International Journal of Nursing and Health Science
2018; 5(2): 31-41
http://www.openscienceonline.com/journal/ijnhs
ISSN: 2381-4861 (Print); ISSN: 2381-4888 (Online)

Open Science

Deep Vein Thrombosis Among Critically Ill Patients: Implementing a Structured Prophylaxis Protocol

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To cite this article

Mona Mohamed Elhady, Amany Mohammed Shebl, Mohamed Ahmed Ahmed Sultan, Aida Faried Abd-Elwaness. Deep Vein Thrombosis Among Critically Ill Patients: Implementing a Structured Prophylaxis Protocol. *International Journal of Nursing and Health Science.* Vol. 5, No. 2, 2018, pp. 31-41.

Received: June 3, 2018; **Accepted**: July 3, 2018; **Published**: September 1, 2018

Abstract

Deep vein thrombosis is a third leading cause of mortality in intensive care unit. Diagnosis and assessment for deep vein thrombosis are important, also appropriate prophylaxis and prevention when risk is present is the most effective way of avoiding deep vein thrombosis. Aim: This study aimed at evaluating the effect of a structured prophylaxis protocol on prevention of deep vein thrombosis among critically ill patients. Design: A quasi-experimental design study was performed on sixty adult patients admitted to trauma intensive care unit in Emergency Hospital, Mansoura University, Egypt. The sample was randomly assigned to either deep vein thrombosis prophylaxis protocol group or control group. Two observational tools were used to assess patient's risk factors, and clinical and nonclinical indicators for deep vein thrombosis development. The overall reliability of the tools was measured using alpha Cronbach's test (0.953 & 0.977). Findings: The results revealed that, patients in the prophylaxis protocol group have low clinical and nonclinical indicators for deep vein thrombosis development, with significant reduced length of hospital stay than patients in control group. Conclusion: Implementing a prophylaxis protocol for all critically ill patients and continuous educational program for all critical care nurses was recommended to prevent deep vein thrombosis in intensive care units. Implications for Practice: The study findings may be useful as an empirical reference for critical care nurses caring for traumatic patients during hospitalization period to prevent development of deep vein thrombosis.

Keywords

Prophylaxis Protocol, Deep Vein Thrombosis Prevention, Critically Ill Patients

1. Introduction

Deep vein thrombosis (DVT) is a third leading cause of mortality in intensive care units [1]. [2] stated that DVT is a silent killer associated with high morbidity and mortality in critically ill patients. The prevalence of DVT among critically ill patient is from 10% to 80% worldwide particularly in those receiving no prophylaxis (25% to 60%), compared with those receive some form of prophylaxis "11 to 16%" [3, 4, 5]. DVT and pulmonary embolism (PE) together are responsible for more than 100,000 deaths each year. Many of those who survive will be affected for the rest of their lives and 30% of them will suffer from a recurrent episode in the next 10 years [1].

Deep vein thrombosis is the formation of thrombus or thrombi in one of the body's deep veins causing partial or complete blocking of circulation in this vein. The lower

extremities are the most common site for DVT and estimated 50% risk of PE if not treated [6, 7]. All critically ill patients are considered high risk for DVT, even after routine prophylactic anticoagulation with 2 to 4 additional risk factors for venous thromboembolism "VTE" [5].

Critically ill patients have ICU acquired risk factors (vasopressor use, sedation, mechanical ventilation, central venous catheter) beside general risk factors for DVT as advanced age, immobilization, obesity, past history of VTE, or neoplasm, sepsis, stroke, respiratory, renal or heart failure, trauma, or recent surgery [8, 9].

Patients in ICUs may have DVT within the first week of admission. Most literature and international guidelines on DVT considered prevention is more important and cost-effective than treatment. DVT can be prevented by performing appropriate prophylaxis protocol that must include symptoms and risk assessment and preventive strategies [10].

Many patients with DVT are asymptomatic. Symptomatic DVT usually occur in one leg in the form of calf erythema, pitting edema, homans sign, increased calf circumference, palpable thrombosed superficial veins and blue discoloration [11, 12, 13].

In addition to evaluating risk factors and presenting symptoms, pretest probability scoring tools as Hamilton Score, Modified Wells Score, DVT Risk classification system and Caprini's risk stratification score card may be useful to advance the accuracy of a diagnosis of DVT [14]. Also blood clotting tests like partial thrombin time, haemoglobin, haematocrite, platelets and D-dimmer are important in diagnosis of DVT [15]. If the risk of DVT is low, intermediate or high, an imaging study includeing Doppler ultrasound, Contrast venogram and Magnetic resonance imaging needs to be done [13, 2].

Critical care nurses play a key role in the detection and prevention of DVT. They must use DVT prophylaxis which contains pharmacological and non-pharmacological prophylaxis [16]. [17] recommend some principles about thromboprophylaxis in critical care patients that include thromboprophylaxis should be begin and followed as soon as possible in all ICU patients. Also newly updated prophylaxis should be personalized and evidence-based. In addition to daily checked the prophylaxis to ensure its appropriateness and not be interrupted for procedures/surgery or ICU transfer orders.

Non pharmacological prophylaxis should include mechanical prophylaxis and peripheral circulation improving measures (early ambulation, patient's repositioning and active range of motion exercise to lower extremities every 2 hours, and evaluate the patient`s overall hydration). Mechanical prophylaxis (Graded Elastic Compression Stockings "GECS", and Intermittent Pneumatic Compression "IPC" of the calf) alone is recommended for critically ill patients at high risk of bleeding with contraindications to anticoagulants [8, 18, 19].

Using heparin thromboprophylaxis decreases DVT in critically ill patients [20]. In general, Low-molecular-weight heparin (LMWH) and unfractionated heparin (UFH) have similar efficacy and safety. While enoxaparin (LMWH) more effectiveness than subcutaneous UFH for patients with major trauma. In order to ascertain the provision of optimal care, nurses must be guided by established protocol of nursing practices for critically ill patients. Nursing protocol reflect the value and priorities of the nursing profession, provide direction for professional nursing practices, and provide a framework for the evaluation of nursing practices [21, 22].

1.1. Significance of the Study

Early prevention of DVT has become a major goal in the management of critically ill patients. Effective strategies for prophylaxis of DVT are widely available, but remain underused, especially in ICUs [15]. Most of published DVT guidelines were implemented on non-traumatic patients. Currently, the optimal VTE prophylaxis strategy for trauma patients is unknown [1]. Moreover, there are limited numbers of the protocols for prevention of DVT in critically ill patients in Egypt.

1.2. Aim of the Study

The aim of the study is to evaluate the effect of implementing structured prophylaxis protocol on preventing deep vein thrombosis among critically ill patients.

1.3. Research Hypothesis

We hypothesized that patients who are subjected to a structured thromboprophylaxis protocol (thromboprophylaxis group) will not develop deep vein thrombosis than those who do not (control group).

2. Materials and Method

2.1. Research Design

A Quasi experimental design was used in performing the recent study.

2.2. Setting

This study was conducted in trauma intensive care unit at Emergency Hospital of Mansoura University, Mansoura, Egypt.

2.3. Sample

A convenience sampling method was used on sixty adult patients of both sexes who newly admitted to previously mentioned ICUs. While, patients had DVT, Acute coronary artery disorders, fluid restriction and exercises contraindication were excluded. Patients were assigned randomly into two groups (control and thromboprophylaxis group) 30 patients in each. Control group was received routine preventive measures for DVT by critical care staff, whereas thromboprophylaxis group was received structured thromboprophylaxis protocol provided by researchers from ICU admission until discharge.

Sample size calculation:

Sample of 60 adult patients of both sexes fulfilling inclusion criteria was calculated using Epidemiological information. Program version 6.02 after taking into consideration the total number admitted to the ICUs of Emergency Hospital during the year 2013 was 180 patients (30 patients admitted to the setting × 6 month the period of the study) and the study power of 80% confidence interval of 95% and relative precision 15%.

2.4. Tools of Data Collection

Two tools were used for data collection.

2.4.1. First Tool

DVT risk classification tool:-

This tool was developed by researchers to evaluate patient's profile data, risk factors and biological factors and therapeutic modalities in ICUs. It is composed of three parts; Patient's profile part includes patient's age, gender, marital status, level of education, date of admission, diagnosis, smoking history and past medical history. DVT risk factors classification scale part developed by Autar (1994) and adopted by the researchers for the current study. It consists of seven parameters; age specific group, body mass index, mobility level, special risk category, trauma risk factors, and surgical interventions. Total score of the scales is 30 that range from ≤ 6 as no risk, 7-10 low risk, 11-14 moderate risk to ≥ 15 as high risk [17]. Internal reliability of the scale was documented and showed high reliability (chromnpa alpha was 0.98). The special biological factors and therapeutic modalities in the ICU part includes assessment of hydration status; skin turgor, mucous membrane, CVP, intake and output and medications administered; analgesics, anticoagulants and thrombolytics.

2.4.2. Second Tool

DVT incidence evaluation sheet

This tool was developed by researchers to detect occurrence of DVT. Tool consists of three parts which were organized in a flow sheet to document patient's data during hospitalization period. DVT manifestations part was used to clinically diagnose the development of DVT; calf pain or pitting edema, tenderness or amputation, skin temperature, swelling, blue discoloration of the legs and palpable thrombosed superficial veins. Each manifestation graded from 0 as absent and 1 as present. Laboratory tests findings part was developed to monitor coagulation status of patient; partial thromboplastin time (PTT), prothrombin time (PT), Fibrinogen level, platelets count, hemoglobin and haematocrite which were performed three times during study period: at beginning of study (time 0), 4th hospitalization day (time 1) and at patient discharge from ICU (time 2). Doppler ultrasound findings part was done to assess blood supply in veins of lower limbs and detect development of DVT. It was performed at admission time (time 0), fourth hospitalization day (time 1) and at discharge time from ICU (time 2). Its result grades categorized from (0) as negative to (1) as positive.

2.4.3. Validity and Reliability

All instruments were reviewed by 5 critical care experts to test their contents validity. The overall reliability of the tools were measured using alpha Cronbach's test and the value was (0.95) for tool I & (0.97) for tool II.

2.4.4. Ethical Considerations

Study approval was obtained from the Ethics Committee of the Faculty of Nursing and hospital responsible authorities at the Mansoura University. All patients were assigned a code number to ensure confidentiality and informed consent was taken from the patient (if conscious) or patient's closest relative (if patient unconscious).

2.4.5. The Pilot Study

A pilot study was performed on 10% of the study sample (6 patients) who were excluded from the total sample.

2.5. Procedure

The actual fieldwork started at the beginning of January 2014 and was completed by the end of November 2015. It was conducted on the four phases; observation phase, preparation phase, operation phase and evaluation phase (figure 1).

2.5.1. Observation Phase

During observation phase the researchers documented patient's profile data, and biological factors and therapeutic modalities used in ICU at patient's admission. After that they observed DVT risk factors and clinical DVT indicators daily and nonclinical DVT indicators three times during hospitalization period for studied patients. Also the ICU LOS was documented at the discharge time.

The control group was received the routine preventive care for DVT which contains non pharmacological and pharmacological management by the critical care staff. Non pharmacological care was included elastic stocking application, patients repositioned every 2 hours, and range of motion exercises for lower limbs. Also some patients were received pharmacological prophylaxis in the form of anticoagulants that based on the physician opinion not on a protocol or guidelines.

2.5.2. Preparation Phase

Preparation phase of thromboprophylaxis protocol was conducted by the researchers through an extensive literature review to identify all available evidences concerning DVT prophylaxis protocol for critically ill patients. Protocol content was based on the results reported in the literature and the cooperation of a group of experts (critical care nursing and medicine, physiotherapist and pharmacist). The results of the content analysis were used to construct the protocol. The expert group proposed the construction of protocol which should include both pharmacological (e.g., anticoagulants) and non-pharmacological prophylaxis (e.g., elastic stocking, ROM exercise, early mobility, repositioning, chest

physiotherapy, adjunct pneumatic compression device).

2.5.3. Implementation Phase

During implementation phase, thromboprophylaxis group were received the designed protocol by the researchers daily from patient's admission until discharge. Thromboprophylaxis protocol was initiated by assess patient's risk factor for DVT using DVT risk factor stratification scale daily in the morning shift (8-9 am). Then pharmacological prophylaxes were decided based on the risk factor category: for low risk only non-pharmacological prophylaxis were received, and for moderate risk the patient was given heparin 5000 units every 12 hrs subcutaneous or enoxaprine 40 mg subcutaneous daily. While High risk patients were received heparin 5000 units every 8 hrs subcutaneous or enoxaprine 40 mg subcutaneous daily and adjunct pneumatic compression device. Non-pharmacological prophylaxes including the nursing interventions for applying elastic stocking, patient's positioning, deep breathing and coughing exercises, ROM exercises, and early mobilization were performed throughout 24 hours in combination with pharmacological prophylaxis to all risk categories.

2.5.4. Evaluation Phase

Evaluation phase was conducted by the researchers through comparing the results of the outcomes; DVT clinical & Non-clinical indicators & ICU LOS of both groups to determine the effect of implementing a structured thromboprophylaxis protocol.

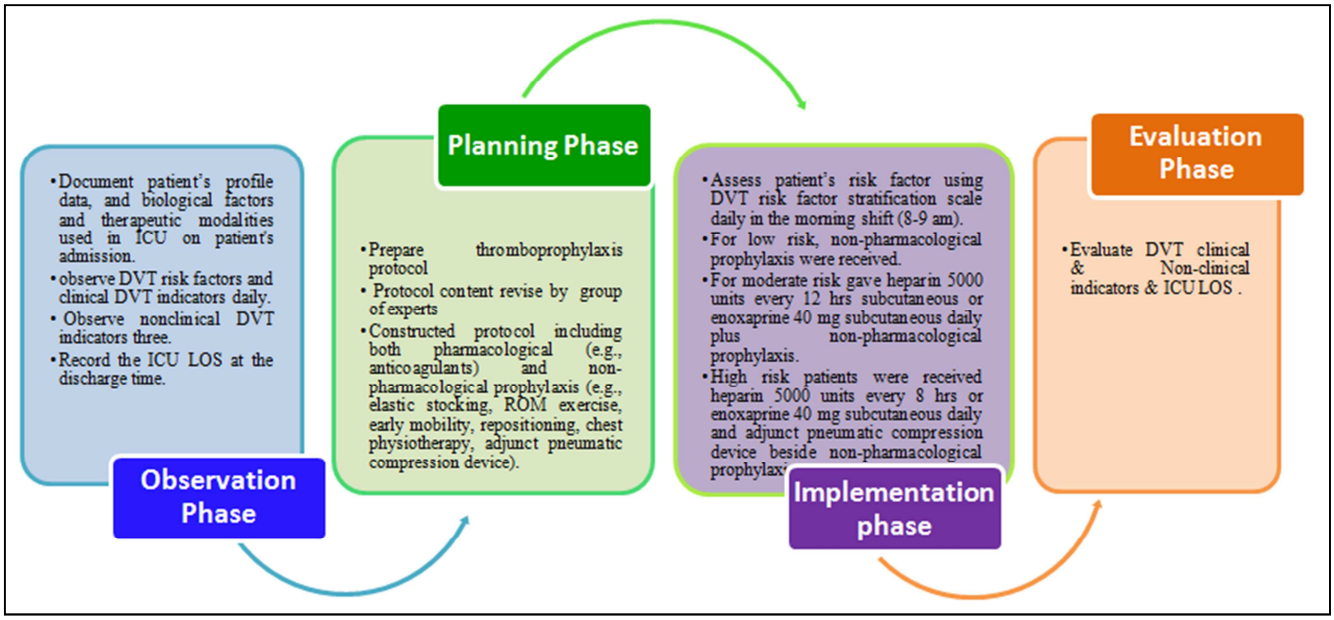


Figure 1. *Thromboprophylaxis protocol Algorithm.*

2.6. Statistical Analysis

The collected data were analyzed using PC with Statistical Package for Social Sciences (SPSS) version 15.0. The 0.05 level was used as the cut off value for statistical significance and the following statistical measures were used: Descriptive statistics including numbers and percentage used for describing qualitative data. Arithmetic mean and standard deviation (SD) for normally distributed quantitative data. In addition to analytical statistics including Reliability analysis (Cronbach's Alpha), Chi square ($\chi 2$) and Paired sample t- test were used.

3. Results

Table 1: shows patient's profile data for studied sample. When comparing the thromboprophylaxis and control groups, they are matching with no significant differences were noted.

Table 2: highlights patient's DVT risk category stratification among studied sample. As depicted in table 2, 53.3% of the control group and prophylaxis group had moderate risk for DVT (11-14) with no statistical significant difference between them at patients' admission. At patients' discharge, half of control group remain at moderate risk category while majority of thromboprophylaxis group become low risk with statistically significant difference between two groups.

Table 3: summarizes a comparison between thromboprophylaxis and control groups regarding factors affecting development of DVT including special biological factors and therapeutic modalities in ICU. The study findings revealed that; there were not significant differences of special biological factors (skin turgor, mocuos membrane, CVC, CVP interpretation and intake and output balance) between the two groups ($p = 0.5, 0.79, 0.3, 0.7$ & 1.00 respectively). Also, therapeutic modalities in the ICU (analgesics, thrombolytics and anticoagulants) were not significantly different on patients' admission ($p = 0.19, 0.6, 0.8$ respectively).

Figure 2: represents the number of patients receiving pharmacological prophylaxis during hospitalization period. It

was recorded that 70% of patients in control group were not received anticoagulants regardless elevated their risk category (53.3% were moderate risk and 10% high risk) while 63.3% of patients in thromboprophylaxis group were received anticoagulants according to the prevention protocol on initiation of the study.

Table 4: display comparison between studied groups in relation to DVT manifestation. It was represent that DVT manifestations at the beginning of the study were absent in the control and thromboprophylaxis groups. While DVT manifestations at the end of study were non-significantly increased in control group more than prophylaxis group (43.3% vs 26.7 for calf pain, 46.7% vs 33.3% for calf tenderness, and 43.3% vs 26.7% for calf swelling, 43.3% vs 26.7% increased leg temperature, 23.3% vs 13.3% had blue discoloration and 23.3% vs 13.3% had palpable thrombosed superficial veins respectively).

Table 5: shows that there was a significantly higher positive result of legs Doppler ultrasound for the control group than patients in the thromboprophylaxis group only on patients' discharge (p= 0.000*).

Table 6: displays comparison between control and thromboprophylaxis groups regarding coagulation findings. On patient's admission there were not significant differences between both groups regarding partial thromboplastin time, haemoglobin, haematocrite, platelets, prothrombin time and fibrinogen (p = 0.356, 0. 447, 0.403, 0.488, 0.498, and 0.357 respectively). While, on discharge there was a significant differences only in partial thromboplastin time (p=0.013).

Table 7: displays comparison between control and thromboprophylaxis groups regarding length of stay (LOS). The mean ICU LOS for the thromboprophylaxis group was 4.73±0.44 day compared to 7.83±2.06 day for the control group.

Table 1. *Patient's profile data of the studied sample (N = 60).*

Variable	Control group (n=30)		Prophylaxis group (n=30)		t/χ2 test	P
	No	(%)	No	(%)		
Age in years (mean ± SD)	**45.3±14**		**45.67±13.1**		**0.162**	**1.00**
Gender						
Male	23	76.7	20	66.7	0.739	0.39
Female	7	23.3	10	33.3		
Marital status						
Not married	10	33.3	12	40	0. 287	0.7
Married	20	66.7	18	60		
level of education						
Educated	12	40	11	36.7	0. 071	1.00
Non educated	18	60	19	63.3		
Smoking						
Non smoker	10	33.3	10	33.3	0. 000	1.00
Smoker	20	66.7	20	66.7		
Past medical history						
Heart disease	5	16.7	3	10		
Diabetes mellitus	6	20	9	30		
Hypertension	6	20	9	30	3.690	0.29
Respiratory disease	9	30	4	13.3		
Neurological disease	10	33.3	14	46.7		

*Significant at p≤ 0.05

Table 2. *Patients risk category stratification for the control group and DVT prophylaxis protocol group at admission and discharge times.*

Risk category	On admission					On discharge				
	Control group (n=30)		Prophylaxis group (n=30)		FET (P)	Control group (n=30)		Prophylaxis group (n=30)		FET (P)
	No	(%)	No	(%)		No	(%)	No	(%)	
NO risk (≤ 6) (r)	3	10	4	13.3	(r)	0	0.00	8	26.7	(r)
Low risk (7-10)	8	26.7	7	23.3	1.00	6	20	11	36.7	0.00
Moderate risk (11-14)	16	53.3	16	53.3	1.00	15	50	7	23.3	0.00
High risk (≥ 15)	3	10	3	10	1.00	9	30	4	13.3	0.00

* Significant at p≤ 0.05 ^ FET: Fisher's Exact test (r): reference group

Table 3. *The special biological factors and therapeutic modalities for the control group and prophylaxis group.*

Variables	Control group (n=30)		Prophylaxis group (n=30)		X^2	(P)
	No	(%)	No	(%)		
I. Special biological factors						
Skin turger						
Poor	11	36.7	13	43.3	0. 278	0.5
Good	19	63.3	17	56.7		
Mucous membrane						
Dry	14	46.7	13	43.3	0. 067	0.79

Variables	Control group (n=30)		Prophylaxis group (n=30)		X^2	(P)
	No	(%)	No	(%)		
Moist	16	53.3	17	56.7		
Central venous catheter presence						
Yes	13	43.3	17	56.7	1.067	0.3
No	17	56.7	13	43.3		
Central venous pressure interpretation						
Normovolemia	1	3.3	2	6.7		
Hypervolemia	3	10	5	16.7	1.419	0.7
Hypovolemia	9	30	10	33.3		
Intake and output balance						
Negative	9	30	9	30	0.000	1.00
Positive	21	70	21	70		
II. Therapeutic modalities						
Anticoagulant						
Yes	9	30	8	26.7	0.066	0.80
No	21	70	22	73.3		
Analgesic (NSAID)						
Yes	19	63.3	14	46.7	1.684	0.19
No	11	36.7	16	53.3		
Thrombolytic therapy						
Yes	3	10	4	13.3	0. 162	0.6
No	27	90	26	86.7		

X^2: Chisquar * Significant at p≤ 0.05 NSAID: Non-steroid anti inflammatory drugs

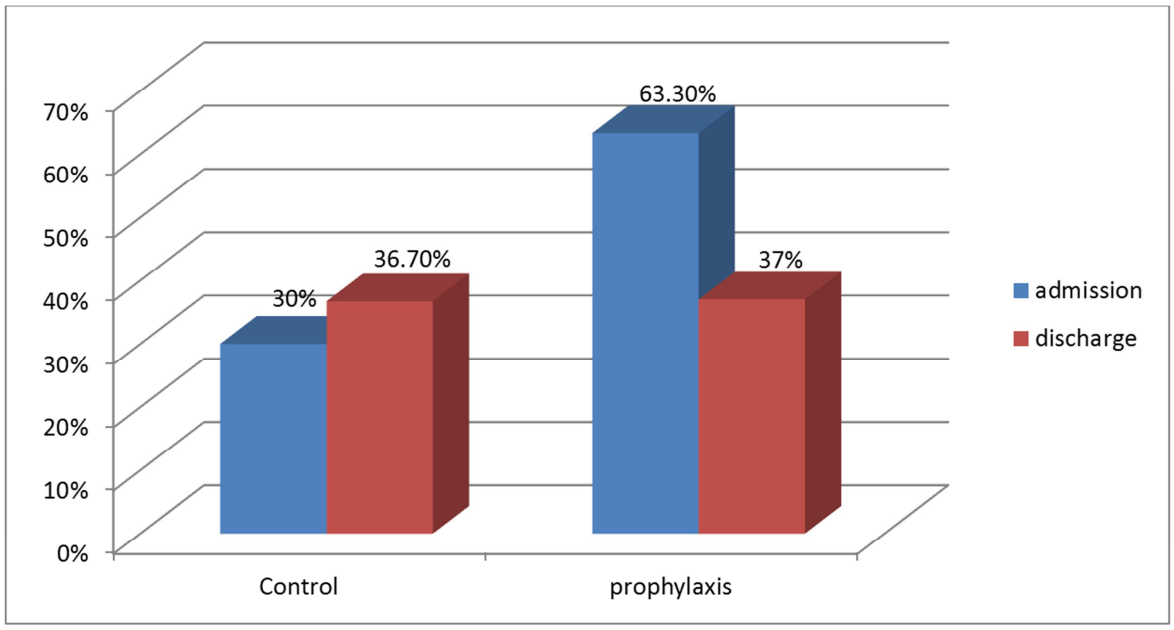


Figure 2. *Comparison between the control and prophylaxis groups regards anticoagulants received at admission and discharge times.*

Table 4. *Comparison between the control and prophylaxis groups regards occurrence of Deep Vein Thrombosis manifestations.*

Variables	On admission						On discharge					
	Control (n=30)		Prophylaxis (n=30)		X^2 (P)	P	Control (n=30)		Prophylaxis (n=30)		X^2 (P)	P
	NO	(%)	NO	(%)			NO	(%)	NO	(%)		
Calf pain												
Absent	30	100	30	100	--	--	17	56.7	22	73.3	1.83	0.17
Present	0	0	0	0			13	43.3	8	26.7		
Calf tenderness												
Absent	30	100	30	100	--	--	16	53.3	20	66.7	1.1	0.2
Present	0	0	0	0			14	46.7	10	33.3		
Calf swelling												
Absent	30	100	30	100	--	--	17	56.7	22	73.3	1.83	0.17
Present	0	0	0	0			13	43.3	8	26.7		
Leg temperature												
Normal	30	100	30	100	--	--	17	56.7	22	73.3	1.83	0.17
Increased	0	0	0	0			13	43.3	8	26.7		

Variables	On admission						On discharge					
	Control (n=30)		Prophylaxis (n=30)		X^2 (P)	P	Control (n=30)		Prophylaxis (n=30)		X^2 (P)	P
	NO	(%)	NO	(%)			NO	(%)	NO	(%)		
Blue discoloration												
Absent	30	100	30	100	--	--	23	76.7	26	86.7	1.002	0.31
Present	0	0	0	0			7	23.3	4	13.3		
Palpable thrombosed veins												
Absent	30	100	30	100	--	--	23	76.7	26	86.7	1.002	0.31
Present	0	0	0	0			7	23.3	4	13.3		

* Significant at p≤ 0.05 χ2 :Chi square test

Table 5. *Comparison between the control and prophylaxis groups regards Doppler ultrasound findings throughout the study period.*

Doppler findings	Right leg						Left leg					
	Control (n=30)		Prophylaxis (n=30)				Control (n=30)		Prophylaxis (n=30)			
	NO	(%)	NO	(%)	X^2	P	NO	(%)	NO	(%)	X^2	P
On admission												
Negative	30	100	30	100	--	--	30	100	30	100	--	--
Positive	0	0	0	0	--	--	0	0	0	0	--	--
On the fourth day												
Negative	30	100	30	100	--	--	30	100	30	100	--	--
Positive	0	0	0	0	--	--	0	0	0	0	--	--
On discharge												
Negative	20	66.7	30	100	12	0.000	19	63.3	30	100	13.46	0.000
Positive	10	33.3	0	0			11	36.7	0	0		

* Significant at p≤ 0.05 χ2: Chi square test

Table 6. *Comparing mean and standard deviation of the laboratory tests result between the control and prophylaxis groups at admission and discharge times.*

Laboratory tests	On admission				On discharge			
	Control group (n=30)	Prophylaxis group (n=30)			Control group (n=30)	Prophylaxis group (n=30)		
	Mean ± SD	Mean ± SD	t. Test	p	Mean ± SD	Mean ± SD	t. Test	P
Partial thromboplastin time (seconds)	26.13±5.47	25.40±5.50	0.39	0.356	31.81±13.83	50.20±14.62	3.60	0.013*
Haemoglobin (g/dl)	10.82±1.35	10.73±1.35	0.14	0. 447	10.32±1.40	11.88±1.18	0.449	0.338
Haematocrite (%)	43.27±5.59	42.43±5.25	0.61	0.403	43.52±5.16	43.93±4.42	0.196	0.426
Platelets (thousand/cmm)	253.97±74.77	256.30±79.12	0.03	0.488	253.97±74.77	256.30±79.12	0.03	0.488
Prothrombin time (second)	10.086±2.40	10.07±2.42	0.004	0.498	10.087±1.89	11.488±1.57	1.17	0.153
Fibrinogen (mg/dl)	246.67±62.88	240.67±56.32	0.391	0.357	316.67±46.11	306.66±25.7	0.272	0.399

* Significant at p≤ 0.05

Table 7. *Intensive care unit length of stay for control and prophylaxis protocol patients (n=60).*

Length of stay	Control group		Prophylaxis group		t. test	P
	No	(%)	No	(%)		
1-5 days	1	3.3	30	100		
6-10 days	21	70.0	0	0.0		
11-15 days	8	26.7	0	0.0	8.019	0.000*
Mean ± SD	7.83±2.06		4.73±0.44			
Median	7.0		5.0			

* Significant at p≤ 0.05

4. Discussion

Deep Vein Thrombosis is a common, severe and frequently unrecorded complication of critical illness which causing high morbidity and mortality [23, 8]. Several preventive guidelines that concentrate on pharmacological prophylaxis only have been published [24, 10, 25]. But there are few studies that focused on the critically ill patients. These studies concluded that there was not adherence to prophylaxis guidelines, anticoagulant prophylaxis may be delayed, interrupted, or withheld because of risk of bleeding and the use of sequential compression devices and stockings have not been assessed rigorously in critically ill patients [26, 27, 28, 29].

The authors developed this study that includes a detailed, objective and systematic analysis of the effects of structured prophylaxis protocol on preventing DVT among critically ill patients.

Critically ill population includes patients with complex medical co-morbidities, post-operative general surgical patients, poly-trauma, neuro-intensive care and bariatric patients coupled with risk factors acquired during their ICU stay stimulates the inflammatory response that increasing the

thromboembolic risk [30]. The findings of current study explore that more than half of the control and prophylaxis groups were at moderate to high risk for DVT without statistical significant difference between them on patients' admission. On discharge, majority of thromboprophylaxis group were at low risk category while majority of control group remain within moderate risk category. This result can be attributed to use mechanical prophylaxis methods for all patients in thromboprophylaxis group during hospitalization period. On the same point of view [31] reported that prolonged rest and coagulation abnormalities of trauma patients increasing risk of thrombus formation. Also [32] documented that patients who received mechanical and pharmacological prophylaxis had a lower risk of DVT. On the other side [33] did not find evidence of effectiveness for either pharmacological or mechanical interventions on reducing risk for DVT.

To evaluate the effect of a designed prophylaxis protocol on the prevention of DVT, the researchers compared DVT manifestations; Laboratory tests results and Doppler ultrasound result between prophylaxis and control groups.

Regarding DVT manifestations, it was obvious that on admission all studied sample were free from DVT manifestations. While on discharge DVT manifestations had fewer occurrences in prophylaxis group than control group without statistical significant difference between both groups. This may be resulting from use non pharmacological prophylaxis including mechanical prophylaxis (GECS and IPC of the calf) and peripheral circulation improving measures (early ambulation, patient's repositioning and active ROM exercise to lower extremities every 2 hours, and evaluate the patient`s overall hydration) with all patients in prophylaxis group which improving peripheral circulation and prevent venous stasis. While all patients in control group didn't ambulated in ICU, and received ROM exercise to lower extremities once daily. This finding is supported by [34] who found that the incidence of DVT as manifested by symptoms was lower among patients receiving anticoagulants plus compression stocking without statistical significance.

On opposite side [35] demonstrated that symptoms in venous thromboembolism patients as swelling of limb was manifested by the majority of the patients and calf pain was manifested by more than the half in these patients (89.4% and 61.3%) respectively.

Most literatures recommend performing coagulation studies (PT, PTT, platelets, fibrinogen, haemoglobin, and haematocrite) for all critically ill patients to detect occurrence of DVT [36]. The current study demonstrates that all coagulation studies were remain within normal ranges during admission for patients in both control and prophylaxis groups except haemoglobin that decreased below normal levels which can be resulting from bleeding from traumatic events that occurs to patients. On discharge, the hemoglobin value increased in prophylaxis group while decreased in control group. This result is supported by [37] who state that presence of statistical significant difference was found between the mean value of hemoglobin on discharge (day 14) from value at admission (day 0) among studied patients.

In addition the results demonstrated that there was not significant differences' between both groups on patients' admission and discharge except PTT that was increased in prophylaxis group more than control group. This may be attributed to that the majority of prophylaxis group were received anticoagulants according to their risk category stratification during hospitalization period while the majority of control group were not received anticoagulants regardless increased their risk categories. These results are supported by [20, 38, 39, 23] who suggest use of heparin thromboprophylaxis to decrease DVT and PE in critically ill patients. These results are matching with [40] who evaluated the prevalence of thrombotic syndrome among 328 patients. They were found statistical significant difference in the coagulation tests (PTT, PT) on admission ($p < 0.05$) and discharge ($p \leq 0.10$).

On opposite side [27], discover that only 17.4% of the studied patients had abnormal coagulation test with no statistical significant difference at discharge from hospital. Also, [41] disagree with these findings. They studied the correlation between six risk factors (smoking status, immobility, exsiccosis, diabetes mellitus, coagulation disorders including D-dimere, leucocytes, C-reactive protein (CRP), partial thromboplastin time (PTT), fibrinogen, thrombocytes, erythrocytes, quick, and creatinin, and renal insufficiency) and VTE among 102 critically ill patients with versus without DVT. They concluded that no significant correlation was found for any of the named laboratory values ($p = 0.69$). Also [42] documented that there is no significant difference in the PT value among the control group and experimental group in his study.

Doppler ultrasound imaging is a sensitive, definitive, direct, noninvasive method for detecting DVT [43]. The recent research found that on admission and fourth study day there weren't an indicator of DVT in both groups which revealed by negative results of Doppler ultrasound. While by progress to discharge time the positive result of Doppler ultrasound appeared among control group only with high statistically significant difference between two groups. This may be occurred due to a significant decrease in ICU length of stay after implementation of DVT protocol for prophylaxis group than patients of the control group. [44, 45, 46] studies are in harmony with our result. They mentioned that more than third of patients in ICU were developed DVT that discovered by Doppler ultrasound.

On contrast [47, 31] found low incidence rate of DVT among studied sample as evidenced by negative results of Doppler Ultra Sound. Regardless his result he recommended frequently Doppler Ultra Sound screening during hospitalization period for all critically ill patients.

This result is supported by [48, 49, 25, 50, 51] who stated that ICU LOS could be reduced through best commitment to DVT prevention guideline and protocols. Also, [23, 8] reported that despite prophylactic anticoagulation, DVT can be expected in about 10% of patients staying at the ICU for

more than three days.

On contrast of our results [52] studied the effect of 8 days pharmacological and non pharmacological prophylaxis program on the incidence of DVT and hospital length of stay. Their results found that the incidence of DVT was low and the mean length of stay was 9 days. In addition, [53] reported that there were no differences in femoral venous blood flow velocity before and after 7 days of admission and without signs of DVT.

From the result of current study it was obvious that implementing the designed DVT prophylaxis protocol could enhance the quality of care in terms of early detection for DVT, maintaining blood flow velocity in risky patients and prevent DVT among critically ill patients.

5. Conclusion

This study has been beneficial in illustrating that implementing prophylaxis protocol for critically ill patients can preventing the occurrence of DVT during hospitalization period and decrease ICU length of stay. Structured surveillance and early prophylaxis protocol to prevent DVT are meticulous to every critically ill patients admitted to ICU during hospitalization period. It has positive effects in decreasing morbidity and mortality and length of stay. It should be focused on combining pharmacological and mechanical prophylaxis when dealing with risky patients to help in preventing of DVT. DVT prophylaxis is recommended to performe in a protocolized approach that is based on risk stratification and with collaboration of all multidisciplinary team and encouraging early ambulation and physical activity for the critically ill patients. Hence, critical care nurses must be educated and encourage integrating DVT prophylaxis protocol in the plan of care for all critically ill patients during hospitalization period. This study had few limitations that must be acknowledged. The study used a convenience sample, and the sample size was relatively small which limits the ability to generalize the findings. Also, the study was performed only on the traumatic critically ill patients.

Acknowledgements

The authors would like to thank health care providers working in ICUs of Mansoura University Hospital for their cooperation and support during data collection period.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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