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 events in elective lower extremity and non-elective foot and ankle surgery, guidelines for VTE prophylaxis have not been established.1 The Caprini Risk Assessment Model (RAM) has been validated in other medical specialties, but not yet in foot and ankle surgery.1,2 These validation studies from different surgical specialties identified significant VTE risk with a Caprini RAM >8, with a single orthopedic study reporting a score ≥12 in hip fracture patients.3,4,5

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.

Methodologies & 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 outcome 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 any comorbidities. Caprini RAM was not extracted for analysis as it 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 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<0.05 on two-tailed tests was considered statistically significant. Statistical analyses were performed using IBM-SPSS Statistics, version 24.0 (IBM Corp., Armonk, New York).

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

<table>
<thead>
<tr>
<th>VTE Prophylaxis</th>
<th>Low risk (&lt;1 risk factor) (N=414)</th>
<th>Medium risk (2 risk factors) (N=323)</th>
<th>High risk (3-4 risk factors) (N=14)</th>
<th>Very high risk (&gt;5 risk factors) (N=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No prophylaxis recommended</td>
<td>EC ASA 325-650 mg PO BID</td>
<td>EC ASA 325-650 mg PO BID, heparin or LMWH or no DVT prophylaxis</td>
<td>LWMN SQ or enoxaparin 40 mg or ASA 325-650 mg PO BID</td>
<td>LWMN SQ or enoxaparin 40 mg or ASA 325-650 mg PO BID</td>
</tr>
<tr>
<td>Duration</td>
<td>N/A</td>
<td>N/A</td>
<td>10-14 days postop with aggressive prophylaxis extended during immobilization</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Results
This study included 496 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 = 0.51), sex (p = 1.0), or median Modified Caprini RAM score (p = 0.58). 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 = 0.69) (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 of 5-116 days. VTE developed in patients that received prophylaxis and received it between the time of surgery, postoperative, and ankle surgery. Four patients were symptomatic with DVT onset. Four of the VTE occurred while the patient’s were NBW (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 ultrasonography. 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 14 days (Table 1). 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 occurrence.2 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.

Figure 1: Modified Caprini RAM Calculator

Figure 2: Caprini RAM Score