per 1,000 patients with principal discharge diagnoses of PE. Among patients receiving IVCFs, we determined the rates of in-hospital, 30-day, 6-month, and 1-year all-cause death. Time zero for all deaths was the date of IVCF placement, and mortality rates are reported as percentages. We determined the length of hospital stay and trends in utilization rate and outcomes of IVCF placement from 1999 to 2010. We also determined the utilization of IVCFs across 9 U.S. census regions.

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