

**Comparative evaluation of venous thromboembolic risk in urologic inpatients using different risk assessment models**Konstantinos Douroumis<sup>1</sup>, Evangelos Fragkiadis<sup>1</sup>, Napoleon Moulavasilis<sup>1</sup>, Panagiota Stratigopoulou<sup>2</sup>, Ioannis Adamakis<sup>1</sup>, Ioannis Anastasiou<sup>1</sup>, Dionysios Mitropoulos<sup>1</sup><sup>1</sup>First Department of Urology, National and Kapodistrian University of Athens, Athens, Greece; <sup>2</sup>Anesthesiology Department, Laikon General Hospital of Athens, Athens, Greece*Acknowledgements: The project was financed, in part, by a GSK unrestricted educational grant.***Cite as:** Douroumis K, Fragkiadis E, Moulavasilis N, et al. Comparative evaluation of venous thromboembolic risk in urologic inpatients using different risk assessment models. *Can Urol Assoc J* 2025 January 14; Epub ahead of print. <http://dx.doi.org/10.5489/cuaj.8907>

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**ABSTRACT**

**Introductions:** The process of determining thromboprophylaxis decisions in urologic surgery entails assessing the risk of venous thromboembolism (VTE) in comparison to the risk of bleeding. Risk assessment models (RAMs) have been created to systematically calculate an individual's risk of VTE. In our study, we evaluated the risk of VTE in urologic inpatients using two RAMs specifically designed for urology by the European Association of Urology (EAU) and the American Urological Association (AUA), the Caprini score, and the CHA2DS2-VASc score.

**Methods:** The study group consisted of 236 inpatients within the urology department. Data from medical records included information on various factors, such as age, gender, body mass index,

**KEY MESSAGES**

- EAU and AUA VTE RAMs provide consistent recommendations for thromboembolism prophylaxis in urologic patients.
- Caprini model may lead to excessive prophylaxis recommendations.
- EAU model is user-friendly and based on high-value evidence.
- Decision for prophylaxis should be based on an individual patients.

personal and family history of the patients. The risk of VTE was determined using the RAMs provided by EAU and AUA, the Caprini score, and the CHA<sub>2</sub>DS<sub>2</sub>-VASc score.

**Results:** Chemical prophylaxis was advised for 48 (35.3%) patients according to the EAU model, 47 patients (34.6%) according to the AUA model, 128 (94.1%) patients based on the Caprini score, and 80 (58.8%) patients according to the CHA<sub>2</sub>DS<sub>2</sub>-VASc score. Limitations of the study include a small sample size and lack of post-surgery venous thromboembolic events recording.

**Conclusions:** The VTE RAMs developed by the EAU and AUA provide consistent recommendations for thromboembolism prophylaxis in urologic patients, while the Caprini model's strict adherence may lead to excessive prophylaxis recommendations. The EAU approach is user-friendly but urologists must judiciously weigh bleeding and VTE risks on an individual basis, ensuring optimal prophylaxis use.

## INTRODUCTION

Urological patients, particularly men over the age of 50, are considered at high risk for venous thromboembolic events (VTE). This risk is underscored by a prior study revealing that 30.5% of hospitalized urology patients were on antiplatelet/anticoagulation agents<sup>1</sup>. A recent pilot observational study<sup>2</sup> found that 25% of urological patients not receiving these agents could be considered at an increased thromboembolic risk based on European Association of Urology (EAU) criteria<sup>3</sup>.

The significance of venous thromboembolic complications in urologic surgery cannot be understated, contributing to perioperative morbidity and mortality. Approximately 1-5% of urologic surgery patients develop VTE symptoms<sup>4-6</sup>, with pulmonary embolism being the most common cause of postoperative death<sup>7</sup>.

This raises concerns about the necessity of prophylactic antithrombotic treatment, especially for patients undergoing potentially hemorrhagic operations<sup>8-11</sup>. Decisions on thromboprophylaxis involve balancing the risk of VTE against bleeding, considering patient- and procedure-specific factors. Risk assessment models (RAMs) have been developed to calculate individual VTE risk, aiming to minimize unnecessary chemoprophylaxis. However, there is significant variation between RAMs in terms of composition and risk category assignment.

In this study, we aimed to estimate VTE risk in urological inpatients using two "urology-specific" RAMs developed by EAU<sup>3</sup> and AUA<sup>12</sup>, an older and more general model, the Caprini score<sup>13</sup>, and a "cardiology-specific" one, the CHA<sub>2</sub>DS<sub>2</sub>-VASc score<sup>14</sup>, primarily used in atrial fibrillation patients. The study compared the recommendations for chemical prophylaxis between these different risk assessment models. The findings will contribute to a better understanding of the risk-benefit balance in administering prophylactic antithrombotic treatment in urological surgery.

## METHODS

This study involved a prospective analysis of data collected over a 20-month period, spanning from March 2021 to October 2022. All urology inpatients scheduled for surgery were considered eligible for inclusion. Informed consent was obtained from the patients, and the study received approval from the Scientific and Ethics Committee of our Hospital.

The study cohort comprised 136 patients, ranging in age from 20 to 96 years, with a mean age of  $66.4 \pm 14.4$  years, and the majority (80.9%) were male. Body Mass Index (BMI) ranged from 19.1 to 43.5, with a mean of  $27.4 \pm 4.1$ . Surgical procedures included major pelvic operations in 25 patients (18.4%), endoscopic operations of the upper urinary tract in 29 patients (21.3%), endoscopic operations of the lower urinary tract in 44 patients (32.4%), operations involving the penis, urethra, and scrotum in 9 patients (6.6%), laparoscopic operations in 5 patients (3.7%), and open operations of the upper urinary tract in 24 patients (17.6%). Additionally, 25 patients received some form of antiplatelet or anticoagulant agent. Patients characteristics are summarized on Table 1.

Patient records provided comprehensive information on various factors, including age, gender, BMI, personal and family history of venous thromboembolism, trauma (major or lower extremity), immobility, paresis, malignancy, cancer therapy (hormonal, chemotherapy, or radiotherapy), pregnancy and the postpartum period, estrogen-containing oral contraception or hormone replacement therapy, selective estrogen receptor modulators, acute medical illness, heart or respiratory failure, inflammatory bowel disease, nephrotic syndrome, myeloproliferative disorders, paroxysmal nocturnal hemoglobinuria, smoking, varicose veins, central venous catheterization, and inherited or acquired thrombophilia. The calculation of VTE risk and recommendations for prophylaxis utilized the EAU VTE, AUA VTE, Caprini, and CHA<sup>2</sup>DS<sup>2</sup>-VASc scores.

Data collection, extraction, and organization were carried out using Microsoft Office (Microsoft, Redmond, Washington, DC, USA). Statistical analyses were conducted employing the  $\chi^2$ -test and Analysis of Variance (ANOVA) test.

## RESULTS

According to EAU VTE risk assessment model 78 (57.4%) patients were considered low VTE risk, 50 (36.8%) patients were considered medium VTE risk, and 8 (5.9%) patients were considered high VTE risk. AUA VTE risk assessment model categorized the patients as follows: 7 (5.1%) patients had low VTE risk, 73 (53.7%) patients had moderate VTE risk, 44 (32.4%) patients had high VTE risk, and 12 (8.8%) patients had highest VTE risk. As for Caprini score the values were ranged from 0 to 11, with a mean range  $6.1 \pm 1.9$ , and it was very low (0) in 2 (1.5%) patients, low (1-2) in 9 patients (6.6%), moderate (3-4) in 16 patients (11.8%), and high ( $\geq 5$ ) in 109 patients (80.1%). Finally, CHA<sup>2</sup>DS<sup>2</sup>-VASc score values ranged from 0 to 6, with a mean value  $1.9 \pm 1.4$ . Patients' categorization in VTE risk groups is summarized in Table 2.

Caprini score values had statistically significant variance ( $p < 0.001$ ) between the different EAU and AUA VTE risk groups. Specifically, low EAU VTE risk patients had  $5.5 \pm 2.1$  mean

Caprini score, medium risk patients had  $6.5 \pm 1.3$  mean Caprini score, and high risk patients had  $8.5 \pm 0.7$  mean Caprini score. Similar results were observed in the comparison between AUA VTE risk groups and the patients' Caprini score. Low risk AUA VTE risk patients had  $1.7 \pm 1.6$  mean Caprini score, moderate risk patients had  $5.7 \pm 1.7$  mean Caprini score, high risk patients had  $6.9 \pm 1.4$ , and highest risk patients had  $7.2 \pm 0.9$  mean Caprini score.

Also, statistically significant variance ( $p < 0.001$ ) in the mean  $\text{CHA}^2\text{DS}^2\text{-VASc}$  score values was observed between the different EAU and AUA VTE risk groups. Mean  $\text{CHA}^2\text{DS}^2\text{-VASc}$  score values were  $1.3 \pm 1.2$ ,  $2.8 \pm 1.1$  and  $3.4 \pm 1.3$  in EAU low, medium, and high risk patients, respectively. AUA low VTE risk patients had  $0.3 \pm 0.5$  mean  $\text{CHA}^2\text{DS}^2\text{-VASc}$  score, moderate risk patients had  $2.0 \pm 1.4$ , high risk patients had  $2.1 \pm 1.3$ , and highest risk patients had  $2.6 \pm 1.4$  mean  $\text{CHA}^2\text{DS}^2\text{-VASc}$  score values. Also, a statistically significant correlation between Caprini score values and  $\text{CHA}^2\text{DS}^2\text{-VASc}$  score values was observed ( $p < 0.001$ ).

After categorizing the patients according to EAU RAM, the recommendation for prophylaxis is based on the type of surgery<sup>3</sup>. Mechanical prophylaxis was recommended in 52 (38.2%) patients and chemoprophylaxis, with low molecular weight heparins or direct acting oral anticoagulants, in conjunction with mechanical prophylaxis in 48 (35.3%) patients.

In the AUA RAM the type of surgery is one of the major components in the categorization of patients<sup>12</sup>. A combination of mechanical and chemical prophylaxis was recommended in 47 (34.6%) patients and a decision between mechanical and chemical could be made in 17 (12.5%) patients.

On the other hand, according to Caprini score a combination of mechanical and chemical prophylaxis should be administered to 128 (94.1%) patients and a decision between mechanical and chemical should be made in 4 (2.9%) patients<sup>15</sup>.

Finally, 80 (58.8%) patients should receive chemoprophylaxis according to  $\text{CHA}^2\text{DS}^2\text{-VASc}$  score, and 33 (24.3%) patients could receive chemoprophylaxis, but with a weak recommendation. It should be noted that the first line chemoprophylaxis recommended for atrial fibrillation are direct acting oral anticoagulants<sup>16</sup>.

## DISCUSSION

Thromboprophylaxis following major urologic surgery is a subject of ongoing debate, requiring careful consideration of the balance between the risk of venous thromboembolism (VTE) and bleeding. Both major urological societies have devised VTE risk assessment models tailored to patients and surgeries, aiming for simplicity and practicality.

The VTE risk assessment model by the European Association of Urology (EAU) is based on high-quality evidence but lacks validation<sup>3,17</sup>. Similarly, the American Urological Association (AUA) has its own model, which remains unvalidated<sup>12,18</sup>. In contrast, the Caprini score has been validated across various surgical domains<sup>15,19-21</sup>, and the  $\text{CHA}^2\text{DS}^2\text{-VASc}$  score, although traditionally used in atrial fibrillation, has robust evidence<sup>22</sup>.

Comparing recommendations for thromboembolism prophylaxis, both EAU and AUA models align closely, suggesting a combination of mechanical and chemical prophylaxis for

approximately 35-36% of patients. Conversely, the Caprini model advocates prophylaxis for a significantly higher percentage of patients, raising concerns about its specificity in urologic surgery.

Studies supporting the Caprini score's application in major urologic surgery highlight a challenge in discriminating thromboprophylaxis needs, especially for older patients undergoing malignancy-related procedures<sup>23</sup>. Notably, a meta-analysis indicates that the benefit of chemoprophylaxis using the Caprini score is most evident in patients with scores  $\geq 7$ <sup>24</sup>.

The CHA<sup>2</sup>DS<sup>2</sup>-VASc score, although not previously used in surgical cohorts, demonstrates its predictive ability for thromboembolic risk in atrial fibrillation patients<sup>16,25</sup>. However, its application in urological surgery requires further exploration.

Noteworthy variations in Caprini score values among different VTE risk groups, as well as significant differences in CHA<sup>2</sup>DS<sup>2</sup>-VASc score values, emphasize the ability of EAU and AUA VTE RAMs to effectively stratify patients' VTE risk, aligning with validated models.

While the Caprini score boasts precision with numerous factors, the EAU VTE RAM stands out for its simplicity, considering only four key factors. However, limitations of the study, including a small sample size and lack of post-surgery venous thromboembolic events recording, should be acknowledged.

## CONCLUSIONS

the VTE RAMs developed by the EAU and AUA provide consistent recommendations for thromboembolism prophylaxis in urological patients, while the Caprini model's strict adherence may lead to excessive prophylaxis recommendations. The EAU approach is user-friendly, but urologists must judiciously weigh bleeding and VTE risks on an individual basis, ensuring optimal prophylaxis use.

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## FIGURES AND TABLES

<b>Table 1. Patient characteristics</b>	
<b>Patients, n (%)</b>	<b>136(%)</b>
Age, years	66.4±14.4 (20–96)
Gender	
Male	110 (80.9%)
Female	26 (19.1%)
BMI	27.4±4.1 (19.1–43.5)
Type of surgery	
Major pelvic	25 (18.4)
Upper urinary tract endoscopy	29 (21.3)
Lower urinary tract endoscopy	44 (32.4)
Penis, urethra, and scrotum	9 (6.6)
Laparoscopic	5 (3.7)
Open surgery of the upper urinary tract	24 (17.6)

BMI: body mass index.

<b>Table 2. Patients' categorization in VTE risk groups, according to different RAMs</b>			
VTE risk category	Risk assessment model		
	EAU	AUA	Caprini
Low	78(57.4%)	7(5.1%)	11(8.1%)
Medium/moderate	50(36.8%)	73(53.7%)	16(11.8%)
High/higher	8 (5.9%)	44(32.4%)	109(80.1%)
Highest		12(8.8%)	

AUA: American Urological Association; EAU: European Association of Urology; RAMs: risk assessment models; VTE: venous thromboembolism.