

Effect of Implementing Nursing Guidelines on Occurrence of Deep Venous Thrombosis for Critically Ill Patients

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Abstract: Deep venous thrombosis (DVT) is a major health problem that results in significant morbidity and mortality for the critically ill patients in the critical care units. It was documented that DVT occurs in about two million Americans each year, whereas pulmonary embolism (PE) as a complication of DVT causes approximately 50.000 to 60.000 deaths. Moreover, it was revealed by a study done in Assuit University Hospital that out of 220 surgical patients, 12 (5%) died with pulmonary embolism as a complication of DVT. Other research done at Alexandria University in El-Hadra Hospital on 50 orthopedic patients revealed that seven patients were detected with DVT. The critical care nurses are the key players in the prevention of DVT and its complications. They are in the ideal position to assess patient risk factors early and ask for DVT prophylaxis. **Objective:** the current study was carried out to evaluate the effect of implementing nursing guidelines on the occurrence of DVT for critically ill patients. **Methods:** Four critical care units were used to collect the data for this study at Assuit University Hospital, sixty critically ill patients were included in this study, they were divided into two groups **G1** (control group) and **G2** (interventional group) 30 patients each. Two tools were used to collect the data of this study. **Tool one: "Patient's assessment for DVT, and Tool two: the "DVT evaluation sheet".** **Results and conclusion:** Findings of the current study revealed low incidence of DVT for the global sample, only two patients experienced DVT in the control group, and none of the interventional group experienced DVT. Moreover, it was observed that the preventive measures of DVT done by the critical care nurses for the control group using non-pharmacological and mechanical methods were not adequately performed. In addition, it was found that all the studied patients of control group did not wear the elastic stocking, while small proportion of this group performed leg exercises, changed their position, did deep breathing, and coughing exercises, and transfer on the chair. It was observed that most of the studied patients experienced low percent of DVT manifestations with no statistically significant difference between the both groups. The present study revealed also that nearly half of the studied patients were in moderate & high risk grades for DVT in the both groups. **Recommendations:** based on the current study findings it can be recommended that this research should be repeated on a large sample size and in multi centers for generalization. Moreover, training programs should be established to update critical care nurses' knowledge and skills about DVT preventive measures, and how to use the technical skills to assess the occurrence of DVT using the evidence base nursing and medicine.

INTRODUCTION

Deep venous thrombosis (DVT) is a common complication for the critical care practitioner; it can be a primary reason for admission to the critical care unit or particularly important to the critical care admission to the critical care unit or

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complication of other critical illness⁽¹⁾. Critically ill patients are at great risk for developing DVT due to their premorbid condition, admitting diagnosis in the critical care units such as sepsis and trauma; and exposure to invasive procedure such as central and peripheral venous catheterization and certain medications as sedative, narcotic, and analgesic. DVT occurs also in critically ill patients who have immobility for an extended period of time⁽²⁾. Most of the clinical studies of DVT in the critically ill patients estimated that 90% of cases of pulmonary embolism (PE) originated in the deep venous system of the lower limb^(3,4).

It was documented that DVT and Pulmonary embolism (PE) constitute a major health problem that result in significant morbidity and mortality for critically ill in the critical care units. DVT occurs in about two million Americans each year, where as PE causes, approximately 50.000 to 60.000 deaths each year in the

United States^(2,5). A study done in Assuit University Hospital revealed that out of 220 surgical patients, 12 (5%) died with PE as a complication of DVT⁽⁶⁾. Other research was done at Alexandria University in El-Hadra Hospital (2004) on 50 orthopedic patients revealed that seven patient only were detected with DVT⁽³⁾. Previous research has shown that DVT of the lower limbs is primarily responsible for the vast majority of cases of pulmonary embolus in hospitalized patients⁽⁷⁾. Recent studies have shown that despite prophylaxis, DVT occurs in approximately 11% of intensive care patients. A number of reviews have been undertaken in recent years to examine the development and prevention of DVT in intensive care patients⁽⁸⁾.

Critical care nurses are the key players in the prevention of DVT and its complications. They are in the ideal position to assess patient risk factors early and ask for DVT prophylaxis. Admission assessments are an opportune time to

evaluate patient risk factors such as immobility, age, previous history of DVT, and medical conditions that increase the risk of developing DVT in hospitalized patients. Patient risk assessment should be ongoing throughout hospitalization but especially with condition changes^(9,10).

Once a patient is considered at risk for developing DVT, critical care nurses must advocate for timely prevention mechanisms. This can be done by notifying physicians about the risk factors and asking for orders to initiate prophylaxis early or following an established hospital protocols and guidelines⁽¹¹⁾. Once prophylaxis orders are obtained, they need to be initiated as soon as acute care. Critical care nurses should be well-acquainted with the two forms of the disease (DVT and its dreaded sequel, pulmonary embolism). Preventing and detecting these two conditions have long been essential components of quality nursing. It was documented that PE is the most common undiagnosed cause of death

in hospitalized patients⁽¹²⁾. Even with best efforts in the critical care unit, it might never be able to eliminate all cases of venous thromboembolism, but it should be equipped with nursing expertise and the latest tools for dealing with this potential killer. Critical care nurses can help reduce its incidence and save lives⁽¹²⁾. **Hence this study was carried out to evaluate the effect of implementing nursing guidelines on the occurrence of DVT in critically ill patients.**

MATERIAL AND METHOF

Material

Design:

A quasi experimental research design was adopted to conduct this study.

Setting:

This study was carried out in 4 intensive care units (ICUs) namely, stroke, general, trauma, and post operative ICUs, at Assuit university Hospitals.

Subject:

The sample of this study comprised of

60 adult patients including both sex, their age ranged from 20-60 years old, and admitted to the previously mentioned settings. They were selected by convenience and randomly assigned to two equal groups, control (G1) and interventional group (G2) (30 patients each).

Exclusion Criteria:

Any patients with the following conditions were excluded from the study:

- Coronary artery diseases in acute stage.
- Fluid restriction.
- Exercises contraindication.

Tools:

Two tools were used to collect the data in this study and developed by the researcher based on the related literatures (10,14,15).

Tool one: "Patient's assessment for DVT", this tool was developed to assess the patient's risk factors, it included four parts:

Part I: - "patients profile" to document the patient's name, age, sex, diagnosis, date of

admission, and type of ICU.

Part II: "DVT risk factors scale", this part was initially developed by Autar (1996)⁽¹⁶⁾, then it was modified by Abd Elmanam (2004)⁽³⁾, and further modification was done by the researcher based on the literature review⁽¹⁷⁻¹⁹⁾ to suit the critically ill patients. It included nine items as age of the specific group, weight, mobility level, special risk category, site of trauma, surgical operations, high risk diseases, family history of DVT, and type of anesthesia.

Part III: "the special biological factors and therapeutic modalities in the ICU":

This part was developed by the researcher based on the literature review^(7,20) it included assessment of the hydration status as (skin turgor, mucous membrane, central venous catheter and intake and out put data), mechanical ventilator connection, and medications.

Part IV: "DVT preventive measures" this part was used to assess the preventive measures that were done by the critical

care nurses for the control group (nursing procedures that are considered to be effective in prevention of DVT), These measures included:

- Applying elastic stocking & leg elevation (check list ten Items).
- Changing position in bed (check list nineteen Items).
- Deep breathing and coughing exercise (check list ten Items).
- Range of motion of lower limb (check list twelve Items).
- Transferring patient from bed to chair (check list twenty one Items).

Tool two: "DVT evaluation sheet", this tool was developed by the researcher based on the extensive review of related literatures)⁽²¹⁻²²⁾, it was used to assess the occurrence of DVT, and to evaluate the effect of nursing guidelines, it included three parts:

Part I: "DVT manifestations", this part was used to assess DVT manifestations as the presence of six items (calf pain, calf

tenderness, calf circumference, skin color and distension of superficial vein, and warm calf).

Part II: "Laboratory tests findings" , this part was used to interpret the data related to the laboratory testes findings to determine coagulation status of the patient, as partial thromboplastin time (PTT), prothrambin time (PT), hemoglobin (HB), platelets and, fibrinogen level.

Part III: "Doppler findings", this part was used to assess the blood supply in the veins in the lower limbs, that indicate the occurrence of DVT.

Method

- Permission to conduct the study was obtained from the responsible authorities of all the selected ICUs after explanation of the aim of the study.
- Development of the tools after reviewing the related literature was done.
- The tools were reviewed by a jury for face clarity, feasibility, applicability, and the content validity of the tools

and all the necessary modifications were done. The Jury members were ten experts representing related content area. This included 3 medical staff, 2 from Vascular Department, one professor of anesthesia and intensive care, one Critical Care nursing staff from Assuit University, 4 Nursing Faculty staff from Critical Care Nursing Department, and 2 staffs from Nursing Education Department of the Faculty of Nursing, Alexandria University. Reliability was done on the tools by Cronbach's Alpha ranging from 0.80 to 1.00.

- Informed consent was obtained from each patient or from the responsible person for the unconscious patients.
- A pilot study was conducted on 5 patients who met the predetermined selection criteria to test the applicability of the tools. Appropriate study modifications were done prior to data collection.

Data collection:

The data were collected from the first day of admission after stabilization of the patient's condition and for ten consecutive days, every day and every shift then the data were recorded in the developed tools.

Data were collected on **three phases**.

Assessment Phase for the control group:

- **The patients profile was collected** from the patient or from nurses if the patient was comatose, and recorded in **part I, tool one**.
- then assessment of the **risk factors of DVT** was done by the assessment scale using **Part II in tool one** as the following:-
 - **For the age:** 20 < 30 years scored -- 0, if 30 <40 years scored --1, if 40 <50 years scored ---2.
 - **The weight:** was assessed by using Chumlea equation⁽²³⁾ the knee height was measured by centimeter tap and recorded in equation to determine the

- body weight, and then divided the weight (kg) on the height (m²) to determine the body mass index.
- **The body mass index:** by using Chumlea equation and classify the weight as the following: if (20 <25) → ideal weight and scored ---0, (25 <30) → over weight---1 and (≥ 30) → obese ---2.
 - **Level of mobility:** if the patient was ambulant scored---0, if slightly ambulant---1, if very limited---2 and immobile---3.
 - **Special risk category:** if female on contraceptive pills scored--1, if pregnant or in the pureperium period scored ---2, if smoking man---3.
 - **Trauma risk factors:** these factors were scored only preoperative, if no trauma scored ---0, head & neck scored ---1, chest scored---1, chest & neck---2, spinal---2, pelvic---3, lower limbs---4. After that surgical operation if none ---0, if pelvic---1, orthopedic---2, spinal---3.
 - **High risk diseases:** if none scored ---0,if nephrotic syndrome---1, ulcerative colitis---1, anemia---2, if congestive heart failure---3, myocardial infarction---4, malignancy---5, hyper coagulation diseases---6, varicose vein---7, stroke---7.
 - **Family history of DVT:** if negative scored---0, if positive---1.
 - **Anesthesia:** if spinal scored---0, if general---1 then the entire patient's data were marked in the scale to collect number.
 - **The total score of the risk factors** ranged from **1** as minimum to **28** as a maximum. The increased number was considered as high risk for development of DVT.
 - After that **assessment of the hydration status** was done by observation of the skin turgor and the mucous membrane, then central venous pressure and intake and output was measured and documented in the patient's chart every day and every shift.

- **Then the special therapeutic Modalities** were assessed every day and every shift (as mechanical ventilator connection, and the medications that the patients received) and recorded in **tool one part II.**
- Evaluation of clinical outcomes for the patients in the control group (GI):**
- Data for this group were collected from 30 patients who met the predetermined criteria in the control group who received the routine unit care, using tool two part I (manifestations of DVT), part II (the laboratory tests) and part III (Doppler ultrasound) findings.
- Assessment of the nursing performance for DVT preventive measures for the control group using check lists.** The actual nursing practices related to DVT preventive measures for the patients were observed by the researcher, using DVT prevention check lists that included the following check lists:
- Applying elastic stocking & leg elevation (check list ten Items).
 - Changing position in bed (check list nineteen Items).
 - Deep breathing and coughing exercise (check list ten Items).
 - Range of motion of lower limb (check list twelve Items).
 - Transferring patient from bed to chair (check list twenty one Items).
- The patient's legs were assessed for DVT manifestations. The assessment included six items, which were scored as follows, calf pain scored as absent (0) or present 1, calf tenderness absent (0), present (1), calf edema skin color, and, distension of superficial vein and skin temperature of legs (warm calf). All data were recorded in the tool two parts I. The total score of manifestations scale = 12.
- **Total risk category stratifications = total score of risk factors scale (28) + total score of manifestations DVT (12) [28 + 12] = 40.**

- To determine the grade of high risk for DVT if <9--- No risk, low risk (9 <14), moderate risk (14 <21) and high risk $\geq 21-40$.
- After that the **laboratory data** of the patients (prothrombin, time, hemoglobin, haematocrite, platelets, and fibrinogen level were recorded. These laboratory tests were done routinely, these data were recorded in the first day, fifth day, seventh day, and tenth days to determine coagulation status and compare patient's value with normal value.
- **Doppler ultrasound** was done to evaluate the blood supply flow in the veins of the lower limbs to detect the presence or absence of DVT. This was done in the first day, third day, fifth day, seventh day, and tenth day.

Implementation phase of the DVT preventive nursing guidelines:

- During this phase, the developed DVT preventive guidelines were implemented

for **the intervention group** which consisted of 30 patients who met the predetermined criteria.

The following steps were followed during its implementation:

Assessment phase:

Assessment phase was conducted as previously done with the control group.

Implementation phase for the interventional group (G2):

- This phase was begun from first day of admission for ten consecutive days every day and every shift.
- During this phase the developed nursing guidelines performed to all the studied patients (intervention group).
- These preventive measures were performed by the researcher with assistance of the physiotherapist and the critical care nurses that involved in providing direct patient's care after training on the guidelines.

Measuring the outcome of using DVT nursing guidelines:

- To evaluate the effect of the nursing guidelines on the occurrence of DVT for the interventional groups, tool two was used part I (**manifestations of DVT**), part II **laboratory tests**, and part III **Doppler ultrasound findings**. As previously done for the control group.
- Fisher exact test was used to identify the relationship between DVT manifestations, also the relationship between the level of risk grade and the special risk factors that may have effect on the occurrence of DVT.
- The level of Qui square is significance at <0.05.

Evaluation phase:

- This phase was done to evaluate the effect of the nursing guidelines on the occurrence of DVT by comparing the results of outcomes of the both groups by using tool two part I, II, III.
- Cronbach`s Alpha was done to test reliability of the tools.

RESULTS

Findings of this study regarding the effect of implementing nursing guidelines on the occurrence of DVT for critically ill patients presented in four parts:-

Statistical analysis:

The collected data were coded, analyzed using Statistical Package for Social Sciences (SPSS/ version 13) software, and tabulated.

- Descriptive statistics as number and percent, mean and standard deviation were used.
- Z-test was used. (This test was used to compare between the both groups in relation to sign and symptoms.

Part I: Characteristics of the both groups in relation to their profile and DVT risk factors (figure1, 2, 3, 4, table 1, table 2):

Table (1) illustrates characteristics of the both groups (control group (G1), and interventional group (G2) in relation to their profile and DVT risk factors. The mean age of patients in G1and G2 was found to be

45.33±14 and 45.67±13.1, respectively with no statistical significance difference between them. Concerning the gender of the sample, 50% of the studied patients in G1 and 67% in G2 were males. Moreover, it was observed that forty four percent of the studied patients in G1 and 66% in G2 were over weight and obese. As for the mobility status, it was found that about 37% of the studied patients in G1 and 20% in G2 were with very limited activity, 53% in G1 and 70% in G2 were immobile. Concerning the type of anesthesia, it was indicated that 40% of the patients in G1, and 30% in G2 received general anesthesia.

Findings of the current study revealed also that patients were selected equally in the two groups from the four types of ICUs, namely stroke, trauma, general, and postoperative ICU. The most common diagnosis in the stroke ICU was found to be 40% of the patients in G1 and 60% in G2 had cerebral infarction and cerebral hemorrhage. In trauma ICU 40% of the

studied patients in G1 and 50% in G2 experienced head and pelvic trauma. For the patients in the general ICU 60% in G1, and 80% in G2 suffered for respiratory from diseases. While 60% of the patients in the both groups in the post operative ICU experienced abdominal surgery, and 40% of the patients had open heart surgery. Concerning the smoking habit, 50% of the patients in G1 and 60% in G2 were smoker from males and the rest of the sample were females and were not smokers.

Table (2) shows the comparison between the two groups in relation to the special biological factors and therapeutic modalities in the ICU. As for the hydration status, 30% of the studied patients in G1 and 40% in G2 had poor skin turgor and dry mucous membrane. Moreover, about 27% of the studied patients in G1 and about 13% in G2 had central venous catheter, and 30% of the studied patients in G1 and only 17% in G2 had intake and out put chart with negative balance. Fifty percent of the

studied patients in G1 and 33% in G2 were connected with mechanical ventilator. Concerning to the given medications, 70% of the studied patients in G1, and 60% in G2 were not receiving anticoagulant. Moreover, 40% of the studied patients in G1, and 36% in G2 did not receive antipyretic analgesic non-steroidal, and 90% of the studied patients in G1, and 87% in G2 did not receive anti-thrombolytic drugs.

Part II: assessment of the DVT preventive measures done by the critical care nurses for the control group (tables 3):

Table (3) indicates the mean and standard deviation of the DVT preventive measures done by the nurses for the control group. It was observed that no body was found in the control group **to wear the elastic stocking**. The mean number of the studied patients that **changed their position** in G1 was found to be 57.03 ± 17.4 . The mean number of the studied patients in G1 was 2.22 ± 10.27 that performed **deep**

breathing and coughing exercises. While the mean number of the patients that performed **range of motion for the lower limbs** was found to be 10.00 ± 30.51 . The mean number of the studied patients was found to be 3 ± 10.0 that were **transferred to the chair**.

Part III: Evaluation of the effect of the guidelines as indicated by DVT manifestations and Doppler findings among the both groups. (Tables 4, 5, 6 and 7)

Table (4) presents the DVT manifestations as compared in the both groups (G1, G2). Finding of the current study indicated that calf pain was experienced in about 43% of the studied patients in G1, and about 27% in G2, with no statistical significant difference between the two groups. It was observed that calf tenderness was experienced by 47% of the studied patients in G1, and by 33% of the patients in G2. Calf edema was found to be about 43% of the studied patients in G1, and about 33% in G2 with no statistical

significant difference between the two groups. Skin color changes were observed in 20% of the studied patients in G1, and 7% in G2. Furthermore, distention of superficial veins was experienced by 13% of the studied patients in G1, and 10% in G2. The warm calf was found to be 53% of the studied patients in G1, and 57% in G2 with no statistical significant difference between the two groups.

Table (5) depicts the mean and standard deviation of the laboratory tests for the both groups, the mean of the partial thrombin time was found to be $[15.72 \pm 2.57$ and $15.4 \pm 5.12]$, respectively in the both groups. Concerning the mean of the Hemoglobin was found to be $[9.62 \pm 1.45$ and $10.62 \pm 2.11]$ in G1 and G2, respectively. Regarding the mean of the Hematocrit was found to be $[29.9 \pm 4.35$ and $31.70 \pm 4.16]$ in G1 and G2, respectively. While the mean of the platelets was found to be $[272000.4 \pm 98.9$ and $237000.6 \pm 77.96]$ in G1 and G2, respectively, with no statistical

significant difference between the both groups.

Table (6) indicates the comparison between the two groups in relation to the Doppler findings. It was observed that throughout the 10 days and the 5 times of observation of the Doppler findings two patients were found in G1 with evidence of DVT, one patient in the 5th day of observation and the other one in the 7th day of observation. As for the G2 no evidence of DVT was found throughout the 10 days of observation as evidence by Doppler findings.

Table (7) reveals the comparison between the both groups in relation to risk category stratification among the both groups. It was observed that the studied patient were considered at moderate risk for DVT ($14 < 21$), this risk category constituted about 53% of the studied patients in G1, and 47% in G2, with no Statistical significant difference between of them.

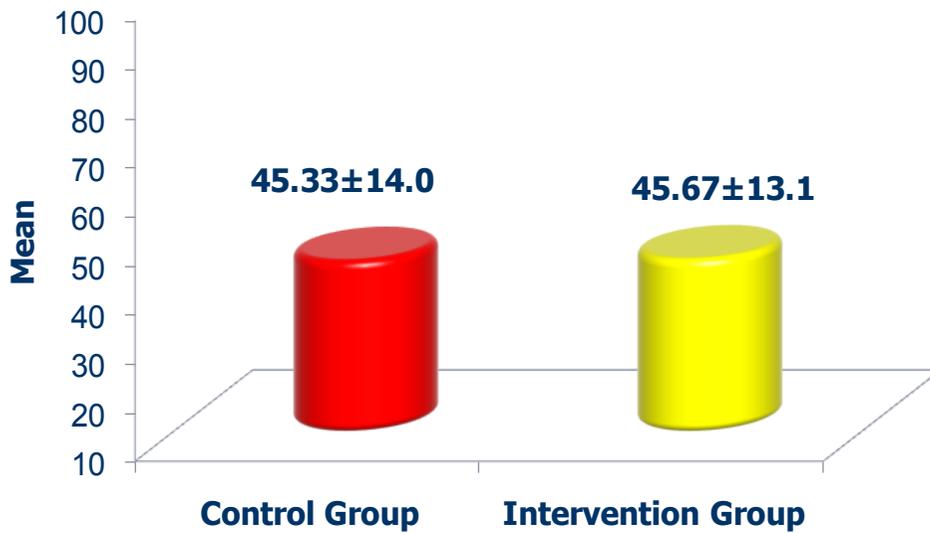


FIGURE (1) THE MEAN PERCENT OF AGE IN THE BOTH GROUPS

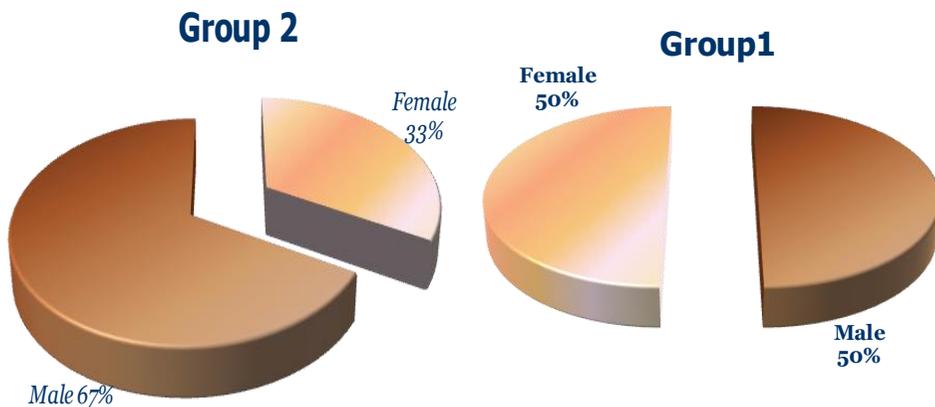


FIGURE (2) PERCENT DISTREBUTION OF THE BOTH GROUPS IN RELATION TO SEX

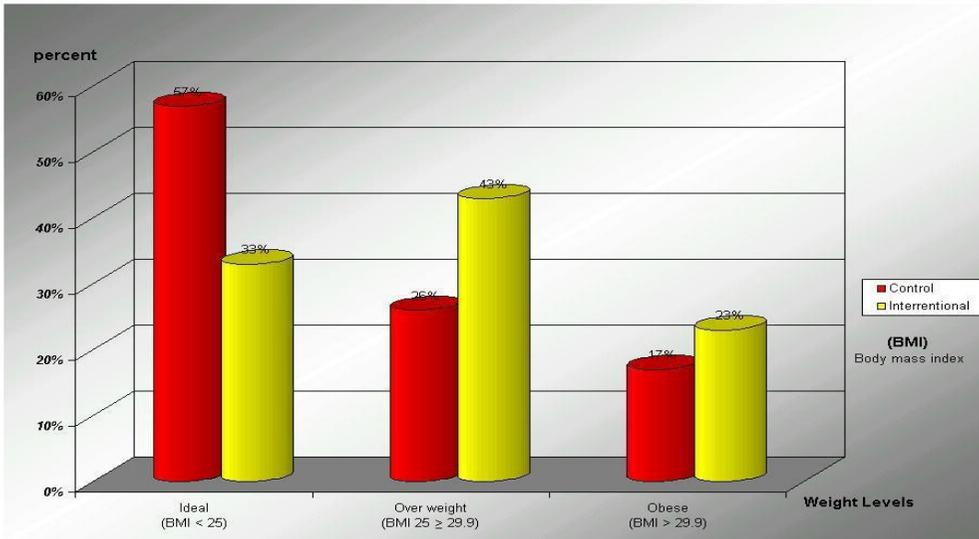


FIGURE (3) PERCENT DISTRIBUTION OF THE STUDY SAMPLE BY WEIGHT IN EACH GROUP.

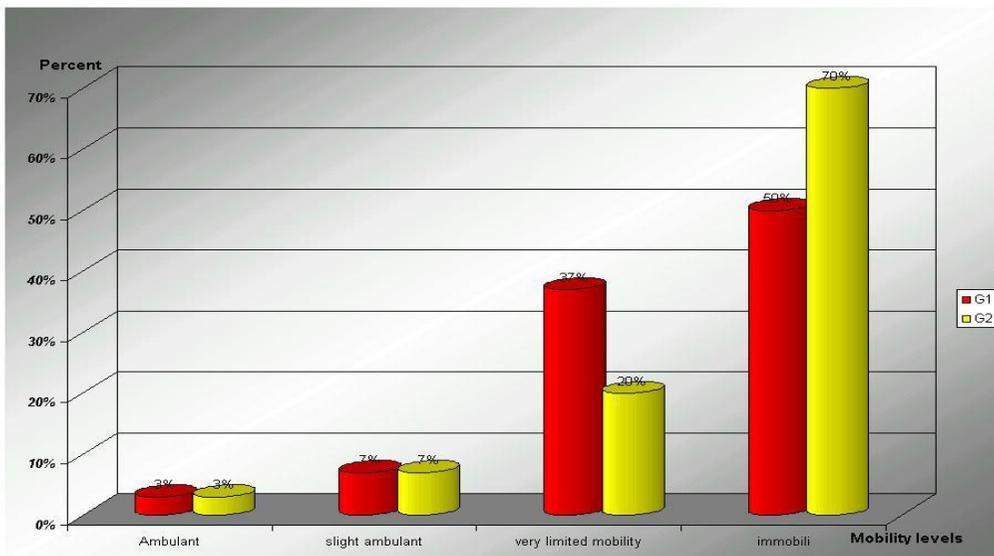


FIGURE (4) PERCENT DISTRIBUTION OF THE STUDY SAMPLE BY MOBILITY LEVELS IN EACH GOUP.

Part I: Characteristics of the both groups in relation to their profile and DVT risk factors.

Table (1): Characteristics of the both groups in relation to their profile and DVT risk factors.

Variables	G1 No= 30		G2 No= 30		Significance Tests
	No.	%	No.	%	
- Type of (ICU)					$\chi^2=0$ P= 1
- Trauma	10	33.3	10	33.3	
- Stroke	10	33.3	10	33.3	
- General	5	16.7	5	16.7	
- Post operative	5	16.7	5	16.7	
Total	30	100	30	100	
-Diagnosis Stroke ICU					Z= .4, p= .34 Z=2.2, p= 0.01
- Cerebral infarction	4	40	6	60	
- Cerebral hemorrhage	5	50	2	20	
- Encephalitis	1	10	2	20	
Total	10	33.3	10	33.3	
- Diagnosis Trauma(ICU)					Z= 4.39, p= .34 Z=4.61, p= 0.03
- Head and pelvic	4	40	5	50	
- Chest	6	60	5	50	
Total	10	33.3	10	33.3	
- Diagnosis General(ICU)					P .41, Z= .23 Z=.01, p=0.496
- Respiratory diseases	3	60	4	80	
- Drug toxicity	1	20	---	---	
- Hepatic encephalopathy	1	20	1	20	
Total	5	33.3	5	33.3	
- Diagnosis Post operative ICU					Z=.0, p= 0.5 Z=.0, p=0.5
- Open heart surgery	2	40	2	40	
- Abdominal surgery	3	60	3	60	
Total	5	33.3	5	33.3	
- Smoking					$\chi^2= 7.00$ P= .402
- Male					
- Yes	15	50	20	60	
- No	---	---	---	---	

P = 0.05

Table (2): Comparison between the two groups in relation to the special biological factors and therapeutic modalities of the studied patients in the ICU.

Variable	G1 No= 30		G2 No= 30		Significance tests (P=0.05)
	No.	%	No.	%	
- Hydration status					$\chi^2=.65$ P= .417
- skin turgor					
-Poor	9	30	12	40	
-Good	21	70	18	60	
Total	30	100	30	100	
- Mucous membrane					$\chi^2=.671$ P= .791
- Dry	11	36.7	12	40	
- Moist	19	63.3	18	60	
-Central venous pressure (C.V. P)					MCP = .342
-present	8	27	11	37	
- Low	5	17	7	23	
- High	2	7	2	7	
- Normal	1	3.3	2	7	
-absent	22	73.3	19	63	
-Intake and output chart					$\chi^2=1.49$ P= .222
-Positive	21	70	25	83.3	
-Negative	9	30	5	16.6	
Total	30	100	30	100	
-Mechanical ventilator					$\chi^2= 1.71$ P= .19
Yes	15	50	10	33.3	
No	15	50	20	66.7	
-Medications					$\chi^2=28.7$ P=.59
- Anticoagulant					
-Yes	10	30	12	40	
-No	20	70	18	60	
- Antipyretic					$\chi^2=3.2$ P=7.05
-Analgesic (NSAID)					
-Yes	18	60	11	36.3	
-No	12	40	19	36.3	
- Antithrombotic					$\chi^2= 1.86$ P= .194
- Yes	3	10	4	13.3	
- No	27	90	26	86.7	
Total	30	100	30	100	

Part II: assessment of the DVT preventive measures done by the critical care nurses for the control group.

Table (3): Mean percent of patients in the control group in relation to the DVT preventive measures that were performed for them

Preventive measures.	Control group (no.= 30)
	Mean (SD)
- Elastic stocking	-----
- Positioning	57.03±17.4
- Deep Breathing & cough exercise	2.22±10.27
- Rang of motion	10.00±30.51
- Transferring on the chair	3.00±10.0

Part III: Evaluation of the effect of the guidelines as indicated by DVT manifestations and Doppler findings among the both groups. (Tables 4, 5, 6 and 7).

Table (4): DVT manifestations as compared for the both groups.

Manifestations	Control G1 No= 30		Interventional G2 No= 30		Significance tests Fisher exact test
	No.	%	No.	%	P
- Calf pain					
- present	13	43.3	8	26.7	2.86 ¥
- absent	17	56.7	22	73.3	
Total	30	100	30	100	
-Calf tenderness					
-Present	14	46.7	10	33.3	.492 ¥
- Absent	16	53.3	20	66.7	
Total	30	100	30	100	
- Calf edema					
- Present	13	43.3	10	33.3	.593 ¥
- Absent	17	56.7	20	66.7	
Total	30	100	30	100	
- Skin color					
- Present	6	20	4	6.7	1.000 ¥
- absent	24	80	28	93.3	
Total	30	100	30	100	
- Distension of superficial vein					
- Present	4	13.3	3	10	1.000 ¥
- absent	26	86.7	27	90	
Total	30	100	30	100	
- Warm calf					
- Present	16	53.3	17	56.7	.112 ¥
- absent	14	46.7	13	43.3	
Total	30	100	30	100	

¥ = Fisher exact test.

Table (5): Mean and standard deviation of the laboratory tests for the both groups.

Laboratory tests	G1 No. = 30		G2 No.= 30		Significance tests	
	Mean	St.d	Mean	St.d	Z	P
-Partial thrombin time (seconds)	15.72	±2.57	15.4	±5.12	1.526	.127
-Hemoglobin (g %)	9.62	±1.45	10.63	±2.11	2.329	.020
- Hematocrit (%)	29.9	±4.35	31.70	±4.16	2.433	.015
-platelets (thousand/ cmm)	272.4	±98.9	237.6	±77.96	1.3	.193

P = 0.05

Table (6): Comparison between the two groups in relations to the Doppler findings.

Days	G1				G2				χ^2 . p
	Rt. Leg		Left leg		Right leg		Left leg		
	No.	%	No.	%	No.	%	No.	%	
1st day - present - absence	---	---	---	---	---	---	---	---	$\chi^2 = 2.06$ P=.15121 N.S
3rd day - present - absence	30	100	30	100	30	100	30	100	
5th day - present - absence	---	---	1	3	---	---	---	---	
7 th day - present - absent	---	---	1	3	---	---	---	---	
10 th day - present - absence	---	---	---	---	---	---	---	---	
	30	100	30	100	30	100	30	100	

P = 0.05

Table (7): Patients risk category stratification for both groups.

Risk category Stratification	G1		G2		Test of significant	
	No.	%	No.	%	χ^2	P
- No risk < 9	4	13.3	6	20	.75	.86138
- Low risk 9<14	8	26.7	11	33.3		
- Moderate risk 14<21	16	53.3	11	46.67		
- High risk ≥ 21	2	6.7	2	6.7		
Total	30	100	30	100		

P = 0.05

DISCUSSION

Critically ill patients with a variety of medical and surgical disorders can develop DVT and pulmonary thromboembolism that complicate their underlying conditions. The diagnosis of pulmonary thromboembolism in such critically ill patients is often difficult to make or confirm. The usual method of treatment with anticoagulation is hazardous and may be contraindicated in some of these patients. Therefore, there is increased emphasis on the prevention of deep venous thrombosis and pulmonary thromboembolism in ICU patients given to that they have multiple risk factors for this disease^(11,13,14).

Incidence of DVT:

Findings of the current study revealed low incidence of DVT in the global sample, only two patients experienced DVT in the control group, and none of the interventional group experienced DVT. This result may be attributed to the small sample size, short period of observation and follow

up, and the administration of pharmacological medications of anticoagulant that were given as prophylaxis. Abd Elmanam (2004)⁽³⁾ indicated that less than one quarter of the studied patients experienced DVT, which is considered to be low percent in relation to the orthopedic patients. Moreover, Gamal Eldeen (1999)⁽⁴⁾ reported that none of her studied abdominal surgical patients developed DVT.

DVT risk factors:

Wendy *et al.*, (2004)⁽²⁴⁾ reported that the following risk factors as **age, sex, weight, mobility status, trauma, surgical operations, anesthesia, previous history of DVT, and many diseases, all** should be considered when determining patients risk for development of venous thromboembolism. Although individual risk factors are important in considering the need for DVT prophylaxis, multiple risk factors lead to an ever greater risk, therefore, the critically ill patients should be

screened for DVT risk upon admission; and DVT prevention techniques should be initiated based on the risk assessment.

Findings of the current study revealed apparently that with increasing age there was increase in the risk of DVT in the both groups. Abd Elmonam (2004)⁽³⁾, and Ebell (2001)⁽²⁵⁾ reported that the patient's age was found to be a significant factor in the development of DVT in the studied patients. Moreover, Autar (1996)⁽¹⁶⁾ proved that there was a linear relationship between advanced age and the incidence of DVT. It was documented that the incidence of DVT increases linearly with increasing age, three factors have been proposed to explain this increase. First: as the increased vein age, they lose their elasticity, and the resulting dilatation and tortuosity contributes to an increase in the stasis of blood. Second: the decrease in muscle mass of the venous pump effectiveness add additional venous stasis. Third: there is an increased incidence with associated conditions and

diseases, as malignancy, heart disease which predisposes older patients to thromboembolic complications⁽²²⁾.

Gender was documented also to be another factor for DVT development. The gender in the current study sample was found to be equal in G1, while more than half of the studied patients in G2 were males. Abd Elmonam (2004)⁽³⁾ pointed out that sex was found to be a significant variable in DVT development. Snow *et al.*, (2007)⁽²⁶⁾ reported that females were generally at increased risk for DVT. They indicated that it could be related to the pregnancy and using contraceptives. On the other hand, Criner, *et al.*, (2002)⁽²⁷⁾ identified that the incidence of DVT in hospitalized patients appear to be equal in males and female.

Concerning the body weight, it was found that forty four percent of the studied patients in G1 and 66% in G2 in the present study were overweight and obese. Haines and Stuart (2003)⁽²⁸⁾ recorded that obese

patients were found to be high risk for DVT development, due to impaired fibrinolytic system in the obese patients that related to impaired hyper-coagulable state. In contrast, Abd Elmonam (2004)⁽³⁾ and Anderson *et al.*, (2003)⁽²⁹⁾ found that obesity was not a statistical significant factor in the development of DVT. Furthermore, the immobility level is considered risk factor, it was observed that most of the studied patients in the current study were immobile. Geerts *et al.*, (2003)⁽⁹⁾ emphasized that immobility is a major risk factor that also affects most of the studied critically ill patients. DVT development was higher in critically ill patients because of bed rest is frequently ordered for monitoring equipment, intravenous lines, drainage tubes, catheters, and other necessary medical equipment.

Regarding the hydration status, it was observed that patients with negative balance were in the moderate and high risk grade of DVT in both groups of the current

study. It was documented that the critical care nurses should check skin turgor and the mucous membrane daily, and those who are found to be in need for more fluid should be reported to the physician for proper hydration. Gamal Eldeen (1999)⁽⁴⁾, indicated that the critical care nurse should advice the patients to receive at least two liters of fluids per day to prevent increase viscosity of the blood if not contraindicated.

As for the connection to the mechanical ventilator, results of the current study revealed that Fifty percent of the studied patients in G1 and 33% in G2 were connected with mechanical ventilator. Gorski *et al.*, (2007)⁽³⁰⁾ reported that occurrence of DVT is common among critically ill patients requiring prolonged mechanical ventilation more than 7 days in the critical care unit, despite the use of prophylaxis measures. Therefore, they documented that the critical care nurses should monitor the air way, breathing pattern, nutritional status, and psychological

status for the patients who were connected to the mechanical ventilator. Moreover, the critical care nurses should change the patient's position, perform range of motion exercises for the lower limbs, and monitor of the hydration status to prevent dehydration

Cook and co workers (2001)⁽¹⁾ pointed out that critically ill patients with high risk of DVT and PE and its potential morbidity and mortality, need accurate diagnosis and effective prevention. Therefore, critical care nurses need to understand approaches used for diagnosis, and to understand national interest in DVT research program. The present study shows that **preventive measures of DVT** done by the critical care nurses for the control group using **non-pharmacological and mechanical methods** were not adequately performed. It was observed that all the studied patients did not wear the elastic stocking. While small proportion of the studied patients performed leg exercises, and changed their

position, did deep breathing exercises and coughing exercises, and transfer on the chair. This inadequacy of DVT preventive measures may be related to the lack of supplies and equipment, lack of in-services training programme about DVT preventive measures, lack of supervision and evaluation. This finding in line with Abd Elmonam (2004)⁽³⁾ who reported that prevention of DVT using of non-pharmacological methods were not adequately used for orthopedic studied patients.

A previous research done by the Martinelli *et al.*, (2004)⁽³¹⁾ strongly recommended the use of mechanical methods of DVT prophylaxis for critically ill patients at increased risk for bleeding. Furthermore, Leizorovice *et al* (2004) ⁽³²¹⁾ documented that mechanical approach can be used in critically ill patients whom pharmacological agents are either contraindication or in whom the likelihood of catastrophic bleeding poses an

unacceptable risk. Mechanical approach may act in a synergistic manner and as a result provides additional protective benefit when combined with mainstay pharmacological prophylaxis. This benefit, however, has yet to be demonstrated empirically in intensive care patients. On the other hands, Geerts *et al.*, (2006)⁽⁹⁾ indicated that the prevention of DVT includes anticoagulant medications and mechanical methods such as compression stocking and intermittent pneumatic compression. Moreover, they recommended that the ideal prophylactic agents should be effective, easy to administer and monitor, cost effective, perfectly matched to the patients, and free of adverse reactions and complications.

The critical care nurses should use the mechanical measures for DVT prevention that include leg exercises, elastic stoking, and deep breathing and coughing exercises and sitting on the chair, each improve venous return and reduce venous stasis in

the leg veins. Morris and Woodcock (2005)⁽³³⁾ pointed out that these measures are simple to use and did not increase the risk of bleeding, making them ideal for most hospitalized patients. Moreover, they reported that foot and ankle exercises, planter and dorsiflexion are important to help improve venous return. While Geerts *et al.*, (2004)⁽³⁴⁾ stated that the use of this exercises is safe for all patients except those with bone injures. Early ambulation is another useful technique, it was recommended for decreasing venous thromboembolism. In addition Khan and Ginsberg (2004)⁽³⁵⁾ reported that the **role of elastic stocking** was based on the presence of symptoms. On the other hand, Kucher and Coldhaber (2005)⁽³⁶⁾ reported that anti-embolic stocking is widely advocated in the prevention of DVT, but it may do more harm, it may cause heal pressure ulceration if not used correctly. Dean *et al.*, (1999)⁽³⁷⁾ recommended that the critical care nurses should ensure that

small designed and well fitting stocking is applied and fitted according to calf size and leg length. If stocking is misused it leads to an inverse gradient and decrease venous emptying.

DVT manifestations:

The signs and symptoms of DVT may include **pain, swelling, erythema, and warmth** in the affected extremities. Many clinicians still check homen's sign, the presence of calf pain with dorsiflexion of the foot. However, this is no longer considered available indicator of DVT. About half of the patients will have no symptoms, and the first indication may be signs or symptoms associated with PE or even sudden death. That is why preventive intervention and treatment in patients at risk are so imperative⁽³⁸⁾. Findings of the current study revealed that most of the studied patients experienced low percent of DVT manifestations with no statistical significant difference between the both groups related to rare signs & symptoms. Moreover,

Qaseem *et al.*, (2007)⁽³⁹⁾ found that pain & swelling resolve more quickly and there is no risk for PE. On the other hand, Kahn (1998)⁽⁴⁰⁾ emphasized that combination of data about risk factor with signs & symptoms have better predictive accuracy for the diagnosis of DVT.

DVT risk grades:

Anderson *et al.*, (2003)⁽²⁹⁾ have categorized risk of thrombosis into **low, moderate, and high risk** categories. It was documented that the preventive measures taken by medical and critical care nurse staff will depend on the level of risk for DVT and potential bleeding complications in critically ill patients. The present study revealed that nearly half of the studied patients were in moderate & high risk grade for DVT in the both groups. This finding could be related to the relative increased age, immobility, alteration of the hydration status, and increase severity of illness of studied patients. A simplified approach to estimate an individual patient's risk, based

on the presence of predisposing risk factors, might provide a suitable way to ascertain a patient's risk. Such a system would allocate patients with a reasonable measure of certainty to low, moderate, or high risk groups so that prophylaxis could be tailored to the element of risk that the critically ill patient is facing⁽¹⁵⁾.

DVT is generally a disorder of critically ill patients, with PE being one of the top preventable killers in these patients. A variety of measures are available to reduce the risk of DVT, these measures include careful risk assessment of the patients and the use of thrombo-prophylactic measures in patients at risk of an event. The introduction of a validated simple bed side tool to estimate the risk of DVT in patients could refine the decision-making process. In view of the thromboembolism event, there is a need for extended prophylaxis in the critical care unit setting to further reduce the incidence of DVT⁽³⁶⁾.

The critical care nurses play an

important role in DVT prevention. She must cooperate with other health professionals to develop system and quality improvement processes which are effective in terms of providing quality, and cost effective management for DVT prevention to critically ill patients. She must use keen judgment to detect patients at risk for DVT and to select appropriate interventions to defend against the onset of this problem.

CONCLUSION

Based on the findings of the current study, it can be concluded that:

Findings of the current study revealed low incidence of DVT in the global sample, It was observed that the incidence of DVT in the control group was found to be two patients, while none of the interventional group experienced DVT.

Furthermore, it can be concluded that DVT preventive measures done by the nurses for the control group were not adequate. No body was found in the control group **wear the elastic stocking**, and the mean percent of the studied patients that

changed their position in G1 was found to be 57.03 ± 17.4 . While the mean percent of the studied patients that performed **deep breathing and cough exercises** in G1 was 2.22 ± 10.27 . In addition, the mean percent of the patients that performed **range of motion for the lower limbs** was found to be 10.00 ± 30.51 , and the mean percent of the studied patients that were **Transferred the patient on the chair** were found to be 3 ± 10.0 .

Concerning the DVT manifestations, it was observed that 43% of the studied patients in the control group experienced DVT manifestations, while in the interventional group was found to be 28%. Furthermore, it was found that most of the studied patients were in the moderate and high risk for DVT (14<21), they constituted about 47% of the studied patients in G1, and 53% in G2, with no statistical significant difference between of them.

RECOMMENDATIONS

From the findings of the present study the following recommendations are suggested:

- Procession of training programmes for critical care nurses.
- Training program should be established to update critical care nurses' knowledge and skills about DVT preventive measures.
- The CC nurses should be provided with posters of DVT nursing guidelines and handout of the procedures of DVT preventive measures.
- Providing the CC nurses with the DVT preventive devices like elastic stocking, talcum powder, and measuring tape to perform the preventive measures.
- Focused attention to documentation should be done for all procedures for DVT prevention, because of documentation serves to promote the continuity of care given by nurses and other health-care providers.
- Further research is recommended on regular scale in multi certain Egyptian

hospitals. Repeat this research on a large sample size and in multi centers for generalization.

REFERENCES

1. Cook D, Mullin M, Hodder R, Stewart T. Prevention and Diagnosis of DVT in Critically Ill Patients: a Canadian survey. *Crit Care*. 2001; 5 (6): 336-42.
2. Attia J, Ray J, Cook D, Dockett J, Giensberg S, Geert W. Prophylaxis of venous thromboembolism in the critically ill. *Arch Intern Med*. 2001; 161:1268- 79.
3. Abd Elmanam F. Construction of Assessment Scale for patients at high risk for DVT among Orthopedic Patients. Master thesis, Faculty of Nursing, Alexandria University. 2004.
4. Gamal Eldeen G. Implementation of new Regimen as prophylaxis against Deep Venous Thrombosis in post operative Patients. Master thesis, Faculty of Nursing, Assuit University, 1999.
5. Joynt G, Kew J, Gomersall C, Leung V, Liu E. Deep venous thrombosis caused by femoral venous catheter in critically ill adult patients. *Chest*. 2000; 117:178 – 83.
6. Mohammed A. Incidence of deep venous thrombosis among surgical patients. Master Thesis, Assuit University Hospital, Faculty of Medicine, 1996.
7. Cook D, Crowther M, Meade M. Deep venous thrombosis in medical-surgical critically ill patients: Prevalence, incidence, and risk factors. *Critical Care*. 2005; 33: 1565-71.
8. Major K, Wilson M, Nishi G. The incidence of thromboembolism in the surgical intensive care unit. *American Surgical*. 2003; 69: 857-61.
9. Geerts W, Cook D, Selby R, Etchells E. Venous thromboembolism and its prevention in Critical Care. *J Crit Care*. 2006; 17: 95-104.
10. Williams M, Aravindan N, Wallace M, Reidal B, Shaw A. Venous thromboembolism in the intensive care unit. *Critical Care Clinic*. 2004; 19: 185-207.
11. Lacherade J, Cook D, Heland D, Church C, Brochard L. Prevention of venous thromboembolism in critically ill patients: a Franco-Canadian cross-sectional study. *J Critical Care*. 2003; 18: 228- 37.
12. Limpus A, Chaboyer W. The use of graduated compression stocking in Australian intensive care units: a national audit. *Australian Crit Care*. 2003; 16:53-8.
13. Albers G, Amarincio P, Easton J, Sacco R, Teal p. Antithrombotic and thrombolytic therapy for ischemic stroke: the Seventh ACCP Conference on Antithrombotic and thrombolytic Therapy. *Chest*. 2004; 126: Suppl: 4835-5125
14. Thompson J, McFarland G, H Jane, Tucher. *Clinical Nursing*. 4thed. Mosby; 1997: 90 - 4– 60.
15. Koziel B, Glenora E, Blais K. *Fundamentals of Nursing*: London: Addison Wesley Longman; 1998: 561 – 665.
16. Autar R. Nursing assessment of Clients at risk of DVT: the Autar scale. *Journal of Advanced Nursing*. 1996 (23): 763-70.
17. Potter P, Perry A. *Fundamental of Nursing*. Philadelphia: Mosby, Inc; 2005: 1452 –1478.
18. Dean R, Brewster D. *Current Diagnosis and Treatment in Vascular Surgery*. Mexico: Appleton & Lange Asimon & Shuster Company; 1998: 375 – 385.

19. Joffe H, Kucher N, Tapson V, Goldhaber S, DVT Steering Committee. *Circulation*. 2004; 110:1605 – 1611.
20. Rhoades R, Planger R. *Human Physiology* 3rd ed. Atlanta: Saunders College publishing; 1999: 535 – 540.
21. Amaragiri S, Lees T. Elastic compression stocking for prevention of DVT. *Cochrane Database System Rev*. 2003; 3: 1484.
22. Fahey V. *Vascular Nursing*. 2nded. Chicago: W.B Sanders Company; 1994: 405–425.
23. Eccles M, Mason J. How to develop cost-conscious guidelines. *Health Technology Assessment*. 2001; 5(16).
24. Wendy M, Kehl G, pruet A. DVT in Hospitalized Patients: A Review of Evidence- based Guidelines for Prevention. *Dimensions of Critical Care Nursing*. 2006; 25(2): 53-95.
25. Ebell M. Evaluation of the patient with Suspected DVT *Journal of Family Practice*. 2001; Feb: 1-10.
26. Snow V, Qaseem A, Barry P, Hornbake R. Venous Thromboembolism: A Clinical Practice Guideline from the American College of physicians and the American Academy of Family Physicians. *Annals of Family Medicine*. 2007; 5:74-80.
27. Criner G, Gilbert E, Alongo D. *Critical Care Study Guide*. Philadelphia: Springer; 2002: 514 – 515.
28. Haines A, Stuart T. venous thromboembolism: pathophysiology and clinical presentation. *American Journal of Health–System Pharmacology*. 2003; 60 (22): 53
29. Anderson F, Spencer F, spencer F. Risk Factors for venous thromboembolism. *Circulation*. 2003; 107: 1-16.
30. Gorski F, Lisa A, Carinne F. Venous Thromboembolism: A Common and preventable condition: Implication for the Home Care Nurse. Lippincott: Williams, Inc; February 2007; 25(2): 94-100.
31. Martinelli I, Ballagliolit M, Bucciarellip D, passamonti S, Mannucci M. Risk factors and recurrence rate of primary DVT of the lower extremities. *Circulation*. 2004; 110: 566 – 570.
32. Leizorovicz A, Cohn A, Torbie A, Olsson C, Goldhaber S. The prevention of venous thromboembolism in a critical ill medical patients. *Circulation*. 2004; 110: 874-9.
33. Morris R, Woodcock J. Evidence-based compression: prevention of stasis and DVT. *Ann Surg*. 2005; 239:162-71.
34. Geerts W, Heit J, Clagett G. Prevention of venous thromboembolism. *Chest* 2004; 119: 1325 –755.
35. Kahn S, Ginsberg J. Relationship between deep venous thrombosis and the post thrombotic Syndrome, *Arch Intern Med*. 2004; 164: 17 – 26.
36. Kucher K, coldhaber S. management of massive pulmonary Embolism. *Circulation* 2005; 112 (2): 28 – 32.
37. Dean R, James S, Brewster D, Current Diagnosis & Treatment in vascular Surgery. Mexico: A Simon & Schuster Company; 1999: 375 –388.
38. Rick B, Daniels R. *Nursing Fundamentals Caring & Clinical Decision Making*. Chicago: Thomson; 2004: 312-316.
39. Qaseem A, Snow V, Barry P, Current diagnosis of Venous Thromboembolism in Primary care: a clinical practices guidelines from American Society of Family Physicians and American College of physicians. *Anne family Med*. 2007; 5(1): 57-62.
40. Kahn S. The clinical diagnosis of DVT. *Archives of International Medicine*. 1999; 158 (23): 2315-22.