Journal of Clinical Orthopaedics and Trauma xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Journal of Clinical Orthopaedics and Trauma

journal homepage: www.elsevier.com/locate/jcot

Full length article

The risk of deep vein thrombosis in total joint patients compared to orthopaedic trauma patients: Need for new prevention guidelines

Michelle Shen, Norele J. Cutrera, Ashley C. Dodd, Christopher Wallace, Frank R. Avilucea, Craig Melbourne, Alex A. Jahangir, Hassan H. Mir, William T. Obremskey, Manish K. Sethi*

The Vanderbilt Orthopaedic Institute Center for Health Policy, 1215 21st Avenue South, Suite 4200, Medical Center East, South Tower, Nashville, TN 37292, United States

ARTICLE INFO

Article history:
Received 10 September 2015
Received in revised form 7 December 2016
Accepted 17 December 2016
Available online xxx

Keywords:
Risk factor
Deep vein thrombosis
Total joint arthroplasty
Orthopaedic trauma
Prophylaxis

ABSTRACT

Background: The development of Deep Vein Thrombosis (DVT) is a major concern following orthopaedic surgery. No study has yet to compare the rate and risk factors for DVT between total joint and orthopaedic trauma patients. To evaluate if DVT prophylaxis for trauma should differ from total joints, we explored the rate and risk factors for DVT between both cohorts.
Methods: Using a CPT code search from 2005 to 2013 in the ACS-NSQIP database, 150,657 orthopaedic total joint patients and 44,594 orthopaedic trauma patients were identified. DVT complications, patient demographics, preoperative comorbidities, and surgical characteristics were collected for each patient. A chi-squared test was used to compare the risk factors for DVT between orthopaedic trauma and total joint patients. A multivariable logistic regression model was built to adjust for comorbidities for each cohort.
Results: The rate of DVT diagnosis in the total joint population was 0.8% (N = 1186) and 0.98% (N = 432) in the orthopaedic trauma population ($p = 0.57$). After controlling for individual comorbidities, dyspnea, peripheral vascular disease, and renal failure were significant risk factors for DVT in total joint patients ($p < 0.05$), whereas age, ascites and steroid use were significant risk factors for DVT in orthopaedic trauma patients ($p < 0.05$).
Conclusions: Historically, the risks for DVT in total joints have been emphasized, yet based on our results, the incidence of DVT is the same for orthopaedic trauma. However, the risk factors varied. It is therefore important to consider specialty-specific DVT prophylaxis for orthopaedic trauma patients in order to improve care and reduce postoperative complications.

1. Introduction

Venous thromboembolism (VTE), including deep vein thrombosis (DVT) and pulmonary embolism (PE), remains a major concern following orthopaedic surgery, particularly since such disease is a leading cause of perioperative morbidity and mortality.[1] Amongst patients hospitalized in the United States, it is the direct cause of death in more than 100,000 patients and a contributing factor of mortality in another 100,000 each year.[2,3] Several patient safety initiatives, such as the Agency for Healthcare Research and Quality Patient Safety Indicators, American Public Health Association's Coalition to Prevent Deep Vein Thrombosis, and the US Surgeon General's Workshop on Deep Vein Thrombosis have aimed to improve detection and prevention of VTE.[4–6]

To our knowledge, no study has yet to compare the risk factors for DVT between total joint and orthopaedic trauma patients. The purpose of this article is to identify the risk factors for DVT in trauma patients and compare to total joint patients through the use of prospective multicenter data in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database. By evaluating the risk factors for DVT in each cohort, our study seeks to explore whether DVT prophylaxis guidelines for total joint patients can be applied to trauma surgery patients. As our health system transitions to bundle payments, it is essential for orthopaedic trauma surgeons to identify those patients most likely to experience thromboembolic complications in order to develop a cost effective DVT prevention program, specifically targeting those patients most at risk.

* Corresponding author.
E-mail address: manish.sethi@vanderbilt.edu (M.K. Sethi).

http://dx.doi.org/10.1016/j.jcot.2016.12.007
0976-5662/

2. Methods

Patients undergoing orthopaedic procedures from 2005-2013 were identified in the ACS-NSQIP database using a Current Procedural Terminology (CPT) code search. Among these patients, a second CPT code search using only orthopaedic trauma "hip/pelvis" and "lower extremity (LE)" injury CPT codes was conducted to identify patients undergoing pelvis and LE orthopaedic trauma procedures. A similar CPT code search of total joint procedures established patients undergoing primary and revision total hip arthroplasty and primary and revision total knee arthroplasty. We chose to focus on lower extremity surgeries because they have previously been documented to have a higher incidence of DVT.[7] Additionally, and more specifically, lower extremity and hip/pelvis orthopedic trauma patients have also been documented to have a higher incidence of DVT than upper extremity orthopedic trauma patients.[8] Therefore we believe these patients would be most in need of new prophylaxis guidelines.

The development of a deep vein thrombosis (DVT) within 30-days following surgery was recorded for each patient. Patients with missing data were not included in the analysis. The ACS-NSQIP database we used encompasses over 300 variables including preoperative risk factors, intraoperative variable, and 30-day postoperative mortality and morbidity outcomes. After a careful literature review, we selected variables we believe to be most relevant to the development of DVT.[9–15] Patient demographics (ASA Class, body mass index [BMI], sex, alcohol use, functional status and smoking status), preoperative comorbidities (ascites, bleeding disorder, ventilator use, diabetes, disseminated cancer, dyspnea, history of congestive heart failure [CHF], history of chronic obstructive pulmonary disorder [COPD], history of myocardial infraction [MI], dialysis, renal failure, use of steroids, preoperative sepsis, pneumonia, hypertension requiring medication, bleeding disorder, radiotherapy, peripheral vascular disease, and weight loss in the last 6 months), as well as operative characteristics (surgical duration, type of surgery for total joint patients, prior operation in last 30 days) were collected for each patient. Bivariate analyses using the chi-squared test and Wilcoxon-Mann-Whitney test were performed to compare risk factors between those who developed a DVT and those who did not for both the orthopaedic trauma and total joint cohorts. Statistical significance was set at $\alpha = 0.05$.

A multivariate logistic regression was then conducted to determine the predictive risk factors for DVT development in orthopaedic trauma and in total joint patients.

3. Results

A total of 195,251 patients who underwent orthoapedic procedures were identified from 2005-2013 in the ACS-NSQIP datebase. Of these patients, 44,594 (22.8%) were orthopaedic trauma patients with pelvis and/or LE injuries and 150,657 (77.2%) were orthopaedic total joint patients. Of the total joint patients, 84,659 (56.2%) patients underwent primary total knee arthroplasty (TKA), 53,290 (35.4%) total hip arthroplasty (THA) and the remaining 12,708 patients (8.4%) underwent revision surgery.

As shown in Table 1, the incidence of DVT within 30 postoperative days for the total joint population [0.8% (n = 1186)] and for the orthopaedic trauma population [0.98% (N = 437)] did not significantly differ between the two groups (p = 0.57). For orthopaedic trauma patients, those who developed a DVT within 30-days following surgery had a significantly higher median age than those who did not: 80.0 (IQR: 69.0–87.0) years verses 77.0 (IQR: 59.0–86.0) years respectively ($p < 0.01$). A greater BMI (p = 0.017) and Caucasian race ($p < 0.01$) was also significantly associated with a higher rate of DVT development for orthopaedic trauma patients. Total joint patients who developed a DVT were also significantly older ($p < 0.01$), had a greater median BMI

Table 1
Selected demographics for DVT for Trauma vs. Total Joint Patients.

Characteristic	Orthopaedic Trauma (n = 44,594)			Total Joint (n = 150,657)		
	DVT (n = 437, 0.98%)	No DVT (n = 44157, 99.0%)	*p*	DVT (n = 1186, 0.80%)	NO DVT (n = 149471, 99.2%)	*p*
Age (median, IQR)	80.0 (69.0–87.0)	77.0 (59.0–86.0)	<**0.01**	66.0 (59.0–74.0)	68.0 (60.0–76.0)	<**0.01**
Gender (n,%)			0.260			0.310
Male	141 (32.3%)	15429 (35.0%)		493 (41.57%)	60098 (40.2%)	
Female	296 (67.7%)	28699 (65.0%)		687 (57.9%)	89134 (59.6%)	
Race (n,%)			<**0.01**			<**0.01**
White	356 (81.5%)	32286 (73.1%)		914 (77.1%)	120265 (80.5%)	
Black	24 (5.5%)	2316 (5.2%)		113 (9.5%)	9819 (6.6%)	
Other	57 (13.0%)	9555 (21.6%)		159 (13.4%)	19387 (13.0%)	
Functional Status			<**0.01**			<**0.01**
Independent	310 (70.9%)	33491 (75.8%)		1133 (95.5%)	144062 (96.4%)	
Partially dependent	96 (22.0%)	8498 (19.2%)		38 (3.20%)	4340 (2.90%)	
Dependent	28 (6.4%)	1761 (4.0%)		7 (0.60%)	262 (0.2%)	
Unknown	3 (0.70%)	407 (0.92%)				
BMI (median, IQR)	25.2 (21.5-29.2)	24.7 (20.6–29.2)	**0.017**	31.2 (27.4–35.8)	30.6 (26.6–35.5)	<**0.01**
Smoke (n,%)	57 (13.0%)	7318 (16.0%)	0.056	115 (9.70%)	15922 (10.7%)	0.310
Alcohol use (n,%)	7 (1.6%)	751 (1.7%)	0.999	8 (0.70%)	1369 (0.92%)	0.320
ASA score (n,%)			<**0.01**			<**0.01**
1	14 (3.2%)	3074 (7.0%)		21 (1.77%)	4274 (2.86%)	
2	88 (20.1%)	12138 (27.5%)		540 (45.5%)	76949 (51.5%)	
3	242 (55.4%)	22775 (51.6%)		588 (49.6%)	65065 (43.5%)	
4	93 (21.3%)	6170 (14.0%)		34 (2.87%	3013 (2.02%)	
5	0 (0.0%)	0 (0.0%)		0 (0.0%)	9 (0.01%)	

Bold values are significant ($p < 0.05$).

Please cite this article in press as: M. Shen, et al., The risk of deep vein thrombosis in total joint patients compared to orthopaedic trauma patients: Need for new prevention guidelines, J Clin Orthop Trauma (2017), http://dx.doi.org/10.1016/j.jcot.2016.12.007