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The Risk Factors for Preoperative and Postoperative Deep Vein Thrombosis in Surgical Patients

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ABSTRACT

Objective: This paper investigated the risk of preoperative and postoperative deep vein thrombosis (DVT) in surgical patients.

Methods: The sample consisted of 377 patients of the general surgery, orthopedics and traumatology, neurosurgery, and cardiovascular surgery clinics of a university hospital. Data were collected using a demographic characteristics questionnaire, the Deep Vein Thrombosis Diagnostic Criteria Form, the Autar Deep Vein Thrombosis Risk Assessment Scale, the Caprini Risk Assessment Model, and the Padua Prediction Score. The data were analyzed using descriptive analysis.

Results: According to the Autar Deep Vein Thrombosis Risk Assessment Scale, most participants were in the "low risk" category in the preoperative period (91%), and more than a quarter of the participants were in the "high risk" category in the postoperative period (30%). According to the Caprini Risk Assessment Model, less than half of the participants were in the "moderate risk" group in the preoperative period (39%), and more than half the participants were in the "high risk" group in the postoperative period (70.6%). According to the Padua Prediction Score, most participants were in the "low risk" category in the preoperative period (82.2%), and more than half the participants were in the "high risk" group in the postoperative period (52.8%). More than half the participants who used graduated compression stocks in the preoperative period misused them (62.7%). A bit more than half the participants who used graduated compression stocks in the postoperative period used them correctly.

Conclusion: The results show that surgical patients are at a higher risk for deep vein thrombosis in the postoperative period than in the preoperative period.

Keywords: Surgical nursing, patient care, deep vein thrombosis, thromboembolism.

1. INTRODUCTION

Deep vein thrombosis (DVT) is a health problem that causes preventable deaths (1). It is a type of venous thromboembolism (VTE), a major risk factor for most hospitalized persons. Half a million cases of DVT and 300.000 cases of pulmonary embolism (PE) are reported annually in six European countries (2). According to the USA national database, the prevalence of DVT is 7.1 cases per 1.000 (3). The prevalence of VTE in postoperative Korean patients is 20.9 cases per 1.000 (4). There is no dataset on VTE in Turkey, but Acun (2012) reported its prevalence and incidence in postoperative patients in Turkey as 0.8% and 1.3%, respectively (5).

Deep vein thrombosis is generally caused by regional trauma, hypercoagulability, and the narrowing of the blood flow in the vascular wall of the lower extremities. It can suddenly burst and result in a blood clot (1). Although DVT generally presents with local pain, swelling, discoloration, and warm skin, different methods (USG and venography) should be used to diagnose it. Deep vein thrombosis can cause long-term posttraumatic syndrome or chronic venous insufficiency, reducing the quality of life and increasing health costs (6, 7).

Age, stroke or paralysis, a history of DVT, immobility, cancer treatment, obesity, cardiac dysfunction, varicose veins, the presence of a central venous catheter, inflammatory bowel disease, pregnancy, estrogen use, and nephrotic syndrome are risk factors for DVT. However, the primary cause of DVT in the lower extremities is major surgical interventions (hip, leg, pelvic fracture, etc.) (8, 9).

Patients should start receiving pharmacological and mechanical prophylaxis at least 24 hours before surgery to

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minimize the risk factors for DVT (10). Early mobility and anti-embolism stockings are the postoperative interventions of choice for low-risk patients. In addition to those interventions, intermediate-risk patients should undergo intermittent pneumatic compression (IPC) and anticoagulant medication therapy. High-risk patients should receive pharmacological treatment (8).

Surgical nurses play a critical role in preventing DVT (7, 11, 12). Healthcare professionals should identify the risk factors for DVT in the first admission and apply medication when necessary. The Safe Surgery Checklist in the Operating Room assesses whether DVT prophylaxis is necessary "before the surgical incision" (13). In the postoperative period, nurses monitor the signs and symptoms of DVT, help patients with early mobility, get them to do deep breathing and coughing exercises, and teach them how to use elastic compression stockings and IPC devices (14).

There are many national and international guidelines for identifying, preventing, and managing the risk factors for DVT (14, 15). Healthcare professionals should use valid and reliable tools to determine the risk level of DVT (14, 16-18).

Nurses should use various scales to identify the risk factors for DVT because it is one of the major complications among surgical patients. This study aimed to identify the preoperative and postoperative risk factors for DVT in surgical patients. We believe that the results will help us better understand the condition and provide further guidance.

1.1. Research Questions

1. What are the individual risk factors for DVT in surgical patients?
2. What are the surgery-related risk factors for DVT in surgical patients?
3. What is the preoperative risk level of DVT in surgical patients?
4. What is the postoperative risk level of DVT in surgical patients?

2. METHODS

2.1. Study Design and Sample

This descriptive study aimed to identify the preoperative and postoperative risk factors for DVT in surgical patients of a state university hospital.

The study population consisted of all patients of the general surgery, orthopedics and traumatology, neurosurgery, and cardiovascular surgery clinics of a state university hospital because they are, in general, at a higher risk of developing DVT (9, 21). A total of 20.605 patients underwent surgery in those clinics in 2017. Participants were recruited using stratified sampling (22). The sample consisted of 377 patients who met the inclusion criteria and agreed to participate (Table 1).

Table 1. *Stratified sampling by clinic*

Stratum No	clinic	Number of Patients (Ni)	Stratum Weight Ni/N=Ai	Number of Patients in the Sample
1	General surgery clinic	7643	7643/20.605=0.37	140
2	Orthopedics and traumatology Clinic	6179	6179/20.605=0.29	113
3	Neurosurgery clinic	4601	4601/20.605=0.22	84
4	Cardiovascular surgery clinic	2182	2182/20.605=0.1	40
	Total	20.605	1.00	377

The inclusion criteria were (1) agreeing to participate, (2) being literate, (3) being over 18 years of age, (4) having no communication problems, (5) undergoing surgery, and (6) staying at the clinic for at least one day before and one day (24 hours) after surgery.

2.2. Data Collection Tools

Data were collected using a demographic characteristics form, a deep vein thrombosis diagnostic criteria form (DVT-DCF), the Autar deep vein thrombosis risk assessment scale (ADVTRAS), the Caprini risk assessment model (RAM), and the Padua Prediction Score (PPS).

The demographic characteristics questionnaire was based on a literature review conducted by the researchers. The questionnaire consisted of three subscales and 33 items (5, 6, 19, 23). The questionnaire elicited information on sociodemographic characteristics and the preoperative and postoperative periods.

The Autar deep vein thrombosis risk assessment scale (ADVTRAS) was developed by Ricky Autar (1996) and revised in 2003 (8, 24). The scale consists of seven categories: age groups, body mass index (BMI), mobility, special risk category, trauma risk category, surgical intervention, and high-risk diseases. The total score ranges from 0 to 31, with higher scores indicating a higher risk for DVT (0-10=low risk, 11-14=moderate risk, 15-32=high risk). Büyükyılmaz, Şendir, Autar, and Yazgan (2015) adapted the scale to Turkish and found its Cronbach's alpha (α) as 0.78 to 0.90 (25). Cronbach's alpha value was found to be 0.37 in the study.

The Caprini risk assessment model (RAM) was developed by Joseph A. Caprini (2005) to determine the risk level for VTE in internal medicine and surgical patients (26). The model assesses age, BMI, type of surgery, mobility, central venous access, sepsis, acute myocardial infarction (MI), hip, pelvis, leg fracture, stroke, or trauma history. The model consists of five categories scored as 1, 2, 3, or 5, with higher scores indicating a higher risk for VTE (0=very low risk, 1–2=low risk, 3–4=moderate risk, and ≥5=high risk). The scale in

the National Venous Thromboembolism Prophylaxis and Treatment Guidelines published by the Turkish Society of Cardiology in 2010. It has been translated into Turkish. The use of RAM is recommended for surgical patients (15). In Aydın's (2014) medical specialty thesis, RAM was used in the Turkish patient population (27).

The Padua Prediction Score (PPS) was developed by Barbar et al. (2010) at the University of Padua, Italy (28). The scale evaluates 11 risk factors; age, active cancer, previous VTE, reduced mobility, already known thrombophilic condition, recent trauma, heart and/or respiratory failure, acute infection and/or rheumatologic disorder, acute MI and/or ischemic stroke, obesity, and ongoing hormonal treatment, each of which is scored on a scale of 1 to 3 (< 4=low risk, ≥ 4=high risk). The Turkish version of the PPS has been published in the National Venous Thromboembolism Prophylaxis and Treatment Guidelines (15). Also PPS was used in the a medical specialty thesis with Turkish patient population (27).

The deep vein thrombosis diagnostic criteria form (DVT-DCF) was based on a literature review conducted by the researchers (5, 7, 19, 23). The form assesses leg pain, edema, tenderness, rising body temperature, loss of motor functions, limitation of motion, sensory loss, change in leg circumference, and Homan's sign (calf pain on dorsiflexion of the foot with the knee straight). Leg pain is scored on a scale of 0 to 10.

2.3. Data collection

The study was conducted between January 1 and March 30, 2018, in two stages: preoperative and postoperative. The researchers informed the patients about the research purpose and procedure and obtained informed consent from those who agreed to participate. Afterward, they asked participants to fill out the demographic characteristics questionnaire. In the postoperative period, the researchers filled out the ADVTRAS, RAM, PPS, and DVT-DCF and obtained lab test results from patient files during evaluation. The data were collected through face-to-face interviews. The researchers conducted the interviews outside of treatment hours in the patients' rooms at their convenience in the absence of distractions (pain, dressing, mobilization, etc.). Data collection took 20-25 minutes.

2.4. Data Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS for Windows, IBM, version 18.0). Descriptive statistics (number, percentage, mean and standard deviation) were used for analysis.

2.5. Ethical Considerations

Before data collection, the study was approved by the Ethics Committee of the university (Decision No/Date: 2017-433/14.11.2017). Written permission was obtained from the university hospital. Verbal informed consent was obtained from patients who agreed to participate. The study was carried out according to the ethical principles outlined by the Declaration of Helsinki.

3. RESULTS

Of all participants, 31.8% had a primary school degree, 35.3% were housewives, 83% were married, 69% were living in the city center, 75.6% had a neutral income (income equals expenses), and 37.1% were general surgery patients, 30% were orthopedics and traumatology patients, 22.3% were neurosurgery patients, and 10.6% were cardiovascular surgery patients.

Participants (176 female and 201 male) had a mean age of 57.20±17.20 years. Of all participants, 38.5% had a normal BMI, 57.3% had a chronic disease (36.9% hypertension), 55.4% were on medication (35.8% antihypertensive drugs), 19.1% were smokers, 17% were exercising regularly, 89.7% had sedentary jobs, and 20.4% had to travel long distances (92% by bus) (Table 2).

The mean duration of surgery was 137.87 ± 5.26 minutes. Of the participants, 30.3% underwent orthopedic surgery (below waist level), 73.5% were under general anesthesia, 64.7% had had surgery before, and 97.3% had no history of DVT (Table 3).

According to the ADVTRAS scores, the majority of the participants (91%) were in the low-risk category in the preoperative period, while less than half were in the moderate (39.2%) or high-risk (30%) categories in the postoperative period. According to the RAM scores, less than half the participants (39%) were in the moderate-risk category in the preoperative period, while more than half (70.6%) were in the high-risk category in the postoperative period. According to the PPS scores, most participants (82.2%) were in the low-risk category in the preoperative period, while a bit more than half the participants (52.8%) were in the high-risk category in the postoperative period (Table 4).

Two hundred and thirty-five (62.3%) participants did not use graduated compression stockings in the preoperative period. More than half of the participants (62.7%) misused them. Most participants (81.2%) were on anticoagulant drugs. In the postoperative period, two hundred and fifty-six participants (67.9%) used graduated compression stockings, more than half of them (55.9%) used the stockings correctly, and more than half of the participants (57.3%) were on anticoagulant drugs. Participants were able to stand on their two feet about 14.85 ± 12.06 hours after surgery, while one hundred and forty-five participants (38.5%) did it in the first eight hours after surgery (Table 5).

The researchers used the DVT-DCF to evaluate the preoperative and postoperative risk factors for DVT. The three most common symptoms of DVT in the preoperative period were leg pain (40.1%), limitation of motion (32.4%), and sensory loss in the leg (10.3%). The three most common symptoms of DVT in the postoperative period were

limitation of motion (47.2), leg pain (35%), and change in leg circumference (9.8%).

Table 2. *Distribution of individual risk factors for DVT (n=377)*

Demographic Characteristics	n	%
Age ($\bar{x}$±SD: 57.20±17.20, **Min-Max:** 18-91 years)		
18-30	36	9.5
31-40	42	11.1
41-50	36	9.5
51-60	81	21.6
61-70	92	24.4
≥71	90	23.9
Gender		
Female	176	46.7
Male	201	53.3
BMI ($\bar{x}$±SD:26.91±5.54, **Min-Max:** 15.24±49.95)		
Underweight (<18.5 kg/m^2)	13	3.4
Normal (18.5-24.9 kg/m^2)	145	38.5
Overweight (25-29.9 kg/m^2)	126	33.4
Obese (30-39.9 kg/m^2)	85	22.6
Morbidly obese (≥ 40 kg/m^2)	8	2.1
Chronic Illness		
Yes	216	57.3
No	161	42.7
Type of Chronic Illness*		
Hypertension	139	36.9
Diabetes mellitus	79	21.1
Malignant (active cancer)	58	15.4
Chronic obstructive pulmonary disease	19	5.1
Coronary artery disease	16	4.2
Others (Cirrhosis, Crohn's disease, acid reflux, hypothyroidism, rheumatoid arthritis, etc.)	14	3.7
Regular Use of Medication		
Yes	209	55.4
No	168	44.6
Type of Medication*		
Antihypertensives	135	52.9
Antidiabetics	77	30.2
Bronchodilators	17	6.7
Heart diseases and anticoagulants	17	6.7
Others (proton pump inhibitors, antipsychotics, hormone therapy)	9	3.5
Smoking		
Yes	72	19.1
No	305	80.9
Regular Exercise		
Yes	64	17.0
No	313	83.0
Sedentary Work Style		
Yes	39	10.3
No	338	89.7
Having to Travel Long Distance		
Yes	77	20.4
No	300	79.6
Means of Transportation		
Bus	347	92.0
Plan	26	6.9
Train	4	1.1

$\bar{x}$:Mean, SD:Standard deviation, Min:Minimum value, Max:Maximum value, BMI:Body Mass Index

** Percentages were based on n as more than one option was marked*

Table 3. *Distribution of surgery-related risk factors for DVT (n=377)*

Characteristics	$\bar{x}$±SD	Min.-Max.
Duration of Surgery (minute)	137.87±5.26	15-600
	n	%
Type of Surgery		
Minor <30 minute	12	3.2
Planned major	24	6.4
Emergency	40	10.6
Abdominal	104	27.2
Neurosurgery (brain and nerve)	84	22.3
Orthopedic	113	30.3
Type of Anesthesia		
General Anesthesia	277	73.5
Local Anesthesia	100	26.5
History of Surgery		
Yes	244	64.7
No	133	35.3
History of DVT		
Yes	10	2.7
No	367	97.3

$\bar{x}$: Mean, SD:Standard deviation, Min:Minimum value, Max:Maximum value, DVT: Deep vein thrombosis

Table 4. *Preoperative and postoperative ADVTRAS, RAM and PPS Scores (n=377)*

Scales	Preoperative Period		Postoperative Period	
	n	%	n	%
ADVTRAS				
Low risk (≤ 10)	343	91.0	116	30.8
Moderate risk (11-14)	34	9.0	148	39.2
High risk (15 ≥)	-	-	113	30.0
RAM				
Very low risk (0-1)	92	24.4	2	0.5
Low risk (2)	33	8.8	24	6.4
Moderate risk (3-4)	147	39.0	85	22.5
High risk (5 ≥)	105	27.8	266	70.6
PPS				
Low risk (<4)	310	82.2	178	47.2
High risk (4≥)	67	17.8	199	52.8

ADVTRAS:Autar deep vein thrombosis risk assessment scale, RAM:Caprini risk assessment model, PPS:Padua Prediction Score

Table 5. *Prophylactic measures for the prevention of preoperative and postoperative DVT (n=377)*

Measures	n	%
Using graduated compression stockings in the preoperative period		
Yes	142	37.7
No	235	62.3
Using graduated compression stockings correctly in the preoperative period (n=142)*		
Yes	53	32.3
No	89	62.7
Being on anticoagulant medication in the preoperative period		
Yes	71	18.8
No	306	81.2
Using graduated compression stockings in the postoperative period		
Yes	256	67.9
No	121	32.1
Using graduated compression stockings correctly in the postoperative period (n=256)*		
Yes	143	55.9
No	113	44.1
Being on anticoagulant medication in the postoperative period		
Yes	161	42.7
No	216	57.3
The first time to stand up on two feet after surgery (hours) (n=356)* $\bar{x}$**±SD:**14.85±12.06 **Min.-Max.:** 0-72		
≤ 8	137	38.5
>8	219	61.5

x̄:Mean, SD:Standard deviation, Min:Minimum value, Max:Maximum value
**Percentages were based on n as more than one option was marked.*

4. DISCUSSION

Deep vein thrombosis is a severe complication that causes mortality and morbidity in surgical patients. Nurses should use accurate measures to identify the risk factors for DVT as early as possible. This study identified the preoperative and postoperative risk factors for DVT in surgical patients of a university hospital.

Healthcare providers should identify the risk factors for DVT before administering prophylaxis to surgical patients. Most of our participants were over 60 years of age (48.3%) and male (53.3%) (individual risk factors for DVT). Deep vein thrombosis occurs at all ages, but the risk is higher after 60 years of age, because aging causes muscle weakness, venous insufficiency, endothelial dysfunction, fragility, reduced mobility, and systemic diseases (32).

More than half of the participants (58.1%) were above normal BMI. Measures for DVT risk identification regard a BMI of > 25 (24, 26) or > 30 as a risk factor (30). Ageno et al. (2008) found that obese individuals were about twice as likely to develop both PE and DVT as normal-weight individuals (23). However, Wang et al. (2015) detected no difference in the incidence of VTE between normal-weight and obese general surgery patients and stated that surgeons should be more careful only when performing abdominal hernia repairs on obese individuals (33). Özkaya et al. (2013) found that the most common individual risk factors for DVT encountered by surgeons in Turkey were a history of DVT and obesity (34).

More than half of the participants (57.3%) had a chronic disease, mainly hypertension, and diabetes mellitus (58%), damaging the endothelial layer of the blood vessels and increasing the risk of DVT (23).

According to the ADVTRAS scores, 91% were in the low-risk category in the preoperative period, whereas 39.2% were in the moderate-risk category in the postoperative period. Büyükyılmaz et al. (2015) reported that patients were in the moderate DVT risk category after orthopedic surgery (25). Özbaş and Karadağ (2020) found that 89.3%, 40.7%, and 11.4% of orthopedic patients were in the low-, moderate-, and high-risk categories in the postoperative period, respectively (35).

According to the RAM scores, 39% of our participants were in the moderate-risk category in the preoperative period, while 70.6% were in the high-risk category in the postoperative period. Bahl et al. (2010) evaluated the RAM scores of 8216 general surgery, cardiovascular surgery, and urology patients and found that 52.1%, 36.5%, 10.4%, and 0.9% were in the very high, high-, moderate-, and low-risk categories, respectively (36). Kim et al. (2020) conducted a study on 750 general surgery patients and reported that 48.9% were in the low – or moderate-risk category, while 43.8% and 7.3% were in the high – and very high-risk categories, respectively (37). Olufemi-Aworinde et al. (2018) also determined that one in every two patients (n=820) was in the moderate-risk category in the postoperative period (38).

According to the PPS scores, 82.2% of our participants were in the low-risk category in the preoperative period, while 52.8% were in the high-risk category in the postoperative period. However, Yormaz et al. (2019) found that patients who underwent bariatric surgery (n=270) were in the low-risk category in the preoperative and postoperative periods (29). Elias et al. (2017) reported that patients with and without VTE had a PPS score of 7.7 and 4.9, respectively (39).

Some studies have compared RAM and PPS scores (16-18). Zhou et al. (2018) concluded that both scales could identify the risk factors for DVT but that RAM was more comprehensive than PPS (18). However, some studies indicate that RAM is better at identifying the risk factors for DVT in hospitalized patients than PPS (16, 17). Our results showed that ADVTRAS, RAM, and PPS categorized the same patients into different risk groups. To develop a professional language, healthcare professionals should use one assessment tool customized to clinics.

Mechanical and pharmacological methods can prevent the development of DVT (14). Özkaya et al. (2013) found that most physicians (72%) used mechanical methods for DVT prophylaxis (34). Özbaş and Karadağ (2020) reported that physicians applied mechanical prophylaxis to 2.9% and 58.6%

of orthopedic patients in the preoperative and postoperative periods, respectively (35). Graduated compression stockings are a mechanical measure commonly used to prevent DVT. Most of our participants did not use compression stockings in the preoperative period, but more participants used them in the postoperative period. However, most participants misused the stockings. The Turkish Guideline for the Treatment of Venous Thromboembolism Prophylaxis suggests that healthcare professionals teach patients how to use graded compression stockings (Evidence level A) (15). Research also shows that patients do not know how to use graduated compression stockings (35, 40). Serpici and Gürsoy (2018) reported that surgical patients trained by nurses were more informed of DVT and were more likely to adhere to interventions to prevent DVT (41). However, Dirimeşe, Yavuz, and Nurulke (2012) reported that most patients knew how to use compression stockings but had difficulty using them (42). According to our clinical observations, patients misused the compression stockings because they were informed only orally and were provided no written material.

Pharmacological measures can also be used to prevent DVT. Of our participants, 81.2% were on anticoagulant medication in the preoperative period, while 57.3% were on anticoagulant medication in the postoperative period. Ferreira et al. (2017) reported that 67.2% of Portuguese patients (n=2747) received thromboembolic prophylaxis, most of whom (88.3%) were on low-molecular-weight heparin therapy (43). Özkaya et al. (2013) determined that 74% of physicians used pharmacological measures to prevent DVT (34). Özbaş and Karadağ (2020) found that the overall pharmacological thromboprophylaxis rate in the preoperative and postoperative periods was 12.9% and 86.4%, respectively (35). The Safe Surgery Checklist, which is mandatory for all patients undergoing surgery in Turkey, has a clause determining whether DVT prophylaxis is necessary or not (13).

Participants were able to stand on their two feet about 14.85 ± 12.06 hours after surgery. Çebi and Tanrıverdi (2009) reported that immobility was the most common risk factor for DVT (52.3%) (44). Özbaş and Karadağ (2020) found that mobilization 17-24 hours after orthopedic surgery was 68.6% (35). Early mobility, especially in the first 24 hours after surgery, is critical for preventing DVT (10). The national guideline in Turkey suggests that healthcare professionals encourage patients for early mobility in the postoperative period (Evidence level A). According to the guideline, surgical patients with a low risk for VTE do not require any prophylactic measure other than early and frequent mobility (very strong recommendation) (15).

4.1. Limitations of the study

This study had one limitation. The results were sample-specific, and therefore, not generalizable to the whole population.

5. CONCLUSION

Most surgical patients have chronic diseases (hypertension and diabetes mellitus) and individual DVT risk factors (advanced age and gender). Most surgical clinic patients have risk factors for DVT due to surgery (long operation, surgery below waist level, general anesthesia, surgical history, etc.). Surgical patients are at a higher risk of developing DVT in the postoperative period than in the preoperative period. Different scales yield different results concerning the risk factors for DVT when applied to the same patient population. Moreover, patients should be trained on how to use graduated compression stockings.

The following are recommendations based on the results:

- Healthcare professionals should use a standardized scale to identify the risk factors for DVT in clinical patients.
- Authorities should develop evidence-based nursing guidelines, algorithms, checklists, and interventions to identify the risk factors for DVT and monitor whether healthcare professionals use them.
- Medical schools should provide nursing students with training in DVT risk assessment and prophylaxis.
- Nurses should be provided with in-service training in DVT risk assessment and prophylaxis.
- A national database on DVT risk assessment and prophylaxis should be developed.
- Multicenter research on DVT risk assessment and prophylaxis should be conducted.

Conflict of Interest: None

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REFERENCES

[1] Watson T, Shantsila E, Lip GY. Mechanisms of thrombogenesis in atrial fibrillation: virchow's triad revisited. Lancet 2009;373(9658):155-166.

[2] Nisio M, Es N, Büller HR. Deep vein thrombosis and pulmonary embolism. Lancet 2016;388(10063):3060-3073.

[3] Kim JY, Khavanin N, Rambachan A, McCarthy RJ, Mlodinow AS, Oliveria GS, Stock MC, Gust MJ, Mahvi DM. Surgical duration and risk of venous thromboembolism. JAMA Surg 2015;150(2):110-117.

[4] Park JH, Lee KE, Yu YM, Park YH, Choi SA. Incidence and risk factors for venous thromboembolism after spine surgery in Korean patients. World Neurosurg 2019;128:289-307.

[5] Acun G. The risk and prevalence of deep vein thrombosis on patients who are hospitalized in surgical clinics. Dokuz Eylül

University. Health Science Institute, Thesis of Master. 2012 (In Turkish).

[6] Dirimeşe E, Yavuz M. Prevention of venous thromboembolism in surgery clinicals. Maltepe Üniversitesi Hemşirelik Bilim ve Sanatı Dergisi 2010;2(3):98-105 (Turkish).

[7] Büyükyılmaz F, Sendir M. An ignored problem in post-surgery care: deep vein thrombosis risk assessment and nursing care. Journal of Health Sciences 2014;23(1):48-54 (Turkish).

[8] Autar R. The management of deep vein thrombosis: the autar dvt risk assessment scale re-visited. Journal of Orthopaedic Nursing 2003;7(3):114-124.

[9] Caprini JA. Risk assessment as a guide for the prevention of the many faces of venous thromboembolism. AJS 2010;199(1):3-10.

[10] Koç B, Karatepe O, Geldigitti T, Tutal F, Karahan SR. Venous tromboembolism prophylaxis practices at surgery clinics. Medical Journal of Bakırköy 2013;9(1):8-11(Turkish).

[11] Akyüz E, Tunçbilek Z. Nurses role and responsibilities on management of antiembolism stockings: antiembolism stocking care protocol. Turk J Cardiovasc Nurs 2018;9(20):96-104 (Turkish).

[12] Gürsoy A, Çilingir D. Silent danger for surgical patients: deep vein thrombosis risk-reducing nursing care. Acibadem University Health Sciences Journal 2018;9(3):213-219 (Turkish).

[13] Performans Yönetimi ve Kalite Geliştirme Daire Başkanlığı(2011).(cited 2020 December 01). Available from: URL: https://kalite.saglik.gov.tr/ Eklenti/4333/0/ guvenlicerrahikontrollistesiuygulamarehberipdf.pdf (Turkish).

[14] National Institute for Health and Care Excellence (2020). (cited 2020 November 27). Available from: URL: https://pathways.nice.org.uk/pathways/venous-thromboembolism.

[15] National Venous Thromboembolism Prophylaxis and Treatment Guidelines (2010). (cited 2020 November 15). Available from: URL: https://www.toraks.org.tr/ uploadfiles/ Ulusal_Venoz_Tromboembolizm_Profilaksi_ve_Tedavi_Kilavuzu2010.pdf (InTurkish).

[16] Liu X, Liu C, Chen X, Wu W, Lu G. Comparison between caprini and padua risk assessment models for hospitalized medical patients at risk for venous thromboembolism: a retrospective study. Interact Cardiovasc Thorac Surg 2016;23(4):538-543.

[17] Chen X, Pan L, Deng H, Zhang J, Tong X, Huang H, Zhang M, He J, Caprini JA, Wang Y. Risk assessment in Chinese hospitalized patients comparing the padua and caprini scoring algorithms. Clin Appl Thromb-Hemost 2018;24(9):127-135.

[18] Zhou H, Hu Y, Li X, Wang L, Wang M, Xiao J, Yi Q. Assessment of the risk of venous thromboembolism in medical inpatients using the padua prediction score and caprini risk assessment model. J Atheroscler Thromb 2018;25(11):1091-1104.

[19] Oh H, Boo S, Lee JA. Clinical nurses' knowledge and practice of venous thromboembolism risk assessment and prevention in South Korea: a cross-sectional survey. J Clin Nurs 2017;26(3-4):427-435.

[20] Karadoğan K, Durna Z, Akın S. Evaluation of nurses' knowledge levels about risk factors for venous thromboembolism and preventive interventions. JAREN 2020;6(1):36-43 (In Turkish).

[21] De Martino RR, Beck AW, Edwards MS, Corriere MA, Wallaert JB, Stone DH, Cronenwett JL, Goodney PP. Impact of screening versus symptomatic measurement of deep vein thrombosis in a national quality improvement registry. J Vasc Surg 2012;56(4):1045-1051.

[22] Esin M.N. Samples. Erdoğan S., Nahcivan N., Esin M.N., editors. Nursing research: process, implementation, and critics. İstanbul: Nobel Publication; 2015.p.178-179 (Turkish).

[23] Ageno W, Becattini C, Brighton T, Selby R, Kamphuisen PW. Cardiovascular risk factors and venous thromboembolism. Circulation 2008; 117(1):93-102.

[24] Autar R. Nursing assessment of clients at risk of deep vein thrombosis (dvt): The autar dvt scale. J Adv Nurs 1996;23(4):763-770.

[25] Büyükyılmaz F, Şendir M, Autar R, Yazgan İ. Risk level analysis for deep vein thrombosis (dvt): a study of Turkish patients undergoing major orthopedic surgery. Journal of Vascular Nursing 2015;33(3):100-105.

[26] Caprini JA. Thrombosis risk assessment as a guide to quality patient care. DM-Dis-a-Mon 2005;51(2-3):70-78.

[27] Aydın Ö. Cross-sectional evaluation of proper use of deep venous thrombosis prophylaxis in patients hospitalized in internal medicine and surgical wards of Hacettepe University Medical Faculty Adult Hospital. Hacettepe University. Health Science Institute, Medical Specialty Thesis. 2014 (Turkish).

[28] Barbar S, Noventa F, Rossetto V, Ferrari A, Brandolin B, Perlati M, Bon E, Tormene D, Pagnan A, Prandoni P. A risk assessment model for the identification of hospitalized medical patients at risk for venous thromboembolism: the padua prediction score. J Thromb Haemost 2010;8(11):2450-2457.

[29] Yormaz S, Yılmaz H, Alptekin H, Acar F, Ece İ, Colak B, Yormaz B, Kafali ME, Sahin M. Evaluation of the risk of pulmonary thromboembolism using a padua score in laparoscopic sleeve gastrectomy: a retrospective study. ACU Sağlık Bil Derg 2019;10(1):73-77 (Turkish).

[30] Goldhaber SZ, Bounameaux H. Pulmonary embolism and deep vein thrombosis. Lancet 2012;379(9828):1835-1846.

[31] Gür Ö, Gürkan S, Cakır H, Gür DÖ, Donbaloğlu O, Ege T. Evaluation of treatment activity in patients with deep venous thrombosis. Cukurova Medical Journal 2012;37(4):198-202 (Turkish).

[32] Engbers M, Hylckama Vlieg A, Rosendaal F. Venous thrombosis in the elderly: incidence, risk factors and risk groups. J Thromb Haemost 2010;8(10):2105-2112.

[33] Wang L, Pryor AD, Altieri MS, Romeiser JL, Talamini MA, Shroyer L, Telem DA. Perioperative rates of deep vein thrombosis and pulmonary embolism in normal weight vs obese and morbidly obese surgical patients in the era post venous thromboembolism prophylaxis guidelines. Am J Surg 2015;210(5):859-863.

[34] Özkaya Ö, Öztürk MB, Egemen O, Öreroğlu AR, Üsçetin İ, Tasasız K, Akan M. The approach of turkish plastic surgeons to the venous thromboembolism prophylaxis and preferred methods in prophylaxis: a survey study. Turk J PlastSurg 2013;21(2):10-15 (Turkish).

[35] Özbaş N, Karadağ M. Determination of knowledge requirements and practices to prevent venous thromboembolism risk in patients undergoing orthopedic surgery. J DU Health Sci Inst 2020;10(2):228-234 (Turkish).

[36] Bahl V, Hu HM, Henke PK, Wakefield TW, Campbell DA, Caprini JA. A validation study of a retrospective venous thromboembolism risk scoring method. Ann Surg 2010;251(2):344-350.

[37] Kim NE, Pearson LC, Kavanah M, Mendez J, Sachs TF, Drake FT, Ko NY, McAneny D, Cassidy MR. Standardized risk assessment and risk-stratified venous thromboembolism prophylaxis

for patients undergoing breast operation. J Am Coll Surg 2020;230(6):947-955.

[38] Aworinde KO, Aworinde O, Olutogun T, Ogunlaja A, Medewase VJ, Akinola N. Predictive value of venous thromboembolism risk assessment scoring tools among surgical patients. Eur J Biomedical Pharm Sci 2018;5(4):88-91.

[39] Elias P, Khanna R, Dudley A, Davies J, Jacolbia R, McArthur K, Auerbach AD. Automating venous thromboembolism risk calculation using electronic health record data upon hospital admission: the automated padua prediction score. J Hosp Med 2017;12(4):231-237.

[40] Miller JA. Use and wear of anti-embolism stockings: a clinical audit of surgical patients. Int Wound J 2011; 8(1):74-83.

[41] Serpici A, Gürsoy A. Nurse-led patient training improves deep vein thrombosis knowledge and self-care practices. Journal of Vascular Nursing 2018;36(2):53-63.

[42] Dirimese E, Yavuz M, Nurulke B. Investigate of eligibility usage of graduated compression stockings. International Journal of Caring Sciences 2012;5(3):354-361.

[43] Ferreira D, Sousa JA, Felicíssimo P, França A. Venous thromboembolism risk and prophylaxis in the Portuguese hospital care setting: the arte study. Revista Portuguesa de Cardiologia. 2017;36(11):823-830.

[44] Cebi N, Tanriverdi S. Aetiology of deep vein thrombosis in 63 Turkish patients. Turk J Med Sci 2009;39(2):223-227.

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