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Prophylactic inferior vena cava filters in patients with fractures of the pelvis or long bones

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ABSTRACT

Background: Which patients with fractures, if any, have a lower mortality with prophylactic inferior vena cava filters has yet to be established. The purpose of this investigation is to determine if patients with low-risk fractures might benefit from a prophylactic inferior vena cava filter.
Methods: Administrative data was analyzed from the National (Nationwide) Inpatient Sample using ICD-9-CM codes. Included patients were aged 18 years or older with a primary diagnosis of non-complex fracture of the pelvis, or fracture of the femuralone, or fracture of the tibia and/or fibula.
Results: From 2003–2012, 1,479,039 patients were hospitalized with low-risk fracture. The vast majority of patients with fracture, 1,461,378 of 1,479,039 (98.8%) did not receive an inferior vena cava filter. Among those who did not receive a filter, 1,446,489 of 1,461,378 (99.0%) did not develop deep venous thrombosis or pulmonary embolism. Pulmonary embolism without a filter occurred in 7207 of 1,461,378 (0.5%) and deep venous thrombosis occurred in 7682 of 1,461,378 (0.5%). Total in-hospital all-cause mortality in those who did not receive a filter was 15,683 of 1,461,378 (1.1%). An inferior vena cava filter was inserted in 17,661 of 1,479,039 (1.2%) of patients with fractures. Most of those who received an inferior vena cava filter, 12,025 of 17,661 (68.1%) did not develop pulmonary embolism or deep venous thrombosis. Total in-hospital all-cause mortality in all patients with an inferior vena cava filter was 516 of 17,661 (2.9%).
Conclusion: The evidence is *against* the use of a prophylactic inferior cava vena filter in patients with a non-complex pelvic fracture or single fracture of the femur or fracture of the tibia and/or fibula.

1. Background

Inferior vena cava filters are inserted prophylactically in a large proportion of patients who receive them.[1] One of the challenges of the use of inferior vena cava filters for prophylaxis is to determine categories of patients who may not benefit from prophylactic filters in order to limit unnecessary placements.[2] Patients with fractures of the pelvis or long bones, intuitively, would be a group who might benefit from prophylactic inferior vena cava filters because the risk of venous thromboembolism is transient, anticoagulant prophylaxis may be contraindicated, and compression devices may be difficult to apply. Retrievable inferior vena cava filters would be appealing in patients with fractures. The purpose of this investigation is to determine the prevalence of use of prophylactic inferior vena cava filters and mortality with and without filters in patients with non-complex pelvic fractures or single fractures of the femur or fractures of the tibia and/or fibula. Our goal is to determine if such patients with fractures might benefit from a prophylactic inferior vena cava filter.

2. Methods

Administrative data was analyzed from the National (Nationwide) Inpatient Sample (NIS), Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality, 2003 through 2012.[3] The NIS provides information on approximately 8 million inpatient stays yearly from about 1000 hospitals. The NIS is designed to approximate a 20% sample of United States non-Federal, short-term, general, and other specialty hospitals.[3]

Beginning with data from 2012, the NIS was redesigned to improve national estimates. To highlight the design change, beginning with 2012 data, the database was renamed from the "*Nationwide* Inpatient Sample" to the "*National* Inpatient Sample." The NIS is now a sample of discharge records from all Healthcare Cost and Utilization Project-participating hospitals, rather than a sample of hospitals from which all discharges were retained.[3]

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We analyzed the prevalence of pulmonary embolism and deep venous thrombosis and in-hospital all-cause mortality according to the prophylactic use of inferior vena cava filters among patients hospitalized with a primary (first-listed) diagnosis of fracture of the pelvis, femur alone or fracture of the tibia and/or fibula.

Included patients were adults (≥aged 18 years) of both genders and all races hospitalized in short-stay hospitals from all regions of the United States. We assume that patients with a first-listed diagnosis of fracture were admitted to the hospital because of the fracture.

The International Classification of Diseases-9-Clinical Modification (ICD-9-CM) Codes for deep venous thrombosis, pulmonary embolism, fractures of the pelvis, femur, tibia and/or fibula and the procedure code for vena cava filter are shown in Table 1. Exclusions were patients with complex fractures of the pelvis (ICD-9-CM codes 808.43, 808.44, 808.53, 808.54), patients with 2 or more long bone fractures, and patients with a pelvic fracture in combination with 1 or more long bone fractures.

2.1. Statistical methods

Descriptive statistics were used. Differences of categorical variables were calculated by Fisher's two-tailed exact test using GraphPad Software (San Diego, CA). Means and 95% confidence intervals (CI) were calculated using Graphpad Quickcalcs (Graphpad, San Diego, California). Linear regression analyses were performed using SPSS Version 22 for Windows (SPSS Inc., Chicago, IL).

3. Results

From 2003–2012, 1,479,039 patients were hospitalized with fracture of the pelvis, femur or tibia. Age was 62 ± 23 years (mean ± standard deviation). Females were 58.8%. Most, 77.4%, were white, and 9.4% were black.

The distribution of fractures was pelvis (36.1%), femur (28.9%), and tibia (35.0%). The proportion receiving an inferior vena cava filter was pelvis (1.6%), femur (1.4%), and tibia and/or fibula (0.6%) ($P < 0.0001$ pelvis compared with tibia and/or fibula and, femur compared with tibia and/or fibula; $P = 0.01$ pelvis compared to femur).

3.1. No inferior vena cava filter

The vast majority of patients with fracture, 1,461,378 of 1,479,039 (98.8%) did not receive an inferior vena cava filter. Among those who did not receive a filter, 1,446,489 of 1,461,378 (99.0%) did not develop deep venous thrombosis or pulmonary embolism (Table 2). Pulmonary embolism in those who did not receive an inferior vena cava filter occurred in 7207 of 1,461,378 (0.5%) and deep venous thrombosis occurred in 7682 of 1,461,378 (0.5%).

All-cause in–hospital mortality among patients who did not receive an inferior vena cava filter was 15,683 of 1,461,378 (1.1%) (95% CI 1.1–1.1). Among those who did not receive an inferior vena cava filter and did not develop pulmonary embolism or deep venous thrombosis, all-cause in-hospital mortality was 14,719 of 1,446,489 (1.0%) (Table 2). Among those who did not receive an inferior vena cava filter and developed pulmonary embolism, all-cause in-hospital mortality was 860 of 7207 (11.9%). Among those who did not receive an inferior vena cava filter and developed deep venous thrombosis all-cause in-hospital mortality was 104 of 7682 (1.4%).

Mortality in those who did not receive an inferior vena cava filter increased with age in those with neither pulmonary embolism nor deep venous thrombosis (Fig. 1) and it increased with age in those with pulmonary embolism (Fig. 2). Mortality decreased from 1.1% in 2003 to 0.9% in 2012 in those with no inferior vena cava filter and no pulmonary embolism or deep

Table 1
ICD-9-CM used.

Condition	ICD 9 CM Code
Fracture of pelvis	
Closed fracture of acetabulum	808.0
Open fracture of acetabulum	808.1
Closed fracture of pubis	808.2
Open fracture of pubis	808.3
Closed fracture of other specified part of pelvis	808.4
Open fracture of other specified part of pelvis	808.5
Fracture of femur	
Fracture of shaft or unspecified part of femur closed	821.0
Fracture of shaft or unspecified part of femur open	821.1
Fracture of lower end of femur closed	821.2
Fracture of lower end of femur open	821.3
Fracture of tibia and/or fibula	
Fracture of upper end of tibia and/or fibula closed	823.0
Fracture of upper end of tibia and/or fibula open	823.1
Fracture of shaft of tibia and /or fibula closed	823.2
Fracture of shaft of tibia and /or fibula open	823.3
Fracture of tibia and/or fibula, torus fracture	823.4
Deep venous thrombosis	
Phlebitis and thrombophlebitis of deep veins of lower extremities	451.1
Phlebitis and thrombophlebitis of lower extremities, unspecified	451.2
Other venous embolism and thrombosis of inferior vena cava	453.2
Acute venous embolism and thrombosis of deep vessels of lower extremity	453.4
Pulmonary embolism	
Pulmonary embolism and infarction	415.1
Inferior vena cava filter	
Interruption Of vena cava/Insertion of implant or sieve in vena cava	38.7

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