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Prophylactic Inferior Vena Cava Filters Prior to Bariatric Surgery

Insights From the National Inpatient Sample

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ABSTRACT

OBJECTIVES The aim of this study was to determine in-hospital mortality, post-surgical thromboembolic events, and health care costs associated with the placement of prophylactic inferior vena cava filters (IVCFs) prior to bariatric surgery.

BACKGROUND The role of prophylactic IVCFs prior to bariatric surgery is controversial, and the nationwide clinical outcomes associated with this practice are unknown.

METHODS This observational study used the National Inpatient Sample database to identify obese patients who underwent bariatric surgery from January 2005 to September 2015. Using propensity score matching, outcomes associated with patients receiving prophylactic IVCFs prior to their bariatric surgery were compared with those among patients who did not receive IVCFs.

RESULTS A total of 258,480 patients underwent bariatric surgery, of whom 1,047 (0.41%) had prophylactic IVCFs implanted. Patients with prophylactic IVCFs compared with those without IVCFs had a significantly higher rate of the combined endpoint of in-hospital mortality or pulmonary embolism (1.4% vs. 0.4%; odds ratio: 3.75; 95% confidence interval [CI]: 1.25 to 11.30; $p = 0.019$). Additionally, prophylactic IVCFs were associated with higher rates of lower extremity or caval deep vein thrombosis (1.8% vs. 0.3%; odds ratio: 6.33; 95% CI: 1.87 to 21.4; $p < 0.01$), length of stay (median 3 days vs. 2 days; $p < 0.01$), and hospital charges (median $63,000 vs. $37,000; $p < 0.01$).

CONCLUSIONS In this nationwide observational study, prophylactic IVCF implantation prior to bariatric surgery was associated with worse clinical outcomes and increased health care resource utilization.
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About 200,000 bariatric operations are performed annually in the United States (1). Given the increased risk for venous thromboembolism (VTE) in the setting of obesity, post-surgical immobility, and difficulty with weight-based pharmacological deep vein thrombosis (DVT) prophylaxis, inferior vena cava filters (IVCFs) are sometimes placed prophylactically prior to bariatric

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ABBREVIATIONS AND ACRONYMS

CI = confidence interval
DVT = deep vein thrombosis
IQR = interquartile range
IVCF = inferior vena cava filter
LE = lower extremity
OR = odds ratio
PE = pulmonary embolism
VTE = venous thromboembolism

surgery in an attempt to reduce rates of postsurgical pulmonary embolism (PE). This practice is driven further by the fact that an estimated 21% of all perioperative bariatric surgery deaths are due to PE, the leading cause of preventable death (2).

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With no well-designed prospective or randomized controlled trials, the effectiveness of IVCF insertion prior to bariatric surgery for primary prophylaxis against VTE is unknown and controversial (3-5). The Society of Interventional Radiology and the American College of Radiology lend limited support to the practice, while the American College of Chest Physicians opposes it (**Table 1**) (6-9). Additionally, the prophylactic use of IVCFs is considered off label because it lies outside the official recommendation of the U.S. Food and Drug Administration (4).

A PubMed search in August 2017 found no published nationwide studies on the subject. We sought to assess the association of prophylactic IVCFs prior to bariatric surgery with in-hospital clinical outcomes, and health care costs by propensity score-matched comparison using 11 years (2005 to 2015) of national inpatient sample data.

METHODS

STUDY DATA. The study data were obtained from the Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project National Inpatient Sample files between January 2005 and September 2015. The authors designed the study and are responsible for analyzing the data and for the accuracy of the analysis presented. No industry involvement existed in the design, conduct, or analysis of this study.

The National Inpatient Sample is the largest publicly available all-payer health care database, which contains clinical and hospital-specific discharge information for a 20% stratified sample collected from more than 1,000 U.S. nonfederal hospitals. Data are collected from more than 7 million hospital discharges annually and can be used to estimate approximately 35 million hospitalizations annually. Using an Agency for Healthcare Research and Quality sampling and weighting method, the National Inpatient Sample data were used to calculate national estimates of the entire U.S. population of hospitalized patients (10).

STUDY POPULATION. Bariatric surgery patients for weight loss were identified using the International Classification of Diseases-Ninth Revision procedure codes for laparoscopic gastric bypass (44.38), laparoscopic gastric band (44.95), laparoscopic gastroplasty (44.68), open gastric bypass (44.31 or 44.39), laparoscopic vertical sleeve gastrectomy (43.82), laparoscopic duodenal switch (43.89 only), or open duodenal switch (43.89, 45.51, and 45.91), along with principal discharge diagnosis codes for obesity and morbid obesity (278.00, 278.01, 278.8, or 278.1) (11). IVCF implantations during the same hospitalization were identified using the International Classification of Diseases-9th Revision procedure code 38.7. Only IVCF implantations performed during the hospitalization on or before the day of bariatric surgery were considered to have been performed for prophylactic purposes; patients who underwent IVCF implantation after the surgery or at an unknown time in relation to the surgery were excluded. Comparative analysis

TABLE 1 Guideline Recommendations for the Use of Inferior Vena Cava Filters as Primary Prophylaxis in Bariatric and Abdominal Surgery

Organization	Title (Publication Year)	Guideline Excerpts
Society of Interventional Radiology	Guidelines for the Use of Retrievable and Convertible Vena Cava Filters: Report From the Society of Interventional Radiology Multidisciplinary Consensus Conference (2006)	"The primary means of therapy and prophylaxis of VTE are pharmacologic." "No unique indications for optional vena cava filters exist that are distinct from permanent vena cava filters."
American College of Radiology	Appropriateness Criteria Radiologic Management of Inferior Vena Cava Filters (1996, revised 2012)	"PE is a leading cause of perioperative death in bariatric patients due to their many comorbidities. However, there is little evidence to support routine use of filters in place of adequate prophylaxis, such as anticoagulation."
American College of Chest Physicians	Antithrombotic Therapy and Prevention of Thrombosis, 9th Edition: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines: Prevention of VTE in Nonorthopedic Surgical Patients (2012)	"For general and abdominal-pelvic surgery patients, we suggest that an inferior vena cava filter should not be used for primary VTE prevention (Grade 2C)."

PE = pulmonary embolism; VTE = venous thromboembolism.

with rigorous propensity matching was then performed between bariatric surgery patients receiving prophylactic IVCFs and those who did not receive IVCFs. Data regarding the use of pharmacological and mechanical prophylaxis against VTE were not available and thus were not included.

COMPARATIVE OUTCOMES ANALYSIS. Given that the comorbid and demographic characteristics of patients receiving prophylactic IVCFs would be different from those of patients without IVCFs, propensity score matching was used to reduce selection bias and heterogeneity between the groups. Propensity scores were calculated using 25 covariates, including the Elixhauser comorbidity index (Online Table 1) (12). Nearest neighbor 1:1 variable ratio, parallel, balanced, propensity matching with a caliper width of 0.01 was used to create 2 well-matched groups for comparative outcomes analysis.

STATISTICAL ANALYSIS. Descriptive statistics for categorical variables are presented as frequencies with percentages. Continuous variables that were not normally distributed as assessed using a Kolmogorov-Smirnov goodness-of-fit test are reported as median (interquartile range [IQR]). Unmatched data were compared using the Pearson chi-square test for categorical variables and the Mann-Whitney *U* test for continuous variables. Matched categorical variables were compared using the McNemar test or an exact binomial test, and continuous variables were compared using the Wilcoxon signed rank test.

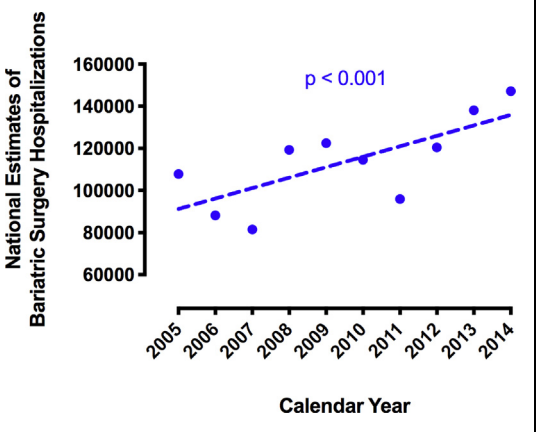
In-hospital outcomes (death, acute PE, acute lower extremity [LE] or caval DVT, blood transfusions, procedure-related hemorrhage or hematoma, acute kidney injury) and resource utilization (length of stay, hospital charges) were compared between the 2 matched groups. Conditional logistic regression was used to estimate odds ratios (ORs) and 95% confidence intervals (CIs) (after adjusting for covariates that were not balanced after matching). A p value of <0.05 was considered to indicate statistical significance.

Sensitivity analysis was performed using a rule-out approach to illustrate how strongly a single unmeasured binary confounder would have to be associated with both prophylactic IVCF use and the endpoint to fully explain the significant findings.

Unweighted counts were used for all statistical analyses except trend assessments, for which nationally weighted estimates were used. A Cochran-Armitage test was used to evaluate trends in prophylactic IVCF use over time. A 2-sided threshold of significance was established at $p < 0.05$.

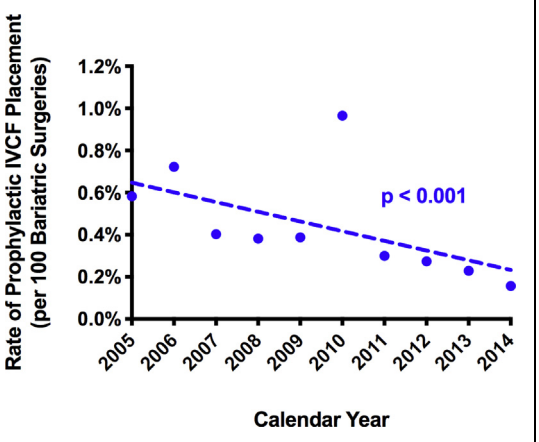
SPSS version 22.0 (IBM, Armonk, New York) and SAS version 9.4 (SAS Institute, Cary, North Carolina) were used for analyses.

FIGURE 1 National Estimates of Bariatric Surgery Hospitalizations From January 2005 to December 2014



Across the United States, the number of annual hospitalizations for bariatric surgery rose steadily between 2005 and 2014.

FIGURE 2 Rate of Prophylactic Inferior Vena Cava Filter Implantations per 100 Bariatric Surgical Procedures From January 2005 to December 2014



Between 2005 and 2014, there was a steady decrease in the annual rate of prophylactic inferior vena cava filters (IVCFs) placed when adjusted for the number of bariatric surgical procedures performed.

TABLE 2 Key Baseline Characteristics of Patients in Unmatched and Propensity Score–Matched Groups

	Prophylactic Filter Group	No Filter Group	p Value
Unmatched group			
Total patients	1,047	257,109	NA
Age, yrs	47.0 (38-55)	44.0 (36-53)	<0.01
Female	680 (64.9)	202,635 (78.9)	<0.01
Race			<0.01
White	616 (58.8)	157,141 (61.1)	
African American	185 (17.7)	32,895 (12.8)	
Other	86 (8.2)	35,906 (14.0)	
Unknown	160 (15.3)	30,785 (12.0)	
Bariatric surgery type			<0.01
Laparoscopic gastric bypass	500 (47.8)	130,662 (50.8)	
Laparoscopic gastric banding	70 (6.7)	32,829 (12.8)	
Laparoscopic gastroplasty	5 (0.5)	2,803 (1.1)	
Open gastric bypass	251 (24.0)	17,089 (6.6)	
Laparoscopic vertical sleeve	103 (9.8)	60,707 (23.6)	
Laparoscopic duodenal switch	90 (8.6)	10,788 (4.2)	
Open duodenal switch	28 (2.7)	2,231 (0.9)	
History of VTE	270 (25.8)	4,319 (1.7)	<0.01
Coronary artery disease	73 (7.0)	11,241 (4.4)	<0.01
Hypercoagulable state	112 (10.7)	773 (0.3)	<0.01
Chronic kidney disease	44 (4.2)	3,819 (1.5)	<0.01
Diabetes with complications	44 (4.2)	5,144 (2.0)	<0.01
Propensity score–matched group			
Total patients	1,047	1,047	NA
Age, yrs	47.0 (38-55)	48.0 (39-56)	0.02
Female	680 (64.9)	652 (62.3)	0.08
Race			0.08
White	616 (58.8)	604 (57.7)	
African American	185 (17.7)	161 (15.4)	
Other	86 (8.2)	100 (9.6)	
Unknown	160 (15.3)	182 (17.4)	
Bariatric surgery type			0.32
Laparoscopic gastric bypass	500 (47.8)	505 (48.2)	
Laparoscopic gastric banding	70 (6.7)	90 (8.6)	
Laparoscopic gastroplasty	5 (0.5)	6 (0.6)	
Open gastric bypass	251 (24.0)	182 (17.4)	
Laparoscopic vertical sleeve	103 (9.8)	189 (18.1)	
Laparoscopic duodenal switch	90 (8.6)	57 (5.4)	
Open duodenal switch	28 (2.7)	18 (1.7)	
History of VTE	270 (25.8)	290 (27.7)	0.06
Coronary artery disease	73 (7.0)	79 (7.5)	0.59
Hypercoagulable state	112 (10.7)	71 (6.8)	<0.01
Chronic kidney disease	44 (4.2)	47 (4.5)	0.74
Diabetes with complications	44 (4.2)	44 (4.2)	0.99

Values are n (%) or median (interquartile range).
NA = not applicable; VTE = venous thromboembolism.

RESULTS

CHARACTERISTICS OF THE STUDY POPULATION. From the 84.7 million total hospital discharges between January 2005 and September 2015, 258,480 bariatric procedures were identified (representing a national estimate of 1,250,500 over the 11-year study period). Figure 1 shows the increasing temporal trends of these procedures from January 2005 to December 2014. The temporal trends of prophylactic IVCF hospitalizations are shown in Figure 2, and the patient selection flow diagram is shown in Online Figure 1. Of all hospitalizations, a total of 1,371 IVCFs were placed, with 1,047 being prophylactic (76.4%), 95 post-surgery (6.9%), and 229 (16.7%) at an unknown time interval in relation to surgery. Of the prophylactic IVCFs, 822 (78.5%) were implanted on the day of the bariatric surgery, and 193 (18.19%) were implanted 1 day before the bariatric surgery (Online Figure 2). The overall rate of prophylactic IVCF placement at the time of bariatric surgery (0.41%) was low and had a significant decrease over the 11-year study period. There was no association found between hospital bariatric surgical volume and the rate of prophylactic IVCF implantation.

CHARACTERISTICS AND OUTCOMES OF PROPENSITY-MATCHED GROUPS. The 1,047 patients identified as having prophylactic IVCFs placed prior to bariatric surgery were used for comparative effectiveness analysis. The propensity score-matching algorithm resulted in 1,047 well-matched patients in each group, with an excellent C statistic of 0.79 (Online Figure 3). Of the 25 covariates used, only 2 covariates (the diagnosis of a hypercoagulable state and the bariatric procedure of open gastric bypass) were not balanced even after propensity matching (i.e., did not achieve an absolute standardized difference <10% after matching; see Online Figure 4). Table 2 shows the baseline characteristics for the unmatched and matched groups of bariatric surgery patients. As shown in the unmatched group, patients receiving prophylactic IVCFs were older and more likely to be male, to be African American, and to have a history of VTE; additionally, prophylactic IVCFs were more often used if an open surgery was being performed (as opposed to laparoscopic procedures).

Table 3 shows the matched clinical and resource utilization outcomes. Prophylactic IVCF use resulted in a higher association with the combined endpoint of in-hospital mortality or acute PE compared with patients who did not receive IVCFs (1.4% vs. 0.4%; OR: 3.75; 95% CI: 1.25 to 11.30; p = 0.019). Additionally, there was no difference in the 2 groups with in-hospital mortality alone (0.6% vs. 0.4%; OR: 2.00; 95% CI: 0.50 to 8.00; p = 0.32).

Prophylactic IVCFs were associated with a higher rate of acute LE or caval DVT (1.8% vs. 0.3%; OR: 6.33; 95% CI: 1.87 to 21.4; p = 0.001) (Central Illustration) and an increased rate of acute PE (0.9% vs. 0.1%; OR: 10.00; 95% CI: 1.3 to 78.1; p = 0.007). The overall PE rates, however, were <1% in both groups. Additional matched clinical outcomes showed no significant

difference in procedure-related hemorrhage (2.1% vs. 1.4%; p = 0.25) or acute kidney injury (2.6% vs. 2.3%; p = 0.67), but IVCFs were associated with higher blood transfusion rates (3.7% vs. 2.0%; p = 0.02).

Finally, the matched group receiving prophylactic IVCFs had significantly higher lengths of stay (median 3 days [IQR: 3 to 4 days] vs. 2 days [IQR: 2 to 3 days]; p < 0.01), and hospital charges (median $63,000 [IQR: $39,000 to $96,000] vs. $37,000 [IQR: $28,000 to $53,000]; p < 0.01) compared with the group without IVCFs.

When stratified according to bariatric surgery subtype, there were no significant differences in mortality or acute PE rate between the prophylactic IVCF and no IVCF groups (Online Table 2).

SENSITIVITY ANALYSIS. Several sensitivity analyses were performed to assess the validity of the matched results. First, given the standardized difference of more than 10% for the diagnosis of hypercoagulable state, a subgroup sensitivity analysis was performed to analyze patients with a known hypercoagulable state and/or history of VTE to see if prophylactic IVCFs prior to bariatric surgery resulted in different outcomes in death and VTE. In patients with diagnoses of a hypercoagulable state, the use of prophylactic IVCFs was not associated with a significant difference in rates of death (0.00% vs. 0.39%; p = 0.99), acute PE (0.0% vs. 0.52%; p = 0.99), or acute LE or caval DVT (2.68% vs. 0.52%; p = 0.047) (Online Table 3).

Among patients with histories of VTE, those who underwent IVCF implantation had similar rates of acute LE or caval DVT (0.74% vs. 0.16%; p = 0.09) and death (0.00% vs. 0.12%; p = 0.99) compared with patients with histories of VTE without IVCF placement (**Table 4**). IVCF implantation in this patient subgroup was associated with a significantly higher PE rate (1.11% vs. 0.19%; p = 0.023).

A second sensitivity analysis was performed for the association between acute LE or caval DVT and prophylactic IVCFs. With the wide 95% CI of OR, we conservatively used the lower bound of 1.48 to conduct the sensitivity analysis. Using the rule-out approach, sensitivity analysis estimated that an unmeasured confounder needed to be 5.0 times more prevalent in prophylactic IVCF group to fully explain the outcome of acute LE or caval DVT being higher in that group; additionally, it would itself have to increase the risk for acute LE or caval DVT by 5.8 times (Online Figure 5).

TABLE 3 Comparative Clinical and Hospital Resource Outcomes for Bariatric Surgery Patients Receiving Prophylactic Inferior Vena Cava Filters

	Prophylactic Filter Group (n = 1,047)	No Filter Group (n = 1,047)	Odds Ratio* (95% CI)	p Value
Combined endpoint of death or acute pulmonary embolism	15 (1.4)	4 (0.4)	3.75 (1.25–11.30)	0.019
Death	6 (0.6)	3 (0.3)	2.00 (0.50–8.00)	0.32
Acute pulmonary embolism	10 (0.9)	1 (0.1)	10.00 (1.3–78.1)	0.007
Acute LE or Caval DVT	19 (1.8)	3 (0.3)	6.33 (1.87–21.4)	0.001
Blood transfusions	39 (3.7)	21 (2.0)	1.90 (1.11–3.27)	0.02
Acute kidney injury	27 (2.6)	24 (2.3)	1.13 (0.65–1.98)	0.67
Procedure-related hemorrhage	22 (2.1)	15 (1.4)	1.47 (0.76–2.83)	0.25
Length of stay, days	3 (2–4)	2 (2–3)		<0.01
Total charges, ×$10,000	6.3 (3.9–9.6)	3.7 (2.8–5.3)		<0.01

Values are n (%) or median (interquartile range). *Adjusted for hypercoagulable state.
CI = confidence interval; DVT = deep vein thrombosis; LE = lower extremity.

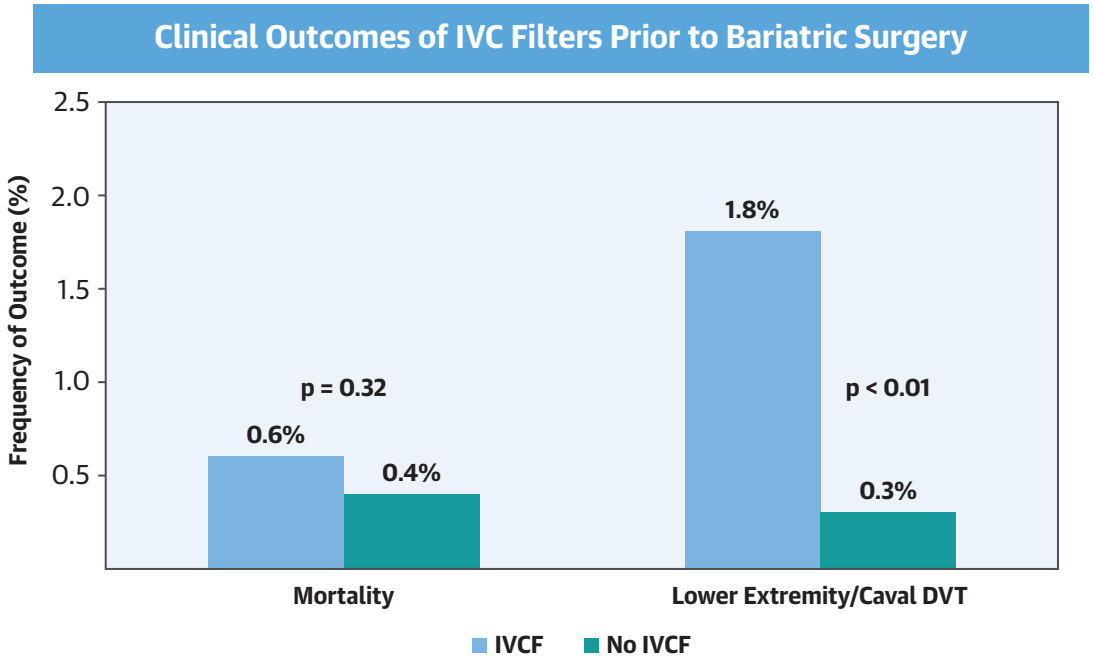
DISCUSSION

In this large observational nationwide study, we demonstrated that prophylactic IVCF placement prior to bariatric surgery confers no reduction in the combined endpoint of in-hospital mortality or PE and is associated with a higher rate of acute LE or caval DVT. Furthermore, prophylactic IVCFs are associated with longer lengths of hospital stay and higher hospital charges. Even in patients with known hypercoagulable state or history of VTE, prophylactic IVCFs prior to bariatric surgery resulted in no differences in the rate of death or acute LE or caval DVT.

Our results suggest that attempting to safeguard bariatric surgery patients from VTE-related morbidity and mortality with prophylactic IVCFs is ineffective. Other studies, including a meta-analysis of 7 smaller observational institutional studies (combined n = 102,767, with average follow-up between 3 weeks and 3 months) by Kaw et al. (3), suggested that preoperative IVCFs with bariatric surgery may be associated with an increased risk for DVT and mortality without a reduction in PE. Additionally, an observational propensity-matched study of patients in Michigan (n = 35,477) performed by Birkmeyer et al. (13) found statistically higher rates of post-operative DVT, PE, and death with prophylactic IVCFs.

Because our study showed that prophylactic IVCFs were associated with significantly higher resource utilization (increased length of hospital stay and total charges), it is important that a rigorous economic analysis be a part of any future studies investigating this practice. Our analysis showed that the median hospital charge for prophylactic IVCFs was $26,000 higher than when patients did not receive IVCFs; this difference arises likely in part from the cost of the IVCF implantation procedure and the higher rates of IVCF-related complications. However, this figure may be an underestimation of the true overall

CENTRAL ILLUSTRATION **Clinical Outcomes Associated With Prophylactic Inferior Vena Cava Filters Prior to Bariatric Surgery**



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The use of prophylactic inferior vena cava filters (IVCFs) prior to bariatric surgery resulted in no difference in in-hospital mortality and was associated with a higher rate of lower extremity or caval deep vein thrombosis (DVT).

cost burden, because we were unable to include costs associated with future filter retrieval or with the long-term medical sequelae associated with the devices. Out-of-hospital costs may be further driven by additional clinic visits and the potential need for imaging prior to filter retrieval. Our study found the median cost of bariatric surgery for patients receiving prophylactic IVCFs to be $63,000, similar to a study of Medicare data that found that the cost of gastric band reoperations (including revision to a different bariatric procedure and device removal or replacement) was about $69,000 per patient (14).

The prophylactic IVCFs used in our analysis were all placed on or before the day of bariatric surgery. The overall rate of prophylactic IVCFs was low at 0.41%, but this may have been underestimated. Our study did not include 229 (or 16.7% overall) identified IVCF implantations, because the procedures were done at an unspecified time point during the hospitalization in relation to the bariatric surgery. Additionally, IVCFs placed prior to the hospitalization were not included. That said, higher risk patients in our study with histories of VTE or a hypercoagulable state did receive prophylactic IVCFs about 25.8% and 10.7% of the time, respectively. These rates are similar to other studies, with estimates as high as 28% in high-risk patients (15,16). Interestingly, IVCF use in this higher risk patient population failed to produce a mortality benefit.

TABLE 4 **Clinical Outcomes Related to Patients With Known Histories of Venous Thromboembolism Receiving Prophylactic Inferior Vena Cava Filters Prior to Bariatric Surgery**

	Patients With Histories of VTE With Prophylactic Filters (n = 270)	Patients With Histories of VTE Without Filters (n = 4,317)	p Value
Death	0 (0)	5 (0.12)	0.99
Acute pulmonary embolism	3 (1.11)	8 (0.19)	0.02
Acute LE or caval DVT	2 (0.74)	7 (0.16)	0.09

Values are n (%).
Abbreviations as in Tables 2 and 3.

STUDY LIMITATIONS. First, body mass index is an important risk factor for VTE perioperatively, but this

variable could not be included in our analysis, because more than 70% of hospitalization records did not code for body mass index, and the diagnosis for level of obesity was overwhelmingly skewed to only morbid obesity. Although this limitation did not affect our results with respect to the general bariatric surgery population, stratifying patients into a high-VTE risk group was limited to those who carried the diagnosis of hypercoagulability or had histories of VTE.

Second, as with any observational study, there was the potential for unmeasured confounders to bias our results. However, using a rigorous propensity score-matching algorithm with a strong C statistic of 0.79 that was validated by sensitivity analysis greatly supports the validity of our positive categorical associations.

Third, the small sample size of patients with histories of hypercoagulable state (n = 112) who underwent IVCF placement limits our ability to determine true efficacy of IVCF placement in this patient population.

Fourth, the use of other VTE prophylaxis therapies, such as anticoagulant agents and compression devices, could not be identified. As such, whether patients were receiving optimal protection against VTE is unknown.

Fifth, it is possible that patients receiving prophylactic IVCFs underwent more chest and LE imaging, which led to higher identification of VTE. The extent of imaging surveillance could not be determined from our dataset.

Sixth, because this analysis was based on hospital claims, the data were subject to the inaccuracies of administrative datasets. For example, as bariatric procedures are sometimes performed for nonelective, non-weight loss purposes, our dataset may contain extraneous hospitalizations. By limiting our dataset to only those patients with principal discharge diagnoses of obesity or morbid obesity, this potential confounder was minimized. Similarly, by including only those IVCFs that were coded as being implanted on or before the day of the bariatric surgery, we were able to better maintain the integrity of our dataset.

Finally, our analysis contained information only from the hospitalization during which the bariatric surgery was performed. Any prior hospitalizations or outpatient procedures during which an IVCF was placed or any long-term outcomes were not measured.

CONCLUSIONS

From this 11-year nationwide observational study, we report that prophylactic IVCFs for bariatric surgery are associated with a higher rate of the combined endpoint of in-hospital mortality or PE, a higher rate of DVT, and increased health care resource utilization. In the absence of randomized controlled trials or substantial prospective data, the routine use of prophylactic IVCFs in patients undergoing bariatric surgery is not indicated. Future randomized trials evaluating the use of prophylactic filters should focus specifically on high-risk subgroups, such as patients with histories of hypercoagulability. Further research and development in other options such as pharmacological DVT prophylaxis, mechanical LE compression devices, and early post-operative mobility strategies specifically targeted toward the needs of obese surgical patients may be higher yielding endeavors for protection against VTE.

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PERSPECTIVES

WHAT IS KNOWN? Although prophylactic IVCF implantation prior to bariatric surgery is performed in an attempt to reduce VTE-associated morbidity and mortality, its nationwide clinical outcomes are unknown.

WHAT IS NEW? This 11-year national study shows that prophylactic IVCFs prior to bariatric surgery are associated with higher combined endpoint of mortality and VTE events than in bariatric surgery patients without IVCFs.

WHAT IS NEXT? The implantation of prophylactic IVCFs prior to bariatric surgery should not be performed without further evidence supporting their use. Research and development of other options, such as pharmacological DVT prophylaxis, mechanical LE compression devices, and early post-operative mobility strategies specifically targeted toward the needs of obese surgical patients, may be higher yielding endeavors for protection against VTE.

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APPENDIX For supplemental tables and figures, please see the online version of this paper.