

Establishing Nursing Standards For Prophylaxis Of Deep Vein Thrombosis Among Patients Undergoing Hip Surgery

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Abstract : Hip surgery including total hip replacement and hip fracture surgery are very successful orthopaedic procedures that relieve pain, improve function and enhance the quality of patients' lives. However, these procedures are also associated with a risk of morbidity and mortality from the development of DVT and its sequel, pulmonary embolism (P.E.) Occurrence of DVT will lead to emotional consequences of pain, extended isolation and impaired social interaction that have impact on every aspect of patient's life⁽¹⁸⁻²⁰⁾. Consequently more attention has to be paid to nursing interventions related to DVT prevention in orthopedic health care. Therefore; the present study aims to establish nursing standards for prophylaxis of DVT among patients undergoing hip surgery. This study was conducted at EL-Hadara Orthopaedic and Traumatology University Hospital in Alexandria. **jury subjects** consisted of experts from the following categories:- faculty members of Medical Surgical Nursing Department, Faculty of Nursing, Alexandria University (20), Ten orthopaedic surgeons from Faculty Of Medicine, all head nurses working in the hospital (10) and ten vascular surgeons from Faculty Of Medicine, Alexandria University. DVT prophylaxis opinionnaire was developed by the researcher after reviewing related literature to elicit opinions of expert groups regarding hospital structure and process standards. The study established valid and reliable nursing standards for prophylaxis of DVT among hip surgery patients.

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1. Introduction

Hip surgery including total hip replacement and hip fracture surgery are becoming more common^(1,2). Worldwide, more than 600,000 total hip replacements are performed annually^(3,4). The American Academy of Orthopaedic Surgeons estimates that there are more than 193,000 total hip replacements (THR) performed every year in USA⁽⁵⁾.

Hip surgery procedures that relieve pain, improve function and enhance the quality of patients' lives. However, these procedures are also associated with a risk of morbidity and mortality from the development of venous thrombo-embolic disease (6,7).

Venous thromboembolic disease (DVT) is a term encompassing deep vein thrombosis (DVT) and pulmonary embolism (PE) (8,9). DVT is a common vascular condition that arises from the formation of a blood clot within the deep veins of the circulatory system. PE occurs when a segment of that thrombosis detaches or separates from the vein wall, travels through the bloodstream, and lodges in the pulmonary artery (1-3).

DVT is the most frequent complication following surgery of the hip (10,11). Without prophylaxis, this disorder occurs in 40-60% of patients after hip replacement and in 58 % following hip fracture surgery (10,12). In addition, occurrence of DVT will

prolong patient's period of hospitalization. It also leads to emotional consequences of pain, extended isolation and impaired social interaction that will have impact on every aspect of patient's life (13).

There are many risk factors for the development of deep vein thrombosis. However, even without underlying risk factors; patients who sustain a hip fracture are at the highest risk for the development of venous DVT^(12,13). Other factors have been demonstrated to increase the risk of DVT after hip fractures. Preexisting medical conditions, including advanced age, obesity, cardiopulmonary disease, and previous DVT, increases the risk of DVT after hip fractures^(14,15).

Without mechanical or pharmacologic prophylaxis, deep vein thrombosis has been reported in approximately 50% of patients. Proximal deep vein thrombosis will develop in 20% to 25% of patients. Although these rates are similar to those seen after lower-extremity total joint arthroplasty, the incidence of fatal pulmonary embolism is more common in patients with hip fractures^(2,3).

Clinical diagnosis of DVT is difficult since more than 50% of patients with DVT do not have any signs or symptoms^(9,10). This is particularly so with proximal vein thrombosis, that is thrombosis of the popliteal veins and above, where a small thrombus in a large

vein may initially cause only minimal disturbance to blood flow⁽³⁾. This is especially relevant in hip surgery where 20% of deep vein thromboses are localized to the femoral vein close to the site of surgery⁽⁶⁾. Most clinically important pulmonary emboli arise from thrombi in the proximal veins. Such patients may simply present with pulmonary embolus, which is fatal in 1-3% of cases⁽³⁾.

Since diagnosis is difficult and treatment is not always satisfactory, Prevention of DVT is obviously essential. Prevention of DVT is the effective approach to reduce death from PE and morbidity from DVT . Prevention decreases length of hospital stay, improves quality of life, decreases rehabilitation time and decreases economic burden^(3,5). The selection of a prophylactic regimen depends on the balance between efficacy and safety.

Although definitive treatment of DVT is the role of the physician, nurses have a vital role in prevention (9). Nurses play a key role in the detection, treatment and prevention of DVT. An awareness of the signs and symptoms of DVT is vital in providing optimal nursing care (13). Nurses are responsible for prevention of DVT by proper assessment using standardized assessment tool, education and applying preventive measures. Nurses' adherence to these measures will help reduce the incidence and potentially life-threatening complications of DVT (13).

Increased recognition of the impact of DVT has prompted accreditation and quality organizations to take interest in DVT risk assessment and prophylaxis as a measure for institutional performance ratings and even reimbursement^(10,11).

The Joint Commission on Accreditation of Healthcare Organizations and the National Quality Forum have launched a joint project to develop a set of standardized inpatient measures to evaluate hospitals' practices for the prevention and treatment of DVT⁽¹²⁾.

Similarly, the ongoing Surgical Care Improvement Project (SCIP) has targeted DVT prophylaxis as one of a handful of priority areas for reducing surgical complications. Moreover, SCIP set a national goal in 2005 to reduce preventable surgical morbidity and mortality by 25% by 2010⁽¹⁶⁾.

To encourage health care organizations to improve overall patient safety, **The Agency for Healthcare Research and Quality (2001)** ranked 79 of the most common issues in hospitals. The highest ranked recommendation was the "appropriate use of prophylaxis to prevent DVT in patients at risk"⁽¹⁷⁾. This recommendation was based on evidence that thromboprophylaxis reduces adverse patient outcomes while decreasing overall costs.

Prevention of DVT is an important field in orthopaedics. Hence, more attention has to be paid to nursing interventions in this field (4). Application of evidence – based practice in orthopaedic nursing can

only be achieved through structured care strategies. These strategies are dependent on tools that are used to identify best practice, facilitate standardization of care and provide mechanisms for tracking variance, quality enhancement and outcome measurement. One of these tools is standards of care which has become increasingly important in orthopedic health care .

Formulation of standards is the first step toward efficient nursing care delivery. It provides the required knowledge and skills that can be used to orient new staff and guide nurses in clinical practice. Moreover, standards serve as a base by which the quality of care can be judged.

Unless standards for orthopaedic nursing practices are set, monitored and evaluated, it is unlikely that the desired quality of nursing practice will be achieved and maintained (7). By developing this standard, orthopaedic nurse will be provided with an action plan to expand their role in clinical decision making with other members of health care team (4).

To promote best practices for DVT prevention, as for any medical condition, standards of prophylaxis must be developed, disseminated, tested, and implemented⁽¹⁶⁾.

Yet, there is no nursing standards prophylaxis of deep vein thrombosis among patients undergoing hip surgery in Egypt. It is obvious that there is a felt need to establish such a standard with the ultimate goal of prevention and optimal health for hip surgery patients.

2. Material and methods

I- Material

Study Design:

The research design of this study is an exploratory type of research.

Setting:

This study was conducted at EL-Hadara Orthopaedic and Traumatology University Hospital in Alexandria.

Subjects:

The subjects of this study includes jury subjects that consisted of experts from the following categories:-

- All faculty members of medical surgical nursing department, Faculty of Nursing, Alexandria University (n=20).
- Ten orthopaedic surgeons from Faculty of Medicine, Alexandria University.
- All head nurses working in the hospital (n=10).
- Ten vascular surgeons from Faculty of Medicine, Alexandria University.

Tool:

DVT prophylaxis opinionnaire.

A structured opinionnaire was developed by the researcher after reviewing related literature to elicit opinions of expert groups regarding hospital structure and process standards⁽⁷⁾.

This tool consists of two parts:

Part I: Hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.

This part is a schedule of the ideal hospital structure items for prophylaxis of DVT among patients undergoing hip surgery. it includes 10 items namely, DVT prophylaxis policy, DVT prophylaxis guidelines, setting up DVT prophylaxis committee, DVT prophylaxis consultants, educational sessions for nurses regarding prophylaxis of DVT, supervision of nurses performance, availability of facilities and equipment for : DVT assessment procedure and DVT prophylaxis including ambulation using walker, intermittent pneumatic compression (IPC) device, anticoagulant drug and computer programs for electronic alerts for patients at risk of DVT and preventive measures, hip surgery patients health education booklet regarding DVT prophylaxis, documentation sheet for : DVT assessment, application of DVT preventive measures and hip surgery patient education.

Part II: Basic nursing competencies for DVT prophylaxis among patients undergoing hip surgery.

This part is a structured schedule comprising the basic nursing competencies for DVT prophylaxis among patients undergoing hip surgery. The opinionnaire comprised major broad competencies which were splitted into nursing activities and skills to be answered by jury and scored as follows: strongly agree (4), agree (3), disagree (2) and strongly disagree (1).

Tool II : an assessment sheet of the hospital structure standards regarding prophylaxis of DVT among patients undergoing hip surgery.

II-Methods

- Permission to conduct the study was taken from the hospital administrator and the director of the nursing service department after explanation of the purpose of the study.
- DVT prophylaxis opinionnaire was developed by the researcher through reviewing of the recent relevant literature.
- **Validity testing of DVT prophylaxis opinionnaire :**

The opinionnaire was submitted to every member of the expert groups to assure its content validity using the personnel interview method. The interviews were carried out by the researcher to elicit experts' opinions in relation to the importance of the hospital structure items as well as the activities pertaining to each competency as regards the prophylaxis of DVT among patients undergoing hip surgery. Jury members were informed about the nature of the study and each interview lasted from 30-45 minutes.

The hospital structure items and the competencies from DVT prophylaxis opinionnaire

which received 70 % agreement by the experts were considered nursing standards for DVT prophylaxis among patients undergoing hip surgery.

Reliability testing of DVT prophylaxis opinionnaire :

Reliability testing was carried out for DVT prophylaxis nursing standards by the expert group using test-retest at one month interval.

Data required for validity and reliability testing of the opinionnaire was carried out over a period of 6 months .

The assessment of hospital structure was done by the researcher as being "available" or "not available".

Interviews were conducted by the researcher with the hospital administrator, nursing matron and head nurses of the hospital departments to investigate the availability of some structure items in the hospital including DVT prophylaxis policy, guideline, DVT prophylaxis consultants, educational sessions regarding DVT, supervision of nursing performance regarding DVT prophylaxis, assessment of availability of facilities and equipments for DVT assessment, prophylaxis measures and computer programs.

Statistical analysis

After data collection, it was coded and transformed into a specially designed format so as to be suitable for computer feeding. Following data entry, checking and verification processes were carried out to avoid errors during data entry. The statistical package for social sciences (SPSS) version 17 for windows was used for data analysis.

The following statistical tests were used:

A- Data analysis related to validity studies of the DVT prophylaxis opinionnaire.

1- Number and percentage: used for calculating content validity of the opinionnaire.

2- Mean, standard deviation, t difference test and f (ANOVA) tests were calculated to determine construct validity of the opinionnaire.

B - Data analysis related to reliability studies.

The reliability of the established standards was estimated using Pearson's r correlation test, Cronbach's Alpha and Guttman Split Half tests.

Pearson's r correlation test:

It was used to measure test retest reliability of the opinionnaire items which reflects stability of the items over time. Its value ranges from +1 to -1.

Cronbach's Alpha reliability test:

It was used to measure the internal consistency of the opinionnaire. Reliability value is r. Its maximum value is 1.0, which indicates highest correlation. The minimum accepted value is 0.7. Below which indicates unreliable tool.

Guttman Split Half reliability test.

It is a reliability test which was used to correlate the 1st half of the opinionnaire items with the 2nd half.

Correlation of both halves indicates high reliability level of the tool.

3. Results

Section I: Validity and reliability testing of DVT prophylaxis opinionnaire.

Table (I) shows expert groups' opinions regarding hospital structure items for prophylaxis of DVT among patients undergoing hip surgery (content validity).

It can be noticed that all nursing educators, orthopedic surgeons, vascular surgeons and head nurses considered the following hospital structure items as being very important for prophylaxis of DVT among patients undergoing hip surgery. These hospital structure items are DVT prophylaxis guidelines, training sessions for nurses regarding prophylaxis of DVT including pre service and in - service training sessions, supervision of nurses performance , facilities and equipment for: DVT assessment procedure, ambulation using walker and pharmacological prophylaxis , hip surgery patients health education booklet regarding DVT prophylaxis and documentation for DVT assessment , application of DVT preventive measures and hip surgery patient education and patient response.

On the other hand, there was variation of jury opinions agreement regarding the degree of importance related to DVT prophylaxis Policy, DVT Nurse Specialist, Intermittent pneumatic compression (IPC) devices and the use of computer programs for electronic alerts for patients at risk of DVT.

The table also reveals that 80 % of nursing educators as well as orthopedic surgeons considered DVT prophylaxis policy very important hospital structure item for prophylaxis of DVT among patients undergoing hip surgery. While, 20% of both groups considered it slightly important item for prophylaxis of DVT among patients undergoing hip surgery.

Regarding setting up DVT prophylaxis committee, the highest proportions of nursing educators (35 %) considered it slightly important hospital structure item. While, the highest proportions of orthopedic surgeons (60 %) considered it not important hospital structure item. Moreover, 50 % of vascular surgeons considered it slightly important and the other half of them considered it not important hospital structure item. On the other hand, the majority of head nurses (70 %) considered it as not important hospital structure items and only 30 % of them considered it as slightly important hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.

Concerning intermittent pneumatic compression (IPC) devices, all educators, orthopedic surgeons and vascular surgeons considered it as very important hospital structure item. While, only 40 % of head

nurses considered it as very important hospital structure items and 60 % of them considered it as important hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.

Regarding the use of computer programs for electronic alerts for patients at risk of DVT, opinions of expert groups varied as 80 % of nursing educators and vascular surgeons considered it as very important hospital structure item. While, 20 % of both groups considered it as an important hospital structure item for prophylaxis of DVT among patients undergoing hip surgery.

On the other hand, the same proportions of orthopedic surgeons (40 %) considered it as very important and important hospital structure item. While, 20 % of them considered it slightly important hospital structure items for prophylaxis of DVT among patients undergoing hip surgery. In addition, 60 % of head nurses considered it very important hospital structure item and only 40 % of them considered it important hospital structure item for prophylaxis of DVT among patients undergoing hip surgery.

Table (II) shows means and mean percent scores of the expert groups' opinions regarding the extent of importance of the hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.

It can be noticed that mean percent opinions scores of nursing educators, orthopedic surgeons, vascular surgeons and head nurses were 100 % for the following hospital structure items : DVT prophylaxis guidelines, setting up DVT prophylaxis committee, training sessions for nurses regarding prophylaxis of DVT, supervision of nurses performance, facilities and equipment for: DVT assessment procedure, ambulation using walker and pharmacological prophylaxis , hip surgery patients health education booklet regarding .

DVT prophylaxis and documentation for DVT assessment , application of DVT preventive measures and hip surgery patient education and patient response. In addition, DVT prophylaxis policy had a high mean percent opinions score for nursing educators, orthopedic surgeons, vascular surgeons and head nurses (\bar{x} = 86.66, 93.33, 90 and 90) respectively.

Moreover, mean percent opinions scores of (\bar{x}) nursing educators, orthopedic surgeons, and vascular surgeons for intermittent pneumatic compression (IPC) devices were 100 %. While, (\bar{x}) was only 80 % for head nurses.

Table (I): Opinions Of The Expert Groups Regarding Importance Of The Hospital structure items For Prophylaxis Of DVT Among Patients Undergoing Hip Surgery (Content Validity).

Hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.	Nursing educators N=20				Orthopedic surgeons N=10				Vascular surgeons N=10				Head nurses N=10			
	v. imp %	Imp %	Sl. Imp %	Not imp. %	v. imp %	Imp %	Sl. Imp %	Not imp. %	v. imp %	Imp %	Sl. Imp %	Not imp. %	v. imp %	Imp %	Sl. Imp %	Not imp. %
1. DVT prophylaxis Policy (Be kept in an accessible place in each ward in the hospital.)	80	0	20	0	80	20	0	0	70	30	0	0	50	50	0	0
2. DVT prophylaxis guidelines.(Be kept in an accessible place in each ward in the hospital.)	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0
3. Setting up DVT prophylaxis committee: include: a Haematologist, Physician, Radiologist, Vascular Surgeon, Orthopaedic Surgeon, Anaesthetist, Anticoagulant Pharmacist and DVT nurse specialist	25	20	35	20	0	0	40	60	0	0	50	50	0	0	30	70
4- DVT prophylaxis consultants : Vascular Surgeon and Orthopaedic Surgeon.	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0
5- Training sessions for nurses regarding prophylaxis of DVT among patients undergoing hip surgery: a- Pre service training sessions. b- In - service training sessions	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0
6- Supervision of nurses performance by trained nurse supervisor regarding DVT prophylaxis	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0

v. imp = very important. Imp= important. Sl. Imp = slightly important. Not imp= not important.

Cont. table (I)

Hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.	Nursing educators N=20				Orthopedic surgeons N=10				Vascular surgeons N=10				Head nurses N=10			
	v. imp %	Imp %	Sl. Imp %	Not imp.	v. imp %	Imp %	Sl. Imp %	Not imp.	v. imp %	Imp %	Sl. Imp %	Not imp.	v. imp %	Imp %	Sl. Imp %	Not imp.
7- Facilities and equipment for DVT assessment procedure: - DVT assessment sheet - Centimeter tape for measuring calf circumference. - Doppler Device. - lukewarm gel - Base line coagulation laboratory investigations (PT, PA, INR)	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0
8- DVT prophylaxis facilities and supplies: a- For ambulation using walker: clean and dry floor adequate lighting Walker with rubber tips Height of walker is slightly below patient's waist. Adjustable beds. Bed side rails. Available spaces between patients beds.	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0

V. imp = very important. Imp= important. Sl. Imp = slightly important. Not imp= not important.

Cont. table (I)

Hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.	Nursing educators N=20				Orthopedic surgeons N=10				Vascular surgeons N=10				Head nurses N=10			
	v. imp %	Imp %	Sl. Imp %	Not imp.	v. imp %	Imp %	Sl. Imp %	Not imp.	v. imp %	Imp %	Sl. Imp %	Not imp.	v. imp %	Imp %	Sl. Imp %	Not imp.
b- Intermittent pneumatic compression (IPC) devices. Training sessions regarding IPC devices are conducted every 6 months.	100	0	0	0	100	0	0	0	100	0	0	0	40	60	0	0
c- pharmacological prophylaxis	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0
d- Computer programs for electronic alerts for patients at risk of DVT and preventive measures.	80	20	0	0	40	40	20	0	80	20	0	0	60	40	0	0
9- Hip surgery patients health education booklet regarding DVT prophylaxis	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0
10- Documentation for : DVT assessment. Application of DVT preventive measures. Hip surgery patient education and patient response	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0

V. imp = very important. Imp= important. Sl. Imp = slightly important. Not imp= not important.

Regarding the use of computer programs for electronic alerts for patients at risk of DVT, nursing educators and vascular surgeons had the same mean percent opinions score (= 93.33). While, mean percent opinions scores (\bar{X}) for orthopedic surgeons and head nurses were 73.33 and 86.66 respectively.

On the other hand, DVT Nurse Specialist had the lowest mean percent opinions score for nursing educators, orthopedic surgeons, vascular surgeons and head nurses (\bar{X} = 50, 13.33, 16.66 and 10) respectively.

Table (III): Shows test – retest and cronbach's alpha reliability testing of the hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.

It can be noticed that test – retest reliability correlations were complete ($r = 1$) for all of the hospital structure items for prophylaxis of DVT among patients undergoing hip surgery except for setting up DVT prophylaxis committee and computer programs for electronic alerts for patients at risk of DVT and preventive measures (0.925 and 0.946) respectively.

Regarding Cronbach's alpha reliability test, alpha reliability co-efficient for the constructed opinionnaire regarding the hospital structure items for prophylaxis of DVT among patients undergoing hip surgery showed very high value ($r = 0.952$) which indicates internal consistency of the opinionnaire

A- Results of Validity and reliability for basic competencies of prophylaxis of DVT among hip surgery Patients.

Table (IV): Shows expert groups' opinions regarding basic competencies of prophylaxis of DVT among hip surgery patients (content validity).

It can be noticed that all nursing educators, orthopedic surgeons, vascular surgeons and head nurses 100 % strongly agreed about all nursing competencies required from orthopedic nurses for DVT prophylaxis among patients undergoing hip surgery except competencies related to Leg elevation on an angle 10-20 degrees, Teaching patient isometric post operative exercises program and Ensuring that every hip surgery patient will use elastic stockings properly.

Regarding leg elevation on an angle 10-20 degrees, opinions of expert group varies as 30 % of nursing educators strongly agreed and 70 % agreed, 30 % of orthopedic surgeons agreed and 70 % disagreed and 70% of head nurses agreed and 30 % disagreed. While, all vascular surgeons strongly agreed.

In relation to teaching patient isometric post operative exercises program, all nursing educators, orthopedic surgeons and vascular surgeons 100 % strongly agreed. While, 30 % of head nurses strongly agreed and 70 % agreed.

Regarding ensuring that every hip surgery patient will use elastic stockings properly, nursing educators and head nurses had the same distribution of opinions as 40 % agreed and 60 % disagreed. While,

orthopedic surgeons and vascular surgeons had the same distribution of opinions as 20 % agreed and 80 % disagreed.

On the other hand, the competencies strongly agreed upon by all subjects of the experts groups (100 %) were related to all the preoperative nursing competencies which included DVT risk assessment, physical examination of patients' legs, assessment of venous blood flow using Doppler device and checking admission coagulation profile laboratory investigations (PT, PA and INR).

Furthermore, the following post operative competencies were agreed upon by all the subjects: daily examination of DVT manifestations, daily use of Doppler device, checking coagulation profile every 3 days, performing post operative range of motion exercises for hip, knee and ankle joints, application of intermittent pneumatic compression device, assisting patients in using walker for ambulation, administration of anticoagulant drug, avoiding anticoagulant drug side effects, starting DVT health education from patient admission till patient discharge and doing continuous recording for DVT prophylaxis measures.

Table (V): Shows construct validity by comparing means of the total scores of first and third quartiles of the expert opinions regarding the basic competencies of prophylaxis of DVT among hip surgery patients.

It can be noticed that there was significant difference between mean of total scores of first and third quartiles of the expert responses regarding basic competencies of prophylaxis of DVT among hip surgery patients (91.71 and 158.62) respectively. This significant difference indicates construct validity of the tested competencies.

Table (VI): shows construct validity by comparing means of the total scores of the expert groups' opinions of basic competencies of prophylaxis of DVT among hip surgery patients.

The table reveals that there were significant differences between means of the total scores of the expert group opinions (nursing educators, orthopedic surgeons, vascular surgeons and head nurses) regarding basic competencies of prophylaxis of DVT among hip surgery patients, indicating construct validity of the tested competencies .

Table (VII): Shows test – retest, Cronbach's alpha and Guttman Split half reliability testing of Basic Competencies of Prophylaxis of DVT (DVT) Among Hip Surgery Patients.

It can be noticed that test – retest reliability correlations were complete ($r = 1$) for all nursing competencies except for leg elevation on an angle 10-20 degrees, ensuring that all precautions are followed to prevent hemorrhagic side effects of anticoagulant

drug, ensuring that health education is started from patient admission till patient discharge and ensuring that continuous recording is done from patient admission till discharge. These nursing competencies had very high test – retest reliability correlations which were 0.942, 0.941, 0.945 and 0.941 respectively.

Regarding Cronbach's alpha reliability test, alpha reliability co-efficient for the constructed opinionnaire regarding basic competencies of prophylaxis of DVT among hip surgery patients showed very high value ($r = 0.9466$) which indicates internal consistency of the opinionnaire.

In relation to Guttman split half reliability that correlates the first half of the items of the opinionnaire regarding basic competencies of prophylaxis of DVT among hip surgery patients with the second half of the items, the co-efficient value was very high ($r = 0.9252$).

Section II

Assessment of the hospital structure regarding prophylaxis of DVT among patients undergoing hip surgery.

Table (VIII): shows assessment of hospital structure related to DVT prophylaxis among hip surgery patients.

The table reveals that the following items related to hospital structure items were available : base line coagulation laboratory investigations (PT, PA, INR), some items required for ambulation using walker namely: clean & dry floor, well lighted room, and walker with rubber tips, Height of walker is slightly below patient's waist. In addition, intermittent pneumatic compression device and pharmacological prophylaxis , all items are available namely; clexane stored in refrigerator and vit K ampoules.

On the other hand, the following hospital structure items were not available: DVT prophylaxis policy, DVT prophylaxis guidelines, DVT prophylaxis consultants, training secessions for nurses regarding DVT prophylaxis among hip surgery patients including pre service and in service training sessions, supervision of nurses performance regarding DVT prophylaxis, DVT assessment sheet , centimeter tape for measuring calf circumference and Doppler device.

Moreover, concerning ambulation using walker, adjustable beds, bed side rails and adequate spaces between patients beds are not available.

Although intermittent pneumatic compression device is available, but training secessions regarding IPC devices are not available.

It can be noticed that computer programs for electronic alerts for patients at risk of DVT and hip surgery patients health education booklet regarding DVT prophylaxis and documentation were also not available.

Table (II): Means And Mean Percent Scores Of The Expert Groups Opinions Regarding The Extent Of Importance Of The Hospital Structure Items For Prophylaxis Of DVT Among Patients Undergoing Hip Surgery.

Hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.	Nursing educators N=20		Orthopedic surgeons N=10		Vascular surgeons N=10		Head nurses N=10	
	Mean score. Max = 3	Mean percent score \bar{X}	Mean score. Max = 3	Mean percent score \bar{X}	Mean score. Max = 3	Mean percent score \bar{X}	Mean score. Max = 3	Mean percent score \bar{X}
DVT prophylaxis Policy	2.6	86.66	2.8	93.33	2.7	90	2.7	90
DVT prophylaxis guidelines.	3	100	3	100	3	100	3	100
Setting up DVT prophylaxis committee: include: a Haematologist, Physician, Radiologist, Vascular Surgeon, Orthopaedic Surgeon, Anaesthetist, Anticoagulant Pharmacist and DVT Nurse Specialist	1.5	50	0.4	13.33	0.5	16.66	0.3	10
4- DVT prophylaxis consultants : Vascular Surgeon and Orthopaedic Surgeon	3	100	3	100	3	100	3	100
5- Training sessions for nurses regarding prophylaxis of DVT among patients undergoing hip surgery: a- Pre service training sessions. b- In - service training sessions	3	100	3	100	3	100	3	100
6- Supervision of nurses performance by trained nurse supervisor regarding DVT prophylaxis	3	100	3	100	3	100	3	100

Cont. table (II).

Hospital structure items for prophylaxis of DVT among patients undergoing hip surgery.	Nursing educators N=20		Orthopedic surgeons N=10		Vascular surgeons N=10		Head nurses N=10	
	Mean score. Max = 3	Mean percent score \bar{X}	Mean score. Max = 3	Mean percent score \bar{X}	Mean score. Max = 3	Mean percent score \bar{X}	Mean score. Max = 3	Mean percent score \bar{X}
Facilities and equipment for DVT assessment procedure:	3	100	3	100	3	100	3	100
DVT prophylaxis facilities and supplies:	3	100	3	100	3	100	3	100
a- For ambulation using walker.	3	100	3	100	3	100	3	100
b- Intermittent pneumatic compression (IPC) devices.	3	100	3	100	3	100	2.4	80
c- Pharmacological prophylaxis.	3	100	3	100	3	100	3	100
d- Computer programs for electronic alerts for patients at risk of DVT and preventive measures.	2.8	93.33	2.2	73.33	2.8	93.33	2.6	86.66
Hip surgery patients health education booklet regarding DVT prophylaxis.	3	100	3	100	3	100	3	100
10- Documentation sheet for : DVT assessment. Application of DVT preventive measures. Hip surgery patient education and patient response	3	100	3	100	3	100	3	100

Unaccepted item by the majority of the experts

Table (III): Test – Retest And Cronbach's Alpha Reliability Testing Of The Hospital Structure Items For Prophylaxis Of DVT Among Patients Undergoing Hip Surgery.

<i>Hospital Structure Items For Prophylaxis Of DVT Among Patients Undergoing Hip Surgery.</i>	r
1- DVT prophylaxis Policy	1.000
2- DVT prophylaxis guidelines.	1.000
3- Setting up DVT prophylaxis committee: include: a Haematologist, Physician, Radiologist, Vascular Surgeon, Orthopaedic Surgeon, Anaesthetist, Anticoagulant Pharmacist and DVT Nurse Specialist	0.925
4- DVT prophylaxis consultants : Vascular Surgeon and Orthopaedic Surgeon,	1.000
5- Training sessions for nurses regarding prophylaxis of DVT among patients undergoing hip surgery: a- Pre service training sessions. b- In - service training sessions	1.000
6- Supervision of nurses performance by trained nurse supervisor regarding DVT prophylaxis	1.000
7- Facilities and equipment for DVT assessment procedure:	1.000
8- DVT prophylaxis facilities and supplies:	1.000
a- For ambulation using walker.	1.000
b- Intermittent pneumatic compression (IPC) devices.	1.000
c- Pharmacological prophylaxis.	1.000
d- Computer programs for electronic alerts for patients at risk of DVT and preventive measures.	0.946
9- Hip surgery patients health education booklet regarding DVT prophylaxis.	1.000
10 Documentation sheet for : DVT assessment. Application of DVT preventive measures. Hip surgery patient education and patient response	1.000
Cronbach alpha	0.952

Table (IV): Opinions Of The Expert Groups Regarding Basic Competencies Of Prophylaxis Of DVT (DVT) Among Hip Surgery Patients (Content Validity).

Nursing Competency	Nursing educators N=20			Orthopedic surgeons N=10			Vascular surgeons N=10			Head nurses N=10		
	SA %	A %	D %	SA %	A %	D %	SA %	A %	D %	SA %	A %	D %
Pre Operative Nursing Competencies pre operative DVT assessment: The Orthopedic nurses: A- Perform admission physical examination of patients' legs for DVT manifestations. B- Perform admission assessment of venous blood flow using Doppler device for femoral vein. C- check admission coagulation profile laboratory investigations : prothrombin time (PT) prothrombin activity (PA) International normalized ratio (INR)	100	0	0	100	0	0	100	0	0	100	0	0
	100	0	0	100	0	0	100	0	0	100	0	0
	100	0	0	100	0	0	100	0	0	100	0	0

SA= strongly agree. A= agree. D = disagree.

CONT. Table (IV):

Nursing Competency	Nursing educators N=20			Orthopedic surgeons N=10			Vascular surgeons N=10			Head nurses N=10		
	SA %	A %	D %	SA %	A %	D %	SA %	A %	D %	SA %	A %	D %
Post Operative Nursing Competencies 1- post operative assessment: The Orthopedic nurses: 1- Perform a daily physical examination of patients' legs for DVT manifestations. 2- Assess venous blood flow daily using Doppler device for femoral vein. 3- Check coagulation profile laboratory investigations every 3 days. prothrombin time PT prothrombin activity PA International normalized ratio INR.	100	0	0	100	0	0	100	0	0	100	0	0
	100	0	0	100	0	0	100	0	0	100	0	0
	100	0	0	100	0	0	100	0	0	100	0	0
2-Ensure that every hip surgery patient will elevate legs on an angle 10-20 degrees immediately postoperatively.	30	70	0	0	30	70	100	0	0	0	70	30
3- Assist patient in performing post operative range of motion exercises for hip, knee and ankle joints on 1 st postoperative day for about 10-15 minutes 4 times a day.	100	0	0	100	0	0	100	0	0	100	0	0
4 -Teach patient post operative isometric exercises to be repeated 3 times per hour to : Strengthening: Quadriceps Set Hip- Gluteal Set HAMSTRING SET	100	0	0	100	0	0	100	0	0	30	70	0

SA= strongly agree. A= agree. D = disagree.

CONT. Table (IV):

Nursing Competency	Nursing educators N=20			Orthopedic surgeons N=10			Vascular surgeons N=10			Head nurses N=10		
	SA %	A %	D %	SA %	A %	D %	SA %	A %	D %	SA %	A %	D %
5- Assist every hip surgery patient in using walker for ambulation starting from the 2 nd post-operative day once and at least twice daily from the 3 rd postoperative day.	100	0	0	100	0	0	100	0	0	100	0	0
6- Ensure that every hip surgery patient will use elastic stockings properly.	0	40	60	0	20	80	0	20	80	0	40	60
7- Ensure that administration of pharmacological prophylaxis for every hip surgery patient will be correctly & safely.	100	0	0	100	0	0	100	0	0	100	0	0
8-Ensure that all precautions are followed to prevent hemorrhagic side effects of anticoagulant drug.	100	0	0	100	0	0	100	0	0	100	0	0
9-Apply Intermittent pneumatic compression device Properly & effectively.	100	0	0	100	0	0	100	0	0	100	0	0
10-Ensure that DVT health education is started from patient admission till discharge.	100	0	0	100	0	0	100	0	0	100	0	0
11- Ensure that continuous recording for DVT prophylaxis measures is done from patient admission till discharge.	100	0	0	100	0	0	100	0	0	100	0	0

SA= strongly agree. A= agree. D = disagree.

Table (V): Construct Validity By Comparing Means Of The Total Scores Of First And Third Quartiles Of The Expert Opinions Regarding The Basic Competencies Of Prophylaxis Of DVT Among Hip Surgery Patients.

Quartile	N	Mean	SD	t value and P
First	14	91.71	1.267	7.759 (0.000)*
Third	13	158.62	32.284	

* Significant difference at P level < 0.05

Table (VI): Construct Validity By Comparing Means Of The Total Scores Of The Expert Groups Opinions Of Basic Competencies Of Prophylaxis Of DVT Among Hip Surgery Patients.

Expert groups	N	Mean	SD	F value and P
Nursing Educators	20	93.05	1.638	3163.656 (0.000)*
Orthopedics Surgeons	10	96.2	4.566	
Vascular Surgeons	10	97.8	0.919	
Head Nurses	10	175.6	0.843	
Total	50	111.14	32.689	

* Significant difference at P level < 0.05

Table (VII): Test – Retest, Cronbach's Alpha And Guttman Split Half Reliability Testing Of Basic Competencies Of Prophylaxis Of DVT Among Hip Surgery Patients.

Nursing Competency	r
Pre Operative Nursing Competencies	
pre operative assessment:	
The Orthopedic nurses:	
A- Perform admission physical examination of patients' legs for DVT manifestations.	1.000
B- Perform admission assessment of venous blood flow using Doppler device for femoral vein.	1.000
C - check admission coagulation profile laboratory investigations:	
prothrombin time (PT)	1.000
prothrombin activity (PA)	1.000
International normalized ratio (INR).	1.000
Post Operative Nursing Competencies	
1- post operative assessment:	
Perform daily physical examination of patients' legs for DVT manifestations.	1.000
Assess venous blood flow daily using Doppler device for femoral vein.	1.000
check coagulation profile laboratory investigations every 3 days.	1.000
2-Ensure that every hip surgery patient will elevate legs on an angle 10-20 degrees immediately postoperatively.	0.942
3- Assist patient in performing post operative range of motion exercises for hip, knee and ankle joints on 1 st postoperative day for about 10-15 minutes 4 times a day.	1.000
4- Teach patient post operative isometric exercises to be repeated 3 times per hour.	1.000
5- Assist every hip surgery patient in using walker for ambulation starting from the 2 nd post-operative day once and at least twice daily from the 3 rd postoperative day.	1.000
6- Ensure that every hip surgery patient will use elastic stockings properly.	1.000
7- Ensure that administration of anticoagulant drug for every hip surgery patient will be correctly & safely.	0.000
8- Ensure that all precautions are followed to prevent hemorrhagic side effects of anticoagulant drug	0.941
9- Apply Intermittent pneumatic compression device Properly & effectively.	1.000
10- Ensure that DVT health education is started from patient admission till discharge	0.945
11- Ensure that continuous recording is done from patient admission till discharge.	0.941
Cronbach alpha	0.946
Guttman Split half	0.925

Table (VIII): Assessment Of Hospital structure Related To DVT (DVT) Prophylaxis Among Hip Surgery Patients.

Structure items for Prophylaxis of DVT among Patients Undergoing Hip Surgery.	Available	Not Available
DVT prophylaxis Policy (Be kept in an accessible place in each ward in the hospital.)		√
DVT prophylaxis guidelines (Be kept in an accessible place in each ward in the hospital.)		√
3- DVT prophylaxis consultants		√
4- Training sessions for nurses regarding prophylaxis of DVT among patients undergoing hip surgery:		
A- Pre service training sessions.		√
B- In - service training sessions.		
5- Supervision of nurses performance regarding DVT prophylaxis		
Facilities and equipment for DVT assessment procedure:		
DVT assessment sheet		√
Centimeter tape for measuring calf circumference.		√
Doppler Device.		√
lukewarm gel	√	√

Base line coagulation laboratory investigations (PT, PA, INR)		
DVT prophylaxis facilities and supplies:		
a- For ambulation using walker:		
clean and dry floor		
adequate lighting		
Walker with rubber tips		
Height of walker is slightly below patient's waist.	√	
Adjustable beds.	√	√
Bed side rails.	√	√
Adequate spaces between patients beds (spaces that allows patients ambulation using walker).	√	√

Cont. table (VIII):

A- Hospital structure items for Prophylaxis of DVT among Patients Undergoing Hip Surgery.	Available	Not Available
b- Intermittent pneumatic compression (IPC) device. Training secessions regarding IPC devices are conducted every 6 months.	√	√
c- pharmacological prophylaxis (anticoagulant drug) : Stored in a refrigerator. Vitamin K ampoules	√	
d- Computer programs for electronic alerts for patients at risk of DVT and preventive measures.		√
Hip surgery patients health education booklet regarding DVT prophylaxis		√
<u>Documentation sheet for :</u> DVT assessment. Application of DVT preventive measures. Hip surgery patient education and patient response		√ √ √

4. Discussion

In the era of patient safety, there is a growing pressure on health care providers and professionals to maintain and improve the quality of provision of health care services⁽¹⁸⁾. Moreover, the quality of health care is on the agenda in most countries. Assessing the quality of care has become increasingly an important to providers, regulators, and patients⁽¹⁹⁾. The opportunity for nurses to implement evidence-based practice to achieve quality health care is tremendous, but it requires measures that are meaningful, interpretable, and of demonstrable value in helping to improve quality of patient care⁽¹⁷⁾.

The first step in improving quality of nursing care is an articulation of standards of care that provide a means for determining quality of care as well as accountability of the nurses. In addition, establishing standards is a useful starting point as they provide a benchmark and a reference point for the organization as a base for its care⁽¹⁶⁾.

The Agency for Healthcare Research and Quality (AHRQ) systematically evaluated and ranked 79 safety practices based on the strength of evidence supporting each intervention and on its impact on patient outcomes. They determined that the appropriate use of thrombo prophylaxis was the number one Patient safety practice for hospitals⁽¹⁷⁾. So, the present study is carried out to establish nursing standards for prophylaxis of deep vein thrombosis among patients undergoing hip surgery.

The process of developing standards is a complicated and multi-step process⁽¹⁹⁾. These processes

include studies to evaluate validity and reliability of the developed standards. Validity studies were carried out for hospital structure standards and basic nursing competencies that will be converted later on to be process standards. In this respect, **Berk (1990)**⁽²⁰⁾ stressed that validity is the most fundamental consideration in standard development.

Content validity studies were carried out for the hospital structure standards. While, content and construct validity studies were carried out for basic nursing competencies for prophylaxis of DVT among hip surgery patients. In this respect, Borsboom, D., GJ Mellenbergh, and J. Van Heerden. 2004⁽²¹⁾ emphasized that Content validity is a central concern during standard development, whether such development occurs in a research setting or in the context of professional practice.

Moreover, the results of the present study shows very high test - retest reliability of the developed opinnionaire which indicates high stability of the instrument. This is supported by **Pant & Richard (2009)**⁽²²⁾ who explained that two main attributes of reliability for establishing standards are stability and homogeneity of its component items. The stability of an instrument is the instrument's ability to produce the same results with repeated testing. Stability of instrument over time is an important attribute when an instrument is used in repeated events.

The homogeneity of an instrument means internal consistency which ensures that the items within an instrument reflect or measure the same concept. Homogeneity was assessed using split half

reliability and cronbach's alpha . The results of the present study revealed that the reliability co-efficient values for Guttman split half reliability and cronbach's alpha of the developed opinionnaire were very high. In this respect, **Pant and Richard (2009)**⁽²²⁾ stressed that high value of reliability measurement is essential for any developed standard as the implementation of the standard is the most important consideration, since it is expected to be used on daily base and by a wide group of people rather than occasional by few. In addition, **Harris, et al (1998)**⁽²³⁾ emphasized that an indicator of good reliability for development of standards is the high value obtained by Cronbach's alpha which indicates significant internal consistency of the standards items.

Concerning the validation of the hospital structure standards, the findings indicated that all experts agreed by more than 70 % for all hospital structure standards except for setting up DVT prophylaxis committee. The structure standards agreed upon were eleven namely: DVT prophylaxis policy and guidelines, DVT prophylaxis consultants (orthopedic, vascular surgeons and DVT prophylaxis trained nurse supervisor), training sessions for nurses, supervision of nurses' performance, facilities and equipment for deep vein thrombosis assessment procedure, using doppler device. ambulation using walker, intermittent pneumatic compression , anticoagulant drug, computer programs for electronic alerts for patients at risk of deep vein thrombosis and preventive measures , hip surgery patients health education booklet regarding DVT prophylaxis and DVT prophylaxis documentation sheet .

Since, thromboprophylaxis measures have been shown to decrease the incidence of DVT in hospital inpatients. It has been recommended that, to help deliver venous thromboembolism prophylaxis to all hospital inpatients, all hospitals should develop suitable prophylaxis policies and integrate these policies into clinical practice⁽³⁾. The results of the present study revealed that the great majority of experts considered DVT prophylaxis policy as an important structure item in the established standard. This finding is on the same line with The American College of Chest Physicians (ACCP) guidelines that recommend that every healthcare facility should have a written policy on continuous quality improvement related to DVT risk assessment, diagnosis and prophylaxis⁽²⁴⁾.

Moreover, **Amin and Deitelzweig (2009)**⁽²⁵⁾ stressed that hospital policies on thromboprophylaxis are an essential first step as they enable senior clinicians to consider the evidence, reach agreement on best practice in their facility, and support all staff in their practice. Policies should also clarify which staff is responsible for assessing patient risk, as well as

initiating, maintaining, and documenting the proper use of thromboprophylaxis measures⁽¹⁵⁾.

All experts considered DVT prophylaxis guidelines as an important structure item in the established standards. In this respect, McCarthy, Byrne and Silverman 1998⁽²⁶⁾ conducted a study and demonstrated that merely setting up a policy for venous thromboembolism prophylaxis does not necessarily mean that hospital inpatients will receive the appropriate prophylaxis. This has implications not only for venous thromboembolism prophylaxis policies but also for all clinical management policies introduced to deliver health care. This highlights the fact that the introduction of clinical policy needs to be supplemented and supported by using DVT prophylaxis guidelines⁽¹⁵⁾.

In this respect, **Long (2003)**⁽²⁷⁾ explained that policy is a broad statement that addresses what the rule is rather than how to implement the rule. While, a guideline is a set of systematically developed standards or rules which assist in the decision about how to apply the policy.

The results of the present study revealed that all experts considered educational and training sessions for nurses regarding prophylaxis of deep vein thrombosis among patients undergoing hip surgery as an important hospital structure item in the established standards. In this respect, **Peterson, et al (1999)**⁽²⁸⁾ conducted an educational program to promote the hospital's guidelines which increased the proportion of surgical patients (n=250) receiving appropriate prophylaxis from 59% to 70% (P<.05), and the proportion of high-risk patients receiving appropriate prophylaxis from 25% to 77% (P<.05).This program involved presentations to staff, posters placed around the hospital, dissemination of baseline results, and the distribution of a card summarizing the guidelines.

Moreover, The Joint Commission consensus standards include the provision of a provider training and education system that encompasses all aspects of DVT prevention⁽¹⁶⁾. In addition, **Michota (2007)**⁽²⁹⁾ stressed that provider awareness and knowledge of DVT, and its prevention should be starting points of any quality improvement initiative that will help in decreasing the incidence of DVT.

The results of the present study revealed that all experts considered supervision of nurses' performance by trained nurse supervisor regarding deep vein thrombosis prophylaxis as an important hospital structure standard in the established DVT prophylaxis standards. In this regard, **Passman (2010)**⁽³⁰⁾ stressed that all orthopedic nurses must receive mandatory training in the prevention of venous thromboembolism with continuous supervision by trained qualified senior nurse.

Furthermore, the findings revealed that majority of experts considered computer programs for electronic alerts for patients at risk of deep vein thrombosis and preventive measures as an important hospital structure item in the established DVT prophylaxis standards. The majority of vascular surgeons and nursing educators believed that the use of medical informatics technology, including computerized decision support, will lead to safer, more efficient, and higher-quality care. In addition, the majority of head nurses said that computing systems have become increasingly common in all health-care settings including laboratory results, radiology reports and advanced machines in intensive care units. In this respect, **Cohn and his colleagues (2006)**⁽³¹⁾ stressed that in most DVT-prophylaxis improvement studies, provider education has been combined with provider reminders, and computer decision support system.

Moreover, great proportions of orthopaedic surgeons believe that designing and implementing computing system is an important but challenging because of the computing infrastructure required the need for patient data in a machine-processible form, and the changes to existing workflow that may result. This is supported by **Piazza, Goldhaber. (2009)**⁽³²⁾ who stated that despite difficulties of applications of computing system for reminding health care staff for DVT prophylaxis, there is substantial evidence from trials in a wide range of clinical settings that computer decision support systems help clinicians do a better job caring for patients. As computer-based records and order-entry systems become more common and automated decision support systems will be used more broadly.

All experts considered availability of documentation sheet for DVT assessment, application of DVT preventive measures and hip surgery patient education as an important hospital structure item in the established DVT prophylaxis standards. This is supported by **Urquhart & Grant (2009)**⁽³³⁾ who said that it is difficult to quantify nursing unless a nursing activity, its rationale, and its outcome are recorded in letters or numbers, because nursing is a profession involving practice. In addition, **Currell & Urquhart (2003)**⁽³⁴⁾ stressed that the documentation sheet is an important instrument with several purposes: to ensure continuity in patient care, as a tool for healthcare professionals, as a source of information for the patient, for quality assurance, for self-evaluation, for audits of performance, for legal aspects, and for research. The importance of the nursing record has recently increased as more focus has been placed on patient outcomes in monitoring the quality of health care services.

On the other hand, hospital structure standards that were agreed upon by less than 70 % of the experts

and not included in the developed structure standards were Setting up DVT prophylaxis committee which include: a Haematologist, Physician, Radiologist, Vascular Surgeon, Orthopaedic Surgeon, Anaesthetist, Anticoagulant Pharmacist and DVT Nurse Specialist. This structure standard was replaced by the experts to be DVT prophylaxis consultants including orthopedic surgeon, vascular surgeon and DVT trained nurse supervisor. This result may be due to facilitating feasibility and applicability of the committee work for prophylaxis of DVT. In this respect, The results of **Laverick et al survey (1991)**⁽³⁵⁾ showed that venous thromboembolism is regarded as a frequent complication of orthopaedic surgery, and that most orthopaedic surgeons take active steps to try to prevent its occurrence. Orthopaedic surgeons are aware of the problem of deep venous thrombosis and pulmonary embolism and knowledgeable about the risk factors for thromboembolism in their practice.

Validity studies for determining the basic competencies required from orthopaedic nurses for prophylaxis of DVT among hip surgery patients were carried out. In this respect, **Zhang Z, Luk W, Arthur D, et al 2001**⁽³⁶⁾ define competency as a general statement which describes the knowledge, skills and abilities necessary for safe nursing practiced in a specific area as well as it provides a road map for the range of behaviors that produce excellent performance. In the same line, **McAllister (1998)**⁽³⁷⁾ stated that competencies could provide clarity and clearer role boundaries regarding the nature of nursing work and professional accountability. In addition, Competency standards' is by now a familiar term to most nurses, and the rate at which many nursing organizations are developing their own set of standards.

All experts strongly agreed about the all suggested competencies except for leg elevation on an angle 10-20 degrees for hip surgery patients immediately postoperatively and the use of compression stockings. The agreed competencies are namely: daily examination of deep vein thrombosis manifestations, daily use of Doppler device, checking coagulation profile every 3 days, performing post operative range of motion exercises for hip, knee and ankle joints, application of intermittent pneumatic compression device, assisting patients in using walker for ambulation, administration of heparin, avoiding heparin side effects, starting deep vein thrombosis health education from patient admission till discharge and doing continuous recording for deep vein thrombosis prophylaxis measures.

The findings revealed that all experts considered pre and post operative DVT assessment as basic competency in the established standards as orthopaedic and vascular surgeons stressed that admission and postoperative assessments are an

opportune time to evaluate patient condition regarding development of DVT. In addition, nursing educators and head nurses explained that when a hip surgery patient is assessed for DVT, nurses must advocate for timely prevention mechanisms. This may mean notifying physicians of patient evaluation condition and asking for orders to initiate prophylaxis early or following an established hospital protocol. Once prophylaxis orders are obtained, they need to be initiated as soon as possible. In this respect, **Alexander & Giangola (1999)**⁽³⁸⁾ explained this collaborative work between nurses and physicians regarding prophylaxis of DVT as nurses are with patients at time of admission and take care of patients throughout their hospital stay. They are in the ideal position to assess patient early and ask for DVT prophylaxis.

All experts considered assisting patient in performing post operative range of motion exercises for hip, knee and ankle joints on 1st postoperative day for about 10-15 minutes 4 times a day and teaching patient post operative isometric exercises to be repeated 3 times per hour as basic competencies in the established standards. This is supported by **Yamashita et al (2005)**⁽³⁹⁾ who confirmed that foot exercise by a nurse for 5 minutes was effective in increasing peak blood flow velocity of the femoral vein and The effect of the 5-minute foot exercise lasted for 2 hours which subsequently reduce the risk of the development of thrombosis. In addition, **Mangione (2005)**⁽⁴⁰⁾ results confirmed the beneficial homodynamic effects of active movement of the foot in the postoperative period and suggested that patients should perform leg range of motion and isometric exercises postoperatively as part of a prophylactic regimen directed at decreasing the risk of venous thrombosis.

Consequently, all hospital structure items and all process competencies that were stated as comprehensive and supportive standards are valid, reliable, interrelated and complementary to each other. In this respect, **Donabedian (2005)**⁽⁴¹⁾ believed strongly on the importance of healthcare agency structure, seeing it as a driving force for later care processes and ultimately for health outcomes.

The availability of these valid and reliable nursing standards does not improve hip surgery patient safety unless these standards are incorporated into clinical practice. So, for testing the applicability of the established standards, development of an assessment tool to assess actual level of studied nurses' performance was necessary. This is supported by **Dozeir (1998)**⁽⁴²⁾ who stressed that established standards are useful in the evaluation of nurses' performance. In addition, using standards as a reference point for comparing what actions were or

were not taken can often serve as a starting point to evaluate care

Conclusions

It can be concluded that The established nursing standards for prophylaxis of DVT among hip surgery patients are valid and reliable.

Recommendations

From the forgoing conclusions, it is recommended that the orthopaedic hospital administrative system be supportive of regular, consistent and competent implementation of DVT prophylaxis standards. So, it should provide the following:

- DVT prophylaxis policy and guidelines for raising nurses' awareness about: DVT as a serious problem, availability of DVT prophylaxis standards as evidence for best practice and the importance of collaborative work between physicians and nurses in order to achieve the goal.

- Pre and in-service educational and training sessions and workshops for nurses to enhance their knowledge and skills related to DVT prophylaxis.

- Adequate facilities that permit implementation of DVT prophylaxis standards including Doppler and intermittent pneumatic compression devices, walkers, adjustable beds, bed side rails, documentation records and health education booklets.

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