Quality Improvement: An Analysis of Venous Thromboembolism Rates in Post-Operative Surgical Patients

Dylan S. Goto, MD[1] ; Rachel Lew,[1] ; Myah McDonald[2] ; Angelique Fontaine[1]; Chad Cryer, MD[1]

[1]University of Hawaii; [2]University of New Mexico

Introduction: This study aims to identify institution-specific factors associated with rates of postoperative venous thromboembolism. Annually, venous thromboembolism (VTE) is estimated to affect up to 600,000 patients and contribute up to an additional $15,000 in hospital costs, with overall national expenses of $7-10 billion. Identifying modifiable risk factors for postoperative VTE has utility in improving hospital quality metrics and postoperative disease burden.

Methods: We performed a single-center retrospective study at a 575-bed tertiary institution in Hawaii. Twenty-one surgical patients who presented with VTE within 30 days of a procedure from December 2015 to November 2022 were identified using the NSQIP database. Patient factors, operative variables, and postoperative complications were then assessed. The Modified Caprini Score was used to stratify patients by VTE risk. Nonparametric bivariate analyses (alpha=0.05) were utilized.

Results: Eighty-one percent of patients met criteria for high risk for VTE according to the Modified Caprini Score. Nineteen percent of patients met criteria for moderate risk. No patients met criteria for low or very low risk. The average operative time among patients was 199 minutes, with a range of 35 to 516 minutes. Only one (5%) of the 21 patients received both pre- and postoperative DVT prophylaxis appropriate for their risk group. Eleven patients (52%) received appropriate postoperative prophylaxis, however seven (33%) had a lapse in their postoperative prophylaxis. The most common reason was concern for postoperative bleeding. The remainder of patients received either no perioperative prophylaxis or failed to receive either pre- or postoperative prophylaxis when both were indicated. One patient refused treatment.

Risk Factor		Score
Age	41-60	1
	61-74	2
	>=75	3
BMI	>25	1
Women	OCP or HRT	1
	Pregnancy or Postpartum	1
	Historyy of unexplained or recurrent miscarriage/stillborn infant	1
Thrombophilia	Elevated serum homocysteine	3
	Positive factor V Leiden mutation	3
	Positive prothrombin 20210A mutation	3
	Positive lupus anticoagulant	3
	Positive anticardiolipin antibodies	3
	Positive anti-beta2-GPI antibodies	3
	HIT	3
	Other congenital or acquired thrombophilia	3
Venous Disease	Lower limb edema	1
	Varicose veins of lower limb	1
	History of VTE	3
	Family history of VTE	3
Immobilization	Medical patient currently at bedrest	1
	Patient confined to bed (>72 hours)	2
	Limb immobilized in plaster cast	2
Surgery	Minor surgery planned	1
	Arthroscopic surgery	2
	Major surgery (> 45 mins)	2
	Laparoscopic surgery (>45 mins)	2
	Elective arthroplasty	5
	Hip, pelvis, or leg fracture	5
Other	Sepsis (< 1 month)	1
	Serious lung disease, including pneumonia (<1 month)	1
	Abnormal pulmonary function	1
	Acute myocardial infarction	1
	Onset or exacerbation of heart failure (< 1 month)	1
	History of inflammatory bowel disease	1
	Central venous access	2
	Malignancy	2
	Stroek (< 1 month)	5
	Acute spinal cord injury (< 1 month)	5
Interpretation	Score 0: Very low risk	
	Score 1-2: Low risk	
	Score 3-4: Moderate risk	
	Score >= 5: High risk	

Modified Caprini Score	Open or Laparoscopic	Name of procedure	Duration of Procedure	Type of thrombus	Treatment	Preop Prophylaxis	Post op Prophylaxis on Day 1	Post op Prophylaxis on day 2	Lapse in Post op prophylaxis
High	Lap,Robot	Robotic recurrent incisional hernias with component separation	480	Basilic and Cephalic Thrombosis	Heparin	No	Yes	Yes	Continued
High	Open	Exploratory laparotomy, explantation of mesh, washout, temp abdominal closure	210	Left cephalic vein	Lovenox	No	No	No	
High	Open	Exploratory laparotomy, small bowel resection, abthera	35	Soleal	SQH	No	No	No	
High	Open	Diagnostic laparoscopy, converted to exploratory laparotomy	52	LE DVT	Lovenox, Coumadin	No	Yes	Yes	Continued
High	Open	Exploratory laparotomy, abdominal washout	69	Left saphenous vein, cephalic vein	Lovenox, warfarin	No	Yes	Yes	Continued
High	Open	Open right hemicolectomy	120	Soleal DVT	Lovenox	No	Yes	Yes	Lapse
High	Open	Gastrojejunostomy	70	LE DVT	Xarelto	No	No	No	
High	Lap,Robot	Robotic assisted bilateral inguinal hernia repair with mesh	180	Portal vein	Eliquis	No	No	No	
High	Lap,Robot	Laparoscopic cholecystectomy with intraoperative cholangiogram	277	UE DVT	Eliquis	No	Yes	Yes	Continued
High	Lap,Robot	Xi robotic-assisted ultra low anterior resection	516	LE DVT	Heparin, argatroban	Yes	Yes	Yes	Continued
High	Open	Exploratory laparotomy, low anterior resection	187	LE DVT	Heparin gtt	No	No	Yes	Lapse
High	Lap,Robot	Xi robotic assisted sigmoid resection	467	LE DVT	Eliquis	Yes	Yes	Yes	Lapse
High	Lap,Robot	Laparoscopic lysis of adhesions, laparoscopic right colectomy, Incisional hernia repair.	145	LE DVT	Heparin	Yes	Yes	0	Lapse
High	Lap,Robot	Laparoscopic Incisional hernia repair with mesh	119	LE DVT	Heparin gtt	Yes	Yes	Yes	Lapse
High	Open	Diagnostic laparoscopy converted to open laparotomy, right hemi colectomy with primary anastomosis, TAP block	195	LE DVT	Lovenox	No	Yes	Yes	Continued
High	Lap,Robot	Laparoscopic adhesiolysis	190	LE DVT	IVC filter	No	No	Yes	Lapse
High	Open	Exploratory laparotomy, right hemicolectomy and creation of end ileostomy and mucous fistula.	137	LE DVT	Lovenox, apixaban	No	No	Yes	Lapse
Moderate	Lap,Robot	Xi Robotic assisted Type 4 Para esophageal hernia repair with mesh and fundoplication	415	LE DVT	Heparin gtt	No	No	Yes	Continued
Moderate	Open	Leg debridement	60	Right subclavian and axillary vein	SQH	Refused	Refused	Refused	
Moderate	Open	Exploratory laparotomy, liver bx, gastrojejunostomy	60	UE DVT	Lovenox	No	Yes	Yes	Continued
Moderate	Open	Total proctocolectomy with creation of permanent end ileostomy.	196	SMV	Lovenox	No	No	No	

Conclusion: The majority of the patients at our institution with postoperative VTE failed to receive either timely or risk-group appropriate DVT prophylaxis. Given that our institution represents the largest hospital in the state of Hawaii, quality improvement measures targeted at improving rates of DVT prophylaxis have the potential to significantly decrease healthcare costs and postoperative disease burden in the state. Our ongoing studies into the etiologies of these findings will help to identify areas of optimization at our institution.

References:

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c. McMuster Textbook of Internal Medicine. Empendium. Table 3.20-7. A modified Caprini risk assessment score