Modified Caprini Risk Assessment Model for Venous Thromboembolism Prophylaxis in Elective Foot and Ankle Surgery

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Statement of Purpose

Venous thromboembolisms (VTE) can pose a significant risk to patients in the postoperative period. Due to the reported low incidence (0.3%-12.2%) of VTE following elective and non-elective foot and ankle surgery, guidelines for VTE prophylaxis have not been established.[1,2] The Caprini Risk Assessment Model (RAM) has been validated in other medical specialties, but not yet in foot and ankle surgery.[3-10] These validation studies frequently found significant VTE risk with a Caprini RAM >8, with a single orthopedic study reporting a score ≥ 12 in hip fracture patients.[4-6,8,9,11]

The primary aim of this study is to assess the validity of a modified Caprini RAM for VTE risk assessment and prophylaxis guidelines in elective foot and ankle surgery. This study examines the rate of VTE occurrence in elective surgical cases with a single surgeon.

Methodology & Procedures

All patients undergoing elective foot and ankle surgery with a single surgeon (B.H.) between 2013 and 2017 were included in this study. The minimum postoperative follow-up required was one year. All elective surgical patients underwent a Modified Caprini RAM preoperatively (Figure 1). Postoperative VTE prophylaxis was determined from the Modified Caprini RAM score (Table 1). Study exclusion criteria included any non-elective, semi-urgent, or emergent surgeries.

A retrospective chart review was performed to extract data from all elective foot and ankle surgeries including: age, sex, Modified Caprini RAM, and VTE occurrence postoperatively. Data extracted from patients that experienced a VTE included: surgical procedure, date of surgery, weight bearing status at time of DVT, VTE prophylaxis, VTE diagnostic modality, VTE symptoms, date of VTE occurrence, and history of psychiatric disorder. Comorbidities were not extracted for analysis as this was evaluated within the Caprini RAM.

Data analysis began with assessment of the normality of continuous variables using the Kolmogorov-Smirnov test. The variables Age and the Modified Caprini RAM Score were non-normally distributed therefore the median was reported. The Mann-Whitney U test, the chi-square test, and Fisher's exact test were used for analysis, as appropriate. A value of P<.05, on two-tailed testing, was considered statistically significant. Statistical analyses were performed using IBM-SPSS Statistics, version 24.0 (IBM Corp., Armonk, New York).

Assign 2 risk factor:
- Immobilization in a cast or external fixator for >1 week

Assign 3 risk factor:
- Congestive heart failure

Inherited (assign 3 risk factors):
- Factor 5 Leiden/activated protein C resistance
- Antithrombin III deficiency
- Proteins C and S deficiency
- Dysfibrinogenemia
- Homocysteninemia
- 20210A prothrombin mutations

Acquired (assign 3 risk factors):
- Lupus anticoagulant
- Antiphospholipid antibodies
- Myeloproliferative disorders
- Disorders of plasminogen and plasmin activation
- Heparin-induced thrombocytopenia
- Hyperviscosity syndromes
- Homocysteinemia

Clinical Setting (assign 1 risk factor):
- Age 40-60 years
- Pregnancy or postpartum <1 month
- Varicose veins
- Obesity defined as >20lbs over ideal body weight
- Diabetes Mellitus
- Hypertension
- Hyperlipidemia
- Smoker
- PCOS

Clinical Setting (assign 2 risk factors):
- Age over 60 years
- Oral contraceptive or receiving hormone replacement therapy
- Inflammatory bowel disease
- Currently treated or history of malignancy

Clinical Setting (assign 5 risk factors):
- History of Deep Venous thrombosis or pulmonary embolism

Figure 1: Modified Caprini RAM Calculator[12]

		Non-VTE	VTE	P value
N		449	7	
Age	Median Range	53.0 4-91	54.0 26-64	0.51
Sex, n (%)	Male Female	209 (46.5) 240 (53.5)	3 (42.9) 4 (57.1)	1.0
Modified Caprini RAM	Median Range	2.0 0-11	2.0 0-3	0.58

Table 2: Demographics

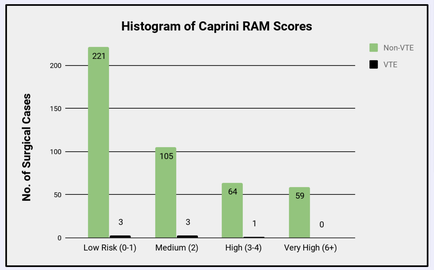

Figure 2: Caprini RAM Scores

		VTE
Procedure	Forefoot Midfoot Rearfoot Ankle	0 3 2 2
Prophylaxis	Yes No	4 3
Symptomatic DVT	Yes No	4 3
Time to VTE	Range Mean	5-116 45.71
Weight Bearing	NWB WB	4 3
Psychiatric Disorder	Yes No	3 4

Table 3: VTE Analysis

	Low risk (0-1 risk factors)	Medium risk (2 risk factors)	High risk (3-4 risk factors)	Very high risk (5+ risk factors)
Outpatient surgery	No prophylaxis recommended	EC ASA 325-650 mg PO BID	EC ASA 325-650 mg PO BID, heparin or LMWH or anti-Xa	LMWH SQ qd or anti-Xa or ASA 325-650mg BID
Duration	N/A	During acute recovery until 1st postop reassessment	7-14 days postop with possible extension if immobilized	10-14 days postop with aggressive prophylaxis extended during immobilization

Table 1: VTE prophylaxis based on the calculated Modified Caprini RAM in Figure 1[12]

Results

This study included 456 elective foot and ankle surgeries on 381 patients. The average Caprini RAM score was 2.0 in both the non-VTE and VTE group (Table 2). No significant differences were observed between the two groups in terms of median patient age (p = .51), sex (p = 1.0), or median Modified Caprini RAM Score (p = .58). A significant patient population was identified that was determined to be low risk without evidence of VTE and did not necessitate prophylaxis (N=221). There was no significant difference between groups in the patient distribution across the four risk categories of the Modified Caprini RAM Score (p = .69) (Figure 2).

The overall VTE rate was 1.5% (N=7). The average time from surgery to VTE was 45.71 days with a range 5-116 days. VTE developed in patients that received procedures ranging from midfoot, rearfoot, and ankle surgeries. Four patients were symptomatic with DVT onset. Four of the VTE occurred while the patient's were NWB (Table 3). Of the patient's who experienced a VTE, three were categorized as low risk, three medium risk, and one high risk. Two of the patients in the VTE group developed a VTE while receiving prophylaxis.

All DVT cases were diagnosed by venous duplex ultrasound. Two pulmonary embolisms (PE) were diagnosed using computed tomography angiography and one was diagnosed post-mortem. Most patients recovered fully following VTE diagnosis with the exception of one patient who died five days postoperatively from a PE. Three of our VTE patients had diagnosed psychiatric disorders, unlike other risk factors, evaluation for this was not included within the modified Caprini RAM (Table 3).

Analysis & Discussion

Guidelines for VTE prophylaxis must be established in foot and ankle surgery to limit unnecessary chemical treatment, prevent negative side effects, and avoid potential life threatening postoperative VTE complications. The findings above support the Modified Caprini RAM for VTE prophylaxis guidelines. The reported low incidence of VTE (1.5%) is consistent with previously reported rates in foot and ankle surgery, however no previous studies have provided a risk assessment score for preoperative use. The mean time to VTE onset is similar previously reported.[13] The use of Modified Caprini RAM may allow the opportunity to target prophylaxis to patients at risk and prevent unnecessary prophylaxis, as demonstrated with the findings above. Within this study evaluation for evidence of psychiatric disorders was analyzed due to an undetermined correlation in the literature to VTE occurance.[14] While this study demonstrates the Modified Caprini RAM as a viable option, further research is needed to determine if it is the most beneficial VTE prophylaxis guideline. In addition, due to the significant range of onset of VTE occurrence and weight bearing status, additional research needs to be done on the length of VTE prophylaxis.

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