Safe Nurses' Practices Regarding Phlebotomy Technique Among Patients Receiving Anticoagulants

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Abstract

Background: Phlebotomy is one of the most common invasive nursing procedures performed worldwide. It is considered safe if the procedure is conducted in accordance to the established guidelines. However, patients on anticoagulants are at a higher risk for complications, particularly bleeding therefore, it is crucial for nurses to adhere to safe practices to minimize the risk of adverse events. **Aim of the study:** to assess safe nurses' practices regarding phlebotomy technique among patients receiving anticoagulants. **Design:** A descriptive cross-sectional research design was used. **Setting:** The study was conducted at four inpatient units in Itay Elbaroud General Hospital affiliated to El-Beheira Health Directorate, Ministry of Health and Population, Egypt. **Subjects:** All nurses (n=109) at the time of data collection were included in the study. **Tool:** One tool used for data collection which was "Phlebotomy safe nurses' practices observational checklist". **Results:** The results revealed that 80.6% of the studied nurses had an unsatisfactory level of practice regarding phlebotomy among patients receiving anticoagulants, with a mean percent score of 68.5±7.0, in addition, there was a statistically significant relation between the average of safe nurses' practices and their age, those working in orthopedic department, longer years of previous nursing experience, and longer experience in the current ward; where p-values were (0.002, 0.002, 0.001, and 0.001) respectively. **Conclusion:** The majority of the studied nurses had unsatisfactory practices regarding phlebotomy technique among patients receiving anticoagulants. **Recommendations:** Ongoing and regular in-service training programs should be conducted to improve nurses' phlebotomy-related practices for patients on anticoagulants such as avoiding probing, and proper tourniquet use.

Keywords: Phlebotomy, Anticoagulants, Safe nurses' practices.

Introduction

Anticoagulant is considered a primary strategy to prevent the devastating consequences resulting from thrombus formation **(Palmer, 2023).** Globally; tens of millions of patients use anticoagulant medications which have lately grown among hospitalized patients **(Burnett & Barnes, 2022)**. In the United States, anticoagulants have been identified as one of the top five drug types associated with patient safety incidents **(Center for Disease Control and Prevention, 2024).**

In addition, anticoagulants have the highest rate of medication-related Adverse Drug Events (ADEs) even in inpatient settings, most of these anticoagulation-related ADEs may be preventable. In this regard, the Joint Commission in collaboration with the

Anticoagulation Forum has suggested considerations that focus on developing guidelines to guide anticoagulation management, optimizing the ability to identify potential risks, and taking action to improve anticoagulant safety practices **(Dager et al., 2020).**

Regrettably, despite the overall favorable safety practices, the risk of bleeding remains a dominant adverse event when treating patients with anticoagulants, especially after invasive procedures **(Dreijer et al., 2019).** One of the most common invasive nursing procedures performed worldwide is phlebotomy which is defined as the practice of drawing blood by penetrating a vein with a needle attached to a blood collection device or syringe for blood tests **(McCall, 2023).**

Despite the simplicity of the phlebotomy procedure, it has a great failure rate up to 30% and it may require several trials, so nurses should be trained in that procedure especially; standard operating techniques, and standard precautions that should be followed such as biosafety mechanisms, patients' safety, communication to achieve safe practice **(Srikanth & Lotfollahzadeh, 2021).**

Patient safety practice is defined by **(Chatzi & Malliarou, 2023)** as: "the state in which harm to patients from nursing practice is eliminated or reduced so far as reasonably practicable through a continuing process of adverse effects' identification". The action of nurses is imperative for the adoption of safe practices and better-quality healthcare, especially in invasive procedures **(Biresaw et al., 2020).**

Complications of the phlebotomy procedure in patients receiving anticoagulants are pain, proximal nerve injury, bleeding, hematoma formation at the puncture site, and hemoconcentration from prolonged use of a tourniquet. In addition, among patients with poor vascular status, phlebotomy may prolong the sampling time, resulting in unreliable laboratory values and lead to patients' dissatisfaction with care **(Kaganovskaya et al., 2023)**.

Accordingly, many international practice guidelines consider that patients' safety is significantly impacted by the practice, attitude, and expertise of the healthcare providers during phlebotomy procedure, they suggested that there is a need for guideline adherence improvement to several crucial phlebotomy practices **(Clinical and laboratory standards Institute, 2017; Simundic et al., 2018; World Health Organization, 2010)**.

Significance of the study

Nurses as health care providers are considered responsible for ensuring the safety and quality of patient care at all times, so nursing staff should improve their practices when caring for patients on anticoagulant therapy as it's a high-alert medication;

especially when performing phlebotomy procedure as it's the most frequently encountered in hospitals **(Vaismoradi et al., 2020).**

Considering this a study conducted by **(Ahmed & Ali, 2016)** has recommended determining the effect of nursing intervention on the prevention of the phlebotomy local complications among patients receiving anticoagulants. To the best of our knowledge, no available researches have studied nurses' performance regarding phlebotomy among patients receiving anticoagulants. Thus, the current study aimed to assess the nurses' safe practices in phlebotomy techniques in those patients as an initial step for designing information-based interventions. Ultimately, this research aids in improving patient safety outcomes by addressing areas where further education and training may be needed to enhance nurses' competence in performing phlebotomy procedures safely and efficiently.

Aim of the study

The aim of this study was to assess safe nurses' practices regarding phlebotomy technique among patients receiving anticoagulants.

Operational definitions:

- **Phlebotomy:** in this study refers to drawing or removing blood from the veins through a puncture to obtain a specimen, not for blood donation, and only by syringe not by vacuum systems.

- **Safe nurses' practices**: in this study refer to the practices performed by the nurses to reduce the risk of adverse events before, during, and immediately after performing phlebotomy on adult patients receiving anticoagulants.

Research question:

What are the safe nurses' practices regarding phlebotomy technique among patients receiving anticoagulants?

Subjects and Methods:

Research design: A descriptive cross-sectional research design was used to conduct the study.

Research Setting:

This study was conducted at the four inpatient units in Itay Elbaroud General Hospital, affiliated to El-Beheira Health Directorate, Ministry of Health and Population (MOHP). These units are the medical, surgical, orthopedic, and neurosurgery units.

Research subjects:

The study included all nurses (n=109) who were working in the above-mentioned setting, assigned to provide bedside nursing care for patients receiving anticoagulants, and responsible for the phlebotomy procedure at the time of data collection.

Tool of data collection:

One tool was used to collect data in this study "Phlebotomy safe nurses' practices observational checklist", it was developed by the researchers after reviewing the recent relevant literature **(Booth & Mundt, 2019; Clinical and Laboratory Standards Institute, 2017; Hoeltke, 2019; Lister et al., 2021; World Health Organization, 2010).** It was designed to assess the safe nurses' practices regarding phlebotomy among patients receiving anticoagulants. It included two parts:

Part 1: Nurses' demographic datasheet: this part was used to collect demographic and academic data of nurses including age, gender, marital status, academic qualification, current department, years of previous experience, years of experience in the current department, and previous attendance of training programs about safe practices of anticoagulant therapy.

Part 2: **Phlebotomy safe nurses' practices among patients receiving anticoagulants observational checklist**: it included the following headings:

 Section 1: Nurses' practices before starting the phlebotomy procedure including: checking the patient's chart, checking prerequisites, hand washing, equipment preparation, patient preparations, and environment preparation.

Section 2: Nurses' practices during phlebotomy procedure including: assessment and site selection, application of a tourniquet, measures to improve vein visibility, site palpation, needle size selection, wearing gloves, site preparation, venipuncture performance, sample withdrawal, removing the needle from phlebotomy site, and measures in patients who developed swelling from the procedure.

Section 3: Nurses' practices after phlebotomy procedure including: patient instruction, sample transfer to the test tube, observation of the phlebotomy site, measures to control bleeding, labeling of the tube, safe discarding of equipment, hand washing, patient positioning, documentation and reporting after finishing the procedure.

Scoring system:

- Each step and sub-step of the observed nurses' practices in the observational checklist was scored as follows: (2) for safe correct and complete practice, (1) for safe correct and incomplete practice, and (0) for missed practices or those done incorrectly. The total score ranged from 0- 164; the total score for each nurse was summed up and converted into percent, and classified according to the following:

- Total score of ≥75% was considered as satisfactory nursing practice, which corresponded to 123-164.

- Total score of <75% was considered as unsatisfactory nursing practice, which corresponded to 0-122.

 Operational design: It was conducted in four phases: the preparatory phase, tool validity, pilot study, tool reliability, and fieldwork.

Preparatory phase:

A review of the recent relevant related literature covering the various aspects of the

research problem was done by using articles, journals, internet periodicals, and textbooks to develop the tool of data collection.

Tool validity

The developed tool was tested for content validity, completeness, and clarity of items by a panel of five experts at the Faculty of Nursing, Damanhour University; from the Medical-Surgical Nursing and Critical Care Nursing departments. Accordingly, modifications were done.

Pilot study

A pilot study was conducted on 10% of the total sample size (n=11 Nurses), who were excluded from the study sample to ensure the feasibility, and clarity of the study tool and to identify obstacles or problems that may be encountered during data collection.

Tool reliability

The reliability of the tool was tested for (part 2) by Cronbach's coefficient Alpha test, which was 0.72 indicating accepted reliability.

Fieldwork:

Approval

An official letter of permission was obtained from the Dean of Faculty of Nursing, Damanhour University, and it was directed to the administrative authorities of the selected setting (general director of Itay El-Baroud General Hospital), and the Directorate of Health Affairs in El-Beheira Governorate to have their permission to collect the data after an explanation of the study's aim.

Data collection:

Data was collected over a period of five months; from mid-September 2023 to mid-February 2024. The researcher interviewed head nurses of each department individually in their working office for about 20 minutes to explain the aim of the study and determine nurses who provide bedside nursing care. Each nurse was observed by the researcher twice using (part 2) according to their assignment schedule; the first observation was done during the morning shift, and the second one was done during the evening shift in another day for the same nurse through concealed observation as the researcher explained that the aim of the study was patients' safety and its relation to blood sampling frequency.

The researcher observed the whole phlebotomy procedure, then after completion of all observations for the studied nurses, the researcher interviewed all the observed nurses to obtain their demographic and academic data using (part 1) for nearly 5 minutes for each nurse individually.

Ethical considerations:

Permission was obtained from the ethical committee in the Faculty of Nursing at Damanhour University to conduct the study on (16/3/2023), with the ethical approval code (74-b). Also, an official letter of approval from the Scientific Research Ethics Committee of MOHP was obtained on 13/9/2023. Witness-informed written consent was obtained from the head nurses of the departments after an explanation of the aim of the study. Anonymity, confidentiality, and privacy of all the studied nurses' data were assured to the nurses.

Statistical analysis:

The collected data were organized, tabulated, and statistically analyzed using the Statistical Package for Social Studies (SPSS) Version 23.0. Qualitative data were described using numbers and percentages. Quantitative data were described by mean and standard deviation. The mean of the two observations (part II) was calculated and obtained. Finally, analysis and interpretation of data were conducted.

The following statistical analysis measures were used:
- Paired t-test for normally distributed quantitative variables, to compare between 1st and 2nd observations.

- Chi-square (Monte Carlo) test for categorical variables, to compare between different categories
- P-values of 0.05 or less were considered statistically significant.

Results:

Table (1) shows the percentage distribution of the studied nurses according to their demographic and academic data, it was noticed that all the studied nurses were females, had a technical nursing qualification, and did not attend any training programs about safe nursing practices for patients on anticoagulant therapy. Also, more than half (57.1%) were from the age group from 20 to less than 30 years old, and more than two-fifths (42.9%) of them had from 5 to less than 10 years of previous nursing experience. In addition, the highest percent (69.4%) had from 1 to less than 5 years of experience in the current department.

Table (2) illustrates the percentage distribution of the average observation of safe nurses' practices before the phlebotomy procedure among patients receiving anticoagulants. It was found that more than half (58.2%) of the studied nurses didn't wash their hands before the procedure, and only 6.1% of studied nurses identified their patients correctly and completely.

Table (3) Shows the percentage distribution of the average observation of safe nurses' practices during the phlebotomy procedure among patients receiving anticoagulants. It was observed that all the studied nurses inserted the needle correctly followed by the vast majority of them (95.9%) anchored the vein, and more than three-quarters of them (77.6%) avoided probing, in addition, the majority of nurses (91.7%) pulled the needle

out and applied firm pressure with gauze when hematoma was formed, while none of them applied ice to the site.

Table (4) reveals the percentage distribution of the average observation of safe nurses' practices after the phlebotomy procedure among patients receiving anticoagulants. It was noticed that the majority of the studied nurses (83.3%) didn't instruct their patients to avoid bending the arm when the antecubital veins were used.

Table (5) exhibits the distribution of the studied nurses according to their scores of safe practices regarding phlebotomy in the first and second observation. It was found that there were statistically significant differences between safe practices in the first and second observations; as the first observation was higher than the second observation after the phlebotomy procedure and in the total practices score; where p values were (<0.001, 0.001) respectively.

Figure (1) reveals that the majority of the studied nurses (80.6%) had unsatisfactory practices regarding their overall safe phlebotomy practices among patients receiving anticoagulants.

Table (6) depicts the relationship between nurses' demographic and academic data and their phlebotomy safe practices among patients receiving anticoagulants, it was observed that there were statistically significant relations between the average levels of safe nurses' practices and their age, current department, previous years of experience, and experience in the current ward; where p-values were (0.002, 0.002, <0.001, and < 0.001) respectively.

Table (1): Percentage distribution of the studied nurses according to their demographic and academic data.

Demographic and academic data	No.	%
	n= 98	
➢ **Gender**		
• Female	98	100.0
➢ **Age (years)**		
• 20 < 30	56	57.1
• 30 < 40	42	42.9
Min. – Max. Mean ± SD	23-39 28.85±3.68	
➢ **Marital status**		
• Single	1	1.0
• Married	95	97.0
• Divorced	1	1.0
• Widowed	1	1.0
➢ **Qualifications**		
• Technical	98	100.0
➢ **Current department**		
• Surgical	35	35.8
• Orthopedic	22	22.4
• Medical	30	30.6
• Neurosurgery	11	11.2
➢ **Previous years of experience**		

• 1 <5	31	31.6
• 5 <10	42	42.9
• 10 <15	25	25.5
Min. – Max. Mean ± SD	1.0 – 14.0 6.51 ± 3.54	
➢ **Experience in current department**		
• 1 <5	68	69.4
• 5 <10	30	30.6
Min. – Max. Mean ± SD	1.0 – 9.0 3.64 ± 1.81	
➢ **Previous training about safe nursing practices for patients on anticoagulant therapy**		
• No	98	100.0

Table (2): Percentage distribution of the average observation of safe nurses' practices before the phlebotomy procedure among patients receiving anticoagulants.

Steps of safe nurses' practices before phlebotomy	Average observation (n= 98)							
	Not done /done incorrectly		Done correctly and incomplete		Done correctly and complete		Not applicable	
	No.	%	No.	%	No.	%	No.	%
➢ **Check the patient's chart for**								
• Written physician order.	0	0.0	0	0.0	98	100.0	0	0.0
• Diagnosis.	0	0.0	0	0.0	98	100.0	0	0.0
• Anticoagulant therapy.	57	58.2	0	0.0	41	41.8	0	0.0
• Last lab. Results.	93	94.9	0	0.0	5	5.1	0	0.0
• Associated diseases.	5	5.1	0	0.0	93	94.9	0	0.0
➢ Check for pre-collection instructions.	(n= 30)						68	69.4
	0	0.0	0	0.0	30	100.0		
➢ Identify special requirements for the specimen.	(n= 5)						93	94.9
	0	0.0	0	0.0	5	100.0		
➢ Wash hands.	57	58.2	0	0.0	41	41.8	0	0.0
➢ **Prepare equipment and supplies.**								
• Clean tray.	15	15.3	0	0.0	83	84.7	0	0.0
• Disposable gloves.	13	13.3	0	0.0	85	86.7	0	0.0
• Disposable tourniquet, syringes, sample tubes.	0	0.0	0	0.0	98	100.0	0	0.0
• Alcohol swabs.	30	30.6	0	0.0	68	69.4	0	0.0
• Gauze swabs.	4	4.1	0	0.0	94	95.9	0	0.0
• Adhesive tape.	45	45.9	0	0.0	53	54.1	0	0.0
• Safety needle box.	0	0.0	0	0.0	98	100.0	0	0.0
➢ **Patient's preparation**								
• Proper patient identification.	26	26.5	66	67.4	6	6.1	0	0.0
• Explain the procedure.	0	0.0	71	72.4	27	27.6	0	0.0
• Ask the patient about the phlebotomy preference site.	94	95.9	0	0.0	4	4.1	0	0.0
• Ask the patient about previous phlebotomy problems.	97	99.0	0	0.0	1	1.0	0	0.0
• Adjust the patient's position.	0	0.0	0	0.0	98	100.0	0	0.0
• Stop IVI for 2 min before obtaining the sample.	n=14						84	85.7
	8	57.1	0	0.0	6	42.9		
• **Environment preparations.**	0	0.0	74	75.5	24	24.5	0	0.0

Table (3): Percentage distribution of the average observation of safe nurses' practices during the phlebotomy procedure among patients receiving anticoagulants.

Steps of safe nurses' practices during phlebotomy	Average observation (n= 98)							
	Not done /done incorrectly		Done correctly and incomplete		Done correctly and complete		Not applicable	
	No.	%	No.	%	No.	%	No.	%
➢ Proper selection of sampling site.	0	0.0	0	0.0	98	100.0	0	0.0
➢ Avoid the use of a tourniquet if possible.	98	100.0	0	0.0	0	0.0	0	0.0
➢ **If the tourniquet is used**								
• Correctly apply tourniquet.	50	51.0	0	0.0	48	49.0	0	0.0
• Check distal pulse.	98	100.0	0	0.0	0	0.0	0	0.0
• Remove the tourniquet with a single motion.	1	1.0	0	0.0	97	99.0	0	0.0
• Keep the tourniquet less than 1 minute.	50	51.0	0	0.0	48	49.0	0	0.0
• Place tourniquet between IVI and insertion site.	**n= 9**						89	90.8
	5	55.6	0	0.0	4	44.4		
➢ **Methods to improve vein visibility**								
• Place the arm in a dependent position.	0	0.0	0	0.0	98	100.0	0	0.0
• Ask the patient to clench the fist.	8	8.2	0	0.0	90	91.8	0	0.0
• Gentle tapping vein.	4	4.1	0	0.0	94	95.9	0	0.0
• Apply a warm compress (5- 10) minutes.	98	100.0	0	0.0	0	0.0	0	0.0
➢ Palpate the selected vein.	0	0.0	0	0.0	98	100.0	0	0.0
➢ Release the tourniquet.	98	100.0	0	0.0	0	0.0	0	0.0
➢ Choose an appropriate-size needle.	2	2.0	0	0.0	96	98.0	0	0.0
➢ Wear gloves.	13	13.3	0	0.0	85	86.7	0	0.0

Table (3): "Continued"

Steps of safe nurses' practices during phlebotomy	Average observation (n= 98)							
	Not done /done incorrectly		Done correctly and incomplete		Done correctly and complete		Not applicable	
	No.	%	No.	%	No.	%	No.	%
➢ Proper disinfection of the site.	30	30.6	0	0.0	68	69.4	0	0.0
➢ Avoid re-palpation after disinfection.	76	77.6	0	0.0	22	22.4	0	0.0
➢ Reapply the tourniquet.	98	100.0	0	0.0	0	0.0	0	0.0
➢ **Venipuncture performance**								
• Remove the cap of the needle without touching.	0	0.0	0	0.0	98	100.0	0	0.0
• Inform patient about feeling a stick, take a deep breath.	98	100.0	0	0.0	0	0.0	0	0.0
• Anchoring the vein.	4	4.1	0	0.0	94	95.9	0	0.0
• Insert the needle with the bevel upward at 15-30º.	0	0.0	0	0.0	98	100.0	0	0.0
• Avoid probing around the site.	22	22.4	0	0.0	76	77.6	0	0.0
➢ Hold the syringe securely, slowly pull back the plunger.	0	0.0	0	0.0	98	100.0	0	0.0
➢ Release the tourniquet.	0	0.0	29	29.6	69	70.4	0	0.0
➢ Apply a sterile gauze pad over the site.	4	4.1	0	0.0	94	95.9	0	0.0
➢ Remove the needle at the same angle of insertion.	0	0.0	0	0.0	98	100.0	0	0.0
➢ Apply pressure after removing the needle.	23	23.5	0	0.0	75	76.5	0	0.0
➢ **In the case of hematoma formation**	n=12						86	87.8
• Release the tourniquet.	6	50.0	0	0.0	6	50.0		
• Pull the needle out.	1	8.3	0	0.0	11	91.7		
• Apply firm pressure with dry gauze.	1	8.3	0	0.0	11	91.7		
• Apply ice to the site.	12	100.0	0	0.0	0	0.0		

Table (4): Percentage distribution of the average observation of safe nurses' practices after the phlebotomy procedure among patients receiving anticoagulants.

Steps of safe nurses' practices after phlebotomy	Average observation (n= 98)							
	Not done /done incorrectly		Done correctly and incomplete		Done correctly and complete		Not applicable	
	No.	%	No.	%	No.	%	No.	%
➤ Apply further pressure for at least 5 minutes.	1	1.0	0	0.0	97	99.0	0	0.0
➤ Avoid bending the arm if antecubital veins are used.	n=66						32	32.7
	55	83.3	0	0.0	11	16.7		
➤ Transfer blood in the syringe to the test tubes safely.	94	95.9	0	0.0	4	4.1	0	0.0
➤ Gently invert the tube back and forth immediately.	n=88						10	10.2
	2	2.3	0	0.0	86	97.7		
➤ Withhold pressing the phlebotomy site.	48	49.0	0	0.0	50	51.0	0	0.0
➤ Observe the site for 5 to 10 seconds before tape.	98	100.0	0	0.0	0	0.0	0	0.0
➤ Allow gauze to be in place for at least 15 minutes.	11	11.2	0	0.0	87	88.8	0	0.0
➤ Measures to control bleeding after the procedure (if happened).	n=6						92	93.9
	1	16.7	0	0.0	5	83.3		
➤ Label the tubes with patient's data.	0	0.0	41	41.8	57	58.2	0	0.0
➤ Safely discard disposable equipment.	0	0.0	0	0.0	98	100.0	0	0.0
➤ Wash hands.	30	30.6	0	0.0	68	69.4	0	0.0
➤ Keep patient in comfortable position.	0	0.0	0	0.0	98	100.0	0	0.0
➤ Observe the arm after 15 min for any problem.	98	100.0	0	0.0	0	0.0	0	0.0
➤ **Documentation and reporting** • Date /Time.	5	5.1	0	0.0	93	94.9	0	0.0
	n=10						88	89.8
• Number of failed trials.	9	90.0	0	0.0	1	10.0		
• Sites of attempts	10	100.0	0	0.0	0	0.0		
• Unexpected outcomes (bleeding and hematoma) and nursing interventions.	n=18						80	81.6
	18	100.0	0	0.0	0	0.0		
➤ Nurse signature.	0	0.0	0	0.0	98	100.0	0	0.0

Table (5): Distribution of the studied nurses according to their scores of safe practices regarding phlebotomy in the first and second observation.

Safe nurses' practices	Total score	First observation			Second observation			Average mean percent score	t (P)
		Min- Max.	Mean ± SD	Mean percent score	Min- Max.	Mean ± SD	Mean percent score		
➢ Before phlebotomy procedure	54	21.0-46.0	31.9±5.3	64.8±9.8	21.0-44.0	31.8±4.7	65.0±9.3	64.9±9.5	0.951 (0.344)
➢ During phlebotomy procedure	68	28.0-44.0	37.2±3.6	66.8±7.0	28.0-44.0	36.4±3.5	67.1±6.7	64.6±6.4	1.185 (0.239)
➢ After phlebotomy procedure	42	14.0 – 26.0	19.9±2.5	73.7±13.2	13.0 – 26.0	19.8±2.6	63.6±9.5	76.1±9.8	**7.790* (<0.001*)**
➢ Total score	164	68.0-109.0	86.1±8.9	72.2±7.2	68.0-106.0	87.0±9.7	69.8±8.9	68.5±7.0	**3.556* (0.001*)**

t: Paired t-test   *: Statistically significant at $p \leq 0.05$
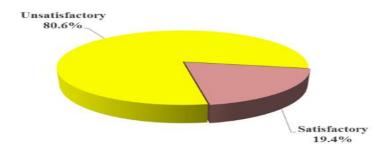
Figure (1): Percentage distribution of the studied nurses according to their overall safe phlebotomy practices among patients receiving anticoagulants.

Table (6): Relationship between nurses' demographic and academic data and their safe phlebotomy practices among patients receiving anticoagulants.

Demographic and academic data	Average level of safe nurses' practices (n = 98)				x^2	^{MC}p
	Unsatisfactory (n = 79)		Satisfactory (n = 19)			
	No.	%	No.	%		
➢ **Age (years)**						
• 20 < 30	51	64.6%	5	26.3%	9.146*	**0.002***
• 30 < 40	28	35.4%	14	73.7%		
➢ **Marital status**						
• Single	1	1.3%	0	0.0%		
• Married	76	96.1%	19	100%	1.394	1.000
• Divorced	1	1.3%	0	0.0%		
• Widowed	1	1.3%	0	0.0%		
➢ **Current department**						
• Surgical	28	35.4%	7	36.8%		
• Orthopedic	12	15.2%	10	52.6%	14.210*	**0.002***
• Medical	29	36.7%	1	5.3%		
• Neurosurgery	10	12.7%	1	5.3%		
➢ **Previous years of experience**						
• 1 <5	30	38.0%	1	5.3%		
• 5 <10	39	49.4%	3	15.8%	35.593*	**<0.001***
• 10 <15	10	12.6%	15	78.9%		
➢ **Experience in current department**						
• 1 <5	62	78.5%	6	31.6%	15.862*	**<0.001***
• 5 <10	17	21.5%	13	68.4%		

χ2: Chi-square test   MC: Monte Carlo   *: Statistically significant at p ≤ 0.05

Discussion

Proper skills of nurses are of utmost importance because any negligence in the standard operating procedures of phlebotomy can result in several unwanted clinical outcomes for patients, and false laboratory results, subsequently leading to faulty diagnosis, treatment, and consequently compromising patients' safety. **(Cornes et al., 2019)** Therefore, the current study aimed to assess nurses' safe practices regarding phlebotomy technique among patients receiving anticoagulants.

The present study results revealed that **the majority of the studied nurses had unsatisfactory practices** which can be interpreted **in the light of the following:** The demographic characteristics of the studied nurses showed that all of them were females, this may be due to the feminization of nursing profession. This finding is in line with a study conducted in Egypt by **(Atalla & Henedy, 2018)** as they found that the majority of their studied nurses were females. Furthermore, another study conducted in Lithuania by **(Stonys & Vitkus, 2024)** found that most of their participants were females.

The current study also revealed that more than half of the studied nurses were between the ages of 20 to less than 30 years old. This could be explained by the fact that recruiting younger nurses offers numerous benefits to departments with a high turnover like the present study settings, as they can tolerate the stressful work environment, and they are more resilient and adaptable to the demands of such healthcare environment. On the contrary, A study conducted by **(Dilshika et al., 2021)** revealed that more than half of their studied nurses were between the ages of 30 to 40 years old, as they conducted their study in a setting with higher bed capacity.

Considering **academic qualification,** the present study revealed that all studied nurses had a technical nursing education, This may be attributed to that technical education typically enables caring for more stable patients at inpatient units where the study was conducted, while those with bachelor's degrees are often assigned to the critical care units where patients require a higher level of expertise and specialized care by highly professional nurses. This finding is consistent with **(Soliman et al., 2019)** and **(Silva et al., 2021)** as the majority of their studied nurses had technical nursing education.

Concerning the studied nurses' **years of experience** in nursing, it was observed that more than two-fifths of them had from 5 to less than 10 years, which is incongruent with **(Allawy& Ibrahim, 2023)** as they reported that more than two-fifths of their subjects had more than ten years of experience, this discrepancy may be due to including a higher sample from different settings in their study.

Moreover, the present study revealed that all the studied nurses didn't attend any training programs about safe nursing practices for patients on anticoagulants previously. This may be due to a lack of in-service training programs conducted inside the hospital. Furthermore, because of the busy and demanding nature of the nursing staff's shifts. On the contrary, a study conducted by **(Jose et al., 2019)** illustrated that all their studied nurses had previous knowledge from in-service education, this disparity could result from being a private multispecialty hospital that has set benchmarks in quality where training courses are scheduled regularly.

Concerning washing hands, the researcher noticed that more than half of studied nurses in the present study didn't wash their hands before starting the procedure, this may be due to unavailable resources as there was only one sink in each studied unit and lack of soap, paper tissues to wash and dry hands. Similar results were reported by **(Ahmed & Ali, 2016)**, and **(Allawy& Ibrahim, 2023)**. On the opposite, a study conducted by **(Rana et al., 2024)** reported that two-thirds of their studied nurses complied with hand hygiene standards before the phlebotomy procedure.

Regarding patient identification, the present study revealed that a minority of the studied nurses could identify patients correctly and completely which may be attributed to the

familiarity between the studied nurses and their assigned patients, as the settings were inpatient units in a hospital. Conversely with these findings, studies conducted by **(Unnithan et al., 2023),** and **(Aggarwal et al., 2022)** reported that proper patient identification was done by the majority of their subjects.

Considering venipuncture performance, the result showed that all nurses inserted the needle correctly, and the majority of them anchored the patient veins correctly. Also, more than three-quarters of them avoided probing around the site. This might be interpreted as they imitate each other and gain the skill through repetition of the procedure in their daily experience. This finding is in the same line, with that of **(Silva et al., 2021)** as almost all of their subjects inserted the needle and anchored the patient's veins correctly.

Moreover, the present study found that the majority of the studied nurses didn't instruct their patients to avoid bending the arm when the antecubital veins were used, this might be interpreted by that they considering bending the arm as an easier way to apply pressure over the site to prevent bleeding than direct pressure. In contrast, **(Oprea et al., 2023)** reported that all their subjects instructed the patients to apply direct pressure over the phlebotomy site and didn't bend the arms.

As for the **overall safe phlebotomy nurses' practices among patients receiving anticoagulants,** the findings of the present study demonstrated that the majority of the studied nurses had unsatisfactory practice regarding the phlebotomy procedure among patients receiving anticoagulants, which might be interpreted by that all the studied nurses were technical and didn't attend any training programs related to safe nursing practices for patients on anticoagulants, this was supported by **(Allawy & Ibrahim, 2023)** and **(Moursy & Elsayed, 2019)** as they interpreted the unsatisfactory practices of their subjects to lack of previous training. In addition, factors that were noticed by the researcher during the collection of data such as the absence of instruction posters and booklets, inadequate nurses' supervision, inadequate

equipment, shortage of staff nurses, and work overload.

The present findings also agreed with **(Hassan et al., 2023)** in that more than two-thirds of their studied nurses had unsatisfactory practice pre-implementation of their nursing guidance about phlebotomy. On the other hand, the present finding is inconsistent with a study conducted by **(Dey et al., 2023)** in India, which revealed that the majority of their studied nurses had good practice regarding phlebotomy.

Moreover, the results illustrated statistically significant higher differences in the first observation than in the second observation in mean scores after phlebotomy and in overall scores. This might be attributed to the availability of a higher number of staff nurses during morning shifts (first observation) than in evening shifts (second observation), as the insufficient number of nurses leads to a higher workload that affects the nurses' safe practices and reflects on the patient's care quality. Also, the presence of the head nurse who directly supervises staff nurses is only during morning shifts. This finding is consistent with a study conducted in Egypt by **(Araby, et al., 2018)** as the majority of their studied nurses had to compromise patient care due to not having enough scheduled nurses on the shift, which increased the workload on them resulting in lack of time, so they had to leave necessary care for their patients undone.

For a better understanding of the results, it was important to explore the relationship between demographic and academic data and the average level of safe nurses' practices. In this context, the results revealed a significant relation between age and the average level of safe nurses' practices; where older nurses (from 30 to less than 40 years) had a satisfactory level of safe practices. This can be explained by that competent performance is gained by practicing the skill for a longer duration as in the case of senior nurses. This finding is congruent with that of **(Mohamed et al., 2022).** However, this result is in contrast with **(Ibraheem et al., 2023)** as they found no statistically significant relation between nurses' total practice and their age.

Also, the results showed a statistically significant relation between the average safe nurses' practices and their previous experience. This result may be attributed to that day-to-day activities enhance nurses' experience and improve their practice. This finding is in line with **(Mohamed et al., 2022)** as they reported a statistically significant relation between nurses' total practice and their years of experience as nurses with experience more than 10 years were more competent than others.

Furthermore, the present study indicated a statistically significant relation between average nurses' safe practice and working in the orthopedic department. This might be interpreted as that the phlebotomy procedure is routinely performed for all orthopedic patients, and all patients were already receiving anticoagulants. In addition, a lesser bed capacity in the orthopedic department in relation to nursing staff manpower might decrease the workload on nursing staff throughout their shifts. In contrast to this finding, a study conducted by **(Soliman et al., 2019)** reported that there was no statistically significant relation between average nurses' level of practice of phlebotomy and their department of work. This may be due to the variety of departments in their studied setting which included nurses from intensive care units, inpatients, and emergency departments as the practices vary considerably between different departments even within the same healthcare setting.

Finally, the findings of this study supported that safe nurses' practices regarding phlebotomy technique among patients receiving anticoagulants were unsatisfactory, besides better practices were found among seniors and older nurses.

Limitations of the study:

The sample was not representative as all subjects in the present study were females and they had technical nursing education which might not be accepted to generalize the results additional research on nurses from different qualifications, both male and female, and in different hospital settings to generalize the results.

Conclusion:

In light of the present study results, it can be concluded that the majority of the studied nurses had unsatisfactory practices regarding their overall safe phlebotomy practices among patients receiving anticoagulants; with a higher level of unsatisfactory practices during the procedure especially regarding tourniquet application, and infection control measures. The findings also indicated statistically significant relations between the safe nurses' practices and older age, those with higher previous experience in nursing, higher years of experience especially in the current department, and nurses working in the orthopedic department.

Recommendations:

Based on the findings of the present study, the following recommendations are suggested:

- **Recommendations for nurses:**

  – On-going and regular in-service training programs concerning phlebotomy are highly recommended to improve nurses' practices among patients receiving anticoagulants. These practices are avoiding probing, correct tourniquet application, bleeding and hematoma control measures, and infection control measures, especially for novice nurses.

- **Recommendations for administration:**

  – Availability of a nursing procedure manual that includes specific instructions and illustrations with what should be avoided during the phlebotomy procedure in all hospital departments as a teaching aid for nurses.

- **Recommendations for further research:**

  – Study the correlation between nurses' practice, type of anticoagulant, and incidence of complications.

  – Evaluate the application of guidelines of phlebotomy technique on the incidence of complications among patients receiving anticoagulants.

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