Nurses' Knowledge and Practices Regarding Venous Thromboembolism Preventive Measures among Post Total Hip and Knee Arthroplasty Patients

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Abstract

Background: Venous Thromboembolism (VTE) is a major threatening health issue worldwide, in which nurses play a critical role in identifying, preventing, and caring for especially in total hip and knee arthroplasty patients. **Aim of the study:** Assess nurses' knowledge and practice regarding venous thromboembolism preventive measures among post total hip and knee arthroplasty patients. **Design:** A descriptive design was utilized in this study. **Setting:** The present study was carried out at orthopedic departments in Suez Canal University Hospitals. **Sample:** A comprehensive sample of 80 staff nurses who were working at the previously mentioned settings. **Tools of data collection:** The data were collected using two tools named Nurses' knowledge regarding VTE preventive measures in post total hip and knee arthroplasty patients structured questionnaire and Observational checklist to assess nurses' practices regarding VTE preventive measures in post total hip and knee arthroplasty patients. **Results:** The majority of the studied nurses (97.5 % & 85 %) had an unsatisfactory level of knowledge and poor level of practice respectively regarding VTE preventive measures. **Conclusion:** Unsatisfactory level of knowledge was prominent in almost all the studied nurses especially the married, and a prominent poor level of practice was among newly hired nurses less than three years of working experience. **Recommendations:** Enhancing nurses' awareness about VTE preventive measures by applying educational guidelines and providing educational materials.

Keywords: Arthroplasty, Knowledge, Practice, Preventive measures, Venous thromboembolism.

1. Introduction

Venous thromboembolism (VTE) is a critical medical condition that involves the formation of a thrombus, or blood clot, within the veins of the systemic venous system, often in the lower limbs, abdomen, or pelvis. This thrombus can travel to the pulmonary arterial system, leading to a potentially life-threatening pulmonary embolism. The two most common forms of VTE are deep venous thrombosis (DVT) and pulmonary embolism (PE) **(Hong et al., 2021).** VTE represents a major global health challenge, with approximately 20% of individuals diagnosed with this condition

dying within a year. In Western countries, about 8% of people will experience VTE at some point in their lives **(Lutsey & Zakai, 2023).** In the United States alone, there are around 1.2 million cases of VTE annually, and the condition affects more than ten million people worldwide each year **(Barco et al., 2021)**

Hospitalization is a particularly high-risk period for developing VTE, with studies showing that 40% to 60% of VTE cases occur during or within three months following a hospital stay. The risk of VTE during hospitalization increases nearly 100-fold, largely due to a combination of underlying health conditions and prolonged immobility **(Lutsey & Zakai, 2023).**

For patients who undergo knee arthroplasty, the incidence of VTE, including both DVT and pulmonary embolism, ranges between 0.45% and 5.30%. In cases of total hip arthroplasty, the incidence ranges from 0.24% to 1.60% **(Kim et al., 2017; Shahi et al., 2018).** VTE is notably the fifth most common cause of unplanned hospital readmissions following surgery and ranks as the third most common cause among patients undergoing total hip and knee arthroplasties **(Barco et al., 2021).**

Preventing VTE in patients who have had total hip or knee arthroplasties is essential for optimizing patient outcomes and reducing healthcare costs. Effective preventive strategies include the use of anticoagulant therapy, compression stockings, and promoting early mobilization. These measures are vital in significantly lowering the risk of VTE and its potential complications **(Nemeth et al., 2021).** Nurses play a fundamental role in the prevention and management of VTE. Their responsibilities include detecting early signs of VTE, using standardized assessment tools, implementing preventive measures, and educating patients about the importance of early ambulation following surgery **(Porfidia et al., 2019; Lazure et al., 2019; Ahmed et al., 2021).**

Despite the critical role nurses play and existence of prophylaxis guidelines, there are still significant challenges in VTE management. The implementation of these guidelines into everyday clinical nursing practice remains difficult. Research indicates that many hospitalized patients do not receive appropriate VTE preventive measures, which can adversely affect patient safety and outcomes **(Al-Mugheed et al., 2023).** Furthermore, the absence of clear guidelines for VTE prophylaxis and concerns about bleeding risks contribute to these challenges. Addressing these gaps in knowledge and practice among nurses, especially for those

caring for patients undergoing total hip and knee arthroplasties, is crucial for improving patient outcomes and reducing the substantial economic impact of VTE. The annual costs of VTE are estimated at $7–10 billion in the United States and €1.5–2.2 billion in the European Union **(Oleksiuk-Bojko et al., 2023).**

2.Aim of the study:

This study aimed to assess nurses' knowledge and practice regarding venous thromboembolism preventive measures among post total hip and knee arthroplasty patients.

Objectives:

1. Assess nurses' knowledge regarding VTE preventive measures among post total hip and knee arthroplasty patients.
2. Assess nurses' practice regarding VTE preventive measures among post total hip and knee arthroplasty patients.

3. Subject and Methods:

A descriptive design was applied in this study. The study sample was comprehensive sample composed of eighty orthopedic nurses were recruited for this study. The study was carried out at the orthopedic departments in Suez Canal University Hospitals in Ismailia governorate.

Tools of data collection:

Tool (I): A structured self-administered questionnaire: It was adapted from **(Khalil, Elshatby & Eweda, 2021)** with total items of 34. These items were multiple choice questions with one or more than one correct answer. It was written in Arabic to suit the nature of the study. It consisted of three parts:

Part 1: It included orthopaedic nurses' profile, this part used to assess demographic characteristics of orthopaedic nurses and contained six items as nurses' age, gender, marital status, educational level, years of experience in orthopaedic surgery department and previous attendance of VTE Prevention Training Program.

Part 2: Nurses' knowledge about VTE which included 15 main items about: characteristics of veins, names of leg veins, definition of VTE, three Virchow's triad, definition of DVT, definition of pulmonary embolism, common site of VTE, risk factors of VTE, signs and symptoms of VTE, lab investigation required for VTE diagnosis, important diagnostic test required for VTE diagnosis, complications of DVT, chemical prophylaxis of VTE, mechanical prophylaxis of VTE and nursing interventions to prevent VTE.

Part 3: It included orthopaedic nurses' knowledge about anticoagulant therapy which included 13 main items about anticoagulant's;

mechanism of action, indications, examples, routes of administration, prophylaxis dose of anticoagulants administration, safety precautions for injection, storage, contraindications, most dangerous side effect warning signs, medications that interact with, monitoring requirements for patients who receive anticoagulant therapy, health teaching for patient and their families regarding safety implications to prevent complications of anticoagulant therapy and nursing intervention for patients who receive anticoagulants.

Scoring system of tool, I (part 2 & 3): -

The nurse knowledge was scored through a three-point Likert scale, where a score of 2 was given to each correct and complete answers, a score of 1 was given for each correct incomplete answer and a score of 0 was given for each wrong or no answer. Then the score of the items were summed and the total was divided by the number of items given a mean score for the part. These scores were converted into a percent score and classified as: satisfactory knowledge was equal to or more than 75% score and unsatisfactory knowledge was below 75% score **(Khalil, Elshatby & Eweda, 2021).**

Tool (II): Nurses' practice observational checklist: It was adapted **from (Khalil, Elshatby & Eweda, 2021)** and consisted of 68 nursing actions in five dimensions of nursing practices of VTE prevention. The first dimension was monitoring and observing patient for development of VTE which included; regularly assessing patient's DVT risks (five steps), and observing the patients regularly for presence of signs and symptoms of DVT or PE per shift (five steps). The second-dimension was physical therapy to prevent VTE a total of (30 steps) divided to; (three steps) encouraging patients for early ambulation gradually, (nine steps) following the principles of using assistive devices as walker, (four steps) applying safety measures to avoid injury during patient's movement, (eight steps) performing post-operative range of motion (ROM) exercise to non-affected part per shift, and (six steps) encouraging patients to perform post-operative isometric exercise to affected part per shift.

The third-dimension was assessing nurse practice regarding administering anti-coagulant therapy (ten steps). The fourth-dimension was other therapies composed of; adequate hydration of patients (one step), applying anti-embolism stocking (four steps), and applying intermittent pneumatic compression (IPC) devices (three steps). The fifth-dimension was providing patient and

their family health education. It was covered through 10 nursing teaching items about risks and prevention of deep vein thrombosis (five items), and discharge plan which includes: VTE prophylaxis prescribed at discharge including intended duration, compliance with medications, ongoing monitoring and follow up requirements, taking medication with schedule, and instruct patient about activity of daily living after discharge (five items).

Scoring system of tool II:

In relation to nurses' practices each nurse performance was scored through 2 points rating scale as, done (1) and not done (0). For each score of practices, the scores of the items were summed up, and the total was divided by the number of items, given a mean score for the part. These scores were converted into a percent score and classified according to **(Khalil, Elshatby & Eweda, 2021)** as the following : Good practices: >75-100%, fair practices: 50-75% and poor practices: 0 <50%.

Field of work:

Data collection of this study was carried out over a six-months period that started from December, 2022 to end of May, 2023. At the orthopedic inpatient department of Suez Canal University hospital, the researcher existed three days a week throughout the long shift at different schedule to collect knowledge and practice from participated nurses. Data collection was conducted through two phases (interviewing and assessment phase) .

Interviewing phase- :

At the orthopedic inpatient department of Suez Canal University hospital, the researcher introduced himself to nurses then explained the purpose and nature of the study, ensuring confidentiality and providing written consent. This phase involved 2 minutes before data collection in assessment phase.

Assessment phase :

After interview phase nurses were asked to complete the (tool 1) a structured self-administered questionnaire about VTE prevention that required 15-20 minutes to complete. It was necessary to be present in the orthopedic units during long shift at different schedule to observe nurses and complete the observational checklists regarding preventive measures of VTE in post total hip and knee arthroplasty patients. The researcher observed orthopedic nurses' practices through observational checklists more than one time and took the highest degree.

Pilot study:

A pilot study was carried out on 10% (8 nurses) of the sample before actual data collection. The purpose of the pilot study is to test the applicability and ensure clarity of the tools. According to the results of the pilot study, items were corrected, modified, omitted, or rearranged. It also helped in estimating the time needed for interviews and evaluating the appropriate sitting to perform the interview. Nurses involved in pilot study were excluded from the study sample to ensure the stability of answers.

Ethical considerations:

The study was conducted after the approval of the Research Ethics Committee (REC) in the faculty of nursing Suez Canal University by code 164 on date 13/9/2022. Official permission was obtained from the directors of the Suez Canal University Hospitals. The agreement for participation of orthopedic nurses was taken after explaining the aim and nature of the study. Assuring the orthopedic nurses that participation in the study is voluntary, also they were assured that the information would renowned confidentiality and was used for the research purpose only, and they have the right to refuse participation and withdrawal from the study at any time.

Statistical design:

Collected data was arranged, coded, and analyzed using Statistical Package for the Social Sciences (SPSS version 29) program. Proper statistical tests were used to determine whether there was a significant statistical difference between variables of the study.

4.Results

In the current study, it was found that 47.5% of the nurses were aged between 20 and 25, with a mean age of 25.18 ± 3.01 years. Regarding gender, 63.7% of the participants were female. In terms of education, 83.7% of the nurses had completed a technical institute. When considering professional experience, 51.2% of the nurses had one to less than three years of experience. As for marital status, 58.8% of the nurses were married, as shown in **Table 1.** The study also revealed that 81.3% of the nurses had not attended any previous courses on VTE preventive measures, while only 18.7% had attended such courses, as depicted in **Figure 1**.

Nurses' Knowledge Regarding VTE Preventive Measures:

The study results indicated that 97.5% of the nurses had an unsatisfactory level of knowledge regarding VTE preventive measures, while only 2.5% had a satisfactory level, as shown in **Figure 2**. Additionally, the

study found that 61.9% of nurses had correct but incomplete knowledge about VTE preventive measures, 24% had complete knowledge, and 14.1% had incorrect knowledge. The highest percentages of correct complete responses were related to the definition of DVT, PE, and VTE pathophysiology (63.8%, 62.5%, and 58.8%, respectively). The most frequent correct incomplete responses were for diagnostic tests and DVT complications (86.3%), followed by VTE risk factors (85%). The most common incorrect responses (42.5%) were related to mechanical prophylaxis of VTE, as presented in **Table 2.**

In relation to anticoagulant therapy, nurses provided correct and complete answers most frequently for identifying the most dangerous side effect, with a correct response rate of 66.3%. For correct but incomplete answers, the highest percentage (86%) was observed for identifying the different routes of anticoagulant therapy administration, as shown in **Table 3.**

Nurses' Practice Regarding VTE Preventive Measures:

The distribution of studied nurses according to their level of practices regarding VTE preventive measures in post total hip and knee arthroplasty patients clarified that, 85% of nurses level of practice was poor, 11.3% of nurses level of practice was fair while only 3.8% of nurses level of practice was good presented in **Figure (3)**

The average total nursing practice regarding VTE preventive measures was (52.5%). Moreover, (82.08%) of the studied nurses encouraging patients for early ambulation gradually followed by (63.54%) of the studied nurses perform post-operative range of motion exercise to non-affected part per shift while, (45.25%) of the studied nurses teaching the patient about discharge plan **Table (4).**

Relations Between Study Variables

Table (5) showed that there was a statistically significant difference between marital status and nurses' knowledge regarding VTE preventive measures as P value 0.03. **Table (6)** illustrated that there was statistically significant difference between years of nurses' experience and nurses' practices regarding VTE preventive measures as P value 0.022. **Table (7)** showed that there was no statistical significance correlation between total nurses' knowledge and practice regarding VTE preventive measures as P value = 0,810.

5.Discussion

Venous thromboembolism is among the top five utmost common vascular diseases in most

countries and involves the correlated diseases of pulmonary embolism and deep-vein thrombosis. However total hip and knee arthroplasty are effective treatments that enhance patients' life, it is highly linked to VTE suffering **(Bakhsh et al., 2023; Lutsey & Zakai, 2023).**

As regard to age, the present study revealed that nearly half of studied nurses aged from 20 to less than 25 years old. This finding agreed with **Ahmed, Ghanem & Khalil, (2020)**, in Assiut, Egypt who found in their study that half of the studied nurses' age was between 25 to less than 30 years old. In addition, **Al-Mugheed et al. (2023)**, in Nicosia, Cyprus who found in their qualitative study that half of the studied nurses ranged in age from 20 to 30 years old .

Meanwhile, this finding disagrees with **Wang et al. (2021),** in Beijing, China who found in their multicentric cross- sectional survey about that about less than one - quarter of the nurses' age ranged from 20-30 years old. This result could be an indicator that the nurses were in the early stages of their careers and the demographics of early-career nurses can be valuable for mentorship programs and tailored support .

As regards to gender, the current study revealed that, nearly two - thirds of the studied nurses were females. This finding was in harmony with **Alyousef et al. (2022),** in Dammam, Saudi Arabia who found that two thirds of the studied nurses were females. Also, this finding agreed with **Hebeshy et al. (2020),** in Ismailia, Egypt in their study that two- thirds of the studied nurses were females. This result could be due to the studying of nursing in Egypt were exclusive for females only till few years and societal expectations reinforced the idea that caregiving and nurturing roles were inherently feminine .

In relation to educational level, the current study revealed that more than three quarters of the studied nurses had graduated from technical institute of nursing. On the same line, these results were supported by **Ahmed et al. (2020),** in Assiut, Egypt who mentioned that three quarters of the studied nurses from the nursing institute. On the other hand, this finding disagreed with **Yan et al. (2021),** in Changzhou, China who found that more than three quarters of the studied nurses had bachelor's degree. This result may be due to that most bachelor nurses are working as supervisor or head nurse in the governmental hospitals, but technical nurses are working as bedside nurse. Moreover, most nurses working

in health facilities in Egypt are graduated from nursing institute, while the minorities of them graduated from faculties of nursing .

As regards nurses' years of experience, the current study revealed that half of the studied nurses had experience between 1-3 years. This result was consistent with **Kiflie et al. (2022),** in Gondar, Ethiopia who found that more than half of the studied nurses had less than 5 years of experience. On the other hand, this finding disagreed with **Yan et al. (2021),** who found that more than one - third of the studied nurses had experience between 5-9 years. This finding could be due to the studied nurses were relatively early in their nursing careers, recently graduated and have gained a low level of experience. Moreover, the most experienced nurses leave their career and travel abroad for work.

Concerning attendance of training courses, the current study revealed that more than three quarters of the studied nurses did not attend previous courses regarding VTE preventive measures. This result was compatible with **Zhou et al. (2019),** whose results revealed that three quarters of the studied nurses didn't receive any training courses about VTE and its prevention. This result may be related to a lack of training courses opportunities as the training may be available for some nurses and not available for others, workload, and shortage of staff. beside that, it may be attributed to nurse's early carrier and low clinical experience.

The present study revealed that the overall nurses' knowledge regarding VTE preventive measures in post total hip and knee arthroplasty patients were unsatisfactory very low. This finding was supported by **Wang et al. (2021) and Ibrahiem, Salah & Mohamed, (2019),** in China and Egypt respectively, both of them reported that about more than three quarters of the studied nurses had unsatisfactory level of knowledge. On the contrary **Silva et al. (2020),** in São Paulo, Brazil who founded that the majority of the staff had good knowledge about VTE. This result could be related to heavy workloads and burnout which can divert nurses' attention away from self-directed learning and professional development, in addition finding time for educational pursuits becomes challenging .

The study found that over half of the nurses had incomplete knowledge about the mechanism, indications, examples, and administration routes of anticoagulant therapy, likely due to their role in following physician orders rather than making medication decisions. This aligns with **Parveen, Masih, and Afzal (2023**) in Pakistan, who also found

poor nurse knowledge about anticoagulant therapy. However, two-thirds of the nurses had good knowledge of the therapy's dangerous side effects and monitoring requirements, consistent with **Gao et al. (2021**) in China. This contrasts with **Yesuf et al. (2021**) in Ethiopia, who reported poor awareness of anticoagulant side effects among nurses.

This study found that nearly two-thirds of nurses had correct but incomplete knowledge about vein characteristics, VTE risk factors, complications of DVT, and preventive interventions, with gaps in understanding mechanical prophylaxis and key diagnostic tests. **Yan et al. (2021)** similarly reported that two-thirds of their nurses lacked general VTE knowledge, a finding echoed by **Yohannes et al. (2022)** in Ethiopia, where more than half of the nurses were found to be inadequately informed about VTE. The lack of continuing education and the nurses' technical training background may contribute to this knowledge gap. However, this contrasts with **Al-Mugheed & Bayraktar (2018),** who found that most nurses in Riyadh had good knowledge of VTE, including its signs, symptoms, diagnostic tests, and mechanical prophylaxis.

Concerning nurses' total level of practices regarding VTE preventive measures in post total hip and knee arthroplasty patients; the present study revealed that more than three - quarters of the studied nurses had a poor level of practice. This finding was in identical line with **Taha & Ibrahim, (2021),** and **Mohammed, Taha and Abdel-Aziz, (2018),** in Benha, and Zagazig governorates in Egypt respectively, founded that more than three - quarters of the staff had poor level of practice about prevention of VTE. This could be due to high nurse-to-patient ratios and staffing shortages which can lead to increased workload and stress and nurses may struggle to provide optimal care, impacting the quality of their practice. Additionally, indicates inadequate access to necessary resources and lack of implementation of VTE protocol in orthopedic units.

While this finding was contradicted with the study done by **Songwathana, Promlek and Naka, (2015),** in Songkhla, Thailand who reported that studied nurses had good level of practice about prevention of DVT.

As regards the relationship between overall knowledge and personnel profile of the studied nurses, the present study showed that there was statistically significant difference between marital status and nurses' knowledge regarding VTE. This could be attributed to higher levels of stress and burnout of married women,

especially if they are managing both professional and family responsibilities. Additionally, married nurses may face time constraints due to family responsibilities and commitments, which could limit the time available for continuous learning and professional development.

This finding supported by **Khalil, Elshatby and Eweda, (2021),** in Alexandria, Egypt who mentioned that there were statistically significant differences between marital status and the overall nurse's knowledge. While this disagreed with **Ahmed, Ghanem and Khalil, (2020),** who reported that there were no statistically significant differences between marital status and the overall nurse's knowledge .

Concerning the relation between overall practice and personnel profile of the studied nurses, this study revealed that there was statically significant difference between overall nurses' practice level and years of experience and nurses' practices regarding VTE preventive measures. The findings highlighted that the number of years of experience is a significant factor influencing nurses' practice levels in addition, the relationship between professional experience and the quality of nursing practice.

This finding was supported **by El-gendy, Mahmoud and Omran, (2022),** in Benha, Egypt who stated that there was statistically significant difference between overall nurses' practice level and years of experience. On the contrary **Yesuf, et al. (2021),** who documented that there was no significant statistical relationship between nurses' total level of practice and years of experience.

As regards, correlation between overall nurses' knowledge and practice regarding VTE preventive measures in post total hip and knee arthroplasty patients; the current study result showed that, there was no statistical significant correlation between total nurses' knowledge and practice regarding VTE preventive measures. These results supported with **Mohammed, Taha and Abdel-Aziz, (2018),and Antony, Moly and Dharan, (2016)** in Egypt, and India respectively mentioned that there were no statistical significance correlation between total nurses' knowledge and practice regarding VTE Prophylaxis. this indicates that level of knowledge was not the driving force to adhere VTE preventive measure, As well as high workload and lack motivation to apply VTE preventive measures.

While these findings contradicted with the study conducted by **Khalil, Elshatby and**

Eweda, (2021), who mentioned there was moderate positive correlation between nurses' knowledge and practice.

6.Conclusion:

In the light of the current study results, it can be concluded that most of the nurses had an unsatisfactory level of knowledge and poor practice regarding VTE preventive measures. The current study showed that there was no statistical correlation between nurses' knowledge and practice regarding VTE preventive measures.

7.Recommendations:

- Establish a system for continuous monitoring and evaluation of nurses' practices related to preventive measures for VTE to identify areas for improvement and ensure adherence to established guidelines and protocols.
- Develop comprehensive educational programs to enhance nurses' knowledge about VTE preventive guidelines enhanced with posters and reference educational martials.

Table (1): Percentage distribution of the studied nurses according to their personnel profile (n=80)

Personal profile	Total Sample (n=80)	
	N	%
Age (Years)		
20:<25	38	**47.5**
25:<30	35	43.8
30:<35	7	8.7
Mean ±SD	**25.18±3.01**	
Gender		
Male	29	36.3
Female	51	**63.7**
Education		
Secondary nursing diploma	8	10
Technical institute	67	**83.7**
Bachelor's degree in nursing	5	6.3
Experience		
1-<3	41	**51.2**
3-<6	30	37.5
6-<9	5	6.3
≥9	4	**5**
Marital status		
Single	30	37.5
Married	47	**58.8**
Widowed	3	3.7

Figure (1): Distribution of studied nurses regarding previous courses received about VTE preventive measures (n=80).

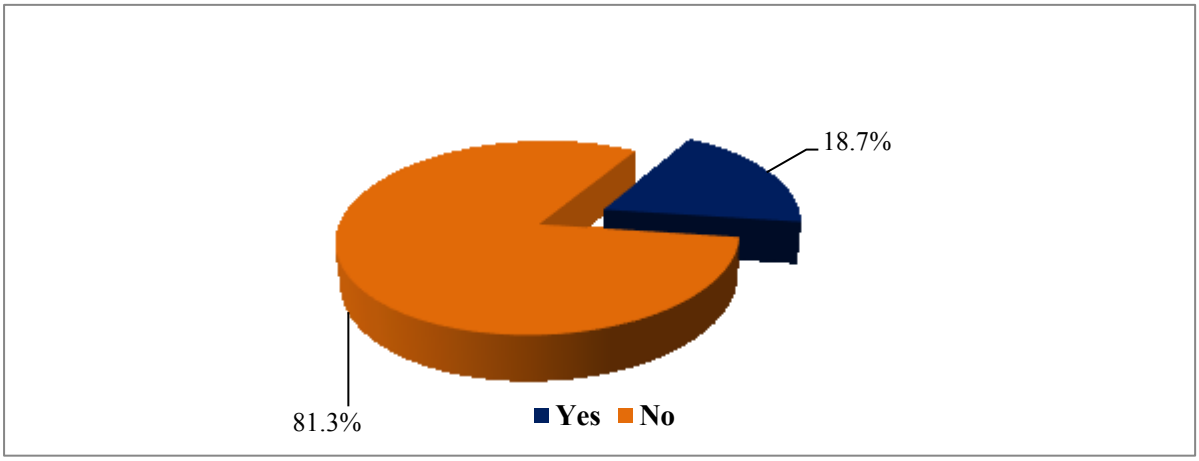

Table 2: Percentage distribution of studied nurses according to their knowledge regarding VTE preventive measures (n=80)

Nurses' knowledge	Correct /complete		Correct /incomplete		Incorrect	
	N	%	N	%	N	%
Physiology of veins	10	12.5	65	**81.3**	5	6.2
Anatomy of leg veins	10	12.5	65	**81.3**	5	6.2
Definition of VTE	16	20.0	54	**67.5**	10	12.5
Three major pathophysiologic determinates of VTE proposed by Virchow	47	**58.8**	20	25.0	13	16.2
Definition of DVT	51	**63.8**	18	22.5	11	13.7
Definition of Pulmonary Embolism	50	**62.5**	17	21.3	13	16.2
Most common site of VTE	8	10.0	62	**77.5**	10	12.5
Risk factors of VTE	4	5.0	68	**85.0**	8	10.0
Signs and symptoms of VTE	18	22.5	53	**66.3**	9	11.2
Most important lab investigation required for VTE diagnosis	19	23.8	45	**56.2**	16	20.0

Most important diagnostic test required for VTE diagnosis	4	5.0	69	**86.3**	7	8.7
Complications of DVT	2	2.5	69	**86.3**	9	11.2
Chemical prophylaxis of VTE	7	8.8	62	**77.5**	11	13.7
Mechanical prophylaxis of VTE	30	37.5	16	20.0	34	**42.5**
Nursing intervention to prevent VTE	12	15.0	60	**75.0**	8	10.0
Composite percentage	**24**		**61.9**		**14.1**	

Table 3: Percentage distribution of studied nurses according to their knowledge regarding anticoagulant therapy (n=80).

Nurses' knowledge	Correct /complete		Correct /incomplete		Incorrect	
	N	%	N	%	N	%
Mechanism of action of anticoagulant therapy	13	16.2	60	75.0	7	8.8
Indications of anticoagulant therapy	4	5.0	68	85.0	8	10.0
Examples for antithrombotic drugs	3	3.8	68	85.0	9	11.2
Different routes of anticoagulant therapy administration	4	5.0	69	86.3	7	8.7
Routes of prophylaxis dose of anticoagulants administration	17	21.2	53	66.3	10	12.5
Safety precautions for anticoagulant injection storage	22	27.5	49	61.3	9	11.2
Contraindications for anticoagulants administration	37	46.3	34	42.5	9	11.2
Most dangerous side effect of anticoagulant therapy	53	66.3	15	18.7	12	15.0
Warning signs of anticoagulant should be contact with medical staff	38	47.5	35	43.8	7	8.7
Medications that interact with anticoagulant therapy	0	0	25	31.2	55	68.8

Monitoring requirements for patients who receive anticoagulant therapy	44	55.0	26	32.5	10	12.5
Health teaching regarding safety implications to prevent complications of anticoagulant therapy	11	13.7	62	77.5	7	8.8
Nursing instructions for patients who receive anticoagulants, and their families	41	51.3	34	42.5	5	6.2
Average percentage	**27.6%**		**57.5%**		**14.9**	

Figure (2): Distribution of studied nurses according to their levels of knowledge regarding VTE preventive measures (n=80).

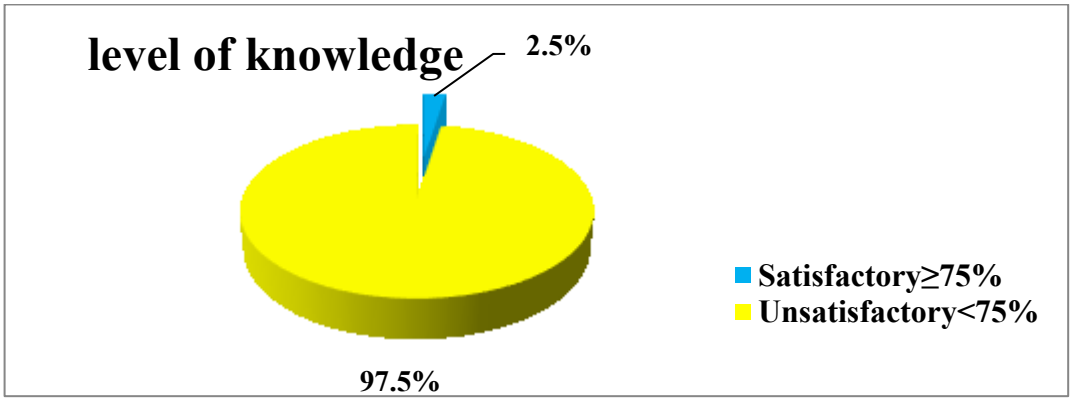

Figure (3): Distribution of studied nurses according to their level of practices regarding VTE preventive measures in post total hip and knee arthroplasty patients (n=80).

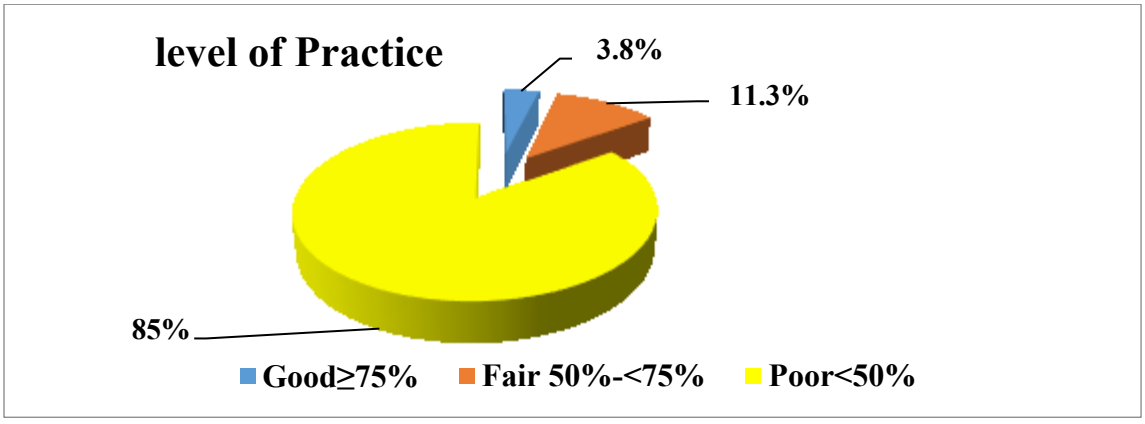

Table (4): Composite percentage of the studied nurses' practices regarding VTE preventive measures (n=80).

Nurses' practices regarding VTE preventive measures	Average percentage (%)
The first dimension was monitoring and observing patient for development of VTE	
Assessing patient's DVT risks regularly.	11.25
Observing the patients regularly for presence of signs and symptoms of DVT / PE per shift.	13.5
The second-dimension was physical therapy to prevent VTE	
Encouraging patients for early ambulation gradually.	**82.08**
Following the principles of using assistive devices (walker).	11.81
Applying safety measures to avoid injury during patient's movement.	19.25
Performing post-operative ROM exercise to non-affected part per shift	**63.54**
Encouraging patient to perform post-operative isometric exercise to affected part per shift.	26.88
The third-dimension was assessing nurse practice regarding administering anti-coagulant therapy	
Assessing nurses practice regarding administering anti-coagulant therapy.	10.38
The fourth-dimension was other therapies	
Adequate hydration.	3.75
Applying of anti-embolism stocking.	20
Applying intermittent pneumatic compression (IPC) devices.	22.17
The fifth-dimension was providing patient and their family health education	
Providing information to patients and relatives about risks and prevention of DVT.	21
Teaching the patient about discharge plan.	**45.25**
Total practice	**52.5**

Table (5): Relation between personnel profile and nurses' knowledge regarding VTE preventive measures.

Nurses' profile	Knowledge				X^2(P value)
	Unsatisfactory		Satisfactory		
	N	%	N	%	
Age (Years)					
20:<25	37	97.4%	1	2.6%	4.89(.165) MC
25:<30	35	100.0%	0	0	
30:<35	6	85.7%	1	14.3%	

Gender					
Male	28	96.6%	1	3.4%	.168(1.000) F
Female	50	98.0%	1	2.0%	
Education					
Secondary nursing diploma	7	87.5%	1	12.5%	3.69(.310) MC
Technical institute	66	98.5%	1	1.5%	
Bachelor's degree in nursing	5	100.0%	0	0	
Experience (in years)					
1-<3	41	100.0%	0	0	3.42(.349) MC
3-<6	28	93.3%	2	6.7%	
6-<9	5	100.0%	0	0	
≥9	4	100.0%	0	0	
Marital status					
Single	29	96.7%	1	3.3%	**12.99 (.03*)** MC
Married	47	100.0%	0	0	
Divorced	2	66.7%	1	33.3%	
Receiving training courses on caring for VTE patients					
Yes	63	96.9%	2	3.1%	.473(1.000) F
No	15	100.0%	0	0	

X^2 is chi-square test, **MC** is Monte Carlo for Chi square test P value is significant <.05, F is fisher's exact test.

Table (6): Relation between personnel profile and nurses' Practice regarding VTE preventive measures.

Nurses' Profile	Practice						X^2(P value)
	Poor		Fair		Good		
	N	%	N	%	N	%	
Age (Years)							
20:<25	34	89.5	3	7.9	1	2.6	5.25(.241) MC
25:<30	30	85.7	4	11.4	1	2.9	
30:<35	4	57.1	2	28.6	1	14.3	
Gender							
Male	25	86.2	4	13.8	0	0	1.98(.416) MC
Female	43	84.3	5	9.8	3	5.9	
Education							

Secondary nursing diploma	6	75.0	1	12.5	1	12.5	2.75(.533) MC
Technical institute	57	85.1	8	11.9	2	3.0	
Bachelor's degree in nursing	5	100.0	0	0	0	0	
Experience (in years)							
1-<3	37	90.2	3	7.3	1	2.4	**18.97(.022*) MC**
3-<6	26	86.7	2	6.7	2	6.7	
6-<9	4	80.0	1	20.0	0	0	
≥9	1	25.0	3	75.0	0	0	
Marital status							
Single	25	83.3	5	16.7	0	0	9.75 (.087) MC
Married	41	87.2	4	8.5	2	4.3	
Divorced	2	66.7	0	0	1	33.3	
Receiving training courses on caring for VTE patients							
Yes	56	86.2	6	9.2	3	4.6	2.03 (.361) MC
No	12	80.0	3	20.0	0	0	

X^2 is chi-square test, MC is Monte Carlo for Chi square test P value is significant <.05

Table (7): Correlation between total nurses' knowledge and practice regarding VTE preventive measures among post total hip and knee arthroplasty patients (n=80).

Knowledge	Practice	
	R	P value
	.027	.810

r is Pearson correlation; P value is significant <.05

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