

## Risk assessment and compliance with hospital guidelines for venous thromboprophylaxis after gynecological surgeries

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### Abstract

**Background and objective:** Venous thromboembolism after gynecological surgery is a major cause of morbidity and mortality. This study aimed to determine the venous thromboembolism risk profile of women who underwent gynecological surgery at a tertiary hospital and review the prescribed venous thromboembolism prophylaxis.

**Methods:** An audit review study was conducted on 490 women who underwent major and minor gynecological surgeries at the Maternity Teaching Hospital, Erbil city, Kurdistan Region, Iraq, from 1st December 2019 to 31<sup>st</sup> December 2020, regarding their risk of developing postoperative venous thromboembolism using the 2013 modified Caprini venous thromboembolism risk assessment model to determine their risk and the correct thromboprophylaxis prescription.

**Results:** According to appropriate thromboprophylaxis administration of low molecular weight heparin, it was administered to two-thirds of the women. It was sufficient in 33.1% of the women, and only 8.2% of the women received it for the correct duration. The probability of incorrect decision was higher for the major surgeries than for minor surgeries [odds ratio (OR) = 15.5; 95% confidence interval (95% CI) = 3.01–80.1]. Moderate risk carried a much higher probability of an incorrect decision than low risk (OR = 196.8; 95%CI = 30.4–1270.5), whereas the association with high risk was not significant. When low molecular weight heparin was administered, there was a higher probability of a wrong decision than when low molecular weight heparin was not administered (OR = 26.4; 95%CI = 7.1–97.6).

**Conclusion:** The gynecologists' adherence to venous thromboembolism prophylaxis after major and minor gynecological surgeries at the hospital mandates more training for all healthcare providers.

**Keywords:** Audit; Thromboprophylaxis; Caprini RAM 2013; Adherence to guidelines; Gynecological surgery.

### Introduction

Women who undergo gynecological surgery are at the highest risk for venous thromboembolism (VTE), with the associated morbidity rate estimated to be as high as 40%–80%, with a 0.2%–5% pulmonary embolism (PE) fatality rate.<sup>1</sup>

Much awareness has been raised regarding this fatal complication in clinical practice in relation to gynecological surgeries. However, the lack of specific

clinical symptoms of VTE leads to high misdiagnosis rates.<sup>2</sup>

Assessing the risk of VTE and providing appropriate prophylaxis is critical for surgical planning and affect the everyday practice of gynecologic surgeons.<sup>3</sup>

VTE prophylaxis has been shown to reduce the incidence of acute deep venous thrombosis (DVT), and the mortality rate of PE has been confirmed by a consensus panel of the American College of Chest

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Physicians (ACCP). VTE prophylaxis is more effective in preventing death and is more cost-effective than treating established diseases.<sup>4</sup> Despite evidence of the benefits of VTE prophylaxis, clinical practices worldwide suggest that VTE prophylaxis is underutilized, and the implementation of guidelines formulated by ACCP is inconsistent and inadequate.<sup>1</sup>

Several different VTE risk assessment models (RAMs) have been developed for use in the postsurgical population.<sup>5</sup> The Caprini RAM was founded on ACCP guidelines. It is based on a risk-scoring system to render the ACCP guidelines to be more user-friendly.<sup>1</sup>

The Caprini RAM was first published in 1991 and subsequently modified in 2005 and 2009. It has been validated in more than 250,000 patients in more than 100 clinical trials worldwide, including patients with cancer.<sup>6,7</sup>

The Caprini RAM has been adopted by many individuals and organizations, including the ACCP, and has been translated into 12 languages.<sup>7</sup> Appropriate treatment options are dependent on the completion of the Caprini RAM. As the numerical score increases, the clinical VTE rate increases in every patient group that has been properly tested. The last updated 2013 Caprini RAM scoring system provides a fixed, comprehensive, and effective method for risk stratification and the option of prophylaxis for VTE prevention.<sup>6</sup>

Regarding the use of the Caprini RAM 2013 in gynecological surgeries, there are many published articles on effectively identifying women at high risk for VTE after surgeries related to malignancy,<sup>2,8,9</sup> but there is a scarcity of reports of its use in benign gynecological surgeries.<sup>1,10</sup>

No data exist at the Maternity Teaching Hospital regarding gynecologists' compliance with VTE prophylaxis after gynecological surgeries. This study aimed to evaluate the VTE risk profile and investigate clinical practices in VTE prophylaxis according to the local recommendations after gynecologic

surgeries (Caprini RAM 2013), as well as describe the errors made and analyze the variables associated with the lack of compliance with the recommendations. To the best of our knowledge, there are no published articles on adherence to VTE prophylaxis after gynecological surgeries. This study is the first to assess the risk factors for VTE after major and minor gynecologic surgeries based on the Caprini RAM 2013 score to correlate them to the gynecologist's adherence to thromboprophylaxis.

## Methods

A cross-sectional review study was conducted on 490 women who underwent minor and major gynecologic surgeries at the Maternity Teaching Hospital from 1<sup>st</sup> December 2019 to 31<sup>st</sup> December 2020.

### Inclusion Criteria

The following women were included: those aged 18–80 years; those with malignant conditions requiring gynecological surgery (endometrial cancer, cervical cancer, and ovarian cancer), benign gynecological surgery (uterine fibroid, benign ovarian cyst, endometrial polyp, and cervical polyp), major gynecological surgery (total abdominal hysterectomy, vaginal hysterectomy, ovarian cystectomy, myomectomy, vaginal repair, diagnostic and therapeutic laparoscopy, and hysteroscopy), and minor gynecological surgery (diagnostic dilatation and curettage, cervical polypectomy, Bartholin cyst, and abscess), and those who accepted to participate in the research.

### Exclusion Criteria

The following women were excluded: women aged <18 years, women already on heparin, women allergic to heparin, those with VTE history 6 months before surgery, those already on long-term anticoagulation therapy, those with renal or hepatic insufficiency, those with known hypersensitivity to LMWH, those with a high risk of bleeding (coagulopathy and thrombocytopenia), pregnant or lactating women, and those who refused to

participate in the research.

Women who were prepared for gynecologic surgeries were interviewed, including history taking, general and local examinations, and investigations related to each type of surgery and each patient.

Evaluation of the participants during the hospital course and postoperative recovery period was performed. Any changes in clinical status would result in a change in the score, resulting in a new score and potentially a revised treatment option.

**Modified Caprini Risk-Scoring System**

The Caprini risk assessment score 2013 was used for VTE prophylactic regimens for women who underwent gynecologic surgeries. Each risk factor was assigned specific scores ranging from 1 to 8 points. Each risk factor was calculated, and the total score was obtained to generate an accumulative risk score to categorize the women into four risk levels: low risk (0–2 points), moderate risk (3–4 points), high risk (5–8 points),<sup>11</sup> and highest risk (>8 points).<sup>12</sup>

The Caprini score was designed in a patient health tracking sheet in each patient's file separately. The sheet included all risk factors to assess VTE prophylaxis before and after surgery. The datasheet

included age (20–80 years old), body mass index (BMI; defined as a person's weight in kilograms divided by the square of the person's height in meters; kg/m<sup>2</sup>),<sup>13</sup> duration of surgery (0–59, 60–119, 120–179, and 180 min), type of surgery (major and minor), varicose vein (enlarged, swollen, and twisting veins, often appearing blue or dark purple), previous personal and family history of VTE, history of current cancer, hormone replacement therapy, and contraception, smoking status, bed rest, and current antiphospholipid antibody syndrome (Table 1).<sup>14</sup>

The academic degrees of the gynecologists who prescribed thromboprophylaxis are board degree and higher diploma 2 years degree.

Data collection regarding the clinical status and examination of each woman was performed before and after gynecologic surgery to identify and assess which women have risk factors for VTE in accordance with the Caprini RAM 2013 using a questionnaire to evaluate the adequacy of thromboprophylaxis prescription and classify the women into very-low-, intermediate-, high-, and highest-risk groups for VTE.

**Table 1** VTE risk assessment model score for participants undergoing surgery

Score 1	Score 2	Score 3	Score 5
Minor surgery	Major surgery	Age: ≥75 years	Major surgery
Time of surgery: 0–59 min	Time of surgery: 60–119 min	Time of surgery: 120–179 min	Time of surgery: ≥180 min
Age: 40–60 years	BMI: ≥40 and	BMI: ≥50 kg/m <sup>2</sup>	<50 kg/m <sup>2</sup>
BMI ≥30 and <40 kg/m <sup>2</sup>	Laparoscopy >45 min	VTE history	
Pregnancy or postpartum (<1 month)	Age: 60–74 years	Family history of VTE	
Varicose veins	Confined to bed for >72 h	Inherited or acquired thrombophilia	
Sepsis <1 month	Prior or present malignancy		
Combined oral contraceptive/hormone replacement therapy			
History of unexplained or recurrent spontaneous abortion			

BMI, Body Mass Index

## Types and Duration of Thromboprophylaxis

The recommended prophylaxis regimens used according to the risk group classification are shown in Table 2, along with the recommended prophylaxis regimens advocated by the ACCP guidelines.<sup>14</sup> In the low-risk (0–2) group, only early ambulation is advised. In the intermediate-risk (3–4) group, LMWH or graduated compression stockings (GCS) is required to be prescribed. In the high-risk group, LMWH+ graduated stockings for 10 days is prescribed. In the highest-risk group, LMWH+ GCS for an extended period is recommended (28 days after discharge from the hospital).

Adherence to thromboprophylaxis was defined as having the correct LMWH units and prescriptions for the correct duration according to the intermediate, high, and highest risk groups.

Any type of prophylaxis (mechanical or pharmacologic), as indicated according to the 2012 ACCP guidelines (9th edition), was defined as proper VTE prophylaxis adherence.

The appropriateness of the prophylaxis administration by the gynecologist corresponded to the Caprini RAM scoring system. Patients were followed until discharge from the hospital to review the dose prescribed to them and the duration of use to be followed. Adherence to the thromboprophylaxis regimen for each patient was defined as follows: “Correct” when the LMWH prescription was in the proper dose and provided for the correct duration of the administered prophylaxis; “not correct” was used when the LMWH prescription was in the improper dose and provided for an incorrect duration of the administered

prophylaxis; “overdose” when excessive VTE prophylaxis prescription was unnecessary to be effective; “unrequired” when, in the absence of indication, the patient received some forms of prophylaxis; and “required” when there was absolute indication with no proper prophylaxis administration.

The adherence to thromboprophylaxis was assessed by comparing the patient's risk factors, and a proper indication of receiving thromboprophylaxis and regimen use in practice was obtained.

All interviews, including assessments of the patients' risk factors and adherence of the obstetricians and gynecologists, were performed by the same researcher.

## Ethics Approval and Consent to Participate

All procedures performed in this study involving the participants were conducted in accordance with the ethical standards of the institutional and national research committee and the Helsinki Declaration of 1964. The study was approved by the Ethics and Scientific Committee of the Kurdistan Board of Medical Specialties (No.4573) in June 2020. Written informed consent was provided by all participants before undergoing surgery.

## Statistical Analysis

Data were analyzed using the statistical package for the social sciences, version 25 (IBM, USA). The Chi-square test of association was performed to compare proportions. Fisher's exact test was performed when the expected count of more than 20% of the cells of the table was <5. Factors found to be significantly associated with the decision regarding LMWH prescription were entered into the binary logistic regression model. A  $P \leq 0.05$  was considered statistically significant.

**Table 2** Recommended prophylactic regimens according to risk category

Low risk (score 1)	Moderate risk (score 2)	High risk (score 3–4)	Highest risk (score ≥5)
No-specific measurements	LMWH or GCS	LMWH + GCS	LMWH + GCS
Early ambulation	Duration: until discharge	Duration: 7–10 days	Duration: 2–4 weeks

GCS: Graduated compression stockings, LMWH: Low-molecular-weight heparin

**Results**

Of the 505 women, only 490 agreed to participate in the study. Five women who refused to participate were excluded, and 10 women were lost to follow-up. The patients' age (mean  $\pm$  standard deviation) was  $49.3 \pm 12.3$  years (median = 48 years, range = 20–80 years).

Table 3 shows that the largest proportion of women (57.6%) were 41–60 years old. Less than one-third (28.8%) of the women were obese; only one woman (0.2%) was

morbidly obese (BMI  $\geq 40$  kg/m<sup>2</sup>).

Approximately two-thirds (67.6%) of the women received LMWH. Table 4 shows that LMWH was not required in 32.9% of the women. The dose was not sufficient in 41.1% of the women who received LMWH, but it was sufficient in 33.1%. The majority (79.6%) of the women who received LMWH received it for an incorrect duration, and only 8.2% received it for the correct duration.

**Table 3** Distribution of the patients by age and body mass index (BMI)

Factor	No.	%
<b>Age (years)</b>		
20–40	110	22.4
41–60	282	57.6
61–74	91	18.6
$\geq 75$	7	1.4
Mean $\pm$ SD age	$49.3 \pm 12.3$	
<b>BMI (kg/m<sup>2</sup>)</b>		
<30	348	71.0
30–39	141	28.8
$\geq 40$	1	0.2
Mean $\pm$ SD BMI	$26.9 \pm 4.1$	
Total	490	100.0

SD: Standard deviation, BMI: Body mass index

**Table 4** Pattern of use of low-molecular-weight heparin (LMWH)

	Number	Percent
<b>LMWH</b>		
No	159	32.4
Yes	331	67.6
Total	490	100.0
<b>Required or not</b>		
Not required	161	32.9
Required	329	67.1
Total	490	100.0
<b>Dose</b>		
Insufficient	153	41.1
Sufficient	123	33.1
Not to be given	43	11.6
To be given	41	11.0
Overdose	12	3.2
Total	372	100.0
<b>Duration</b>		
Incorrect duration	261	79.6
Correct duration	27	8.2
Not to be given	40	12.2
Total	328	100.0



The rate of the incorrect decision was 71.2% in the whole cohort (Table 5). This rate was relatively low (30%) among women aged 20–40 years, but it was much higher among women aged 41–60 years (83%) and 61–74 years (85.7%), and the differences were significant ( $P < 0.001$ ). The rate of the incorrect decision was significantly higher among women with a BMI of 30–40 kg/m<sup>2</sup> (84.5%) than among women with a BMI of <30 kg/m<sup>2</sup> (65.8%;  $P < 0.001$ ). The rate was significantly higher among women who underwent major surgery (88.9%) than among women who underwent minor surgery (22.9%;  $P < 0.001$ ). The rate was (88.8%) among women who underwent surgeries of long duration (60–120 min) and 23.5% among women who underwent surgeries with <60 min duration. No significant association was found between the decision and the following variables: family history of VTE ( $P = 0.493$ ), varicose veins ( $P = 0.367$ ), bed rest ( $P > 0.999$ ), and current cancer ( $P = 0.207$ ). The rate of incorrect decision was very high among women with moderate risk (97.8%) and relatively high among women with high risk (69.1%) compared with that among women with very low risk (26.7%;  $P < 0.001$ ). The rate of incorrect decision was significantly high when LMWH was administered (93.1%) compared with that of women who did not receive LMWH (25.8%;  $P < 0.001$ ). No significant association was found between academic degree and the decision ( $P = 0.564$ ).

As shown in Table 6, no significant association was found between age ( $P = 0.611$ ) and high BMI ( $P = 0.906$ ) and the incorrect decision about prescribing LMWH or its dose and duration of therapy.

The probability of incorrect decision was higher for major surgeries than for minor surgeries [odds ratio (OR) = 15.5; 95% confidence interval (CI) = 3.01–80.1].

Moderate risk carried a much higher probability of an incorrect decision than low risk (OR = 196.8; 95% CI: 30.4–1270.5), whereas the association with high risk

was not significant. There was a higher probability of an incorrect decision when LMWH was administered than when LMWH was not administered (OR = 26.4; 95% CI = 7.1–97.6).

**Table 5** Association between decision regarding prescribing thromboprophylaxis and the studied factors

Factor	Correct decision		Incorrect decision		Total		P value
	No.	%	No.	%	No.	%	
<b>Age (years)</b>							
20–40	70	70.0	33	30.0	110	100.0	
41–60	48	17.0	234	83.0	282	100.0	
61–74	13	14.3	78	85.7	91	100.0	
≥75	3	42.9	4	57.1	7	100.0	<0.001*
<b>Body mass index (kg/m<sup>2</sup>)</b>							
<30	119	34.2	229	65.8	348	100.0	
30–40	22	15.5	120	84.5	142	100.0	<0.001
<b>Surgery type</b>							
Minor	101	77.1	30	22.9	131	100.0	
Major	40	11.1	319	88.9	359	100.0	<0.001
<b>Duration of surgery</b>							
<60 min	101	76.5	31	23.5	132	100.0	
60–120 min	40	11.2	318	88.8	358	100.0	<0.001
<b>Family history of VTE</b>							
No	140	28.7	348	71.3	488	100.0	
Yes	1	50.0	1	50.0	2	100.0	0.493*
<b>Varicose veins</b>							
No	133	29.3	321	70.7	454	100.0	
Yes	8	22.2	28	77.8	36	100.0	0.367
<b>Bed rest</b>							
No	140	28.7	347	71.3	487	100.0	
Yes	1	33.3	2	66.7	3	100.0	>0.999*
<b>Current cancer</b>							
No	129	28.1	330	71.9	459	100.0	
Yes	12	38.7	19	61.3	31	100.0	0.207
<b>Risk classification</b>							
Very low	118	73.3	43	26.7	161	100.0	
Moderate	6	2.2	267	97.8	273	100.0	
High	17	30.9	38	69.1	55	100.0	
Very high	0	0.0	1	100.0	1	100.0	<0.001*
<b>Thromboprophylaxis</b>							
No	118	74.2	41	25.8	159	100.0	
Yes	23	6.9	308	93.1	331	100.0	<0.001
<b>Academic degree</b>							
Diploma	51	27.3	136	72.7	187	100.0	
Board	90	29.7	213	70.3	303	100.0	0.564
Total	141	28.8	349	71.2	490	100.0	

VTE: Venous thromboembolism

\*By Fisher's exact test. The others were by  $\chi^2$  test.

Note 1: Personal VTE history, antiphospholipid antibody syndrome, and contraceptive/hormone replacement therapy intake were not included in the table as no patient had such conditions.

Note 2: The BMI  $\geq 40$  kg/m<sup>2</sup> category was combined with the previous category as there was only one woman in this category.

**Table 6** SPSS output for logistic regression analysis between the incorrect decision as a dependent variable with several covariates

Factor	B	P value	OR	95% CI for OR	
				Lower	Upper
Age (years)		0.611			
20–40 (reference)					
41–60	0.331	0.580	1.392	0.431	4.498
61–74	0.575	0.484	1.776	0.356	8.867
≥75	-0.482	0.676	0.618	0.065	5.913
Body mass index (kg/m <sup>2</sup> )					
<30 (reference)					
30–40	-0.060	0.906	0.942	0.346	2.561
Surgery type					
Minor (reference)					
Major	2.742	0.001	15.520	3.004	80.181
Risk classification		<0.001			
Very low					
Moderate	5.282	<0.001	196.827	30.492	1270.505
High and very high	-1.206	0.162	0.299	0.055	1.626
Thromboprophylaxis					
Not given (reference)					
Given	3.277	<0.001	26.499	7.190	97.660
Constant	-4.297	<0.001	0.014		

CI, confidence interval; OR, odds ratio; LMWH, low-molecular-weight heparin



## Discussion

The main result of this review was that approximately two-thirds of the women who underwent gynecological surgery had received LMWH. The majority of the decisions were incorrect because either insufficient LMWH doses were prescribed for them or incorrect durations were prescribed.

Despite clear recommendations from evidence-based guidelines such as ACCP 2012 and the American College of Obstetricians and Gynecologists,<sup>15,16</sup> that support thromboprophylaxis after surgery, including gynecologic surgeries, VTE prophylaxis is still underused in women who undergo gynecological surgeries.<sup>17</sup>

Approximately two-thirds of the women received thromboprophylaxis, which was not required in 32.9%. Only 8.2% of the women received it for the correct duration and dose. This finding is similar to that obtained by Snyman and Potgieter, who reviewed 109 women who underwent gynecologic surgery at the Kalafong Provincial Tertiary Hospital and assessed their risk of developing perioperative VTE using the modified Caprini VTE RAM. Approximately 5% of the women received correct thromboprophylaxis.<sup>1</sup>

This review for VTE prophylaxis revealed that the moderate- and relatively high-risk groups for VTE were mostly inadequately assessed for the need for optimum thromboprophylaxis. This may result from not individualizing prophylaxis for patients by utilizing a risk factor profile that could be a part of a general defect in the general assessment and proper prescription of thromboprophylaxis. The risk category that was most likely treated correctly was the low-risk group, which, in this study, had been correctly identified as not requiring prophylaxis. This also may be explained as not correlated to a correct decision but low adherence to the risk assessment protocol. These observations led to questions regarding whether the risk in these women was underestimated or whether awareness of the updated recommendations was

simply lacking.

Noncompliance to VTE prophylaxis is likely related to many factors, such as the concern for suspected increased risk of bleeding with the use of heparin, the fear that the patient cannot offer the drug and the lack of clinical knowledge regarding appropriate prophylaxis.<sup>18</sup>

Zipple and Itenberg reviewed the adherence rates to the ACCP guidelines for VTE prophylaxis after abdominal and pelvic oncologic surgeries at a community hospital and state-wide data from the Michigan Surgical Quality Collaborative during the same period. They conducted an educational intervention by creating hospital guidelines and presentations to review the ACCP guidelines and hospital adherence rates. The short-term reevaluation revealed significant improvement after intervention.<sup>19</sup>

With further efforts and regular provision of feedback on the adherence to thromboprophylaxis, the results of this study could help physicians improve their daily clinical practice and highlight the importance of the correct application of VTE prophylaxis. Further studies with larger sample sizes may be warranted. Given the morbidity associated with VTE and the fact that events are highly preventable, our findings highlight the urgent need for further interventions to improve prophylaxis in women undergoing gynecologic surgery.

## Conclusion

Gynecologists' adherence to VTE prophylaxis after major and minor gynecologic surgeries is poor, highlighting the urgent need for further interventions to improve prophylaxis in women undergoing gynecologic surgery.

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## Competing interests

The authors declare that they have no competing interests.

## References

1. Snyman LC, Potgieter J. Venous thromboembolism: Risk profile and management of prophylaxis in gynaecological surgery patients. *S Afr J Obstet Gynaecol.* 2014;20(3):76–9. <https://doi.org/10.7196/SAJOG.490>
2. Shi J, Ye J, Zhuang X, Cheng X, FuR, Zhao A. Application value of Caprini risk assessment model and elevated tumor-specific D-dimer level in predicting postoperative venous thromboembolism for patients undergoing surgery of gynecologic malignancies. *J Obstet Gynaecol Res.* 2019;45(3):657–64. <https://doi.org/10.1111/ijog.13832>
3. Shapiro R, Vogel JD, Kiran RP. Risk of postoperative venous thromboembolism after laparoscopic and open colorectal surgery: an additional benefit of the minimally invasive approach? *Dis Colon Rectum.* 2011;54:1496–502.
4. Sud S, Mittmann N, Cook DJ, Geerts W, Chan B, Dodek P, et al. Screening and prevention of venous thromboembolism in critically ill patients: A decision analysis and economic evaluation. *Am J Respir Crit Care Med.* 2011;184(11):1289–98. <https://doi.org/10.1164/rccm.201106-1059OC>
5. Pannucci CJ, Laird S, Dimick JB, Campbell DA, Henke PK. A validated risk model to predict 90-day VTE events in postsurgical patients. *Chest.* 2014;145(3):567–73.
6. Cronin M, Dengler N, Krauss ES, Segal A, Wei N, Daly M, et al. Completion of the updated Caprini risk assessment model (2013 version). *Clin Appl Thromb Hemost.* 2019;25:1–10. <https://doi.org/10.1177/1076029619838052>
7. Lyman GH, Khorana AA, Kuderer NM, Lee AY, Arcelus JI, Balaban EP, et al. Venous thromboembolism prophylaxis and treatment in patients with cancer: American Society of Clinical Oncology clinical practice guideline update. *J Clin Oncol.* 2013;31:2189–204.
8. Wang X, Huang J, Bingbing Zh, Li S, Li L. Risk factors, risk assessment, and prognosis in patients with gynecological cancer and thromboembolism. *J Int Med Res.* 2020;48(4):0300060519893173. <https://doi.org/10.1177/0300060519893173>
9. Stroud W, Whitworth JM, Miklic M, Schneider KE, Finan MA, Scalici J, et al. Validation of a venous thromboembolism risk assessment model in gynecologic oncology. *Gynecol Oncol.* 2014;134(1):160–3. <https://doi.org/10.1016/j.ygyno.2014.04.051>
10. Sturlese E, Triolo O, Grasso R, Laganà AS, Retto A, Rossetti D, et al. Thromboembolism prophylaxis in laparoscopic surgery for gynecologic benign diseases. Results of a single center experience in 922 procedures. *Ann Ital Chir.* 2017;88:342–7.
11. Krauss ES, Segal A, Cronin M, Dengler N, Lesser ML, Ahn S, et al. Implementation and validation of the 2013 Caprini score for risk stratification of arthroplasty patients in the prevention of venous thrombosis. *Clin Appl Thromb Hemost.* 2019;25:1076029619838066. <https://doi.org/10.1177/1076029619838066>
12. Sterbling HM, Rosen AK, Hachey KJ, Vellanki NS, Hewes Ph, Rao SR, et al. Caprini Risk Model Decreases Venous Thromboembolism Rates in Thoracic Surgery Cancer Patients. *Ann Thorac Surg.* 2018;105:879–85. <https://doi.org/10.1016/j.athoracsur.2017.10.013>
13. World Health Organization. Body mass index–BMI. (Accessed April 24, 2021, at <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>).
14. Illinois Medical Society. Are you at risk for DVT? (Accessed April 23, 2021, at <https://www.venousdisease.com/caprini-dvt-risk-assessment.pdf>).
15. Kahn S, Lim W, Dunn A, Cushman M, Dentali F, Akl E, et al. Prevention of VTE in nonsurgical patients: antithrombotic therapy and prevention of thrombosis, 9<sup>th</sup> ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest.* 2012;141(2):e195S–226. <https://doi.org/10.1378/chest.11-2296>
16. Kearon C, Akl EA, Ornelas J, Blaivas A, Jimenez D, Bounameaux H, et al. Antithrombotic therapy for VTE disease. CHEST guideline and expert panel report. *Chest.* 2016;149(2):315–52.
17. Piróg MM, Jach R, Undas A. Thromboprophylaxis in women undergoing gynecological surgery or assisted reproductive techniques: new advances and challenges. *Ginekol Pol.* 2016;87(11):773–9. <https://doi.org/10.5603/GP.2016.0086>
18. Gao Y, Long A, Xie Z, Meng Y, Tan J, Lv H, et al. The compliance of thromboprophylaxis affects the risk of venous thromboembolism in patients undergoing hip fracture surgery. *Springerplus.* 2016;5(1):1362. <https://doi.org/10.1186/s40064-016-2724-1>
19. Zipple M, Itenberg E. Improving adherence to recommended venous thromboembolic prophylaxis in abdominal and pelvic oncologic surgery. *Surgery.* 2018;164(4):900–4. <https://doi.org/10.1016/j.surg.2018.06.023>