

DETERMINATION OF DEEP VEIN THROMBOSIS RISK IN PATIENTS STAYING IN AN ORTHOPEDICS AND TRAUMATOLOGY CLINIC

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ABSTRACT

Purpose: Deep vein thrombosis (DVT) is an important life-threatening complication in patients having orthopedic surgery and its risk factors are still debatable. This study aimed to determine preoperative and postoperative DVT risk, its risk factors and their effects on preoperative and postoperative DVT risk scores in patients having orthopedic surgery and staying in an orthopedics and traumatology clinic.

Material and Methods: This descriptive, cross-sectional study was performed with 244 patients. Data were gathered with a sociodemographic, health status and prophylaxis for DVT form and the Autar Deep Vein Thrombosis Risk Assessment Scale (Autar DVTRAS).

Results: There was a strong significant difference between the preoperative and postoperative mean scores for the Autar DVTRAS ($p < 0.001$). Advanced age, immobility, history of trauma, high-risk diseases and chronic diseases significantly increased the preoperative moderate and high-risk scores for the Autar DVTRAS. In addition, advanced age, high body mass index, chronic diseases and complete immobility significantly increased the mean postoperative moderate and high-risk scores.

Conclusion: The results of the study suggested that the risk of deep vein thrombosis increases in patients having a major orthopedic surgery and that some risk factors affect preoperative and postoperative scores for the Autar DVTRAS.

Keywords: Deep vein thrombosis, deep vein thrombosis risk, orthopedic surgery

INTRODUCTION

Deep vein thrombosis (DVT), one of the most important causes of deaths in hospitals, is a preventable health problem that can appear in any part of the venous system and develop in all hospitalized patients (1). Among the factors affecting development of DVT are venous stasis, endothelial damage and hypercoagulability, known as Virchow triad (2–4). If undetected and untreated earlier, it may result in severe morbidity and mortality.

The risk of DVT is 0.1% in the society and varies from 15% to 40% in patients having surgery (5). It has been reported to increase to 50%-80% during and after major orthopedic surgeries (hip fracture and hip and knee surgeries) (6,7). In a study conducted in Taiwan (n=120); it was determined that 7.5% of the patients without pharmacologic thromboprophylaxis developed postoperative DVT (8). In another study that included 102 patients undergoing major orthopedic surgery; it was determined that the

patients had a moderate risk of developing DVT on the second postoperative day (9). Due to major surgeries in orthopedics and traumatology clinics (trauma-related fractures and surgical interventions for them, arthroplasty, open reduction, internal fixation and amputation etc.), venous stasis resulting from these interventions and effects of postoperative immobility on the coagulation system, the risk of DVT increases (4,9,10). In addition, many other factors including advanced age, obesity, chronic diseases, longer hospital stay and higher rates of immobility raises this risk in the patients receiving treatment in orthopedics and traumatology clinics (3,4,11).

Nurses have an important role in preventing DVT in patients undergoing orthopedic surgery (6,13). It is extremely important to determine the DVT risk factors of patients, to take precautions before, during and after surgery, and to manage DVT effectively; there are national and international guidelines on the subject in the literature (2,14). DVT is an important complication for orthopedic patients (7,11). It is necessary to determine the risk status and risk factors of the patients before and after the operation. The aim of this study was to determine preoperative and postoperative DVT risk, risk factors and effects of these factors on preoperative and postoperative DVT risk scores in patients having orthopedic surgeries and staying in an orthopedics and traumatology clinic. It is thought that the results of the research will contribute to a better understanding of the situation, revealing the components related to DVT and improving the care process of the patients during the surgical process.

MATERIAL AND METHODS

Study Design, Setting and Time

The study has a descriptive, cross-sectional design and was conducted with 244 patients satisfying inclusion criteria for the study and staying in the orthopedics and traumatology clinic of Uşak Training and Research Hospital between April and October in 2017. The inclusion criteria were volunteering to participate in the study, being older than 18 years, conscious and cooperative, not having a speech or hearing problem or a mental disorder, staying in hospital for minimum two days after surgery, not taking antipsychotics, antidepressants, mood stabilizers or sedative drugs and being hospitalized for the diagnosis of DVT, pulmonary thromboembolism or thrombophlebitis. Patients with coagulation disorders and neurological diseases who

did not have the ability to give accurate information were excluded from the study.

Data Collection Tools

The Autar Deep Vein Thrombosis Risk Assessment Scale

The Autar Deep Vein Thrombosis Risk Assessment Scale (Autar DVTRAS) was developed by Ricky Autar in 1994 to determine DVT risk and then revised by the same researcher in 2003 (12). It has seven subscales, i.e. age group, body mass index (BMI), mobility, special risk category, trauma risk category, surgical intervention and current high-risk diseases and the scores to obtain from the scale range from zero to 32. The scores 15 and higher than 15 indicate high risk for DVT, the scores 11-14 indicate moderate risk and the scores 7-10 indicate low or lack of risk (12).

The validity and reliability of the scale for Turkish population was tested by Şendir and Büyükyılmaz in 2010. Its Cronbach's alpha was found to be 0.65. The researchers reported that the scale had discriminatory power for detection of DVT risk and could be utilized as a data collection tool to determine DVT risk of patients in Turkey (9). In the present study, Cronbach's alpha for the scale was found to be 0.64.

Sociodemographic, Health Status and Prophylaxis for Deep Vein Thrombosis Form

A sociodemographic, health status and prophylaxis for DVT form was created by the researchers in light of the results of a study by Acun (2012) to determine patient characteristics other than those in the Autar DVTRAS (13). As additional risk factors of DVT, presence of chronic diseases and smoking status were evaluated. Concerning prophylaxis for DVT, postoperative heparin treatment was questioned.

Data Collection

The patients undergoing orthopedic surgery were informed about the aim and method of the study. Oral and written informed consent was obtained from those volunteering to participate in the study. Then the Autar DVTRAS (2002) and the sociodemographic, health status and prophylaxis for DVT form were administered. Data were collected in 24 hours after admission to hospital in the preoperative period and in 48 hours after surgery. Data about type of admission, medical diagnosis, type of surgery, current high-risk diseases, use of

Table 1. Sociodemographic Features and Preoperative and Postoperative Risk Factors of the Patients

Sociodemographic Features and Risk Factors	Number	Percentage
Gender		
Female	169	69.3
Male	75	30.7
Age Groups (years)		
10-30	9	3.7
31-40	10	4.1
41-50	18	7.4
51-60	44	18.0
61-70	84	34.4
71 and over 71	79	32.4
BMI		
16-19 kg/m ²	3	1.2
20-25 kg/m ²	50	20.5
26-30 kg/m ²	78	32.0
31-40 kg/m ²	106	43.4
41 kg/m ² and over 41 kg/m ²	7	2.9
Preoperative Mobility Status		
Partly dependent (mobility with a tool such as walker)	159	65.2
Highly dependent (need for assistance)	36	14.8
Confined to wheel-chair	3	1.2
Confined to bed	46	18.8
Risk Status		
Not having risk	244	100
Having risk	0	0
Trauma Status		
Not having trauma	180	73.8
Having injuries of the lower extremities	64	26.2
High-risk Diseases Regarding Deep Vein Thrombosis		
None	208	85.2
Varices	8	3.3
Chronic heart disease	22	9.1
Acute myocardial infarct	4	1.6
Malignity (active cancer)	2	0.8
Surgical Intervention		
Arthroplasty (Knee and hip)	163	66.8
Trauma	63	25.8
Arthroscopy	13	5.4
Revision arthroplasty (knee and hip)	5	2.0
Postoperative Mobility		
Partly dependent (mobility with a tool such as walker)	11	4.5
Highly dependent (need for assistance)	147	60.3
Confined to wheel chair	3	1.2
Confined to bed	83	34.0

Table 2. Additional Risk Factors and Prophylaxis Status

Additional Risk Factors and Prophylaxis Status	Yes (%)	No (%)
Additional Risk Factors		
Chronic diseases	124 (50.8)	120 (49.2)
Smoking	17 (7.0)	227 (93.0)
Prophylaxis		
Postoperative compression stockings	165 (67.6)	79 (32.4)
Heparin administration	235 (96.3)	9 (3.7)
Dose of Heparin	40 mg/day	60 mg/day
	175 (71.7)	60 (24.6)

prophylaxis, other chronic diseases and results of laboratory and radiological tests were derived from patient records.

Data about age, mobilization status, use of oral contraceptives and hormone replacement therapy, trauma risk, smoking status and presence of central catheters were obtained at face-to-face interviews.

Data Analysis

Obtained data were analyzed with the Statistical Package Program for Social Sciences 18.0. Data about patients’ characteristics (age groups and gender etc.) were expressed in numbers and percentages. The mean preoperative and postoperative scores for the Autar DVTRAS were calculated and the difference between these scores was determined with the Student’s t-test. Effects of gender, age, BMI, mobility, risk status, history of trauma, current surgical interventions, current high-risk diseases on mean preoperative and postoperative scores for the Autar DVTRAS were evaluated by using binary logistic regression analysis.

Ethical Considerations

Ethical approval was obtained from Uşak University Clinical Research Ethics Committee (Date: 18.05.2017, Number 2017-31) and permission was taken from the hospital administration and the

physician responsible for the clinic where the study was performed. Oral and written informed consent was taken from the patients volunteering to participate by using an informed consent form.

RESULTS

Sociodemographic features of the patients and their preoperative and postoperative risk factors for DVT are presented in Table 1. Out of 244 patients, 69.3% (n=169) were female and 34.4% (n=84) were aged 61-70 years. Forty-three-point four percent of the patients (n=106) had a BMI of 31-40 kg/m² and 65.2% of the patients (n=159) were partly dependent (mobility with a tool such as a walker). Before surgery, 26.2% of the patients had lower extremity injuries and 9% of the patients had chronic heart disease. Concerning type of surgery, 66.8% of the patients (n=163) had arthroplasty (knee or hip) and 25.8% of the patients had trauma surgery. In the postoperative period, 60.2% of the patients became highly dependent (needed assistance).

As shown in Table 2, 50.8% of the patients had chronic diseases and 7% of the patients were smokers. Regarding prophylaxis for DVT, 73.4% of the patients (n=179) were mobilized and 67.6% of the patients (n=165) had compression stockings in the postoperative period. In addition, 71.7% of the

Table 3. The Mean Preoperative and Postoperative Autar DVTRAS Scores

Autar DVTRAS Scores	n	Mean±SD	Median (min - max)	Sig.
Mean Preoperative Autar DVTRAS Score	244	9.36 ± 3.25	8 (3 - 20)	.0001 (z=12.34)
Mean Postoperative Autar DVTRAS Score	244	12.85 ± 2.59	13 (4 - 21)	
Difference		-3.49 ± 2.37	-5 (-7 - 4)	

Table 4. Evaluation of Risk Factors affecting Preoperative Autar DVTRAS Scores: Binary Logistic Regression Analysis

Risk Factors affecting Preoperative Autar DVTRAS Scores		p	OR	95% Confidence Interval	
				Lower	Upper
Age		0.0001*	1.052	1.024	1.081
Gender (Male)	Ref: Female	0.908	.964	.517	1.798
BMI		0.315	1.009	.992	1.026
Preoperative mobility (highly dependent / completely immobile)	Ref: Dependent	0.0001*	9.852	5.094	19.054
Preoperative trauma risk (Presence of trauma)	Ref: Absence of trauma	0.0001*	21.316	10.331	43.983
High-risk diseases (Presence of high-risk disease)	Ref: Absence of high-risk diseases	0.0001*	10.167	4.607	22.438
Smoking as additional risk factor (Smoker)	Ref: Nonsmoker	0.187	.363	.081	1.633
Chronic diseases as an additional risk factor (Presence of chronic diseases)	Ref: Absence of chronic diseases	0.021*	2.008	1.113	3.624

*p<0.05: statistically significant effect; OR: Odds Ratio; Logistic regression analysis

patients (n=175) were administered low molecular weight heparin (LMWH) 40mg/day, 24.6% (n=60) were administered LMWH 60 mg/day and 3.7% (n=9) were not given heparin.

There was an extremely significant difference between the mean preoperative and postoperative scores for the Autar DVTRAS (p<0.001, Table 3). The mean postoperative score for the Autar DVTRAS was found to increase.

The factors that significantly affected the mean preoperative Autar DVTRAS score being moderate and high were advanced age, immobility, trauma history, high risk diseases and presence of chronic disease. Gender, increased BMI and smoking did not significantly increase the risk score before surgery.

The factors that significantly affected the mean postoperative Autar DVTRAS score being moderate and high were advanced age, high BMI, presence of chronic diseases and complete immobility. Gender, presence of high-risk diseases and heparin administration did not have a significant effect on the mean postoperative Autar DVTRAS score being moderate and high. Being a smoker, not wearing

compression stockings and having trauma (emergency) surgery significantly reduced the moderate and high DVT risk.

DISCUSSION

This study was directed towards determining preoperative and postoperative DVT risk, risk factors and their effects on preoperative and postoperative DVT risk scores in the patients having orthopedic surgery and staying in an orthopedics and traumatology clinic.

The mean scores for the Autar DVTRAS showed low DVT risk before surgery (9.36 ± 3.25) and moderate DVT risk after surgery (12.85 ± 2.59) in the patients (n=244). The mean preoperative and postoperative DVT risk scores were significantly different (p<0.001; Table 3). The mean scores for the Autar DVTRAS were found to increase after surgery. It has been noted in the literature that surgical interventions are major risk factors of DVT (14,15). Due to type of surgery performed, presence of infections and duration of postoperative immobility and disrupted coagulation, damage to deep veins and prolonged

Table 5. Evaluation of Risk Factors affecting Postoperative Autar DVTRAS Scores: Binary Logistic Regression Analysis

Risk Factors affecting Postoperative Autar DVTRAS Scores		p	O.R.	95% Confidence Interval	
				Lower	Upper
Age		0.0001*	1.134	1.090	1.180
Gender (Male)	Ref: Female	0.066	.487	.226	1.050
BMI		0.014*	1.105	1.021	1.197
Postoperative mobility (completely immobile)	Ref: Dependent	0.0001*	15.24	4.157	55.867
High-risk diseases (Presence of high-risk diseases)	Ref: Absence of high-risk diseases	0.086	5.899	.779	44.693
Smoking as an additional risk factor (Smoker)	Ref: Nonsmoker	0.0001*	0.095	0.033	0.272
Chronic diseases as an additional risk factor (Presence of chronic diseases)	Ref: Absence of chronic diseases	0.0001*	6.583	2.435	17.798
Compression stockings as prophylaxis for DVT (Not wearing compression stockings)	Ref: Wearing compression stockings	0.006*	0.338	0.157	0.728
Heparin (administering heparin)	Ref: Not administering heparin	0.999	.000	.000	
Type of surgical interventions Trauma (emergency) surgery	Ref: Planned surgical intervention (arthroplasty)	0.032*	0.425	0.195	0.927

*p<0.05 statistically significant effect; O.R: Odds Ratio; Logistic regression analysis

immobility especially in patients undergoing major surgery, DVT risk considerably rises (2,4). The fact that the present study was performed with patients having orthopedic surgery might have created a significant difference between the preoperative and postoperative Autar DVTRAS scores. Immobilization starting before surgery and its maintenance after surgery, prolonged time between exposure to trauma and surgery and presence of endothelial damage in patients having orthopedic surgery due to traumas considerably increase DVT risk (16–18). In the present study, most of the patients underwent major orthopedic surgeries [66.8% of the patients (n=163) had knee or hip arthroplasty, 25.8% (n=63) had trauma surgery, 2% (n=5) had knee and hip revision arthroplasty] and most of the patients became highly dependent after surgery (60.2% needed assistance).

In many studies about the issue, orthopedic surgeries and resultant immobilization were found to increase DVT risk due to their effects on the coagulation system (9,17,19). According to results of studies in the United States, the perioperative DVT incidence is 2%-3% and this incidence increases to 40%-60% in patients undergoing orthopedic surgeries without thromboprophylaxis (20). In the present study, preoperative and postoperative immobility was found to significantly increase moderate and high risk Autar DVTRAS scores. In addition, presence of a trauma significantly increases moderate and high risk Autar DVTRAS scores. In patients scheduled to have trauma surgery, prolonged bedrest and immobility frequently appear due to trauma in the preoperative period and surgery in the postoperative period, which is reported to raise

DVT risk (19,21). It has been noted in the literature that patients with restricted activity aged 40-60 years have moderate or high DVT risk (22). Obesity and prolonged immobilization are considered as major risk factors in patients having arthroplasty (for knees and hips) and surgery for hip fracture (19,23). Patients older than 60 years and having pelvic and acetabular fractures have been reported to face increased DVT risk when time from trauma to surgery is longer than two weeks (24).

In the current study, age and presence of chronic diseases were found to significantly increase both moderate and high-risk preoperative and postoperative Autar DVTRAS scores. Sixty-one-point eight percent of the patients were 61 years old or older and 50.8% had chronic diseases. The lifelong thromboembolism risk after the age of 45 years has been reported to be 8% (25). It is also stated in the literature that advanced age, presence of cardiovascular diseases and history of DVT lead to an increase in DVT risk of patients having orthopedic surgeries (9,17,19). In a study with patients having traumatic fractures ($n=337$), 216 patients were found to have at least one chronic disease, but no relation was found between presence of a chronic disease and DVT status (26).

In the present study, gender did not have a significant effect on moderate and high risk preoperative and postoperative Autar DVTRAS scores, which is conflicting with the evidence in the literature. It is reported that the DVT incidence is a bit higher in women due to receiving hormonal treatment and pregnancy during the reproductive period and higher in men aged over 45 years (27). According to the results of a study analyzing acquired risk factors of DVT in lower extremities of women, pregnancy and oral contraceptives are the risk factors most affecting women aged 18-45 years and immobility, heart disease and history of DVT are the risk factors most affecting those aged 66-90 years (28). If there are not significant differences between male and female samples, DVT risk increases with age (15,18,27). Age-related increased DVT risk in both genders can be explained by changes in homeostatic factors due to aging (immobility, changes in vessels, presence of a chronic disease, decreased fluid intake, decreased venous blood flow and increased blood clotting) and frequency of hospitalization (17,29,30). Decreased protective effects of estrogens on vessels due to menopause in older women is another important factor (15). When the incidence of DVT in women is

compared with that in age-matched men, it is a bit higher in women in their reproductive period (16-44 years old) and in men over their 45 years (31).

While increased BMI did not have a significant effect on the preoperative Autar DVTRAS scores, it significantly increased the postoperative moderate and high-risk scores. In a study about the effects of BMI on complications in six months after knee and hip arthroplasty, increased BMI was found to increase DVT, pulmonary embolism and surgical wound infections (32). Obesity is also reported to decrease duration of mobility and increase DVT risk by reducing fibrinolytic activity (33).

In the present study, presence of a high-risk disease had a significant effect on the preoperative moderate and high-risk DVTRAS scores, but it did not significantly affect the postoperative scores. Lack of an effect of a high-risk disease on postoperative DVT risk can be explained by the fact that orthopedic surgeries (2,4,9) and resultant immobility considerably increase DVT risk (17,18). In addition, the patients included in the current study had diseases different from those reported to create high risk in the literature (heart disease, acute myocardial infarction and malignity). This might be another reason for the lack of an effect of high-risk diseases. Among the diseases reported to produce high risk for DVT are sickle cell anemia, hemolytic anemia, varices and cerebrovascular events (27).

In the current study, heparin administration did not have a significant effect on the postoperative Autar DVTRAS scores, either, which is incompatible with the literature. Of all the patients, 71.7% ($n=175$) received LMWH 40 mg/day and 24.6% ($n=60$) LMWH 60mg/day. LMWH administration is frequently initiated in patients scheduled for major orthopedic surgeries and having prolonged immobility and other risk factors in the preoperative period. It has been recommended in many studies that LMWH should be prophylactically administered to patients undergoing orthopedic surgeries to reduce DVT risk (34-36). It has a high-quality anticoagulant effect and has fewer side-effects (34,37). In the current study, it was surprising that heparin administration did not affect the risk of postoperative DVT, and it was thought to be due to the characteristics of the patients (advanced age, presence of chronic diseases etc.). Smoking had no significant effect on the preoperative Autar DVTRAS scores; however, it significantly reduced the postoperative moderate and high-risk scores, which is conflicting with the literature (38-40).

Delgado et al. reported that active smokers had higher fibrinogen and factor XIII and decreased factors VII, VIII, XII and von Willebrand and thrombomodulin (a strong clotting inhibitor), which increased DVT risk in smokers (38). Sweetland et al. from England showed that the DVT incidence rose in smokers before surgery and in 12 weeks after surgery and emphasized that DVT risk must be kept in mind in the evaluation of DVT risk (41). The fact that findings obtained in the present study are incompatible with the evidence from the literature might have been related to the number of cigarettes smoked and duration of smoking. The type of tobacco consumed might have also been a factor affecting DVT risk.

Not wearing compression stockings was found to significantly lower the postoperative moderate and high-risk Autar DVTRAS scores, which is not congruent with the literature. In a systematic review about the effectiveness and reliability of using gradient compression stockings for prevention of DVT, it has been stated that these stockings decreased DVT risk and development and could reduce pulmonary embolism risk in hospitalized patients (42). Several studies have yielded high-quality evidence for reduced DVT risk by using gradient compression stockings, moderate-quality evidence for reduced proximal DVT risk and low-quality evidence for reduced pulmonary embolism risk in patients undergoing general or orthopedic surgery regardless of using other thromboprophylaxis methods (17,43). The lowered DVT risk score of the patients not wearing compression stockings in the present study can be attributed to features of the stockings used in the clinic where the study was conducted. Compression stockings have variations and their long-term use can decrease their effects; therefore, compression they can create on the legs can vary (4,17). In addition, in the hospital where the present study was performed, elastic bandages can be utilized when compression stockings are not available, which can change the pressure applied on the legs.

In the present study, the postoperative moderate and high-risk Autar DVTRAS scores were significantly lower in the patients having trauma surgery (emergency surgery). Of all the patients, 74.2% ($n=181$) had planned surgery (arthroplasty, revision arthroplasty and arthroscopy) and 25.8% had trauma surgery (emergency surgery). Most of the interventions performed were major surgeries (knee

and hip arthroscopy and trauma surgery etc.). Major orthopedic surgeries have been reported to increase DVT risk (16,18,24). The finding of the present study conflicting with evidence from the literature can be explained by the fact that orthopedic surgeries performed are as effective as emergency surgeries and that many orthopedic surgeries are major surgeries (10,16). In addition to orthopedic surgeries, patient characteristics (old age and presence of chronic diseases etc.) can increase DVT risk (19,24,44).

CONCLUSION

Consistent with the literature, the results of this study have shown that the risk of DVT increases in patients having major orthopedic surgeries and that risk factors affect preoperative and postoperative Autar DVTRAS scores. Unlike evidence reported in the literature, the present study has a striking finding: smoking, not using compression stockings and having trauma surgeries significantly lowered postoperative moderate and high-risk Autar scores. To decrease and prevent DVT risk in all patients having major orthopedic surgeries, preoperative and postoperative risk factors should be identified and appropriate measures should be taken in accordance with evidence-based guidelines. Orthopedics nurses should plan nursing care for diagnosis and prevention of DVT.

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