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Effect of Nursing Care Guidelines on Preventing Deep Venous Thrombosis among Patients Undergoing Arthroplastic Surgery

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Abstract: **Deep venous thrombosis (DVT) is a common and potentially lethal disease which leads to severe complications with poor quality of life and even sudden death related to pulmonary embolism. Hence, DVT is a serious condition that needs to be considered during nursing care for hospitalized patients to avoid related morbidities and mortalities. Aim of this study was to evaluate the effectiveness of nursing care guidelines on preventing deep venous thrombosis among patients undergoing arthroplastic surgery. Design: A quasi-experimental research design was used to achieve the aim of this study. Setting: The current study was conducted at the Orthopedic Department in Elhosin and Bab El-shaeria University Hospitals, affiliated to El-azhar University. Subjects: A sample of convenience of adult patients (156) admitted to the Orthopedic Unit at the previously mentioned hospitals and all available nurses (40) were recruited for the study. Tools: Data were collected through: I. A structured designed interviewing questionnaire, which included demographic characteristics of nurses and patients, and Nurses' knowledge about DVT II. Autar DVT Risk Assessment Scale III. Assessment of nurses' practices regarding application of DVT preventive guidelines. Results: The most important findings of the study revealed that, there were statistically significant differences between pre/post nurses' knowledge and practices about DVT. As well, two thirds of Arthroplastic surgery patients under study have high risk for DVT. Conclusion: Nursing care guidelines improved nurses' performance regarding prevention of DVT among patients undergoing arthroplastic surgery. Recommendations: This study recommended continuous education on DVT prevention for nurses caring for orthopedic patients through organizing regular in-service training programs. Further study should be conducted on a larger sample and at different settings regarding prevention of DVT occurrence among hospitalized patients.**

Keywords: **Arthroplastic surgery, Deep venous thrombosis, Nursing care guidelines.**

1. INTRODUCTION

Deep vein thrombosis (DVT) is the formation of a blood clot in a deep vein, most commonly in the legs. Manifestations may include pain, swelling, redness, or warmth of the affected area. About half of the cases have no symptoms. Complications may include pulmonary embolism, as a result of detachment of a clot which travels to the lungs, and post-thrombotic syndrome**(Deep Vein Thrombosis, 2017)**Hip surgery (HS) including total hip arthroplasty (THA) and hip fracture surgery (HFS) are the major orthopedic surgical procedures which can cause high morbidity and even mortality. Venous thromboembolism (VTE), an obstruction of a vein by a blood clot, is the third most common cardiovascular disease in the Western world, occurring in about 0.1% of people every year **(William, 2016)**.

The DVT is a silent killer, which kills more people than AIDS, breast cancer, prostate cancer and road accidents combined **(Vivek, 2015)**. Every year, over 4 million patients worldwide are affected by DVT. According to Centers for Disease Control (CDC), the precise number of people affected by DVT/PE is 300,000 to 6 00,000(1-10 per 1000)**(Thrombosis, 2016)**.

Hip and knee arthroplastic rank high among the most successful surgeries performed in the orthopedic field, and approximately one million arthroplastic surgeries are performed yearly in the United States. Although, orthopedic surgeons are encouraged to consider the development of DVT, there are no nationwide reports on the incidence of symptomatic DVT after major orthopedic surgery **(Warwick, 2012)**

Orthopedic nurses play an essential role in the detection, treatment and prevention of DVT among patients undergoing HS. An awareness of all aspects of DVT is vital in providing ideal nursing care for patients undergoing hip surgery in order to improve patients' outcome, reduce the incidence and potentially life threatening complications of DVT **(Anthony, 2013)**.

Amongst hospitalized patients, critical care admission is the strongest risk factor for VTE. This is a function of both the patient's underlying disease process and acquired risk factors during an intensive care unit (ICU) stay, including prolonged immobility, use of neuromuscular blockage and vasopressors, central venous catheter insertion and sepsis**(Hunt, 2014)**. The VTE in this population can be expensive to diagnose and challenging to manage with a huge impact on morbidity and mortality. Up to 14% of post mortems in ICU patients demonstrate massive or submassive pulmonary embolism **(Berlotet al., 2011).** High risk group includes medical and surgical conditions especially immobile patients and clients after cardiac, orthopaedic, neuro and gastro surgery **(Aneena et al., 2015).**

Critical care nurses are the crucial 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 appropriate 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 **(Geerts et al., 2008)**

The current guidelines related to UK National Institute for Clinical Excellence (NICE) recommend VTE risk assessment for all patients on admission to the critical care unit, and offering pharmacological prophylaxis after taking into account the risk of bleeding, current anti-coagulation and comorbidities. If the risk of bleeding outweighs the thrombosis risk, mechanical VTE prophylaxis should be considered. Regular VTE re-assessment is required and more frequently if the clinical condition is changing rapidly (**NICE, 2010)**.

Significance of the study:

Searching in the related literatures, it was found that, the risk of DVT is increased in patients with restricted mobility, a previous history of DVT, or comorbidities such as malignant diseases or clotting disorders. Venous thromboembolism is a leading cause of morbidity and mortality during the acute recovery period. Pulmonary embolism is the leading cause of mortalities in lower limb DVT; it leads to yearly 50-200 thousand deaths in the United States (US). An assessment in US demonstrated that morbidity, and mortality rates could be decreased through systematic and consistent patient education by nurses **(Lavall & Costello, 2015).**

In Egypt, more than one-third of all patients hospitalized for surgery or acute medical conditions are at high risk for developing VTE. However, only a small fraction of these patients receive appropriate VTE prophylaxis. Corrective measures are necessary for preventing VTE morbidity and mortality in these high risk patients **(Goubran et al., 2012).**The DVT is a wide spread complication and important cause of hospital-related deaths worldwide. The ENDORSE study in Egypt is part of a global initiative to uncover the incidence of high-risk surgical and medical patients and determine what proportion of these patients receive appropriate VTE prophylaxis **(Tooher etal., 2010)**.

Nurses can positively affect outcomes in mechanical or physical DVT prophylaxis simply by educating patients regarding the importance of physical therapy and early movement through early ambulation, leg elevation, leg flexing, active and passive range of motion exercises. They are also being on the frontline of thrombosis prevention, by playing a crucial role in diagnosis and risk assessment, applying timely preventive methods and providing vital educational and psychological support for patients with venous thromboembolism, so skilled nursing intervention can be life saving (**Tooher etal., 2010)**.

Lee's team found that a lack of knowledge and performance was the main barrier to performing VTE risk assessment. Given its importance, it is troubling that some nurses continue to have undesirable levels of knowledge with regard to VTE prophylaxis **(Lee et al., 2014)**.Therefore, it was essential to shed light on this hot issue regarding knowledge and performance in caring for patients undergoing arthroplastic surgery at risk for DVT.

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Aim of the study

The present study aimed to evaluate the effectiveness of nursing care guidelines on prevention of deep venous thrombosis among patients undergoing arthroplastic surgery through:

1. Assessing the nurses' performance regarding prevention of DVT among patients undergoing arthroplastic surgery.

2. Designing and implementing nursing care guidelines for preventing of DVT among patients undergoing arthroplastic surgery.

3. Evaluating nurses' performance regarding prevention of DVT among patients undergoing arthroplastic surgery after implementation of nursing guidelines

Research hypothesis

Implementation of the nursing care guidelines will improve nurses' knowledge and performance scores regarding prevention of deep vein thrombosis among patients undergoing arthroplastic surgery.

2. SUBJECTS AND METHODS

Design: A quasi-experimental research (pre-posttest) design was used to achieve the desired aim of the study.

Setting: This study was conducted at the Orthopedic Department in Elhosin University Hospital and Bab El-shaeria University Hospital affiliated to El-Azhar University. The Orthopedic Department at Elhosin Hospital contains six in-patient rooms, each room contains 6 beds while the Orthopedic Department at Bab El-shaeria Hospital contains 14 in-patient rooms, department C and D each room contains 6 beds except 2 rooms contain 3 beds.

The number of nurses in Elhosin Hospital is 15 nurses, while in Bab El-shaeria Hospital they are 25 nurses.

Subjects: Two groups of subjects were included in the study:

(1) A sample of convenience including all available nurses (n=40), who have been working at the Orthopedic Unit in Elhosin University Hospital and Bab El-shaeria University Hospital.

(2) A purposive sample of adult patients admitted to the Orthopedic Unit for arthroplastic surgery at the previously mentioned settings (n= 156) during 3 months from the beginning of August 2018 until the end of October 2018.

The sample size was calculated by using the following formula:

$n = [2(Z_{\alpha/2} + Z_{\beta})^2 \times p\ (1-p)]/(p1 - p2)^2$]Therefore, $n = [2(1.96 + 0.84)^2 \times 0.9\ (1-0.9)]/(0.136 - 0.045)^2$ Hence, total sample size required from both hospitals =155.1 i.e.156.

Inclusion criteria:

1. Patients agreed to participate in the study.

2. Both, males and females

3. Age between 20 to 55years for patients' group.

4. Patient undergoing arthroplastic surgery.

Exclusion criteria:

1. Have no DVT on admission to orthopedic units.

2. Unconscious and patients with co-morbid condition.

Tools of data collection:

Tool I: **A structured designed interviewing questionnaire**

It was developed by the researchers, based on reviewing of the related literature. (**Antony et al., 2016**). It was written in simple Arabic language and it included the following:

A. Demographic characteristics for nurses as: age, years of experience in critical care unit, educational level and attending in-service training course about DVT preventive measures.

B. Demographic characteristics for patients undergoing arthroplastic surgery as: age, gender, marital status, level of education, length of stay, smoking and medical family history of the patients.

C. Nurses' knowledge about DVT : Developed by researchers, based on literature review**,** it involved 5 open-ended questions that, assess nurses' knowledge about deep veins thrombosis as; (definition, causes, risk factors for DVT and precautions to prevent DVT for patients undergoing arthroplastic surgery.

The scoring system was as the following (2) was given for a correct answer, while (1) was given for an incomplete answer and zero for an incorrect one.

The total knowledge score was 10 and it was evaluated as follows:

- Poor knowledge (< 60%) (with scores ranged from (1-6).
- Fair knowledge (60-75%) (with scores ranged from (6.5 – 7.5).
- Good knowledge (>75%) (with scores ranged from (8 - 10).

Tool II: A- Autar DVT Risk Assessment Scale:

This scale was used to evaluate hospitalized patients at risk for DVT occurrence, who have undergone surgery and adapted from **Wells et al.,(1997)**Based on the literature review, it was modified by the researchers. The Autar DVT Scale is a quantifiable and standardized assessment tool, which can increase the awareness of DVT prevention among orthopaedic surgery patients and health practitioners. It included seven items such as; age specific group, "Build Body Mass index" (BMI), mobility, oral contraceptive, trauma risk category, surgical intervention and high risk diseases.

For scoring system of total risk factors is as follows:

-No risk≤ 6

-Low risk7 – 10

-Moderate risk11-14

-High risk ≥ 15

B- Deep vein thrombosis occurrence evaluation sheet:

DVT Manifestation:

Adopted from **Mohamed et al., (2017).**This part was used to assess DVT manifestations. It contains six items (calf pain, calf tenderness, calf swelling, skin temperature, blue discoloration of the legs and palpable thrombosed superficial veins). The nurses were assessed through the researchers' observation based on presence or absence and degree of manifestation; the scores are categorized as follows:

Completely present 3 degrees moderately present 2 degrees, mildly present 1 degree and absent 0 degree.

Tool III: Assessment of nurses' practices regarding application of DVT preventive guidelines: This part was used to assess level of nurses' practices in their work in Orthopedic Unit to prevent DVT, applied by researchers; it consisted of two parts as follows:

Part 1: Applying elastic stocking checklist: Adopted from **Certified Nursing Assistants CNA, 2017)**, which consisted of 14 steps that included preparing equipment, (nurse and patients), applying stocking, checking for sign of decreased circulation and rules for elastic stocking removal.

Part 2: Range of motion exercise for lower limbs: Adopted from **Norkin and White (2011)**, it consisted of 8 questions which included preparing equipment and patient, hip, knee, ankle and foot exercises.

For scoring system of nursing practices one score was given for a done satisfied step, and zero score for not done/unsatisfied step.

The total score for all observation checklists was 22. The scoring levels were categorized as follows:

- Incompetent level of nursing practice (<80%) (with scores ranged from 10-17).

- Competent level of nursing practice (≥80%) (with scores ranged from 18-22).

Content validity

Tools were evaluated by 5 experts, 3 in medical-surgical nursing and two orthopedic physicians to test the content validity. The tools were modified according to the experts' comments.

Tools reliability:

The analysis for the internal consistency (reliability) of the tool had yielded a Cronbach's alpha value of 0.893; this indicated the good reliability of tool III).

Ethical Considerations:

Official approvals were obtained from the Directors of Elhosin and Bab El-shaeria University Hospitals to apply this study following an explanation of its aim. An informed oral consent was gained from the each nurse and patient participate in the study and agreed to they were informed about their optional involvement in the study and that they have the right to withdraw from the study at any time without giving any reasons. Participants were also assured that their data will be treated confidentially and used only for the purpose of the study and their benefits.

Pilot Study:

A pilot study was carried out on 10% (4 nurses & 6 patients) of the study subjects in order to assess the suitability and implication of the study tools and to test applicability and feasibility of the questionnaires as well as to estimate the time needed to answer them; and accordingly modifications were done and those subjects were excluded from the main study sample.

Field Work:

Written official approvals were obtained from the Directors of Elhosin and Bab El-shaeria University Hospitals, as well as the Heads of Orthopedic units to carry out the study after clarification of its purpose.

- The actual fieldwork was carried out from the beginning of august 2018 until the end of October 2018, in the previously mentioned settings.

- The researchers were available in the study settings 3days/week at morning shifts from 9.00 a.m. to 2.00 p.m.

- Content of the guidelines was prepared using the related literature and according to patients` and nurses' needs and level of understanding.

- The researchers introduced themselves to the participants and explained the purpose of the study and its expected outcomes. An oral informed consent was obtained from each participant in the study (both patients& nurses).

Data were collected through the following phases:

Assessment phase:

The aim of this phase was to assess nursing data regarding prevention of DVT and determine the patients who were at risk for DVT occurrence through Autar risk assessment scale and assessment signs and symptoms of DVT on the patient undergoing arthroplastic surgery. In this phase, the researchers collected the following data:

- Demographic data of the nurses included; nurses' knowledge about DVT, nursing practices regarding applying elastic stocking and range of motion exercise. Data were collected before and after implementation of the guidelines to assess any improvement in the nurses' knowledge and practices.

- Demographic data of the patients included; family history and Autar DVT risk assessment scale, which consisted of seven items such as; age specific group, "Build Body mass index" (BMI), mobility, oral contraceptive, trauma risk category, surgical intervention and high risk diseases.

Planning phase: The nursing care guidelines were designed by the researchers, based on the results obtained from the assessment phase and in the light of relevant literature. It was designed to improve nurses' knowledge and practices regarding DVT and to prevent DVT among patients undergoing arthoroplastic surgery. The nursing care guidelines consisted of details about definition, causes, signs and symptoms, patients at risk for DVT and finally what precautions to inhibit DVT for arthroplastic surgery patients.

Implementation phase:

This phase included application of the nursing care guidelines that were implemented over 3 months, followed by the immediately post-test. The total number of nurses was 40 nurses, divided into 8 groups at Elhosin and Bab El-shaeria University Hospitals. The study group attended 5 sessions; 2 sessions for theory and 3 sessions for practice. The duration of each session ranged between 30-45 minutes, which was implemented for a group of 5 to 6 nurses according to work conditions. At the beginning of each session, the researchers started by giving a summary about the previous session, and explaining the objective of the new one.

The sessions contained the following:

Sessions for nurses

Session 1: This session was concerned with the open discussion for identification of the group, clarification of the aim and time table allowed for the nursing care guidelines, the researchers applied brain storming about DVT and its prevention after that provided general introduction about DVT.

Session 2: This session dealt with the meaning of DVT, causes, patients at risk for DVT, signs and symptoms, precautions that should be taken to prevent DVT.

Session 3: The researchers revised what was mentioned in the previous session, and then focused on how to use Autar DVT risk assessment scale to detect high risk patients. The researchers applied this scale on the patients.

Session 4: This session was concerned with nurses' practices regarding applying elastic stocking.

Session 5: This session was concerned with nursing practices regarding range of motion exercise for lower limbs.

- Different teaching strategies were used, these included instructions, lectures, brainstorming, group discussions, clinical teaching and demonstration. The teaching aids used were; handouts and colored posters. The practical part was conducted through demonstration, re-demonstration, video and pictures.

- At the end of each session a summary and conclusion were done and a time was allowed for participants to ask questions and have feedback was given by the researchers.

Session for patients:

Each patient was interviewed separately by the researchers and the importance of the study was explained to each of them. The signs and symptoms of DVT were observed after implementation of nursing guidelines by using an evaluation sheet of DVT occurrence.

Evaluation phase: The effectiveness of the implemented nursing care guidelines was assessed immediately through post-test using the same pre-constructed tools which included nurse's knowledge about DVT, nursing practices regarding applying elastic stocking and range of motion exercise and assessment of signs and symptoms S&S of DVT on patients.

Statistical analysis:

All statistical analyses were performed using the statistical package for social science (SPSS) for windows version 20.0 (SPSS, Chicago, IL). Data were tested for normality of distribution prior to any calculations. Continuous data were expressed in Mean ± Standard Deviation (SD), while categorical data were expressed in number and percentage. Chi-square test was used for comparison of variables with categorical data. Pearson correlation test was used to assess associations of the study variables. Statistical significance was set at $p<0.05$.

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3. RESULT

Table (1)shows that, 40% of the nurses' age ranged between 25 -< 35years, with a mean age of 31.2 ±7.9, while 50% had more than 10 years of experience, and 60% have diploma degree, as well as 80% did not attend in-service training course about DVT preventive measures.

Table (2) Reveals that statistically significant differences were detected between nurses' knowledge about DVT at pre/post implementation of nursing care guidelines**,** at p <0.001for all the parameters, except for the item about an injury that damages veins related to the patients at risk for DVT at p< 0.032.

Figure (1) illustrates that, 92.5%of the nurses had poor knowledge level about DVT, while 2.5% had fair knowledge level and 5% had good knowledge level pre nursing care guidelines, which improved to reach 5% had poor knowledge level, 45% had fair level and 50%had good knowledge level after implementation of the nursing care guidelines.

Table (3) indicates that, there were statistically significant differences between nurses' practices regarding applying elastic stocking at pre and post nursing care guidelines with p <0.001at all the parameters of applying elastic stocking except for items "and assist the patient in lying down position" great and explain the procedure to the patient"and assist the patient in lying down position" with p < 0.006 and p <0.002respectively.

Table (4)shows that, there were statistically significant differences of the patients pre and post application of nursing care guidelines regarding ROM exercise for lower limbs with p <0.001, while more improvement was indicated post nursing care guidelines compared to pre except for item |wear patient a loose gown and cover with bath blanket" with p = 0.074.

Figure (2)represents that, 100% of the nurses had unsatisfactory total level of practices about DVT, while 25% had unsatisfactory level of practices post-nursing care guidelines, which improved to reach 75% had satisfactory practices level after nursing care guideline with p <0.001.

Figure (3) demonstrates that direct correlation was found between the nurses' total knowledge score and their total practices' score post nursing care guidelines, where r=0.477, at p=0.002.

Table (5) shows that, 59.6% of the studied patients aged 50 – 60 years with a mean±SD of 52.6 ± 5.6. Regarding gender, 66.0% were female. All the studied patients were married. Concerning level of education, 70.5% of them were educated and 76.9% were smoker. As well, this table indicates that an equal percentage of 60.3%of the studied patients had hypertension and family history of DVT.

Table (6) indicates that, 59.6% of patients' age under study ranged from 51 – 60 years, 48.7%were overweight, 50.0% with limited mobility, 50.0% were taking oral contraceptive for 20-35 years, 50% had pelvic injury, and 64.1% of patients under study had high risk for DVT.

Table (7) reveals that, almost three fifths(60.3%)of the patients under study are taking heparin as thrombo-prophylaxis measure to prevent DVT, while no one of them (0.0%)are using pneumatic compression

Table (8) shows that, the highest DVT manifestation after application of nursing guidelines was palpable thrombosed superficial veins (32.1%) and the lowest DVT manifestation was blue discoloration of the leg (6.8%).

Table 1: Demographic Characteristics of the Nurses(n=40)

	No	%
Age (years)		
18-< 25	12	30.0
25-< 35	16	40.0
35-< 45	12	30.0
Mean ±SD	31.2 ±7.9	
Experience in critical care unit		

< 5	12	30.0
5 - 10	8	20.0
> 10	20	50.0
Educational level		
Diploma degree	24	60.0
Technical nursing degree	10	25.0
Bachelor degree	6	15.0
Attending in-service training courses about DVT preventive measures		
No	32	80.0
Yes	8	20.0

Table 2: Nurses' Knowledge Regarding DVT Pre / Post Nursing Care Guidelines (n=40)

Items	Pre (n=40)		Post (n=40)			
	No	%	No	%	X^2	p
1. Define DVT	10	25.0	37	92.5	37.602	<0.001
2. Causes of DVT						
Age >40	6	15.0	33	82.5	36.473	<0.001
Sitting for long period	4	10.0	39	97.5	61.596	<0.001
Blood disorders	15	37.5	30	75.0	11.429	<0.001
Pregnancy	3	7.5	31	77.5	40.102	<0.001
Obesity	8	20.0	29	72.5	22.175	<0.001
3. Patient at risk for DVT						
An injury that damages veins	5	12.5	13	32.5	4.588	<0.032
Being over weight	8	20.0	40	100.0	53.333	<0.001
Family history of DVT	4	10.0	33	82.5	42.288	<0.001
Having a catheter placed in a vein	2	5.0	15	37.5	12.624	<0.001
4. Precautions to prevent DVT						
Medication	5	12.5	40	100.0	62.222	<0.001
Compression stockings	15	37.5	40	100.0	36.364	<0.001
Keeping blood pressure under control	4	10.0	37	92.5	54.484	<0.001
Quit smoking	0	0.0	35	87.5	62.222	<0.001
Weight reduction	4	10.0	27	67.5	27.86	<0.001
Exercise	8	20.0	36	90.0	39.596	<0.001

Statistical significant at $p < 0.05$

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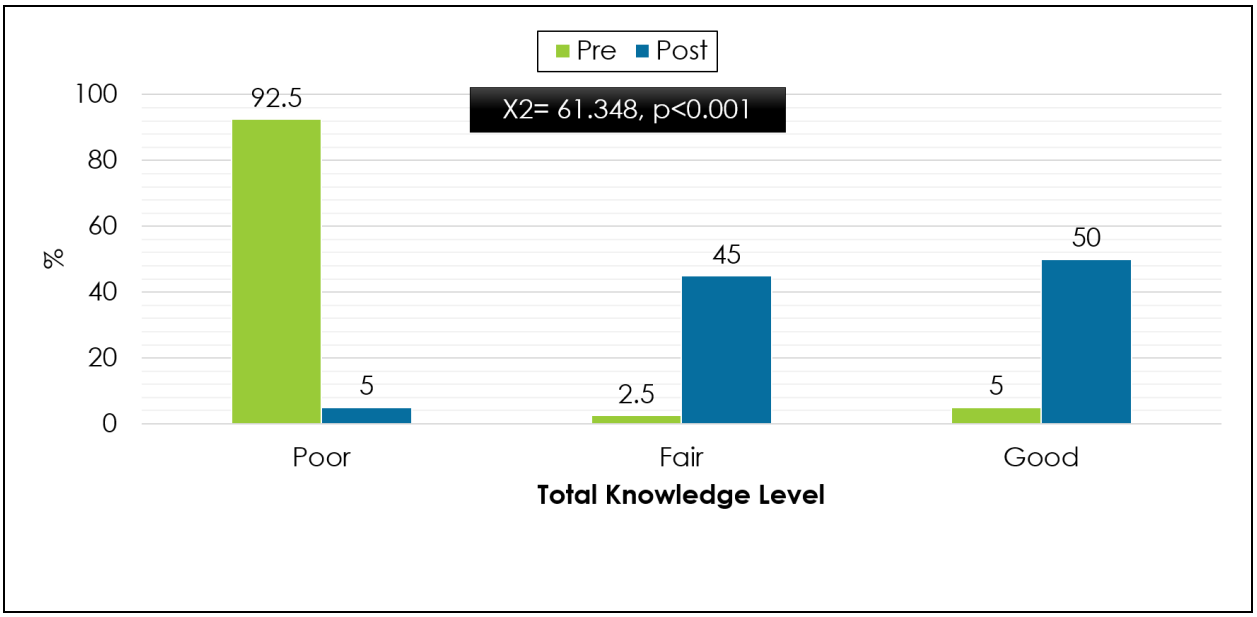

Figure 1: Total Nurses' Knowledge about DVT Pre/post Nursing Care Guidelines

Table 3: Nurses' Practices Pre/Post Nursing Care Guidelines Regarding Applying Elastic Stocking n=(40)

Applying elastic stocking steps	Correctly Done					
	Pre		Post			
Steps	No	%	No	%	X^2	p
1. Preparing supplies.	20	50.0	34	85.0	11.168	<0.001
2. Washing hands.	15	37.5	37	92.5	26.593	<0.001
3. Greet and explain the procedure to the patient.	19	47.5	31	77.5	7.680	<0.006
4. Check the suitable stockings size for patient.	22	55.0	35	87.5	10.313	<0.001
5. Assist the patient in lying down position.	27	67.5	38	95.0	9.928	<0.002
6. Make sure the patient's feet are dry, if not apply talcum powder.	10	25.0	25	62.5	11.429	<0.001
7. Gather the stocking fabric into hand, and place it onto the patient's foot.	5	12.5	29	72.5	29.463	<0.001
8. Roll the stocking upwards until the upper edge of the stocking reaches above the patient's knee.	23	57.5	40	100.0	21.587	<0.001
9. Examine the stocking to ensure there are no wrinkles in the fabric. Check the fitness at the toes and heel.	16	40.0	33	82.5	15.221	<0.001
10. Check the patient's toes for signs of decreased circulation such as; coldness, or discomfort, numbness and tingling	7	17.5	36	90.0	42.288	<0.001
11.Remove stockings every eight hours	12	30.0	39	97.5	39.432	<0.001
12. Return the patient to comfortable position.	11	27.5	31	77.5	20.050	<0.001
13. Remove gloves and dispose them safely.	20	50.0	35	87.5	13.091	<0.001
14.Repeat the hand washing procedure	18	45.0	40	100.0	30.345	<0.001

Statistically significant at p< 0.05

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Table 4: Nurses' Practices Pre/Post Nursing Care Guidelines Regarding ROM Exercise for Lower Limbs (n=40)

Steps	Correctly Done					
	Pre		Post			
	No	%	No	%	X^2	p
1. The following equipment is needed for this skill						
-Bath blanket	2	5.0	27	67.5	33.807	<0.001
-Pillows	29	72.5	39	97.5	9.804	<0.002
2. wear patient a loose gown and cover with bath blanket	16	40.0	24	60.0	3.200	0.074
3. Position bed at appropriate height and use proper body mechanics	4	10.0	29	72.5	32.237	<0.001
4. Hip exercises	15	37.5	32	80.0	14.907	<0.001
5. Knee exercises	21	52.5	39	97.5	21.600	<0.001
6. Ankle exercises	20	50.0	38	95.0	20.313	<0.001
7. Foot exercises	10	25.0	35	87.5	31.746	<0.001
8-Document mobility of joints and patient's tolerance of procedure	5	12.5	37	92.5	51.328	<0.001

Statistically significant at p< 0.05

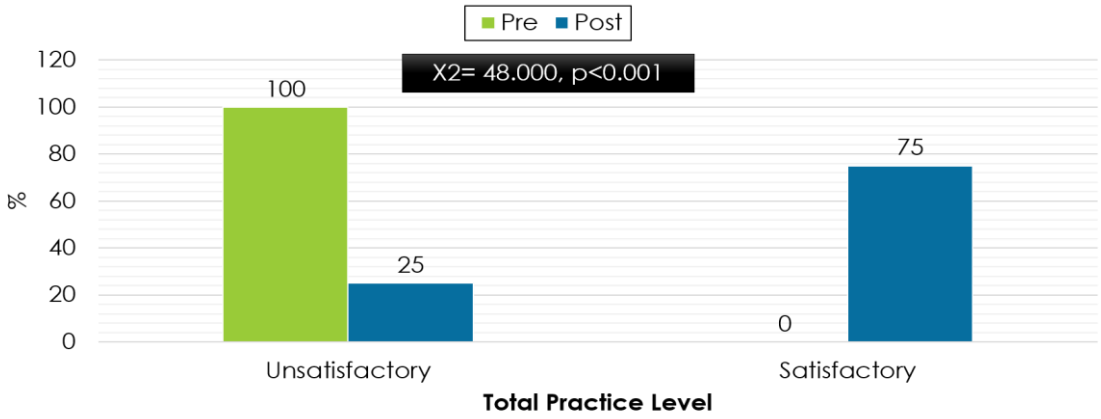

Figure 2: Total Practices Score Toward DVT Preventive Measures at Pre/Post Nurses' Care Guidelines Among Nurses Under Study (n=40)

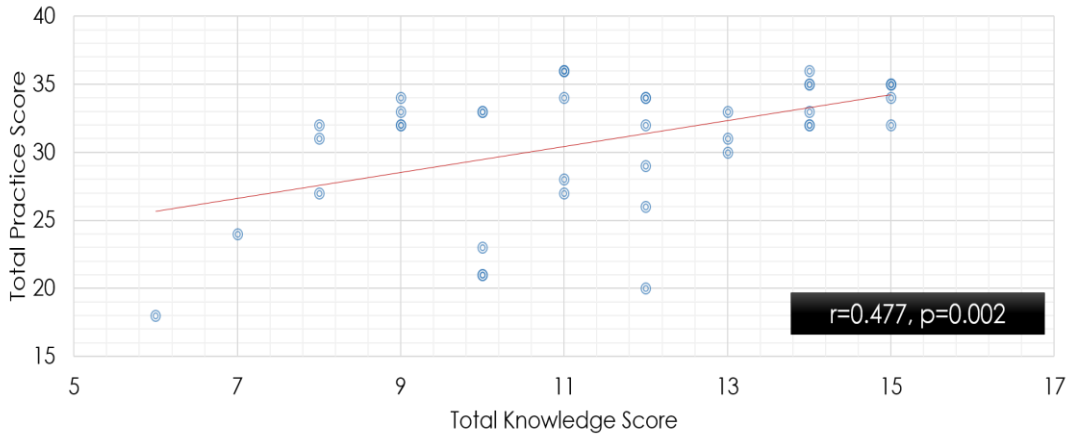

Figure 3: Correlation Between the Total Nurses Knowledge Score and Total Practices' score Post guidelines

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Table 5: Demographic Characteristics of the Patients Under Study& their medical family history (n=156)

items	No	%
Age (years)		
<50	47	30.1
50 – 60	93	59.6
>60	16	10.3
Mean ±SD	52.6 ±5.6	
Gender		
Male	53	34.0
Female	103	66.0
Marital status		
Single	0	0.0
Married	156	100.0
Level of education		
Educated	110	70.5
Non-educated	46	29.5
Length of stay (days)		
<10	47	30.1
10 – 20	63	40.4
>20	46	29.5
Mean ±SD	14.3 ±7.5	
Smoking		
Non-smoker	36	23.07
Smoker	120	76.9
Medical family history of the patients		
Heart disease	48	30.8
Neurological problems	16	10.3
Diabetes mellitus	62	39.7
Hypertension	94	60.3
Others	16	10.3
Family history of DVT	94	60.3

Table 6: The Autar DVT Risk Assessment Scale of the Patients(n=156)

Variables	No	%
Age specific group		
41 – 50 (score 2)	47	30.1
51 – 60 (score 3)	93	59.6
61+ (score 4)	16	10.3
Build/BMI		
Under-weight (score 0)	16	10.3
Average (score 1)	64	41.0
Overweight (score 2)	76	48.7

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Mobility		
Ambulant (score 0)	16	10.3
Limited (score 1)	78	50.0
Very limited (score 2)	16	10.3
Chair bound (score 3)	16	10.3
Complete bed rest (score 4)	30	19.2
Oral contraceptive		
No (score 0)	14	9.0
20 – 35 years (score 1)	78	50.0
35+ years (score 2)	32	20.5
Pregnancy/puerperium (score 3)	32	20.5
Trauma risk category		
Spinal injury (score 2)	32	20.5
Pelvic injury (score 3)	78	50.0
Lower limb injury (score 4)	46	29.5
Surgical intervention		
Planned major surgery (score 2)	94	60.3
Orthopedic surgery (score 4)	62	39.7
High risk diseases		
None (score 0)	30	19.2
Anemia(score 2)	48	30.8
Chronic heart disease (score 3)	14	9.0
Malignancy(score 5)	16	10.3
Varicose veins (score 6)	16	10.3
Previous DVT or CVA(score 7)	16	10.3
Total Autar score		
Range	11 – 25	
Mean ±SD	16.6 ±4.0	
Moderate risk	56	35.9
High risk	100	64.1

	No	**%**
Thrombo-prophylaxis		
Leg elevation	62	39.7
Graduated elastic compression stocking	78	50.0
Pneumatic compression	0	0.0
Heparin	94	60.3

*answers are not mutually exclusive.

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Table (8): Evaluation Sheet of DVT Occurrence for Patients Under Study Post Nursing Care Guidelines (n=156)

Manifestations	Post guidelines	
	No	%
1. DVT Manifestations		
Calf pain or pitting edema	26	16.7
Calf tenderness or amputation	30	19.2
Calf swelling	16	10.3
Increased skin temperature in one leg	20	12.8
Blue discoloration of the legs	10	6.8
Palpable thrombosed superficial veins	50	32.1
2. Laboratory tests		
PT	14.1 ±3.3	
Hemoglobin (Hg)	10.1 ±0.8	
Platelets' count	279.2 ±83.5	
Hematocrit	34.0 ±2.7	

Statistically significant at p< 0.05

4. DISCUSSION

Orthopedic surgeries are strongly associated with a risk of developing DVT. The incidence of asymptomatic DVT after a major orthopedic surgery without prophylaxis reportedly ranges from 30% - 80%. The DVT, a known complication of lower limb surgery, refers to the abnormal coagulation of blood; its complications are pulmonary embolism and embolism syndrome, which not only affect the quality of life of patients, but also can cause high mortality **Yin &Shan (21); Yeo et.al.,(22**). Researchers suggest that, health practitioners should focus on DVT prophylaxis in addition to using an effective risk assessment tool to identify high-risk patients, and implement the appropriate measures to decrease the morbidity rate effectively **Qiu et al., (23).**The aim of this study was to evaluate the effect of nursing care guidelines on preventing DVT among patients undergoing arthroplastic surgery.

Forty nurses caring of patients undergoing arthoplastic surgery were included in the present study, two-fifth of them, their age ranged between 25-<35 years with a mean ± SD of 31.2 ±7.9 and half of them have more than 10 years of experience in critical care unit, three fifth have diploma degree, and the majority of them didn't attend in-service training courses about DVT preventive measures. (table 1)

These results agreed with those of the study of **Ead, et al. (24)** who examined the effect of nursing care standards for preventing DVT among patients undergoing hip surgery on nurses' performance and patients' outcome, and mentioned that, about half of the studied subjects were in the age category > 30 years. However, this study result contradicted with that of the study conducted at the Orthopedic Unit in Alexandria University Hospital by **Abou El Enein et al. (25) entitled:** " Knowledge and performance among nurses before and after a training program on patient falls" they found that, the highest percentage of nurses aged between 18 years to less than 25 years accounted for 55% of the total sample.

According to the level of education for nurses under study, the highest percentage of them had diploma degree in nursing education and are considered bed side care nurses, while the newly graduate nurses with technical nursing and bachelor degree in nursing education were distributed in critical care units rather than other units in the hospitals and appointed as head nurses. This finding disagreed with that of the study conducted by **El Shemey and Elsaay (26) entitled:**"Efficacy of Implementing Nursing Care Protocol on Total Hip Replacement Patient's Outcome in Orthopedic Department at Tanta University Hospital", they found that, the majority of the studied nurses were baccalaureate degree in nursing education.

Concerning to the years of experience for nurses under study, half of them had experience more than 10 years in critical care units. This might be due that more than two-fifth of them their age ranged between 26-< 35 years with a mean of31.2 ±7.9 and due to the stability of most of nurses in their places from their appointment in the orthopedic unit. As regards

attendance of nurses training courses, the present study result showed that, the majority of them did not attend in-service training courses about DVT preventive measures, This finding was supported by **Ead et al.(24**), who documented that, all nurses hadn't attended any previous training courses about nursing care standards for preventing DVT.

Regarding to demographic characteristics of patients under study, the highest percentage representing almost as three fifth of them their age ranged between 50 – 60 years with a mean ± SD of 52.6 ±5.6 years, slightly less than two third of the sample were female and educated, near three quarter were smokers, and an equal percentage of three fifth have family history of hypertension and DVT,(table 5) These characteristics indicated that, the patients under study were at risk for occurrence the DVT, that could be related to pregnancy and using the contraceptive pills. This study results were in agreement with those of **Lee et al., (27),** who examined the incidence of DVT after major lower limb orthopedic surgery: Analysis of a Nationwide Claim Registry, which mentioned that, old age is a well-known risk factor for DVT. The relative risk for DVT was higher in females than in males for knee replacement arthroplasty.

As well, this study result was similar to those **McLendon and Attia (28)**who studied DVT risk factors, and clarified that, it is important to note that smoking is not an independent risk factor, although it increases the risk for cancers and other comorbidities and works synergistically with other independent risk factors. Such as the contraindication for estrogen oral contraceptive pill use in women greater than 35 years of age who smoke.

Considering nursing precautions to be followed to prevent DVT for patients undergoing arthoplastic surgery, this study finding revealed statistically significant improvement post nursing care guidelines than pre-guidelines.(table 2) This may be attributed to that four fifth of the study nurses didn't attend in-service training courses about DVT preventive measures adding to lack of preparation during their basic education. This finding was similar to that of the study of **Bhatti et al., (29**), on "Knowledge, Attitude and Practices of Health Care Providers Towards DVT Prophylaxis in Five Teaching Hospitals of Rawalpindi" and reported that, the knowledge of health care providers about DVT prophylaxis was less than adequate.

The Autar DVT risk assessment scale is a comprehensive and valid instrument that improves the consistency of nursing assessment and creates a reference for preventing DVT in nursing practice **Yin and Shan, (21)**. This study result showed high risk of DVT for patients under study which is characterized by that almost three fifth of patients under study had 51-60 years, around half are overweight, with limited mobility and half of them between age 20-35 years, under oral contraceptive and have pelvic surgery (table 6).All these factors should be considered when determining patients at 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 patients undergoing arthoplastic surgery should be screened for DVT risk upon admission and DVT prevention technique should be initiated based on the risk assessment. This result was consistent with that **McLendon and Attia (28),** who studied DVT, risk factors. They mentioned that, risk factors include age, bed rest, congestive heart failure, estrogen, family history, hematologic cancers, immobility, indwelling catheters, long-distance travel, major trauma, noninfectious inflammatory conditions, obesity, pregnancy (and postpartum status), prior venous thromboembolism, recent surgery, smoking, solid cancers, and stroke.

Regarding nurses' knowledge of DVT, the present study result showed statistically significant improvements in almost all items of knowledge among the studied nurses after the nursing care guidelines (Table 2). These improvements may be attributed to the effectiveness of the nursing care guidelines, clarity and suitability of the content. This finding was similar with that of **Das (30)** on the "Effectiveness of the Planned Teaching Program on DVT among the Staff Nurses of Selected Hospital" which documented that the majority of the staff nurses had unsatisfactory level of knowledge pre implementation planned teaching program on DVT than post implementation.

The unsatisfactory level of knowledge of nurses under study before intervention of the nursing care guidelines may be due to that four fifth of the studied nurses did not attend any in-service training courses about DVT, also may be due to lack of nurses' desire to acquire new knowledge due to overload duties in the work situation. These findings were consistent with those of the study conducted by **Lee et al. (15),** on "Evaluation of Hospital Nurses' Perceived Knowledge and Practices of VTE Assessment and Prevention", they mentioned that, there was a lack of nurses' knowledge and recommended that a substantial need for focused education about VTE prevention for hospital nurses and support for hospital to monitor VTE care.

The present study revealed that, there were statistically significant differences between pre/post nursing care guidelines regarding nursing practices of applying elastic stocking and range of motion exercise for lower limbs of patients undergoing orthopedic surgery (Tables 4, 5). These results may be due to that, the positive effect of nursing care guidelines as it developed nurses' practices. In the same line, the incompetence level of nursing practices pre-intervention may be due to lack of supervision and neglection from nurses and their belief that range of motion is from the duties of physiotherapist only. This finding was supported by those of **Ead et al. (24**), who studied the effect of nursing care standards for preventing DVT among patients undergoing hip surgery on nurses' performance and patients' outcome. They mentioned that, less than quarter of the studied nurses had satisfactory level of practices pre NCSs implementation. However, at post implementation, the majority of nurses had satisfactory level of practices.

Regarding to nurses' total knowledge and practices, this study finding indicated statistically significant difference between pre and post intervention of nursing care guidelines (figures 1, 2).This may be attributed to that the majority of nurses didn't have enough knowledge about nursing care guidelines for preventing DVT as well as, lack of in-service training programs, lack of orientation programs for newly appointed nurses and lack of supervision and evaluation system of nursing practices. These results were similar with that of the study of **McMahon (31**) on nursing standards of practices, which stated that, extending nurses' knowledge is very much needed to improve nurses' practices and to prepare them for their extending roles and hospital requirements.

This part of the study answers the research hypothesis which stated that, implementation of the nursing guidelines will improve nurses, knowledge and practices scores regarding prevention of deep vein thrombosis among patients undergoing arthroplastic surgery

Considering thromboprophylaxis measures of the patients under study, results showed that, almost three-fifth of them are taking heparin and half of them used graduated elastic compression stocking, while none of them use the pneumatic compression (table 7).This may be attributed to the lack of pneumatic compression in the hospitals due to its price compared to heparin and compression stocking which are more commonly used in hospitals. This finding was in accordance with that of the study of **Solayar and Shannon (32), entitled** "Thromboprophylaxis and Orthopaedic Surgery: Options and Current Guidelines, which stated that the drawbacks of IPCDs (Intermittent pneumatic compression devices) include cost and compliance issues.

Similarly, the previous result was similar to that of the study of **Falck et al.(33)** on "Prevention of VTE in Orthopedic Surgery Patients: Antithrombotic Therapy and Prevention of Thrombosis and determined that, the current guidelines from the American Academy of Orthopaedic Surgeons (AAOS) and the American College of Chest Physicians (ACCP) continued to stimulate low molecular weight heparin (LMWH) as the pharmacological thromboprophylactic agent of choice following total joint arthroplasty (TJA)

As well, the above mentioned finding was parallel with that of the study of **Flevas et al.(34),** who studied "Thromboembolism Prophylaxis in Orthopaedics: An Update" they stated that, without VTE prophylaxis, the overall VTE incidence in medical and general surgery hospitalized patients is in the range of 10-40%, while it ranges up to 40-60% in major orthopaedic surgery. With routine VTE prophylaxis, fatal pulmonary embolism is rare in orthopaedic patients and the rates of symptomatic VTE within three months are in the range of 1.3- 10%.

Regarding to evaluation of DVT occurrence post nursing care guidelines implementation, the patients undergoing arthroplastic surgery are more likely to have DVT, as mentioned earlier (Table 6), low percentages of DVT signs and symptoms have been detected after giving nursing guidelines. This result indicated the fact that, the nurses followed the guidelines carefully. This finding was supported by a Canadian study of Lloydet **al. (35)** on "Barriers and potential solutions toward optimal prophylaxis against DVT for hospitalized medical patients: A survey of healthcare professionals", and indicated that, nurses are the most suitable candidates to perform daily assessment of DVT prophylaxis.

Regarding correlation between total nurses' knowledge and their practices scores, the current study result showed that, there was a highly statistically significant direct correlation between pre and post nursing care guidelines (Figure 3).This result indicated that, the level of practices is influenced by the level of knowledge and both are attracted and interconnected to each other which affected on quality of nursing care for patients undergoing arthroplastic surgery. This

finding indicated that, practices can be easily improved especially if linked with relevant scientific base of knowledge. This finding was congruent with that of **Ghanem and El-khayat(36)**,who studied "Chronic Subdural Hematoma: Effect of Developing and Implementing Postoperative Nursing Care Standards on Nurses Performance for Reduction or Prevention Postoperative Complication, and documented that, there was highly statistically significant relation between nurses' knowledge and their practices post NCSs implementation.

5. CONCLUSION

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

Nursing care guidelines improved nursing performance for prevention of DVT among patients undergoing arthroplastic surgery.

6. RECOMMENDATIONS

Based on the current study findings, the following recommendations are suggested:

1. Orientation programs should be provided for all newly appointed nurses to work in critical care units for preventing DVT among patients undergoing arthroplastic surgery.

2. Training programs should be established to update nurses' knowledge and skills about DVT preventive measures, and how to use the technical skills to assess the existence of DVT using the evidence base nursing and medicine.

3. Simple illustrated booklet, written in Arabic language, and posters of DVT nursing guidelines should be developed for DVT prevention among orthopedic patients

4. In-service training nursing education about DVT prevention among orthopedic patients for nurses is recommended to be organized regularly

5. Further study should be conducted on a larger sample of nurses and at different critical care units for prevention of DVT occurrence among hospitalized patients.

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