Venous Thromboembolism after Urological Surgery

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Purpose: We determined the rates of deep venous thromboembolism and pulmonary embolism after common urological procedures in the United States.

Materials and Methods: The NSQIP database was used to identify common urological procedures performed between January 1, 2005 and December 31, 2011. A total of 82,808 patients were included in the study.

Results: Overall 633 (0.76% of 82,808 subjects) deep venous thromboses occurred within 30 days of surgery in this cohort of patients treated with common urological procedures. Among procedures performed at least 500 times the rates of deep venous thrombosis were highest for cystectomy/urinary diversion (3.96% [71/1,792]), partial cystectomy (2.35% [17/722]) and open radical nephrectomy (1.67% [45/2,702]). The rates of deep venous thrombosis were lowest in patients undergoing laparoscopic colpopexy (0.00% [0/707]), placement of a female sling (0.08% [9/10,648]) and hydrocelectomy/spermatocelectomy/varicocelectomy (0.13% [3/2,333]). A total of 349 (0.42%) pulmonary embolisms occurred in this cohort, with cystectomy/urinary diversion having the highest rate overall (2.85% [51/1,792]). Multivariate logistic regression revealed that age greater than 60 years, functional status, history of disseminated cancer, congestive heart failure, anesthesia time greater than 120 minutes and chronic steroid use were independently associated with the formation of deep venous thrombosis/pulmonary embolism. A limitation of the study is that no data were available on thromboembolic prophylaxis.

Conclusions: While deep venous thrombosis and pulmonary embolism are uncommon after urological surgery, this study is the first to our knowledge to provide a comprehensive comparison of deep venous thrombosis/pulmonary embolism rates across a full spectrum of various urological procedures in American patients. This study should give the reader a better understanding of the exact risk faced by the patient when undergoing common urological procedures.

Key Words: venous thrombosis, pulmonary embolism, urological surgical procedures

Abbreviations and Acronyms

BMI = body mass index
CHF = congestive heart failure
COPD = chronic obstructive pulmonary disease
CT = computerized tomography
DVT = deep venous thrombosis
NSQIP = National Surgical Quality Improvement Program
PE = pulmonary embolism
VTE = venous thromboembolism

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DEEP venous thrombosis and pulmonary embolism are potentially life threatening complications following surgery. Many patients undergoing urological surgery have 1 or more risk factors for these complications including malignancy, prior chemotherapy/radiotherapy, advanced age, obesity and smoking.[1] However, the rates of symptomatic venous thromboembolism after many different urological surgeries are not well-defined.

Data from the California Patient Discharge Data Set from the mid 1990s revealed that radical cystectomy had the highest rate of venous

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thromboembolism (3.7%), with invasive brain surgery (3.6%) and total hip replacement (3.1%) following closely.[2] While these data are informative, they are largely from an era when thromboembolic prophylaxis was not widely performed. Furthermore, this study relied on ICD-9 codes and did not evaluate the full scope of urological surgery.

In the current study we defined the rates and time course of VTE more precisely in patients undergoing common urological procedures using the NSQIP. We also constructed a multivariate regression model to evaluate which clinical and demographic variables were the strongest predictors of VTE in this setting.

MATERIALS AND METHODS

Data

Data for this study were obtained from the participant use files of the American College of Surgeons NSQIP. The general methods of the NSQIP have previously been described in detail.[3–5] The NSQIP collects clinical data on patients undergoing major surgical procedures at more than 200 hospitals. These data encompass more than 130 variables including preoperative demographic and comorbidity data, intraoperative and perioperative complications, and mortality outcomes for 30 days after the operation.[6] Trained surgical staff reviewers record the data using standardized definitions. The accuracy of the data is ensured by the use of vigorous quality control measures, including intensive training for data collectors and periodic interrater reliability audits of participating sites.[7] The database has been validated for accuracy and reproducibility, and has a greater than 95% 30-day outcome followup rate.[8]

Study Population, Definitions and Statistics

Patients were included in the study if they had undergone a common urological procedure between January 1, 2005 and December 31, 2011 as determined by the CPT codes listed in the supplementary Appendix (http://jurology.com/). These are the only years available for the NSQIP data set. DVT is defined as a new blood clot or thrombus within the venous system which may be coupled with inflammation within 30 days of the operation. The diagnosis is confirmed by duplex ultrasound, venogram or CT. The patient must be treated with anticoagulation therapy and/or placement of a vena cava filter.[3]

Pulmonary embolism is defined as the lodging of a blood clot in a pulmonary artery with subsequent obstruction of the blood supply to the lung parenchyma within 30 days of the operation. This complication must be documented with a ventilation-perfusion scan interpreted as high probability, a positive CT angiogram, pulmonary arteriogram or spiral CT.[3] Patients were then confirmed to have received some type of treatment (eg initiation of anticoagulation therapy) or placement of mechanical interruption (eg Greenfield filter) if anticoagulation was contraindicated or already instituted. Venous thromboembolism is defined as deep venous thrombosis and/or pulmonary embolism.

In patients with disseminated cancer the disease has spread to 1 or more sites in addition to the primary site, and the presence of multiple metastases indicates the cancer is widespread, fulminant or near terminal.

Descriptive statistics are provided using Stata®/MP version 12.0. Differences in patient demographics and clinical characteristics were evaluated using the chi-square or exact test for categorical data, and the rank sum test was used with interquartile ranges for continuous variables. Univariate and multivariate logistic regression models were used to compare the relationship of VTE and various clinical and demographic variables. Multivariate logistic regression was performed with VTE as the outcome variable, and included terms with established relationships on univariate analysis (age, gender, BMI, functional status, presence of disseminated cancer, history of CHF, COPD, and hypertension, chronic steroid use and anesthesia time greater than 120 minutes). Multicollinearity was assessed using the variance inflation factor. Moderate heteroscedasticity was detected using the Breusch-Pagan test and was resolved with robust standard errors. A significance level (alpha) of 0.05 was used and p values for all tests were 2-sided.

RESULTS

A total of 82,808 patients in the NSQIP database underwent a common urological procedure between 2005 and 2011. Among these patients DVT developed in 633 (0.76%) within 30 days of surgery whereas PE had developed in 349 (0.42%). The supplementary table (http://jurology.com/) summarizes the incidence of DVT and PE by surgery type and, as expected, patients undergoing open pelvic surgery had the highest rates of DVT and PE. Specifically patients undergoing radical cystectomy had a 3.96% risk of DVT and a 2.85% risk of PE 30 days after surgery, whereas laparoscopic colpopexy had the lowest risk of DVT (0.00%) and PE (0.00%) among all procedures with at least 500 cases. No differences were noted between open and laparoscopic radical prostatectomy as the DVT rate was approximately 0.5% for both, and the PE rate was 0.8% for open techniques vs 0.4% for laparoscopic techniques. Notably of the 722 partial cystectomies 166 had no concomitant procedure. Of these 166 cases VTE developed in 5 (3.0%), which is comparable to the VTE rate in the subpopulation of patients undergoing a concomitant surgical procedure (20 [3.6%], $p = 0.71$).

Clinical and demographic characteristics of the cohort stratified by VTE status are listed in table 1. Patients in whom VTE developed were more likely to be older, male, have a higher BMI and reduced functional status on univariate comparison. Patients in whom VTE developed were also much more likely to have a diagnosis of disseminated cancer. No differences were noted in terms of rates