Is DVT prophylaxis necessary for thyroidectomy and parathyroidectomy?

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Background. Recent guidelines suggest pharmacologic deep vein thrombosis (DVT) prophylaxis in all patients undergoing major surgical procedures to minimize the risk of postoperative DVT and pulmonary embolism (PE). Pharmacologic DVT prophylaxis perioperatively might increase the risk of bleeding complications. Our goal was to study the risk/benefit ratio of DVT prophylaxis in patients who undergo thyroidectomy and parathyroidectomy.

Methods. A review of the ACS NSQIP Database from 2005 to 2007 was performed. The incidence of DVT/PE complications in a cohort of 347,862 patients was compared with the 16,022 patients who underwent a thyroidectomy or parathyroidectomy. We identified risk factors for DVT/PE and developed a surrogate variable to determine the risk for postoperative bleeding.

Results. The risk of DVT/PE complication in the thyroidectomy and parathyroidectomy patients (0.16) was 6 fold less than the entire cohort (0.96) (P < .001). The estimated risk of bleeding requiring a return to the operating room was 1.58%, which is 10-fold greater than the risk of developing a DVT/PE (P < .001).

Conclusion. Patients who underwent thyroidectomy and parathyroidectomy have a low incidence of developing DVT/PE complications and have a significantly greater risk of developing bleeding complications. Hence, we believe that DVT prophylaxis should be done at the discretion of the surgeon in select high-risk patients only. (Surgery 2010;148:1163-9.)

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Venous thromboembolism (VTE) is viewed as a serious health care issue in the United States, with an estimated 900,000 cases occurring annually.¹,² VTE including deep vein thrombosis (DVT) and pulmonary embolism (PE) is a common complication in patients who undergo major operative therapy. Despite improvements in perioperative surgical care and preventative measures, VTE continues to be a major problem leading to longer hospital stays, increased mortality, and higher medical costs.

Approximately 300,000 patients die each year as a result of a PE, with approximately one third occurring as sudden death.² Of the remaining cases, 15–18% deaths occur within the next 3 months after the initial event, and another 4% develop chronic thromboembolic pulmonary hypertension within 2 years with clinically important morbidity.² DVT, although less fatal than PE, can lead to phlegmasia alba dolens (white swollen leg) and phlegmasia cerulean dolens (blue swollen leg).³ Venous gangrene may also form if the arterial inflow is obstructed because of venous hypertension and occlusion of the capillary system.³ Patients who experience DVT often have an inferior quality of life after the event, requiring continued anticoagulation, which subjects them to the risks of spontaneous bleeding and the need for repeated blood testing.³

The incidence of VTE is greater if multiple risk factors are identified in patients.¹ These risk factors include fractures of the hip or leg, hip or knee replacement surgery, major general operation, postoperative infection, major trauma including spinal cord injury, thrombophilia, inflammatory bowel disease, immobilization for more than 72 h, use of hormonal contraceptives, a previous history of VTE, and cancer.⁴,⁵ Most hospitalized patients have at least 1 risk factor for VTE, and the most recent American College of Chest Physicians (ACCP) review

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of VTE projected that approximately 40% of hospitalized patients have 3 or more risk factors. Given that VTE is a leading cause of operation-related mortality and is preventable, the latest ACCP guidelines recommend DVT prophylaxis in all patients who undergo major surgical procedures. ACS NSQIP considers thyroid and parathyroid operations as major surgical procedures regardless of anesthesia type.

Pharmacologic DVT prophylaxis may increase the risk of bleeding complications perioperatively in selected patients. A systematic review and meta-analysis published in 2008 by Lloyd et al provided evidence that DVT prophylaxis was associated with a significantly greater risk of major bleeding compared to placebo (RR = 2.00; 95% confidence interval = 1.05–3.79). According to their study, although anticoagulants conferred an absolute risk reduction in DVT formation, it was also associated with a 0.5% absolute risk increase in major bleeding. Bleeding into a restricted space, such as the neck region, can lead quickly to respiratory obstruction and also can result in death if the obstruction is not relieved immediately. Therefore, a life-threatening bleeding complication is the main postoperative concern of most surgeons after thyroidectomy and parathyroidectomy.

Given the push to use pharmacologic DVT prophylaxis in all patients and our concerns about the bleeding risks in our patient population, we sought to study the risk/benefit ratio of DVT prophylaxis in patients who underwent thyroidectomy and parathyroidectomy procedures.

METHODS

Data acquisition and patient selection. We used the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) Participant Use Data File, which is deidentified and Health Insurance Portability and Accountability Act compliant, to perform a retrospective cohort study all of patients that underwent a major surgery between 2005 and 2007. The ACS-NSQIP data set (http://www.acsnsqip.org/) was developed initially as a quality improvement initiative by the Veterans Health Administration in 1994. This data set is a prospective, multi-institutional, risk-adjusted outcomes program that provides participating hospitals with data for the purposes of quality improvement. The details of the ACS-NSQIP developmental history and current details of ACS NSQIP sampling methods, variables included, and outcomes monitored have been described previously. In brief, the program collects detailed data on patient demographics, preoperative risk factors, and laboratory values; intraoperative variables, and postoperative outcomes are evaluated at 30 days after operation. The ACS-NSQIP data set contains information on 363,884 patients who underwent operation from 2005 to 2007 from 186 participating hospitals. Of those, 16,022 patients age 16 years or older who underwent a thyroidectomy or parathyroidectomy (about 5% of the total general surgical procedures) were identified using Current Procedural Terminology (CPT) codes 60505, 60502, 60500, 60271, 60260, 60252, 60240, 60220, and 60290, and these data were used for model development.

Preoperative variables. The potential independent variables in the ACS NSQIP data fields included patient demographics, pre-existing comorbidities, preoperative laboratory values, and intraoperative variables. The standard definitions for these variables have been described previously. Patient demographic variables included age, sex, and race/ethnicity. Lifestyle factors consisted of history of smoking (≥1 year before operation) and alcohol consumption (>2 drinks per day). The patient’s general status was assessed according to the American Society of Anesthesiologists (ASA) class (I/II, normal healthy/mild systemic disease; III, severe systemic disease; IV/V, severe systemic disease that is a constant threat to life/patient will not survive without the operation), dyspnea (none, moderate exertion, and at rest), preoperative functional status (independent, partially dependent, or totally dependent), and body mass index. Comorbidity variables evaluated include a history of chronic obstructive pulmonary disease, ventilator dependence, current pneumonia, hypertension requiring medication, coronary artery disease, peripheral vascular disease, ascites, renal failure, neurologic disease, and diabetes mellitus (requiring oral medication or insulin vs none). The other variables assessed were bleeding disorders, disseminated cancer, steroid use, weight loss (>10% in last 6 months), and current chemotherapy or radiotherapy. The laboratory values were dichotomized using NSQIP definitions of abnormal values.

Outcomes. Patients were followed up for 30 days regardless of whether the patient remained hospitalized, was discharged, or was admitted to a different hospital. Thirty-day outcomes were examined. Both DVT and PE are tracked by NSQIP, and this was used as our primary outcome variable. For our secondary outcome variable, we wanted to assess the risk of postoperative bleeding requiring a return to the operating room. NSQIP tracks bleeding complications but only when the patients
received transfusions in excess of 4 units of whole or packed red blood cells, which was not relevant to our population. NSQIP also tracks the return to the operating room within 30 days, which we modified to use as a surrogate marker for bleeding requiring a return to the operating room (RETURNOR). We considered the reasons a patient may return to the operating room within the first 30 days of operation and identified 3 major causes: bleeding, infection, and completion thyroidectomy for cancer. Therefore, for our secondary analysis, we deleted all patients who had an initial thyroid lobectomy and a final diagnosis of cancer \( (n = 576) \) and any patient that had a surgical site infection and returned to the operating room \( (n = 4) \). After eliminating those patients, we felt that our modified return to the operating room variable (RETURNOR) was a good estimate of the risk of bleeding requiring a return to the operating room.

**Statistical analysis.** A univariate analysis was performed using SAS 9.1.3 for Windows (SAS Inc., Cary, NC; \( P < .05 \)). All \( P \) values reported are 2-sided. The association between potential predictor variables and the occurrence of any adverse event was assessed using a \( \chi^2 \) test when the variable of interest was discrete and a nonparametric and the Wilcoxon rank sum test when the variable of interest was continuous to meet the assumption of normality.

**RESULTS**

**DVT/PE incidence.** Our results show that the risk of developing a DVT and/or PE in thyroidectomy and parathyroidectomy patients is significantly less than the general surgical population. The incidence of DVT/PE complication in the total surgical population was 0.96%, whereas the incidence in the thyroidectomy and parathyroidectomy patients was only 0.16%, which is 6-fold less than the remaining cohort \( (P < .001) \). Only 26 of the 16,022 patients who underwent a thyroid or parathyroid operation were reported to have a DVT/PE complication within the first 30 days. Of these 16,022 patients, 17 patients \( (0.106\%) \) had a DVT, and 9 patients \( (0.056\%) \) were reported to have developed a PE within that period.

We performed a univariate analysis to identify risk factors for the development of DVT/PE. The variables associated with a greater risk of DVT/PE formation were the “duration the patient is in the room,” “anesthesia time,” “duration of total hospital stay,” and “history of cerebrovascular accident (CVA)” (Table I). The history of CVA was considered if patients had a history of CVA (embolic, thrombotic, or hemorrhagic) with persistent residual motor, sensory, or cognitive dysfunction (eg, hemiplegia, hemiparesis, aphasia, sensory deficit, and impaired memory). Other variables, such as patient’s age (Table II), body mass index (Table II), types of anesthesia used, preoperative platelet count, history of bleeding disorders, diabetes mellitus, and smoking, were not associated with a greater risk of DVT/PE complications in this cohort. There was also no increased risk associated with a cancer diagnosis or exposure to previous radiation and chemotherapy.

**The risk of return to operating room.** The ACS NSQIP data set does not track bleeding complications specifically unless 4 units or more of blood is required in transfusion; however, it does record return to the operating room within 30 days of operation. Therefore, to determine the risk of bleeding complication in this cohort of patients who underwent thyroidectomy and parathyroidectomy, we had to rely on a surrogate variable, RETURNOR (described in the Methods section). After eliminating patients who had undergone a thyroid lobectomy and who were found to have cancer \( (n = 576) \), and eliminating patients with wound infections \( (n = 4) \), we found that the remaining patients \( (n = 15,442) \) had a 1.58%
incidence of returning to the operating room within the first 30 days. These data suggest that the risk of bleeding requiring a return to the operating room (1.58%) is 10-fold greater than the risk of developing a DVT/PE (0.16%) \( (P < .001) \). Using a univariate analysis, the variables associated with a greater risk of return to the operating room because of a bleeding complication were a history of disseminated cancer and cases that were considered emergencies (performed no later than 12 h after the patient was admitted to the hospital). We examined all variables that we thought might be associated with bleeding risk, and none of them were significant. NSQIP tracks the “bleeding disorder” variable as any patient who had an anticoagulation or antiplatelet therapy perioperatively that was not discontinued. Interestingly, these patients did not have an increased risk of bleeding.

**DISCUSSION**

The results of our study of the NSQIP data set from 2005 to 2007 suggest that patients who underwent thyroidectomy and parathyroidectomy had a low incidence of developing DVT/PE complications (26/16,022) when compared with the general surgical population (0.16% vs 0.96%). We also demonstrated that this cohort has a significantly greater risk of developing bleeding complications as evidenced by the number of cases that returned to the operating room within 30 days (244/15,442).

The high incidence of hospital-acquired VTE is largely attributed to the underuse of simple, yet cost-effective prophylactic measures indicating the inconsistency between evidence-based VTE prophylaxis guidelines and quality measure implementation. A greater compliance with VTE preventive strategies is projected to decrease the incidence of VTE as well as decrease the financial burden, but currently there are no data on the net savings to the health care system. VTE prevention is being integrated into regulatory agency priorities, national quality priorities, and public reporting to increase general awareness and compliance with the VTE prophylaxis guidelines. CMS (http://www.cms.hhs.gov/) is likely to propose financial incentives for adherence to quality measures for VTE prevention. These ideas were originated by the Leapfrog Group (http://www.leapfroggroup.org/home) and pay-for-performance initiatives, which strive to lessen the burden of health care use and costs from preventable outcomes. Preventing VTE has become a mandated health care quality measure over the past decade, with a growing recognition from quality accreditation organizations. Furthermore, this recommendation was reinforced by The Surgeon General’s Call to Action to Prevent Deep Vein Thrombosis and Pulmonary Embolism 2008, “to serve as a stimulus for the development of a coordinated plan to reverse the current trend and dramatically reduce the morbidity and mortality caused by (DVT/PE).”18

The latest update of the ACCP guidelines published in 2008 provides the most applicable and evidence-based recommendations for most operations. The ACCP advocates against individual risk assessment because we have yet to identify the small population of patients who do not require thromboprophylaxis. Furthermore, individualizing thromboprophylaxis can be complicated and will be associated possibly with suboptimal compliance if institution-wide efforts are not implemented. Nevertheless, because the guidelines are based on clinical trial data, they do recommend evaluating individual patients to determine whether they meet the clinical trial criteria. Not all patients, however, are at high risk for developing DVT/PE; therefore, and therefore only through individual risk assessment can we ensure the best possible balance between the risks and benefits regarding thromboprophylaxis for each patient.

Bleeding in the neck can present acutely and can lead to airway compromise and death if not recognized and treated appropriately. Pharmacologic prophylaxis might lead to increased bleeding. Bleeding is a particular concern for same-day surgery patients (as is the case for the thyroid and parathyroid operations), because they do not have the benefit of postoperative surveillance by trained health care personnel, and often, subtle signs of postoperative bleeding might not be obvious in an outpatient setting before clinically important morbidity has occurred. In this report, we provide evidence that the risk of developing DVT/PE in patients who undergo thyroid or parathyroid operations is 6-fold less than other surgical procedures \( (P < .001) \). We also present data that suggest that these patients are more likely to return to the operating room because of bleeding, which could be life-threatening complication \( (P < .001) \). In our patient population, it seems that the risks of bleeding complications might be significantly greater than the risk of DVT/PE, and therefore, mechanical prophylaxis such as compression stockings may be a safer alternative than pharmacologic prophylaxis.

A drawback to our study is that the ACS NSQIP data set does not include a history of DVT
prophylaxis perioperatively. So, we do not know what percent of patients did or did not receive DVT prophylaxis. Patients who do not receive DVT prophylaxis could have a greater rate of DVT/PE than reported in this study. It is also possible that the nonthyroid/parathyroid patients were treated inadequately with DVT prophylaxis, and the thyroidectomy/parathyroidectomy patients were treated appropriately. Another major limitation in our study is the fact that the data set does not specifically track bleeding unless a transfusion of 4 or more units of whole blood or packed red blood cells are required in a patient. Therefore, to identify the risk of bleeding requiring a return to the operating room, we had to develop a surrogate variable. We considered the reasons a patient may return to the operating room within the first 30 days of operation and identified 3 major causes: completion thyroidectomy for cancer, infection, and bleeding. After excluding the cases that had undergone an initial thyroid lobectomy who were found to have cancer in the final diagnosis, and eliminating patients with wound infections, we felt that we had controlled for the major confounding variables and think that our variable is a reasonable surrogate marker. We are possibly underestimating this variable, because not all patients with a history of bleeding would necessarily return to the operating room, as many patients may have small hematomas that are managed without a reoperation. There is also a possibility that we are overestimating this variable by assuming that pharmacologic DVT prophylaxis was given, and this anticoagulation resulted in greater bleeding. We do not know whether patients who were brought back to the operating room did so because of inadequate operative hemostasis or because of iatrogenic anticoagulation. We also do not know whether patients who were on perioperative anticoagulation or antiplatelet therapy for reasons such as recent vascular or cardiac stent placement, cardiac disease, and stroke prevention were advised to discontinue those medications. In the event that there was no documentation of discontinuation of medication such as low molecular weight heparin, low-dose unfractionated heparin, warfarin, dipyridamole, and so on, ACS NSQIP recorded this as a “yes” for “bleeding disorder” in the data set.17 According to our analysis, bleeding disorder was not associated with a higher risk of return to operating room complications in our cohort. Because the difference in complication rates is 10-fold, even if our surrogate variable is overestimating the difference, it is unlikely that the rates would lose their significant difference.

A combined knowledge of our data and the fact that bleeding into the neck region can lead quickly to respiratory obstruction followed by death implies that these patients may not benefit from pharmacologic DVT prophylaxis; patients might actually be harmed by it. Our data indicate that the risk of DVT/PE is less in participants who spend less time under anesthesia or in the operating room/hospital, and because most of the cases of thyroid and parathyroid operations are performed as an outpatient, these patients are at a lower risk of developing DVT/PE. Hence, DVT prophylaxis should be assessed carefully in these patients. Mandating DVT prophylaxis in a low-risk patient puts him/her at a greater risk of developing a bleeding complication. Pharmacologic VTE prophylaxis, however, should be considered in patients for whom surgical difficulty is anticipated, which may require a longer operation time, as well as patients that have multiple risk factors for developing DVT/PE. Our data suggest that DVT prophylaxis should not be mandatory for all patients undergoing thyroidectomy and parathyroidectomy, and it should be done at the discretion of the surgeon in select high-risk patients.

The ACS-NSQIP and the hospitals participating in the ACS-NSQIP are the sources of data used here; they have not been verified. ACS-NSQIP is not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

REFERENCES


DISCUSSION

Dr Keith Heller (Lake Success, NY): A very nice presentation of a very relevant problem because JACO is coming close to mandating some sort of prophylaxis for all major operations. My question is whether the NSQIP methodology would adequately capture the pulmonary emboli after thyroidectomy. And I ask this because most of our patients go home the next morning. Most DTVs and pulmonary emboli become obvious after that time period.

In many institutions in many communities, certainly in my own, if one of my patients had a pulmonary embolus three or four days postop, they would not come back to my hospital, they would go back to their local community hospital, almost certainly. And I wonder if you know if we are capturing patients like that, because if we are not, then we are underestimating the risk of pulmonary emboli.

Dr Madhu Roy (Madison, WI): The patient’s history is reviewed by specially trained surgical clinical reviewers. So, if there was a history of pulmonary embolism, it would be captured.

Dr Keith Heller (Lake Success, NY): It wouldn’t be on the hospital chart, though, because it would be at a different hospital.

Dr Madhu Roy (Madison, WI): The followup is for 30 days, where the patient is interviewed and tracked for 30 days. So if there were any complications, such as PE, it would be recorded in that NSQIP database.

Dr Barry Inabnet (New York, NY): Congratulations on a very clear, concise presentation. I think one of the pitfalls with the NSQIP data set, when you apply it to diseases such as endocrine surgery, it’s really a general surgical data set and many of the data points are not really applicable to what we do in clinical practice. And I think your presentation and your conclusions highlight that.

For example, many parathyroid operations are done under local anesthesia and, at some centers, thyroidectomy as well. And you grouped your thyroid and parathyroid patients together in one category.

So my question to you is, were you able to determine the type of anesthesia, because obviously, if these cases are done under local regional anesthesia, you would not have a problem with DVT.

And secondly, were you able to stratify based on cancer? Because clearly, the incidence of DVT would be much higher theoretically in patients with thyroid cancer.

Dr Madhu Roy (Madison, WI): To answer your second question, we looked at cancer and incidence of DVT formation. According to our analysis, we did not find a significant correlation between a history of cancer and DVT formation.

To answer your first question, all thyroid and parathyroid surgeries are considered major surgery, whether they are done under any types of anesthesia. And we did look at different types of anesthesia that were used and did not find any significant difference between general or local or regional anesthesia types.

Dr Barry Inabnet (New York, NY): Did you exclude the patients that had local anesthesia in your data analysis?

Dr Madhu Roy (Madison, WI): No, we did not.

Dr Allan Siperstein (Cleveland, OH): The CHEST criteria for DTV prophylaxis for a surgery such as thyroidectomy and parathyroidectomy speak to pneumatic compression stockings and only would recommend pharmacologic therapy in very high-risk patients. I would like to get your thoughts on what you think the risk of pneumatic compression stockings is in terms of any type of bleeding complication, and also, if these are used fairly routinely, they may have greatly reduced the risk of DVT and PE that would otherwise have been seen if these maneuvers weren’t used. I’m also interested in what type of prophylaxis you use at your own institution.

Dr Madhu Roy (Madison, WI): That’s a great point. We routinely use SCDs and TED hose for our practice, and we...
find that it works really well. But recently, our institution has mandated DVT screening for all our patients, and if the patients are under moderate to high-risk group, they require mandatory pharmacologic DVT prophylaxis. Unfortunately, most of our patients do fall in the moderate to high-risk group. So we have petitioned to opt-out of that criteria, and we did the study to support our practice and also for the patient’s benefit.

To answer your question second, we routinely use stockings. And if we feel the need for pharmacologic DVT prophylaxis, we use 5000 units of Heparin s/c one to two hours prior to surgery.

**Dr Samuel Snyder** (Temple, TX): I rise as someone who has experienced personally that one in a thousand complication of DVT—PE, so I am sensitive to the issue. I do use prophylaxis for DVT on my thyroidectomy patients, and recently reported an incidence of bleeding complications that was 0.4%. So I’m a little concerned with your methodology in estimating the 1.6% incidence of bleeding, because I think in reality, it is probably a lot lower than that.

And your DVT incidence, did it take into account whether or not patients received prophylaxis? Some of them did, some of them didn’t. Can you determine that from your methodology?

**Dr Madhu Roy** (Madison, WI): That’s a good point. Unfortunately, DVT prophylaxis is not tracked in the NSQIP database. However, they do track bleeding disorders, which is any patient that is on anticoagulant or antiplatelet therapy. So that includes the patients with MI, stroke, and TIA. We looked at that population and did not find that those patients are at any higher risk of bleeding complications.

To answer your first question, I think that we tried our best to exclude all the patients that might have come back for any complications other than bleeding and controlled for all these variables. But there is also the possibility that not all patients with bleeding would necessarily return to the OR and could have been managed on a non—OR basis, so we might be underestimating the difference.

Since that NSQIP interviewing system or case follow-up system is done by a skilled nurse, I feel confident that we are probably balancing out, and percentage that we reported is probably closer to what it would be.

And overall, the incidences in DVT formation versus bleeding complication, the difference was tenfold. So even if we are overestimating the difference, I think the difference would still be statistically and clinically significant.

**Dr Bryan Richmond** (Charleston, WV): Because the NSQIP database was the source of your information, as far as I’m aware, there’s no allowance for routine duplex surveillance in a NSQIP database. You capture only symptomatic patients who present with DVT or PE. And we know from the general surgery literature, that may underestimate the true incidence of DVT in patients who remain asymptomatic. Do you think there’s any benefit in routinely duplexing these patients at, say, 30 days postop?

Because you were using the NSQIP database for your data source, as far as I’m aware, NSQIP only captures patients who present with symptomatic DVT or PE. There’s no mechanism for routine duplex surveillance. And do you think that if you had done that in this population that the true incidence of DVT may be considerably higher and is there value in investigating that further?

**Dr Madhu Roy** (Madison, WI): I think you’re right. The asymptomatic cases might be missed. And since the tracking is only for 30 days, anybody that presented after 30 days could be potentially missed.