# Effect of Educational Program for Nurses' Performance and Clinical Outcome Regarding Occurrence of Deep Vein Thrombosis among Major Orthopedic Surgery Patients

**Marwa M. Osman[1,2], Seham A. Abd El-Hay [3], Waled M. Ewees [4] and Zeinab F. Bahgat [5,6]**

[1]Bachelor of nursing, faculty of nursing Tanta University, Egypt
[2]Nursing specialist, Internal Medicine Hospital, Tanta University Hospital, Egypt
[3]Professor, Medical & Surgical Nursing, Faculty of Nursing, Tanta University, Egypt
[4]Professor, Orthopedic Surgery, Faculty of Medicine, Tanta University, Egypt
[5]Assist. Professor Medical & Surgical Nursing, Faculty of Nursing, Tanta University Egypt
[6]Assistant Professor Medical Surgical Nursing College of Nursing, KSAU-HS, AlAhsa KSA, King Abdullah International Medical Research Center, Al-Ahsa, Saudi Arabia.

**Corresponding email**: mokamoky950@gmail.com

**Background:** Deep vein thrombosis is a medical condition that can cause disability and a decreased quality of life. **Aim:** evaluate effect of educational program for nurses' performance and clinical outcome regarding occurrence of Deep Vein Thrombosis among major orthopedic surgery patients**. Design** Quasi- experimental design. **Setting**: conducted at Orthopedic Department of Educational International Hospital at Tanta University. **Subjects:** Purposive sample (50) nurses and (40) adult patients that were divided into two groups of 20 patients each of them. **Tools**: 4 tools were applied **Tool I:** Nurses Assessment structure questionnaire**, Tool II:** Observation checklist for nurses' practice, **Tool III:** Patients Assessment Sheet**, Tool IV** an evaluation sheet for DVT**. Results** there was significant progress in the nurses' attitude related to the prevention of deep vein thrombosis. and statistical improvement in clinical outcomes in study group rather than control group after implementing the educational program **Conclusions:** the results concluded that implementation of the nursing educational program resulted in improvement in Nurses' attitude and Patients' clinical outcomes **Recommendations:** Planning educational classes for orthopedic surgical patients about prevention of DVT following orthopedic surgery.

**Key words:** Deep venous thrombosis, Clinical Outcome, Patients undergoing orthopedic surgery

## Introduction

Deep vein thrombosis (DVT) is an obstructive disease with impeding the mechanism of venous reflux. **(Huang et al ,2022)**. DVT represents third most prevalent cause of death, following stroke and heart attacks. **(Parker & Thachil, 2018)**.

About 40% to 60% of major orthopedic surgeries result in DVT. Death can occur in about 6% of DVT patients within a month of diagnosis. **(Tang et al, 2017)**Patients undergoing major orthopedic surgery, such as hip fracture repair, complete knee replacement, or total hip replacement, are particularly vulnerable to developing postoperative DVT. **(Khalid et al, 2021)**

If venous thrombosis is not treated in its early stages, it can lead to pulmonary embolism, which can be fatal when thrombus enters the pulmonary circulation, as well as mild symptoms such as swelling, discomfort, and dysfunction in the affected limb **(Dai et al 2020)**.

Patients undergoing major orthopedic surgery should receive special care and teaching such as thrombo-prophylactic interventions, which are including health education, lifestyle modification, exercise program, nutritional management, appropriately administered antithrombotic medications, physical preventative techniques, and essential preventive strategies. (**Xu , Zhao & Chen,2018**)

Orthopedic nurses are crucial in identifying and preventing deep vein thrombosis among patients undergoing major surgery. (**Anthony ,2013**)

Evaluation of patient risk factors, such as age, immobility, Previous history of DVT , and prolonged hospitalization, are essential during admission investigation. (**Schellack et al, 2016**)

By educating patients about the the advantages of physical therapy and initiating movement through early mobility, limb elevation, leg flexion, active and passive range of motion exercises, nurses may have a positive effect on the results of mechanical or physical DVT prevention. In addition, they are actively participating in the prevention of thrombosis by using prompt preventative measures as well as providing essential psychological support, which may save lives. **(Lau et al, 2017)**

## Significance of the study

Deep vein thrombosis is common cause of pulmonary embolism (PE) which is a life threatening complication. **(Schellack et al, 2016**). Usually, the embolus that causes the obstruction originates at a distant site and passes through the venous system. (**Attia et al, 2015**)

Fifty percent of DVT patients will experience post-thrombotic syndrome, or long-term consequences, including pigmentation, venous ulcers, edema, extremity pain, and venous dilatation. (**D'Alesandro,. 2016**)

In Egypt, the risk of developing venous thrombo embolism (VTE) is elevated in over one-third of hospitalized patients admitted with severe medical conditions or for surgery. Whereas limited proportion of those patients obtain proper VTE prophylaxis. Corrective interventions are required to avoid experiencing VTE that may lead to morbidity and mortality in these high-risk patients. (**Shaaban, 2021**). Thus, the aim of the study is to identify the effect of educational program on the performance

of nurses and patients' outcome relating to occurrence of deep vein thrombosis for patients undergoing major orthopedic surgeries

**Aim of the Study**

Aimed to evaluate effect of educational program for nurses' performance and clinical outcome regarding occurrence of deep vein thrombosis among major orthopedic surgery patients.

**Research Hypothesis:**

1. After implementation of the educational program, nurses' performance related to minimize the occurrence deep vein thrombosis in patients undergoing major orthopedic surgery is expected to be improved.
2. Patients undergoing major orthopedic surgeries will exhibit improvement in their clinical outcomes after educational program than control group.

**Subjects and Method**

**Research design**

In this study Quasi- experimental research design was utilized.

**Setting**

The study was conducted in orthopedic unit of Educational International hospital at Tanta University.

**Subjects**

**1.** All nurses (50) who are providing care for patients undergoing major orthopedic surgeries.

**2.** A convenience sampling of (40) patients who hospitalized for major lower extremity orthopedic surgeries.

The patients divided randomly into 2 equivalent groups; each group consisted of (20) patients:

**Group 1: - Study Group,** (20) patients, they received their nursing care according to educational program that was developed and implemented by the researcher in addition to hospital routine care.

**Group 2: - Control Group**, (20) patients, they obtained regular care provided by hospital nurses.

**Inclusion criteria**

- Adult patients of both sexes.
- Age ranges between 21-60 years.
-Don't have DVT on admission.
- Patients undergoing one of the major lower limb orthopedic surgeries

**Exclusion criteria:**

-Thrombocytopenic purpura and hemophilia.
-Abnormal bleeding or clotting time.

**Tools of the study**

**Tool I: Structure assessment questionnaires: include two parts:**

**-Part (A): The sociodemographic characteristics of nurses** which included; nurses' code**,** age, sex, marital status, years of work experience in the orthopedic unit, education, and previous orthopedic surgery patient care training.

**-Part (B): Nurses' Knowledge Assessment Sheet:**

Evaluate nurses' level of knowledge after and before educational program in relation to prevention of deep vein thrombosis it included the following:

-Knowledge about DVT
-Knowledge about nursing intervention

**Scoring system of knowledge:**

Right and complete answer scored (2)
Right and incomplete answer scored (1)
Don't' know or false answer (0)

The total scoring system was calculated and categorized into:

-Good → > 80%
-Fair → ≥ 60% - 80%
- Poor → < 60%

**Tool II: A checklist for nurses' observations regarding their practice**:

Evaluate nursing performance before and after implementation of educational program regarding practical skills about prevention of DVT among major orthopedic surgery patients, it was including the following:

**- Patient assessment**

**-Elastic stocking application**

**-Lower Limbs Range of motion exercise**

**Practice scoring system:**

-Done practices will take (1).

-Not done practices will take (0).

The total score was calculated and categorized into: -

-Satisfactory → ≥ 80%

-Unsatisfactory → < 80%

**Tool III: Patients Assessment Sheet:** include two parts:

**Part I: Sociodemographic data of the patient**

**Part II: Patient medical sheet**

**Part III: The Autar DVT risk assessment scale**. **Autar R. (2003)**

Autar Scoring system:

| Risk categories | Score range |
|---|---|
| No risk ≤6 | ≤6 |
| Low risk | 7-10 |
| Moderate risk | 11-14 |
| High risk | ≥15 |

**Tool IV: DVT evaluation sheet;** To determine the progress of DVT. It included two parts:

**-Part I**: **Symptoms of DVT:**

Calf pain, calf tenderness, calf circumstance, skin color, and distension and warmth of the calf.

**-Part II: Laboratory tests**:

Partial thrombin time (PTT), prothrombin time (PT), hemoglobin (Hb), platelets and fibrinogen level.

**Method:**

1- Official letters were delivered from the Faculty of Nursing to authorities to implement the study.

2- Written approval hospital letter to conduct the study was obtained from the director of Orthopedic Department of Educational International Hospital at Tanta University.

3- The study did not cause any danger or pain to the entire participants.

4- Consent was taken from patients and nurses after explaining the aim of the study.

5- By using code numbers rather than names for data collection and results, confidentiality and privacy were taken into consideration.

6- The patient's and the nurse's right to withdraw from the study at any time and for any reason was explained.

**7-Tool development**

After reviewing recent related literature **(Collins et al., 2014)** & **(Chan., & Shorr, 2010) (Mohammed et al 2018) & (Eldosoky, 2008). (Flevas et al., 2018) & (Francis, 2013) (Mohamed et al.,2021) & (Mohamed et al.,2017)** the study tools was developed except tool III part III The Autar DVT risk assessment scale was developed by **Autar R.(2003)** .

**8- The data collecting tools** were translated into Arabic.

**9-Tool validity:**

Seven experts in medical surgical nursing evaluated the tools' validity and applicability to ensure they were clear and applicable and modifications were done .It was calculated and found to be = (96%)

**10-A pilot study**

A pilot study was conducted on 10% of the study sample to examine applicability of the tools and to identify any barriers that may be encountered during the period

of data collection. modifications were done by the researcher before the main study, according to the experience gained from the Pilot study was excluded from the original sample.

**11-Reliability**

The reliability for the study tools was calculated by Cronbach's Alpha test: it was 0.742 for tool (I), 0.834 for tool (II), 0.925 for tool (III) and 0.841 for the sheet in total. for about reliability of The Autar DVT risk assessment scale was 0.841 post surgeries.

**12-Data collection:**

The collection of data was conducted from 10/2022 to 5/2023.

**13-The educational program** included 4 stages (Assessment, planning, implementation and evaluation).

**Phase 1: -Assessment: -**

A-Assessment of nurses:

- Assessment of the studied nurse using tool (I) part A to collect sociodemographic data and Tool I part B and Tool II was used to assess knowledge and practice regarding prevention of deep vein thrombosis for patients undergoing major orthopedic surgeries.

b- Assessment of The patient:

Assessment of The patient was carried out by using Tool (III) and Tool (IV) to evaluate studied patient's clinical outcomes pre and post the educational program.

**Phase 2: -Planning: -**

-This phase was formulated from the literature review priorities, assessment phase, goals and expected outcomes.

**Expected out comes included:**

- Improvement of nurses' attitude related to prevention of DVT.

-absence of deep vein thrombosis symptoms as pain, tenderness, distension and warmth of the calf muscle.

**The Planning included:**

**a- Content Preparation**

- An illustrative structured colored booklet
- Booklet, power point, Videos, group discussion, demonstration and re-demonstration.

**-Educational program;** divided into (5) subgroups, each subgroup consisted of 10 nurses. The session took about 30 – 45 minutes.

**b- Environment Preparation:**

It was performed through preparing specific suitable room for educational program implementation,

c- Preparation of the environment for patient; was performed to maintain the privacy of the patients, good ventilation and noise minimized to its minimum level.

**Phase (3):-Implementation:-**

-The First session:

Knowledge about DVT

-The second session:

Knowledge about nursing intervention

-The third session:

Practice about assessment of patients' pre and postoperative surgery

-The fourth session:

-Nursing Interventions to prevent DVT after (surgery)

- As soon as possible, initiate the proper DVT regimen in patients who are at risk, according to organizational policy and practice.

-Elevate the suspected afflicted lower limb by at least 20 degrees above the heart.

- Apply graduated compression elastic Stockings (GCES)

- Remove GCES for 15 to 20 minutes every 8 hours.
-Provide the patient with adequate hydration(2500-3000cc).
- As required, support the patient with their range of passive or active movement.
-Instruct the patient to move their legs and feet at least ten times each hour.
-Based on the patient's tolerance, modify the patient's position every two hours and encourage movement or early walking.
-Avoid compressing or rubbing the limbs that are affected.
- Inform patients that they should not sit for a long period of time with their legs hanging down and that shouldn't cross their legs.
- If there is skin discoloration, blistering, or marking, avoid wearing stockings.

**Range of motion exercise for lower limbs:**

-Preform the exercises once per day.
-Perform each exercise 10 times
-Begin exercises slowly
-Move only to point of resistance.
- At least ten times each hour, encourage the patient to flex and stretch their legs.
-Apply Range of motion exercise and consider deep berating exercise
- As appropriate, help the patient with their range of passive or active movement.

**4. Evaluation:**

The researcher evaluated nurses' knowledge, skills, and patient outcomes prior to, throughout, and one month following the beginning of the educational program to determine the impact of implementing the educational program, a pre- and post-program comparison was made.

**Results:**

**Table (1) Socio demographic characteristics of the studied nurses It showed t**hat more than one third (42 %) of the studied nurse were in the age group from (21-<30) years old, most of them (76, 78%) were female and married respectively.

**Regarding to educational level and experience** above one third (38%) of the nurse were diploma while above quarter (28%) of them were bachelor degree in addition to that above one third of them (36%) worked from (5- <10) years in orthopedic department.

Finally, all of the studied nurse hadn't previous training course in nursing care for patient undergoing orthopedic surgery

**Figure (1) Total knowledge of the studied nurses** It showed that mean score of nurses' total knowledge preprogram (54.20±13.03) comparing to their total knowledge immediately post program (94.72±14.13) and one month after program (89.46±15.62)with a statistical significance progress in the total knowledge of the studied nurse just after ,and one month after implementing the program than preprogram since P =0.001*

**Figure (2) Total practice of the studied nurses It showed that** mean score of nurses' total practice preprogram (48.02±11.26) comparing to their total practice immediately post program (85.52±17.86) and one month after program (84.76±17.66)with a statistical significance progress in the total practice of the studied nurse just after program ,and after one month of implementing the program than preprogram since P =0.001*

**Table (2) Socio demographic characteristics of the studied patients**

**It showed** that above one third 40% of the total studied patients were aged (40-50) years old , compared with the same age

group of the control patients that was more than half 60%.

The table also showed that (60% ,70%) from the studied group were male and married respectively, compared to (60%,50%) from the control group that were female and married respectively

**Table (3) Autar DVT risk assessment scale**

**Regarding risk factor** current study clarified that, above one third (40%) of patients aged (41-50 ) years old, While above half (60%) of the controlled patients were in the same age group.

**Regarding the high risk disease**, the highest percentage (80%, 66.7) of both studied and controlled patients had chronic heart disease respectively.

**Concerning to trauma risk and surgical intervention** current study clarified that above half (60%) of studied patient had lower limb injury, while the proportion of the controlled patients divided equally (50%) between pelvic and lower limb injury. (100%) of patients in study and control group underwent major orthopedic surgery

**Regarding the build Body mass index,** the study clarified that the highest proportion (50%, 60%) of both studied and controlled patients respectively were obese.

**Regarding mobility, study illustrated that above** one quarter (30%) of the controlled patients experienced wheelchair bound. While (90%,65%) of the studied and controlled patients experienced very limited mobility respectively with a significant statistical improvement of the proportion that decreased to (60%) after implementing the program

Finally, the study clarified that (60%,30%,10%) of patients were high, moderate, and low risk category , the proportion improved to be (55%,20%,25%) respectively after implementing the program, while the proportion (85%) of the controlled patients remained constant at the high risk category

**(Table 4) Deep vein thrombosis manifestations of Calf muscle**

According to deep venous thrombosis manifestation of calf muscle this table showed that (100%, 100%, 95%, 95%, 100% and 100%) of the study group haven't (pain, tenderness, redness, warmth, swelling and cramping) respectively Comparing with (80%,75%,75%70%,80%,85%) of the controlled patients after implementing of the educational program

**(Table5) Deep vein thrombosis manifestations of thigh muscle**

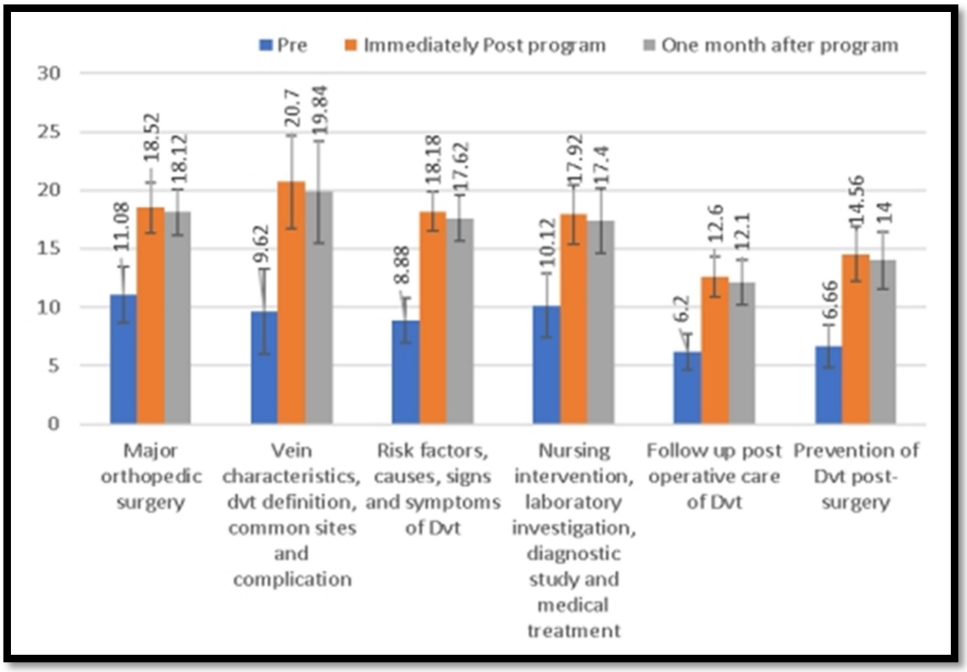
According to deep venous thrombosis manifestation of thigh muscle this table showed that (100%, 100%, 80%, 70%, 100% and 100%) of the study group haven't (pain, tenderness, redness, warmth, swelling and cramping) respectively, comparing with (85%,75%,60%55%,75%,80%) of the controlled patients after implementing of the educational program.

**(Table 6) illustrated Relation between autar DVT and total calf muscle, total thigh muscle** This table demonstrated statistical significant difference regarding relation between the assessment protocol of autar and total calf muscle in control group, The table reveals statistical significant difference concerning the relation between the assessment protocol of autar and total

thigh muscle in both control and study group since p=<0.001*

**Table (1) Socio demographic characteristics of the studied nurses (n=50)**

| Socio demographic data | N | % |
|---|---|---|
| | n=50 | |
| **Age** | | |
| 21-<30 | 21 | 42 |
| 30-<40 | 14 | 28 |
| 40-< 50 | 9 | 18 |
| 50-<60 | 6 | 12 |
| **Sex** | | |
| Men | 12 | 24 |
| Women | 38 | 76 |
| **Marital status** | | |
| Single | 5 | 10 |
| Married | 39 | 78 |
| Widowed | 6 | 12 |
| **Level of education** | | |
| Diploma | 19 | 38 |
| Technical Institute | 13 | 26 |
| Bachelor's Degree | 14 | 28 |
| Master degree | 4 | 8 |
| **Years of experience in orthopedic department** | | |
| 1- <5 | 15 | 30 |
| 5- <10 | 18 | 36 |
| 10- <20 | 10 | 20 |
| 20 or more | 7 | 14 |
| **Previous training courses on nursing care for orthopedic patients** | | |
| Yes | 0 | 0.0 |
| No | 50 | 100 |



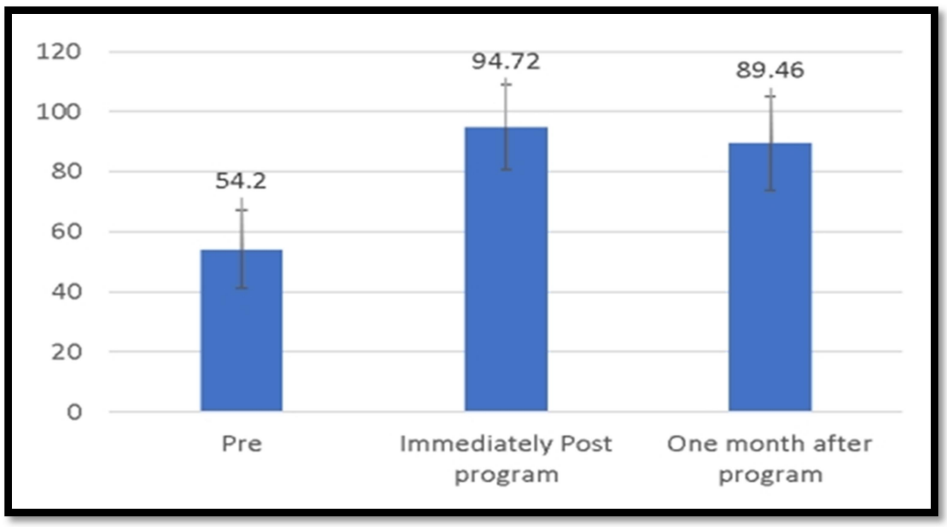




**Figure (1) Total knowledge of the studied nurses**

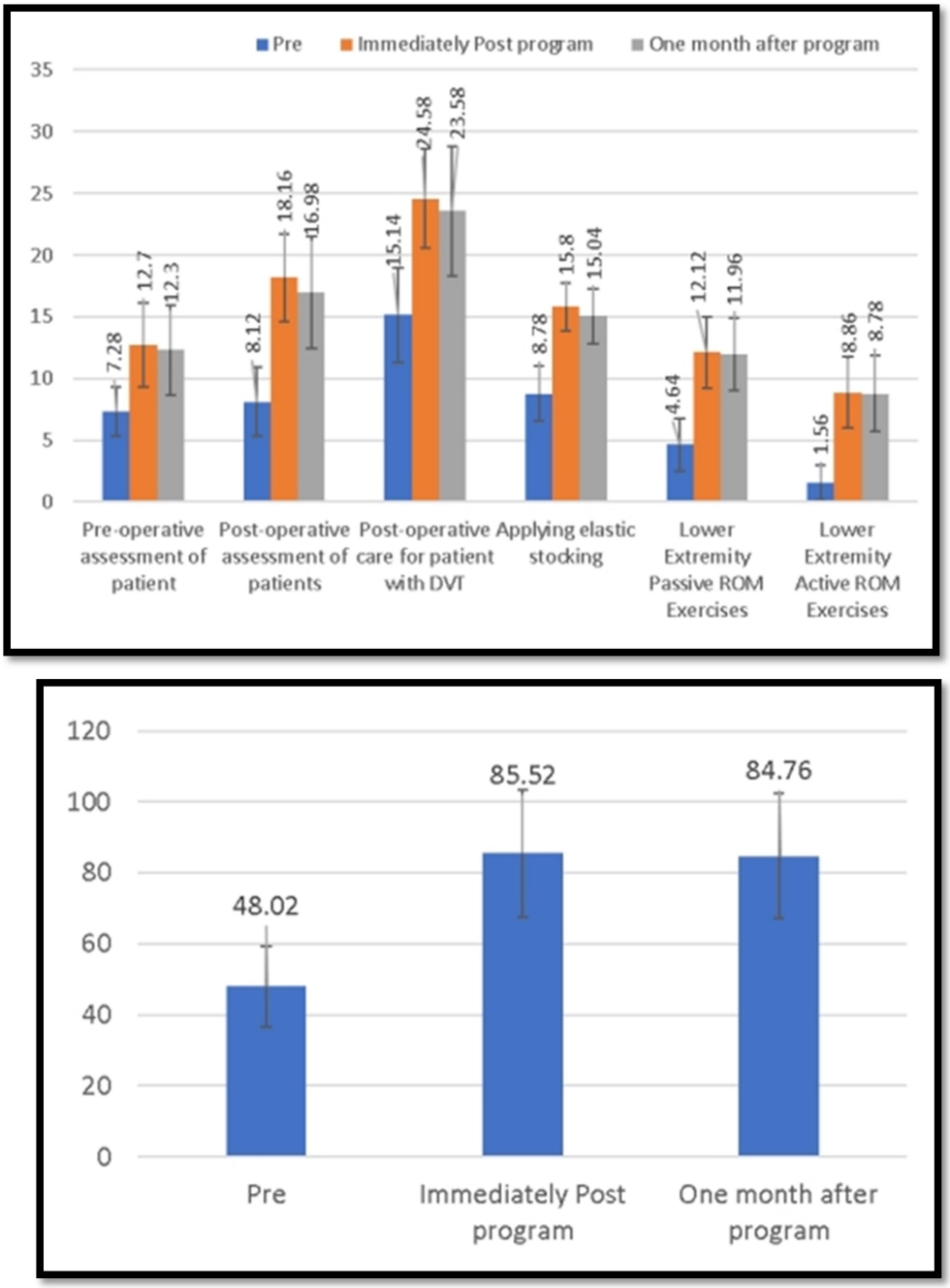



**Figure (2) Total practice of the studied nurses**

**Table (2) Socio demographic characteristics of the studied patients (n=40**

| Studied patients(n=40) | Study (n=20) | | Control (n=20) | | Chi-square | |
|---|---|---|---|---|---|---|
| | N | % | N | % | $X^2$ | P-value |
| **Age** | | | | | | |
| 21- >30 | 6 | 30.0 | 2 | 10.0 | 2.800 | 0.423 |
| 30- > 40 | 2 | 10.0 | 2 | 10.0 | | |
| 40- > 50 | 8 | 40.0 | 12 | 60.0 | | |
| 50- > 60 | 4 | 20.0 | 4 | 20.0 | | |
| **Sex** | | | | | | |
| Male | 12 | 60.0 | 8 | 40.0 | 1.600 | 0.206 |
| Female | 8 | 40.0 | 12 | 60.0 | | |
| **Marital status** | | | | | | |
| Single | 4 | 20.0 | 2 | 10.0 | 7.333 | 0.062 |
| Married | 14 | 70.0 | 10 | 50.0 | | |
| Widowed | 0 | 0.0 | 6 | 30.0 | | |
| Divorced | 2 | 10.0 | 2 | 10.0 | | |
| **Residence** | | | | | | |
| Village | 14 | 70.0 | 12 | 60.0 | 0.440 | 0.507 |
| City | 6 | 30.0 | 8 | 40.0 | | |
| **Level of education** | | | | | | |
| Basic education | 4 | 20.0 | 2 | 10.0 | 1.733 | 0.420 |
| Secondary education | 10 | 50.0 | 14 | 70.0 | | |
| University education | 6 | 30.0 | 4 | 20.0 | | |
| **Occupation** | | | | | | |
| Student | 2 | 10.0 | 2 | 10.0 | 7.333 | 0.119 |
| Government employee | 14 | 70.0 | 10 | 50.0 | | |
| Craft occupations | 2 | 10.0 | 0 | 0.0 | | |
| Self-employment | 0 | 0.0 | 4 | 20.0 | | |
| Mention other | 2 | 10.0 | 4 | 20.0 | | |

**Table (3 Autar DVT risk assessment scale**

| Studied patients (n=40) | Pre program | | | | | | Post program | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Study(n=20) | | Control(n=20) | | Chi-square | | Study(n=20) | | Control(n=20) | | Chi-square | |
| | N | % | N | % | $X^2$ | P-value | N | % | N | % | $X^2$ | P-value |
| **Age specific group** | | | | | | | | | | | | |
| 10-30 | 6 | 30.0 | 2 | 10.0 | 2.800 | 0.423 | 6 | 30.0 | 2 | 10.0 | 2.800 | 0.423 |
| 31-40 | 2 | 10.0 | 2 | 10.0 | | | 2 | 10.0 | 2 | 10.0 | | |
| 41-50 | 8 | 40.0 | 12 | 60.0 | | | 8 | 40.0 | 12 | 60.0 | | |
| 51-60 | 4 | 20.0 | 4 | 20.0 | | | 4 | 20.0 | 4 | 20.0 | | |
| **High risk disease** | | | | | | | | | | | | |
| Ulcerative colitis | 0 | 0 | 1 | 5.5 | 0.871 | 0.647 | 0 | 0 | 1 | 5.5 | 0.871 | 0.647 |
| Chronic heart disease | 8 | 80 | 12 | 66.7 | | | 8 | 80 | 12 | 66.7 | | |
| Varicose vein | 2 | 20 | 5 | 27.8 | | | 2 | 20 | 5 | 27.8 | | |
| **Mobility** | | | | | | | | | | | | |
| Ambulant | 0 | 0.0 | 0 | 0.0 | 7.140 | 0.028* | 4 | 20 | 2 | 10 | 7.515 | 0.057 |
| Limited (users aids self) | 2 | 10.0 | 1 | 5.0 | | | 4 | 20 | 2 | 10 | | |
| Very limited (needs help) | 18 | 90.0 | 13 | 65.0 | | | 12 | 60 | 10 | 50 | | |
| Chair bound | 0 | 0.0 | 6 | 30.0 | | | 0 | 0 | 6 | 30 | | |
| **TRAUMA RISK** | | | | | | | | | | | | |
| Pelvic | 8 | 40.0 | 10 | 50.0 | 0.404 | 0.525 | 8 | 40.0 | 10 | 50.0 | 0.404 | 0.525 |
| Lower limb | 12 | 60.0 | 10 | 50.0 | | | 12 | 60.0 | 10 | 50.0 | | |
| **BUILD BODY MASS INDEX** | | | | | | | | | | | | |
| Average | 6 | 30.0 | 4 | 20.0 | 3.248 | 0.355 | 6 | 30.0 | 4 | 20.0 | 3.248 | 0.355 |
| Overweight | 4 | 20.0 | 2 | 10.0 | | | 4 | 20.0 | 2 | 10.0 | | |
| Obese | 10 | 50.0 | 12 | 60.0 | | | 10 | 50.0 | 12 | 60.0 | | |
| Very obese | 0 | 0.0 | 2 | 10.0 | | | 0 | 0.0 | 2 | 10.0 | | |
| **SPECIAL RISK** | | | | | | | | | | | | |
| 20-35 yrs | 4 | 66.7 | 2 | 33.3 | 1.333 | 0.248 | 4 | 66.7 | 2 | 33.3 | 1.333 | 0.248 |
| 35+ yrs& Hormone replacement therapy | 2 | 33.3 | 4 | 66.7 | | | 2 | 33.3 | 4 | 66.7 | | |
| **SURGICAL INTERVENTIONS** | | | | | | | | | | | | |
| Major Orthopaedic Surgery | 20 | 100.0 | 20 | 100.0 | 0.000 | 1.000 | 20 | 100.0 | 20 | 100.0 | 0.000 | 1.000 |
| **ASSESSMENT PROTOCOL** | | | | | | | | | | | | |
| High | 12 | 60 | 17 | 85 | 3.195 | 0.202 | 11 | 55 | 17 | 85 | 4.371 | 0.112 |
| Moderate | 6 | 30 | 2 | 10 | | | 4 | 20 | 1 | 5 | | |
| Low | 2 | 10 | 1 | 5 | | | 5 | 25 | 2 | 10 | | |

**Table (4) Distribution studied patients according to deep vein thrombosis manifestations of Calf muscle**

| Studied patients(n=40) | Study(n=20) | | | | Control(n=20) | | | | Chi-square | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Present | | Absent | | Present | | Absent | | | |
| | N | % | N | % | N | % | N | % | $X^2$ | P-value |
| **After program** | | | | | | | | | | |
| Pain | 0 | 0 | 20 | 100 | 4 | 20 | 16 | 80 | 4.444 | 0.035* |
| tenderness | 0 | 0 | 20 | 100 | 5 | 25 | 15 | 75 | 5.714 | 0.017* |
| Redness | 1 | 5 | 19 | 95 | 5 | 25 | 15 | 75 | 3.137 | 0.077 |
| Warmth | 1 | 5 | 19 | 95 | 6 | 30 | 14 | 70 | 4.329 | 0.037* |
| Swelling | 0 | 0 | 20 | 100 | 4 | 20 | 16 | 80 | 4.444 | 0.035* |
| Cramping | 0 | 0 | 20 | 100 | 3 | 15 | 17 | 85 | 3.243 | 0.072 |

Table (5) **Distribution of the studied patients according to deep vein thrombosis manifestations of thigh muscle**

| Thigh muscle | Study(n=20) | | | | Control(n=20) | | | | Chi-square | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Present | | Absent | | Present | | Absent | | | |
| | N | % | N | % | N | % | N | % | $X^2$ | P-value |
| **After program** | | | | | | | | | | |
| Pain | 0 | 0 | 20 | 100 | 3 | 15 | 17 | 85 | 3.243 | 0.072 |
| tenderness | 0 | 0 | 20 | 100 | 5 | 25 | 15 | 75 | 5.714 | 0.017* |
| Redness | 4 | 20 | 16 | 80 | 8 | 40 | 12 | 60 | 1.905 | 0.168 |
| Warmth | 6 | 30 | 14 | 70 | 9 | 45 | 11 | 55 | 0.960 | 0.327 |
| Swelling | 0 | 0 | 20 | 100 | 5 | 25 | 15 | 75 | 5.714 | 0.017* |
| Cramping | 0 | 0 | 20 | 100 | 4 | 20 | 16 | 80 | 4.444 | 0.035* |

**Table 6:** Relation between autar DVT and total calf muscle, total muscle thigh

| | | Assessment protocol | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | High | | Moderate | | Low | | Chi-square | |
| | | N | % | N | % | N | % | $X^2$ | P-value |
| **Total calf muscle** | | | | | | | | | |
| **Study(n=20)** | Absent | 11 | 91.7 | 6 | 100 | 2 | 100 | 0.702 | 0.704 |
| | Present | 1 | 8.3 | 0 | 0 | 0 | 0 | | |
| **Control(n=20)** | Absent | 15 | 93.8 | 0 | 0 | 0 | 0 | 15.000 | <0.001* |
| | Present | 1 | 6.2 | 2 | 100 | 2 | 100 | | |
| **Total thigh muscle** | | | | | | | | | |
| **Study(n=20)** | Absent | 12 | 100 | 6 | 100 | 0 | 0 | 20.000 | <0.001* |
| | Present | 0 | 0 | 0 | 0 | 2 | 100 | | |
| **Control(n=20)** | Absent | 14 | 87.5 | 0 | 0 | 0 | 0 | 11.667 | 0.003* |
| | Present | 2 | 12.5 | 2 | 100 | 2 | 100 | | |

**Discussion**:

In critically ill patients, venous thromboembolism is essential cause of morbidity and mortality. Pulmonary embolism and deep vein thrombosis are two signs associated with this health condition. If educated and given the authority to change hospital culture, nurses can significantly contribute to the prevention of DVT. (**Collins et al, 2014**) Corrective measure is required to keep these high-risk patients from experiencing VTE morbidity and mortality. (**Shaaban, 2021)**

**Concerning to socio-demographic data of nurses,** study showed that above one third of studied nurses aged (21- 30) years and most of them female and married. Concerning to education, above one third of nurses had diploma while more than quarter had bachelor degree and above third of them worked in orthopedic unit 5-10 years. This result because of the work in critical units which need power and energy for the hard work load which is available in young adult nurses. This finding was aligned with, **Eldosoky (2008) , Mohammed (2018)** they revealed that, the nurses who are working with DVT patients were females and were married and most of them had diploma, most of nurses were less than 30 years. In addition to this finding was in the same line with **Ahmed., Moubarak & Ghanem (2015)** who revealed that most of the studied nurses' aged (20-35) years old, the majority of the nurses' sample was females and above half of nurses had experience less than 5 years. **Lee et al (2014)** revealed that above half of nurses had Bachelor's in nursing or a Master's degree in nursing.

**In relation to total knowledge regarding DVT** The present study showed that low percentage of nurses had good knowledge concerning to DVT before implementing the educational program. Because most of the nurses in the study had diplomas, there was no ongoing education program, or enough courses, the overall knowledge of nurses may not have been adequate. **On the other** hand the educational program was effective on nurses' knowledge as most of the participants had excellent knowledge after implementing the educational program. This progress indicates effectiveness of the educational program and the teaching sessions that conducted by the researcher. This improvement might also be linked to nurses' motivation to learn new information, their active engagement in the program, and their consistent attendance.

This result was aligned with **McFarland et al (2014)** clarified that low levels of DVT knowledge post orthopedic surgery existed throughout nurses and improved post implementation of training. The result contraindicated with **Lavall (2014)** that knowledge for nurses about DVT was adequate.

The findings also are consistent with **Das, Sahoo & Swain 2014** who denoted increase knowledge score after planned teaching program on deep vein thrombosis among nurses.

**Concerning to practice of nurses** The study reported low percentage of nurses had good total practice regarding DVT before implementing the educational program. On the other hand, there was progress in clinical practice related to preventing DVT after the educational program compared with before the program.

The unsatisfactory level of nurses' practice regarding preoperative nursing assessment and management, post-operative care pre educational program may be related to decrease number of nursing staff, inadequate knowledge, lack of continuous education and deficiency of training

programs. The educational program was effective on nurses' practice that most of them had satisfactory level of practice after educational program.

This result was agreed with **Bhatti et al (2012), Long (2009) Antony, Moly & Dharan (2016)** who stated that poor performance of healthcare providers for implementing DVT prophylaxis was caused by a lack of a hospital supportive system that includes all hospital structure standards, including a lack of DVT prophylaxis policy and guidelines, a lack of training for healthcare professionals, and inadequate facilities for effective DVT prophylaxis measures implementation. Additionally, **Dawooda (2010)** noted that a lack of nurses and the overlap of nursing duties, particularly in morning shifts due to absenteeism and unclear job descriptions, are other issues that impact nurses' practice.

The results of this study are consistent with These published by **(Antony et al (2016), Sahu et al (2017), Lee et al (2014))** who reported a statistically significant improvement in the practice post-teaching program's mean scores of nurses regarding prevention of DVT.

Additionally, the results of this study are consistent with those of **Songwathana, Promlek, and Naka (2011),** who discovered a statistically significant increase in clinical practice for DVT prevention following the intervention as compared to pre-intervention.

The results of this study, however, differ from those published by **Yu et al. (2007)**, who discovered that nurses' adherence to prophylactic guidelines for DVT prevention did not show any statistically significant differences in the total score post-intervention compared with pre-intervention. Most of nurses had inadequate practices related to DVT prevention could be due to complexity of guidelines which complexes implementation and results in clinical practice problems.

**Regarding Socio-demographic characteristics for studied patients,** the present study presented that above one third of the studied participants aged (40-50) years of age while more than half of the controlled group were in the same age group. This result aligned with **Mohamed, et al, (2017)** whose results indicated a substantial correlation between a patient's age and their possibility to develop DVT, with the risk increasing with age. That's also agreed with two Turkish studies by **Susanto et al. (2014)** who demonstrated how the patients' ages significantly raised their risk of developing DVT. The results supporting these findings by **White, 2018** He stated that DVT incidences rise with advancing years. individuals 60 years of age or older had an incidence increase that was more than four times higher than that of individuals under 50.

**In relation to gender**, the current study showed that whereas the majority of patients in the control group were female, the majority of study group members were male. This result was consistent with a study conducted in **2016 by Crous-Bou, Harrington, and Kabrhel**, titled "Environmental and genetic risk factors associated with venous thromboembolism." and discovered that the incidence is almost 18% more in men than in women.

This finding also lined with **Beckman, et al, (2019)** who reported that throughout the reproductive years, males have a little higher total incidence rate than females.. While, it is contradicted by The study performed by **Roach et al. (2018)** was titled "Sex difference in risk of second but not of first venous thrombosis: paradox explained." demonstrated that rates for

women are somewhat higher than those for men. Furthermore, **Lee et al. (2015) in Korea** observed that the gender of the female was associated with an increased risk of postoperative DVT development .

**Related to previous medical history** this study found that hypertension and arthritis were the most common risk variables in the majority of the studied and controlled patients. The result was consistent with **Huang, Li, and Jiang's (2016)** findings that the majority of the patients within study had hypertension and that there was a significant association between the development of DVT and hypertension.

**In relation to mobility,** this study showed majority of controlled and studied patients experience a very restricted mobility. This result agreed with **Kaya , Bilik & Solmaz., (2023)** who they reported that "after orthopedic surgery, most patients become very dependent and need help. Immobilization significantly increases the potential risk of DVT, especially in major surgery patients. From researcher's point of view, immobility causes blood stasis and increases the formation of blood clots, increasing the risk of DVT.

**In respect to trauma risk damage,** most patients in both groups suffered injuries to their lower limbs**.** This finding was supported by **Chu & Haga, (2015)** who reported that hospitalized patients with trauma have the highest risk of venous thromboembolism (VTE), with a reported thirteen-fold increased risk of VTE over non-trauma patients. Patients with major lower limb trauma are approximately six times more likely than those with moderate trauma to have VTE during hospitalization.”. Result is contraindicated with the **Weiguang et al., (2022**) who revealed that "patients with acetabular and pelvic fractures are significantly more likely to develop DVT." and pharmacologic prophylaxis should be recommended in preoperative and inpatient DVT management", the Pelvic injuries increase the risk of developing DVT from intraoperative manipulations, which can lead to increased vascular injury and thrombus formation in patients with pelvic injuries.

**According to body mass index,** the majority of participants in the study and control groups were obese**.** In line with the study findings**, Lorenzet al. (2012)** stated that obesity is linked to pro-inflammatory and prothrombotic conditions, decreased blood velocity in the legs, elevated intra-abdominal pressure, and inactivity. All of these impacts are probably going to increase the chance of venous thromboembolism, which is defined as deep vein thrombosis (DVT) with or without pulmonary embolism (PE) complications. Additionally**, Lorenzet et al. (2012) and Klovaite, Benn, & Nordestgaard (2015)** discovered that there were "about twice as strong associations between BMI and waist circumference and VTE vs. CHD and somewhat stronger associations between PE and DVT**.**

**Regarding chronic diseases**; Most of the study participants and the control group had chronic heart disease. **Tang et al. (2016)** conducted a study titled "Heart failure and risk of venous thromboembolism: a systematic review and meta-analysis," which supports the findings of the current study by reporting that "Reduced heart function with symptoms of congested lungs, fluid and water retention, rapid or irregular heartbeats as a result of congestive heart failure has recently been determined to be an independent risk factor for venous thromboembolism." A meta-analysis also revealed that hospitalized heart failure patients had a higher incidence of VTE among Asians.

**Regarding DVT manifestation** The current study's findings in the calf and thigh muscles showed that there was a statistically significant difference between the study and control groups with respect to DVT signs and symptoms in the calf and thigh muscles, including pain, tenderness, warming, swelling, and absence of signs; similarly, there was a statistically significant difference between the two groups with regard to the presence of cramping, swelling, and tenderness in the thigh muscles. The findings of the current study were supported by **Patel, Chun, and Brenner's (2019) report,** which said that "Deep vein thrombosis (DVT) typically causes pain and limb edema; however, in a given patient, symptoms may be present or absent, unilateral or bilateral, mild or severe." A thrombus that does not result in a blockage of the vein's outflow is frequently asymptomatic**.**

## Conclusion

The majority of the studied nurses had inadequate performance levels (knowledge and practice) with regard to preventing DVT among patients following major orthopedic surgery, according to the current study's findings. On the other hand, when the educational program was implemented, orthopedic nurses' performance levels for DVT prevention were statistically considerably higher. Additionally, the study's conclusions demonstrated that implementing a nursing education program to prevent DVT was statistically significantly effective in improving patient outcomes, such as lowering the incidence of DVT in study group patients undergoing major orthopedic surgery compared to control group patients.

## Recommendations

-The orthopedic hospital administrative system should offer DVT prevention policy and guidelines to raise nurses' knowledge of DVT as a critical issue.

- Orientation training sessions about preventing DVT should be offered.

-Sufficient equipment and facility supplies to improve the application of DVT prevention guidelines

-Additional study should be conducted with larger numbers of participants gathered from various regions of Egypt.

-All patients having major orthopedic surgery should have access to and be given a DVT prevention health education brochure.

## References:

**Ahmed, M. H., Moubarak, M. A., & Ghanem, H. M. (2015).** Developing Nursing Care Standards for Venous Thromboembolism (VTE) for Patients with Orthopedic Surgery. Assiut Scientific Nursing Journal, 3(5), 49-58.

**Anthony, M. (2013).** Nursing assessment of deep vein thrombosis. Medsurg Nurs, 22(2),9598.

**Antony, A. M., Moly, K. T., & Dharan, D. (2016).** Assessment of knowledge and self reported clinical practice on prevention of Deep Vein Thrombosis (DVT) among staff nurses. Journal of Nursing and Health Science, 5(1), 18-24.

**Attia, A., Ali, H., Al Amory, M., & Othman, H. (2015)**. Thromboprophylaxis does not prevent venous thromboembolism after major surgery. Egyptian Journal of Chest Diseases & Tuberculosis, 64(1), 249-254.

**Autar, R**. (2003). The management of deep vein thrombosis: the Autar DVT risk assessment scale re-visited. *Journal of Orthopaedic Nursing*, *7*(3), 114-124.

**Beckman, M. G., Hooper, W. C., Critchley, S. E., & Ortel, T. L. (2019).** Venous thromboembolism: a public health concern. American journal of preventive medicine, 38(4), S495-S501.

**Bhatti, A. M., Ahsin, S., Salim, B., & Mansoor, J. (2012).** Knowledge, attitude and practices of healthcare providers towards deep vein thrombosis prophylaxis in five teaching hospitals of Rawalpindi. Journal of Ayub Medical College Abbottabad, 24(2), 136-139.

**Chan, C. M., & Shorr, A. F.** (2010). Venous thromboembolic disease in the intensive care unit. In *Seminars in respiratory and critical care medicine* (Vol. 31, No. 01, pp. 039-046). © Thieme Medical Publishers.

**Chu, C. C., & Haga, H. (2015).** Venous thromboembolism associated with lower limb fractures after trauma: dilemma and management. Journal of Orthopaedic Science, 20, 364-372.

**Collins, R., MacLellan, L., Gibbs, H., MacLellan, D., & Fletcher, J.** (2014). Venous thromboembolism prophylaxis: The role of the nurse in changing practice and saving lives. *Australian Journal of Advanced Nursing, The*, *27*(3), 83-89.

**Crous-Bou, M., Harrington, L. B., & Kabrhel, C. (2016, November).** Environmental and genetic risk factors associated with venous thromboembolism. In Seminars in thrombosis and hemostasis (Vol. 42, No. 08, pp. 808-820). Thieme Medical Publishers. **Dai, W. L., Lin, Z. M., Shi, Z. J., & Wang, J. (2020).** Venous Thromboembolic Events after Total Knee Arthroplasty: Which Patients Are at a High Risk?. The journal of knee surgery, 33(10), 947-957.

**D'Alesandro, M. (2016).** Focusing on lower extremity DVT. Nursing2022, 46(4), 28-35.

**Das, S., Sahoo, A., & Swain, R. (2014).** Effectiveness of the planned teaching program on deep vein thrombosis among the staff nurses of selected hospital. IOSR Journal of Nursing and Health Science, 3(1), 48-51.

**Dawooda T.(2010)** Esablishing Basic Standards of Nursing Care for faciomaxillary patients Undergoing Surgeries Pp. (76);

**Eldosoky, E. I. (2008).** Effect of a training program for nurses about preventive measures of deep vein thrombosis. Dectorate thesis, Faculty of nursing.faciomaxillary patients Undergoing Surgeries Pp. (76); 2010

**Flevas, D. A., Megaloikonomos, P. D., Dimopoulos, L., Mitsiokapa, E., Koulouvaris, P., & Mavrogenis, A. F**. (2018). Thromboembolism prophylaxis in orthopaedics: an update. *EFORT open reviews*, *3*(4), 136-148..

**Francis, C. W.** (2013). Prevention of VTE in patients having major orthopedic surgery. *Journal of thrombosis and thrombolysis*, *35*, 359-367.

**Huang, L., Li, J., & Jiang, Y. (2016).** Association between hypertension and deep vein thrombosis after orthopedic surgery: a meta-analysis. European journal of medical research, 21(1), 1-7.

**Huang, Y., Ge, H., Wang, X., & Zhang, X. (2022).** Association Between Blood Lipid Levels and Lower Extremity Deep Venous Thrombosis: A Population-Based Cohort Study. Clinical and Applied Thrombosis/Hemostasis, 28, 10760296221121282.

**Kaya Ç, Bilik Ö, & Solmaz P (2023):** Determination of Deep Vein Thrombosis Risk in Patients Staying in an Orthopedics and Traumatology Clinic. J Basic Clin Health Sci 2023; 7: pP .235-244.

**Khalid, A., Ahmed, H., Abdulaziz, A., Alharbi, K. G., Alangari, H. S., Mohammed, A., ... & Wedad, A. (2021).** Efficacy and Safety of Thromboprophylaxis Post-Orthopedic Surgery. Cureus, 13(11)

**Klovaite, J., Benn, M., & Nordestgaard, B. G. (2015).** Obesity as a causal risk factor for

deep venous thrombosis: a M endelian randomization study. Journal of internal medicine, 277(5), 573-584.

**Lau, B. D., Shaffer, D. L., Hobson, D. B., Yenokyan, G., Wang, J., Sugar, E. A., ... & Haut, E. R. (2017)**. Effectiveness of two distinct web-based education tools for bedside nurses on medication administration practice for venous thromboembolism prevention: a randomized clinical trial. PLoS One, 12(8), e0181664.

**Lavall, K. A. (2014).** Increasing public awareness of venous thromboembolism through social media.

**Lee, J. A., Grochow, D., Drake, D., Johnson, L., Reed, P., & van Servellen, G. (2014).** Evaluation of hospital nurses' perceived knowledge and practices of venous thromboembolism assessment and prevention. Journal of Vascular Nursing, 32(1), 18-24.

**Lee, S. Y., Ro, D. H., Chung, C. Y., Lee, K. M., Kwon, S. S., Sung, K. H., & Park, M. S. (2015).** Incidence of deep vein thrombosis after major lower limb orthopedic surgery: analysis of a nationwide claim registry. Yonsei medical journal, 56(1), 139-145.

**Long, J. B. (2009).** Venous thromboembolism: pharmacological and nonpharmacological interventions. Journal of Cardiovascular Nursing, 24(6), S8-S13.

**Lorenzet, R., Napoleone, E., Cutrone, A., & Donati, M. B. (2012)**. Thrombosis and obesity: cellular bases. Thrombosis research, 129(3), 285-289.

**McFarland, L., Murray, E., Harrison, S., Heneghan, C., Ward, A., Fitzmaurice, D., & Greenfield, S. (2014).** Current practice of venous thromboembolism prevention in acute trusts: a qualitative study. BMJ open, 4(6), e005074.

Mohamed M. R., AboZead, S. E. S., Yousef, A. O., & Taha, S. H. (2021). Effect of implementing nursing educational protocol on reducing deep venous thrombosis among orthopedic surgery patients. Minia Scientific Nursing Journal, 9(1), 111-117.

**Mohamed, A., Othman, W., El Alphy, B., & Sheble, A. (2017).** Effect of Implementing Nursing Care Guidelines on the Occurrence of Deep Vein Thrombosis among Orthopedic Patients. IOSR Journal of Nursing and Health Science, 6(3), 28.

**Mohammed, A. S., Taha, N. M., & Abdel-Aziz, E. M. (2018).** Nurses' performance regarding venous thromboembolism prophylaxis at intensive care unit. *Zagazig Nursing Journal*, *14*(1), 1-17.

**Parker, K., & Thachil, J. (2018).** The use of direct oral anticoagulants in chronic kidney disease. British journal of haematology, 183(2), 170-184.

**Patel, K. K., Chun, L. J., & Brenner, B. E. (2019).** What are the signs and symptoms of deep venous thrombosis (DVT)?

**Roach, R. E., Lijfering, W. M., Rosendaal, F. R., Cannegieter, S. C., & le Cessie, S. (2018).** Sex difference in risk ofsecond but not of first venous thrombosis: paradox explained. Circulation, 129(1), 51-56.

**Sahu, R., Menon, S., Anik, S., Rai, A., (2017).** A study to assess the effectiveness of planned teaching program on knowledge and clinical practice regarding Deep Vein Thrombosis among B. Sc. Nursing intern's working in Jawaharlal Nehru Hospital and Research Centre Bhilai (C.G.) Int. J. Nur. Edu. and Research.; 5(3): 272-278.

**Schellack, G., Modau, T., & Schellack, N. (2016).** Clinical overview of venous thromboembolism. South African Family Practice, 58(1), 39-45.

**Shaaban, A. E. (2021).** Effect of nursing care protocol on deep vein thrombosis

occurrence among critically neurological patients. Port Said Scientific Journal of Nursing, 8(1), 206-225.-

**Songwathana, P., Promlek, K., & Naka, K. (2011).** Evaluation of a clinical nursing practice guideline for preventing deep vein thrombosis in critically ill trauma patients. Australasian Emergency Nursing Journal, 14(4), 232-239.

**Susanto, A. P., Krisnanda, C., Tan, D. S., Ong, H. Y., Pratama, D., &Soeparwata, R. (2014)**.Incidence of venous thromboembolism among patients who underwent major surgery in a public hospital in Singapore. Medical Journal of Indonesia, 23(1), 36-41.

**Tang, L., Wu, Y. Y., Lip, G. Y., Yin, P., & Hu, Y. (2016).** Heart failure and risk of venous thromboembolism: a systematic review and meta-analysis. The Lancet Haematology, 3(1), e30-e44.

**Tang, Y., Wang, K., Shi, Z., Yang, P., & Dang, X. (2017).** A RCT study of Rivaroxaban, low-molecular-weight heparin, and sequential medication regimens for the prevention of venous thrombosis after internal fixation of hip fracture. Biomedicine & Pharmacotherapy, 92, 982-988.

**Weiguang Z, Jianlong Z, Tiantian L, Zhenwu L, Li L., & Yingze Z. (2022):** Incidence and risk factors of preoperative deep venous thrombosis following pelvic and acetabular fractures: a retrospective case–control study. Journal of Orthopedic Surgery and Research (2022) 17:77 https://doi.org/10.1186/s13018-022-02972-2

**White, R. H. (2018).** The epidemiology of venous thromboembolism. Circulation, 107(23_suppl_1), I-4

**Xu, Y., Zhao, J., & Chen, Y. (2018).** Prevention of venous thromboembolism in patients undergoing major orthopedic surgery in China: a qualitative study of patients' perceptions. Journal of orthopaedic surgery and research, 13(1), 1-5.

**Yu, H. T., Dylan, M. L., Lin, J., & Dubois, R. W. (2007).** Hospitals' compliance with prophylaxis guidelines for venous thromboembolism. American Journal of Health-System Pharmacy, 64(1), 69-76.