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Perioperative rates of deep vein thrombosis and pulmonary embolism in normal weight vs obese and morbidly obese surgical patients in the era post venous thromboembolism prophylaxis guidelines

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Abstract

BACKGROUND: The increasing prevalence of obesity translates into a greater number of obese patients undergoing general surgery procedures. We questioned if increased awareness and recent prophylaxis guidelines impacted the incidence of venous thromboembolism (VTE) in the obese patients.

METHODS: A total of 33,325 patients who underwent 4 common general surgery procedures from 2005 to 2009 were identified from the American College of Surgeons' National Surgical Quality Improvement Program database. Rates of VTE between 5 body mass index cohorts were compared with univariable analysis.

RESULTS: No significant difference existed between rates of deep vein thrombosis or pulmonary embolism (PE) across the body mass index categories ($P = .32$ and $P = .06$, respectively). With the exception of the positive linear trend in the rate of PE for patients undergoing abdominal wall hernia repair ($P < .01$), there was no difference in deep vein thrombosis or PE rate exhibited by procedure.

CONCLUSION: VTE rates in the obese patients are similar to that of the general population with the exception of PE in those undergoing abdominal wall hernia repair.

Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), remains one of the most common causes of preventable death[1] and the second most common cause for increased hospital length of stay.[2] As surgery is a known risk factor for development of VTE,[3,4] there has been significant attention toward reduction of incidence of such events in the general surgery setting. Effective measures, such as chemical prophylaxis (administration of heparin,

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low-molecular-weight heparin, and fondaparinux), medical education, computerized electronic alerts, and identifying at-risk populations, have been established in the recent years.[5] However, rates are still suboptimal and VTE prevention continues to be a top priority in healthcare quality actions.[6]

In this effort to reduce perioperative VTE, several risk factors and high-risk patient populations have been more clearly identified. Obesity represents another independent risk factor for VTE development in this already high-risk population.[7,8] As prevalence of obesity in the United States has increased dramatically,[9] there is a higher incidence of this patient population undergoing surgery. Several studies have evaluated the risk of VTE in the bariatric surgery patient population.[10–12] However, there is scarcity of data describing its efficacy in obese and morbidly obese patients outside of bariatric surgery. Based on this growing awareness of VTE in obese patients, as well as the push toward strict implementation of VTE protocols, we hypothesized that obesity would not confer increased risk of VTE in the patient undergoing nonbariatric abdominal surgery.

This study determines the rate of VTE in the obese and morbidly obese population vs that of normal weight patients undergoing nonbariatric abdominal surgery in the era post VTE prophylaxis guidelines.

Methods

Data from the American College of Surgeons' National Surgical Quality Improvement Program (NSQIP) were extracted from our Department of Surgery's quality assurance program data warehouse. This retrospective cohort analysis was approved as part of the Stony Brook Medicine Department of Surgery project entitled "Surgical Quality Data Use Group", under Stony Brook University's Committee on Human Subjects in Research approved research protocol #17053-5.

Sample inclusion and exclusion criteria

Records were initially selected for primary procedures including Current Procedural Terminology codes for colectomy (44140, 44141, 44144, 44150, 44151, 44155, 44157, 44158, 44160, 44204 to 44207, 44210, 44211), hysterectomy (58150, 58152, 58180, 58200, 58210), hernia repair (49560, 49561, 49565, 49566, 49568, 49652 to 49656), or small bowel resection (44120, 44121) (n = 113,631). These 4 commonly performed abdominal procedures represent a large portion of general surgical patients. Procedures performed during years 2005 to 2009 were included to represent recent effects of the growing changes in VTE prophylaxis. Patient records were excluded based on the following criteria: history of malignancy (n = 3,620); a current diagnosis of cancer as indicated by the 9th revision of the International Classification of Diseases diagnosis codes 150 to 159.9, 179 to 184.9 (n = 19,925); currently receiving chemotherapy (n = 533) or radiation (n = 127); history of a bleeding disorder (n = 4,599); positive smoking status (n = 18,230); missing data for height or weight (n = 1,549) or age (n = 2); or body mass index (BMI) less than 18.5 (n = 1,036).

Frequency matching strategy

Five BMI categories were created using the World Health Organization classifications for obesity as a guide: normal (BMI 18 to 24.99 kg/m^2), preobese (BMI 25 to 29.99), Obese Class 1 (BMI 30 to 34.99), obese Class 2 (BMI 35 to 39.99), and obese Class 3 (BMI $\geq$ 40). A frequency matching sampling design was used to reduce the confounding effects of age and sex across the 5 BMI categories. Age distribution was graphed to determine the best categorical cutoff points for the matching strategy (less than 40, 40 to 49, 50 to 59, 60 to 69, $\geq$70 years). These 5 age categorical groups were then split by sex to form 10 frequency matching sublevels. The largest number of matches was identified across the BMI categories for each individual sublevel, and simple random sampling was used to select the sublevel matches from each of the 5 BMI categories.

Analysis. Predefined NSQIP variables for preoperative demographic characteristics, comorbidities, and postoperative complications were univariately examined via Pearson's chi-square or Fisher's exact tests. Both overall and procedure-specific DVT and PE rates were univariately examined for differences across BMI categories. All analyses were performed by a statistician using SAS 9.2 software (SAS, Inc, Cary, NC).

Results

The final age and sex of frequency-matched sample included 33,325 patients, with n = 6,665 in each BMI category. Overall, 31.4% were colectomy patients (n = 10,452), 8.6% enterectomy patients (n = 2,869), 8.6% hysterectomy patients (n = 2,871), and 51.4% abdominal wall hernia patients (n = 17,133). Results of preoperative patient variables are shown in Table 1. There were significantly more patients of the white race, followed by black, Hispanic, and other ($P < .01$). There was a significant difference between BMI groups concerning the comorbidity of congestive heart failure, history of cardiac surgery, chronic obstructive pulmonary disease, renal failure, dialysis, sepsis, and alcohol intake ($P < .05$ for each comorbidity). The incidence of hypertension, diabetes, and history of percutaneous coronary intervention was additionally statistically significant and associated with an increasing incidence with increasing BMI ($P < .01$). There were no significant differences found for previous history of myocardial infarction, peripheral vascular disease,