Incidence of Venous Thromboembolism in Otolaryngology–Head and Neck Surgery

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Objective: To examine the incidence of venous thromboembolic disease in the otolaryngology–head and neck surgery (OTO-HNS) patient population.


Intervention: A total of 59,884 total surgical procedures among all the surgical services.

Main Outcome Measures: The incidence of deep venous thrombosis and pulmonary embolism.

Results: There were 5,616 otolaryngology procedures performed during the study period. Clinically evident deep venous thrombosis developed in 3 patients; 2 of these patients also developed a pulmonary embolism. The overall incidence of deep venous thrombosis and pulmonary embolism in OTO-HNS was 0.05% and 0.035%, respectively. All patients who developed deep venous thrombosis or a pulmonary embolism in the OTO-HNS population were inpatients being treated for cancer. There were no deep venous thromboses or pulmonary emboli in patients undergoing same-day or overnight surgery or in patients without an active cancer. The OTO-HNS service had significantly lower rates of venous thromboembolism than did most other surgical specialties despite lower rates of adherence to venous thromboembolism prophylaxis guidelines.

Conclusions: The incidence of deep venous thrombosis and pulmonary embolism among the OTO-HNS patient population at our academic center is lower than the incidence reported in previous studies (range, 0.1%-0.3%) and is significantly lower than the incidence observed in other surgical specialties. It is likely that patient- and specialty-specific factors as well as the more aggressive use of venous thromboembolism prophylaxis during recent years are at least partially responsible for the decreased incidence in our population.


VENOUS THROMBOEMBOLIC disease, including deep venous thrombosis (DVT) and pulmonary embolism (PE), is a significant problem among hospitalized postsurgical patients and has been shown1 to result in significant morbidity, mortality, and resource expenditure. Without thromboprophylaxis, the incidence of confirmed DVT ranges from 10% to 40% for medical and general surgical patients and is as high as 60% following major orthopedic surgery. Among 7 million hospitalized patients, venous thromboembolism (VTE) was found to be the second most common complication, the second most common cause of excess length of stay, and the third most common cause of excess mortality.2 Pulmonary embolism is the most common preventable cause of death among hospitalized patients, and studies3,4 have shown that fatal PE can be prevented by adequate thromboprophylaxis. With these factors known, ensuring adequate prophylaxis against VTE has become a major patient quality-improvement goal at many health care institutions.3

The primary means of preventing VTE is providing patients with adequate prophylaxis. This includes the use of mechanical strategies, such as early ambulation, compression stockings, and sequential compression devices, as well as the use of pharmacologic prophylaxis strategies, such as heparin, low-molecular-weight heparin, and warfarin. Primary thromboprophylaxis, or the use of strategies to prevent VTE from occurring in an otherwise healthy individual, has been proven in multiple randomized controlled trials5,6 to reduce the incidence of DVT and PE as well as to reduce adverse patient outcomes and decrease the cost of care. A better understanding of the risk factors and incidence of VTE among several
surgical specialties, such as orthopedic surgery, general surgery, vascular surgery, and gynecology, has led to the establishment of clear specialty-specific prophylaxis guidelines and improvements in the rates of VTE prophylaxis and patient outcomes in these specialties. There are currently no such specialty-specific guidelines for the field of otolaryngology.

Data regarding VTE are well defined among many surgical specialties; however, data on the incidence of VTE in postsurgical otolaryngologic patients are very limited. Only 2 prior published studies have examined this problem. Moreano et al, from The University of Iowa, published a study in 1998 reporting an overall incidence of DVT of 0.3% among otolaryngology patients. A study reported in 2009 by Innis and Anderson, from the Lahey Clinic in Boston, reached slightly different conclusions and found an overall incidence of DVT of 0.1%. These 2 studies represent the only available published data on DVT and PE among otolaryngology patients; therefore, our knowledge of the true incidence of VTE disease in otolaryngology remains limited. The purpose of our study was to better define the incidence of DVT and PE among patients undergoing otolaryngologic procedures.

This 3-year retrospective study examined the incidence of clinically recognized DVT and PE in an otolaryngology—head and neck surgery (OTO-HNS) practice at an academic tertiary care institution. Our study was reviewed and approved by our institutional review board. At our institution since fiscal year 2008, all cases of DVT and PE that are diagnosed are tracked using diagnostic codes and entered into a computerized database. There is no protocol for screening asymptomatic patients for VTE at our institution. Therefore, all patients who received a diagnosis of DVT or PE underwent some form of radiologic study, such as duplex ultrasonography or computed tomography, which was ordered on the basis of some clinical suspicion or symptom, such as lower extremity pain or edema, dyspnea, tachypnea, oxygen desaturation, and tachycardia. We reviewed all cases of DVT and PE occurring at our institution from fiscal years 2008 to 2011. All surgical patients with a DVT or PE occurring within 30 days after the time of surgery were included. We stratified these patients according to the surgical service to which they belonged and whether they underwent an inpatient or outpatient surgical procedure. We then tabulated the total number of operative cases for each of the surgical services at our institution, which were used to calculate overall incidence data. The Current Procedural Terminology and International Classification of Diseases, Ninth Revision codes and a review of the electronic medical record were used to identify the total number of head and neck oncology procedures, the total number of procedures performed per patient, and the total number of cases of postoperative bleeding requiring a return to the operating room.

Since the beginning of fiscal year 2011, our institution has also routinely been tracking physician adherence to a set of institutional VTE prophylaxis guidelines (Tables 1, 2, and 3), developed using the best available literature. At the time of admission, all inpatients receive a VTE risk score that stratifies them as being at low, moderate, or high risk for developing VTE. Automated alerts are then generated and displayed in the electronic medical record for clinicians who are responsible for ensuring that patients receive adequate prophylaxis—mechanical, pharmacologic, or both—depending on the patient’s risk level. To be considered adherent, the appropriate prophylaxis must be ordered within 24 hours of admission and continued throughout the patient’s hospital stay, unless some contraindication exists. We collected data on adherence to the VTE guidelines for the first 6 months of fiscal year 2011 broken down by surgical service to determine and compare adherence levels. We examined adherence to the Medicare/Medicaid meaningful use guidelines, which require a patient at moderate to high risk to receive some form of prophylaxis within 24 hours of admission, and we examined adherence to our institutional guidelines (Tables 1, 2, and 3), which are considerably more stringent. Because VTE prophylaxis is not recommended in pediatric patients under our institutional guidelines, they were not included in our adherence analysis.

A χ² analysis with a Fisher exact test using the Monte Carlo estimate was used to calculate P values and odds ratios for data on VTE incidence as well as data on adherence to VTE prophylaxis guidelines. All analyses were carried out using commercial software (SAS, version 9.2; SAS Institute Inc).
During the study period from fiscal years 2008 to 2011, there were 59,884 surgical procedures performed. Figure 1 outlines the total number of procedures performed according to surgical specialty. There were 277 DVTs and 130 PEs during the course of the study, with the overall incidence among all surgical services 0.47% and 0.21%, respectively. Among the entire surgery department, nearly all (274 of 277) cases of DVT occurred after inpatient surgical procedures. Only 3 cases of DVT were diagnosed in patients after they underwent an outpatient procedure: 2 orthopedic surgery patients and 1 emergency general surgery patient.

There were 5616 otolaryngology cases during the study period, with an average of 3 procedures performed per surgical case. Three otolaryngology patients developed a DVT; 2 of these patients also developed a PE. The incidence of DVT and PE among the OTO-HNS population was therefore 0.05% and 0.035%, respectively. The incidence of DVT and PE for each of the other surgical specialties is displayed in Figure 2. As can be seen, otolaryngology patients were significantly less likely to develop VTE when compared with most other surgical services.

Pediatric patients accounted for 1576 of the total otolaryngology surgical cases. There were no cases of DVT or PE among that population. When these patients are excluded from analysis, the incidence of DVT and PE among the adult OTO-HNS patient population becomes 0.07% and 0.04%, respectively.

Outpatient surgery, defined as procedures that allowed patients undergoing surgery to be discharged the same day or within 23 hours, accounted for 4809 of the otolaryngology procedures, or 86% of the total. The remaining 807 surgical procedures were performed on inpatients. Of these 807 inpatient procedures, 268 were major oncologic procedures performed for a primary diagnosis of cancer. There were no DVTs or PEs diagnosed among patients undergoing outpatient surgery. All DVTs and PEs in the otolaryngology population occurred after inpatient surgery in patients treated for an active cancer. The incidence of DVT and PE after inpatient surgery was 0.3% and 0.2%, respectively, and the incidence of VTE among otolaryngology inpatients being treated for cancer was 1.1%.

All otolaryngology patients who developed a DVT or PE were receiving some form of prophylaxis. Two of the 3 patients who developed VTE were being treated with pharmacologic prophylaxis; this was discontinued in 1 patient because of bleeding concerns. All 3 patients received prophylaxis with sequential compression devices throughout their hospitalization.

Eighty patients developed bleeding complications severe enough that they required a return to the operating room. Of those 80 patients, 36 developed hemorrhages after tonsillectomy. Patients who undergo tonsillectomy are not typically given VTE prophylaxis. With these cases excluded, the remaining 24 patients required wound explorations for bleeding occurring after such procedures as thyroidectomy, parotidectomy, or neck dissection. Of the 24 patients with bleeding who returned to the operating room, 11 patients (45.8%) were being treated with some form of pharmacologic VTE prophylaxis (eg, warfarin sodium, heparin sodium, low-molecular-weight heparin) and 13 patients (54.2%) were receiving none.

Risk scores of individual patients with VTE were examined for the OTO-HNS inpatient surgical population. Among 84 postsurgical inpatients for the first 6 months of fiscal year 2011, 43 (51.2%) were classified as moderate to high risk for the development of VTE. We also examined adherence to institutional VTE prophylaxis guidelines among the different surgical services using several different criteria (Figure 3). One of these criteria was the Medicare/Medicaid meaningful use guideline. In addition, we evaluated adherence to our more stringent institutional guideline (Tables 1, 2, and 3), and the results of this analysis are shown in Figure 3. Nearly all the surgical specialties had excellent rates of adherence to the Medicare/Medicaid meaningful use guideline, with 11 of 12 services having adherence rates of between 94.9% and 100.0%. We found that 7 of 11 surgical services were more likely than the otolaryngology ser-
vice to provide patients with the institutionally recommended VTE prophylaxis.

**COMMENT**

The incidence of DVT and PE remains rarely described in the otolaryngology literature. The first article to address this question was published by Graham et al in 1976 and looked at the incidence of DVT in 103 patients undergoing otologic and head-neck oncologic surgery; they found evidence of DVT in 17% of their patients. Part of the reason the incidence observed in that study was so high is likely because all their patients underwent screening with a sodium iodide I 125 fibrinogen test regardless of their symptoms or clinical appearance. This is consistent with findings from previous studies showing that up to two-thirds of DVTs are clinically silent. In 1990, Arriaga et al looked at complications in 414 patients after total laryngectomy and found an incidence of clinically apparent postoperative PE of 0.5%. Taken together, these data demonstrate that the incidence of DVT and PE among the postsurgical otolaryngology patient population is poorly described and extremely variable, a situation that is addressed by the present study.

Recently, there have been more studies looking at the incidence of clinically evident DVT and PE in the otolaryngology population. In 1998, Moreano et al reviewed the records of 12,805 operations performed between 1987 and 1994 and found overall incidences of DVT and PE of 0.3% and 0.2%, respectively. The incidence in patients undergoing head and neck oncologic surgery was even higher, at 0.6%. However, that study involved patient data going back for more than 2 decades, and the authors noted that 35% of their patients who developed DVT were receiving no prophylaxis, either mechanical or pharmacologic. This limits our ability to generalize from their data given the widespread recommendation of these prophylactic measures in recent years by organizations such as the American College of Chest Physicians and the American College of Physicians. More recently, in 2009, Innis and Anderson examined patients undergoing 6,122 otolaryngologic procedures and found overall DVT and PE rates of 0.1% and 0.02%, respectively, significantly less than previously reported. They attributed...
this difference in part to the fact that nearly all their patients received prophylaxis with both pneumatic compression devices and subcutaneous heparin. Much like in the study by Moreano et al, Innis and Anderson also found a higher incidence of DVT (0.6%) among patients with cancer. Given that these are the only 2 studies examining the incidence of VTE in the otolaryngology patient population and that their results differ significantly, the true incidence of VTE among our population remains largely unknown.

In our study, after 5616 otolaryngologic surgical procedures, we found the incidences of clinically evident DVT and PE to be 0.05% and 0.035%, respectively. Our observed incidence is slightly less than that found by Innis and Anderson.7 In our study, 3 patients developed a DVT, with 2 then developing a PE. Notably, all of these events occurred among the inpatient surgical population. There was no clinically evident DVT or PE among adult or pediatric patients undergoing same-day or overnight surgical procedures. This is similar to the findings by Innis and Anderson, who identified no cases of VTE in otolaryngology patients undergoing 4582 outpatient surgeries. This finding is clinically relevant and suggests that patients undergoing outpatient surgery are at decreased risk of developing VTE. They therefore may not necessarily benefit from pharmacologic VTE prophylaxis.

A common thread among the otolaryngology patients who developed VTE is that they were all receiving treatment for active cancer—2 patients with anaplastic thyroid cancer and 1 with oral cavity squamous cell carcinoma. There were no episodes of DVT or PE occurring in patients without active cancer. This is similar to the findings of Moreano et al6 and Innis and Anderson,7 with both reporting an elevated incidence of VTE among patients undergoing head and neck oncologic surgical procedures. These data must be interpreted carefully, since each of these 3 otolaryngology patients had multiple other risk factors for the development of VTE, placing them in the high-risk category according to our institutional criteria. Some of the risk factors present in these patients included age older than 75 years, recent major surgery (>60 minutes), chronic or acute lung disease, sepsis or severe infection, acute or chronic heart failure, and immobility. Interestingly, active cancer is not considered a risk factor according to our criteria, although metastatic disease is a risk factor. Thus, although our data suggest that these patients with active cancer may be at a relatively higher risk for developing VTE in the postoperative period, it is likely equally true that all otolaryngology patients stratified as high risk for the development of VTE are at greater risk for developing thromboembolic disease and would benefit from aggressive prophylaxis as well.

One issue that has limited the widespread adoption of pharmacologic VTE prophylaxis after otolaryngologic surgical procedures is concerns over bleeding risk. Prior studies12–14 have demonstrated that there may be a higher risk of bleeding complications in patients given prophylaxis with heparin compared with those receiving prophylaxis with mechanical compression. The small
increased risk of bleeding with pharmacologic prophylaxis has been shown\(^\text{15}\) to be more than offset by the reduction in the risk for VTE in other surgical specialties. However, because a wound hematoma after otolaryngologic surgery can result in potentially life-threatening consequences, such as airway compromise, the risk-benefit ratio of using pharmacologic prophylaxis after otolaryngologic surgery is not as clear cut, particularly given the low incidence of VTE that we found in our population.

In our study, we also examined adherence to institutional VTE prophylaxis guidelines among the various surgical services. Using the Medicaid/Medicare meaningful use criteria of VTE prophylaxis, the rates of adherence across nearly all the surgical specialties were excellent; however, there was still significant variability in the rates of VTE among the different surgical specialties. We compared institutional guideline adherence among the otolaryngology population with that of the other surgical specialties and found that 7 of the 11 surgical services were significantly more likely than the otolaryngology service to adhere to institutional VTE guidelines. Although in the time period evaluated the incidences of DVT and PE among otolaryngology patients were significantly lower than those among most other specialties at our institution, our service was adherent to the institutionally recommended VTE prophylaxis only 53% of the time, which is significantly less than the adherence of most other surgical services measured during the study period. Taken together, these data suggest that differences in adherence to our institutional VTE prophylaxis guidelines are not primarily responsible for the observed differences in the incidence of VTE among our population, and other variables, such as patient-, disease-, and specialty-specific factors, may play more of a role in the development of VTE in the different surgical specialties.

There are several limitations to our study. First, incidence data were calculated on the basis of the total number of surgical procedures performed rather than the total number of patients. It is possible that some patients underwent more than 1 surgical procedure during the study period, which may skew our results. Second, there was no time overlap in the data collected on VTE incidence (collected from fiscal years 2008-2011) and adherence to VTE prophylaxis guidelines (collected from the first 6 months of fiscal year 2011); therefore, we were unable to analyze whether a relationship exists between rates of adherence to VTE prophylaxis guidelines and VTE incidence rates. Another limiting factor is that our institution’s definition of adherence to mechanical and pharmacologic VTE prophylaxis is specific. For example, a patient at moderate risk according to the guidelines should receive only pharmacologic VTE prophylaxis. If sequential compression devices were also prescribed, that case would be marked as an adherence failure despite the fact that the patient received prophylaxis with mechanical compression over and above what the guidelines recommend. To address the appearance of low adherence levels created as a result of our strict and specific institutional prophylaxis policy, we also examined adherence according to the Medicare/Medicaid meaningful use criteria, which demonstrated adherence of more than 94.9% among 11 of the 12 surgical services. This demonstrates that nearly all patients receive some form of VTE prophylaxis within 24 hours of their admission. Regardless, our VTE adherence rates overall may be artificially depressed as a result of specific institutional definitions.

### CONCLUSIONS

The incidences of DVT and PE among the otolaryngology patient population at our academic center were 0.05% and 0.035%, respectively, which is less than those previously reported,\(^\text{16}\) which ranged from 0.1% to 0.3%. This suggests that otolaryngology patients are overall at low risk for the development of VTE. Despite the fact that otolaryngology patients were significantly less likely to receive the institutionally recommended VTE prophylaxis than were patients in many other surgical services, the incidences of DVT and PE in otolaryngology were significantly less than those seen in most other surgical specialties at our institution. These data suggest that differences in VTE incidence among the surgical disciplines are not necessarily related to differences in adherence to VTE prophylaxis strategies but instead are likely related to patient-, disease-, and specialty-specific factors. Given these variables, it is unclear what effect this set of standardized institutional VTE prophylaxis guidelines has on the incidence of VTE in our otolaryngology patient population. Our data, although limited and retrospective, demonstrate that otolaryngology patients undergoing inpatient surgical procedures, particularly those with active cancer and multiple other VTE risk factors, are at higher risk for developing VTE and should likely receive more aggressive prophylaxis. Patients undergoing outpatient or same-day surgery seem to be at lower risk for developing VTE.

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REFERENCES


