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Nurses knowledge, practice and attitude regarding patients safety after cardiac catheterization

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Abstract

Cardiovascular diseases are the number one cause of death globally, more people die annually from CVDs than from any other cause, an estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths: 85% are due to heart attack and stroke. Aim of this study was to Assess Nurses Knowledge, Practice and Attitude Regarding Patients Safety after Cardiac Catheterization.

Design: A descriptive research design was utilized in this study.

Subjects: A purposive sample of all nurses (55) caring for patients after Cardiac Catheterization. Was involved in this study.

Setting: data were collected from the Intensive Care Units at the National Heart Institute. Tools: three tools were used for data collection (I) Nurses' self-administered questionnaire. (II) Nurses' attitude likert scale and (III) Nurses' practice observational checklist.

The results: The result of present study indicated that more than half of studied nurses had satisfactory level of knowledge while, majority of them had satisfactory level of practice and positive level of attitude regarding patient's safety after CC.

Conclusion: more than half of studied nurses had satisfactory level of knowledge while the most of them had satisfactory level of practice and positive level of attitude regarding patient's safety after CC. In addition, there were statistically significant correlations between total level of nurses' knowledge, practice and attitude scores.

Recommendation: There are obvious needs for conducted an educational and training programs to improve nurse's knowledge, practice and attitude regarding patient's safety CC.

Keywords: Cardiac catheterization "CC", patients' safety, cardiovascular diseases

Introduction

Cardiovascular diseases are the number one lead to death globally: more people die every year from CVDs than from any other cause, an estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths: 85% are due to heart attack and stroke (WHO, 2021) ^[31].

Coronary artery disease effect on the lives of millions of patients and their families, together with those who provide and plan care, those responsible for planning and funding care especially in developing countries like Egypt. Indeed, WHO estimates that 60% of the global burden of CAD occurs in developing countries (Ralapanawa& Sivakanesan, 2021) ^[21].

CC is one of the most diagnostic and interventional tools available to the cardiologist today, CC is performed for treat certain cardiovascular conditions. Diagnostic catheters are used to evaluate blood flow and pressures in the chambers of heart, valves and coronary arteries, to assist in the diagnosis and management of congenital heart defects (Mitchell, *et al.*, 2020) ^[16].

Complications after cardiac catheterization are usually momentary and may include minor infections, bleeding, abnormal heartbeats, and reaction to medications or dye (Mohamed, 2018) ^[18].

Nurses have a multiple of roles and functions associated with the patients' care undergoing CC. Nurses provide care of a pt. Before, during, and after CC procedure, it is accountability of cardiac nurses to take care of post cardiac catheterize procedure patients with proper standard because it is very contagious to retain infectious diseases.

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Ideas that most of the threats which relate to patients safety and illness, were elevate from health care provider and organization system factor (Sheikh, *et al.* 2015) ^[27].

Cardiac catheterization nurses have to demonstrate a top level of independence, critical thinking abilities and problem solving skills. Moreover, they need specialized knowledge about CC care that enables them to leads nursing tasks, such as taking patient history, applying nursing diagnosis, planning, implementing nursing activities and assessing the outcome (Rothrock. 2018) ^[24].

Patients' safety has become regional and international priority in last years, with increased confirming across the world in policy reform, legislative changes and development of criteria of care driven by quality improvement initiatives. Patients' safety is often viewed as accountability shared by all operatives in the health care system (WHO, 2020) ^[30].

Significance of the study

Cardiac catheterization unit in the Egyptian national heart institute destines more than 1500 cardiac catheterization every month either diagnostic or therapeutic. It also destines more than 20,000 procedures annually (Statistical Cardiology Department of National Heart Institute, 2016).

In the United States: more than 5million diagnostic and interventional CC is performed each year. CC considered went standard for the diagnosis, evaluation, and treatment of cardiac diseases, although it has declined morbidity and mortality for CV disease, but this invasive procedure is not free of complication (Manda & Baradhi, 2018) ^[13].

Aim of the study

This study aims to assess nurses performance regarding patients safety after cardiac catheterization through:

1. Assess nurses knowledge regarding patients safety after cardiac catheterization.
2. Assess nurses practice regarding patients safety after cardiac catheterization.
3. Assess nurses attitude regarding patients safety after cardiac catheterization.
4. Identify factors affecting patient safety after cardiac catheterization.

Subjects and Methods

Research design

A descriptive exploratory research study was utilized in this study.

Setting

This study was conducted in the CCUs at national heart institute Hospital, The setting consisted of five CCUs and cath labe, 1st unit contained 4 beds, 2nd unit contained 4 beds, 3rd unit contained 8 beds, 4th unit contained 16 beds& the 5th unit contained 17 beds.

Subjects

A purposive sample of all available nurses (55) caring for patients after CC was recruited in this study with the following criteria:-

Inclusion criteria

1. Master of Science in nursing.
2. Postgraduate Diploma
3. Bachelor of Science in nursing.
4. Schools of nursing.

5. Nursing diploma.

6. Nurses age ≤ 44 .

Exclusion criteria

1. Nursing administration team.
2. Student nurses.
3. Nurses age ≥ 45 .
4. Nurses are not interested to participate in the study.

Tools of data collection

The investigator used 3 tools to totaling the data during the study:-

Tool I: Nurses' Self-administered questionnaire sheet: (Appendix I)

This tool consisted of 3 parts:

Part one: It was meaning with demographic properties of nurses under study as age, sex, qualifications, marital status, years of experience and previous attendance of training courses regarding CC (9 items).

Part two: It was meaning with assessment of nurses' knowledge regarding pt. safety after CC. it was adopted from (Mohamed, 2018) ^[18]. It consisted of (56) questions; (46) of them were M.C.Q & the last question including (10) true & false questions, this tool comprised the following:

A- Anatomy of the heart and coronary arteries (4questions), Overview about CC; definition, purpose, indications and contraindications. (10questions), Preparation for CC. (5questions), Information about potential complications following CC (13questions), Nurses' role regarding patients' safety to prevent potential complications after CC (14questions) and Discharge instructions after CC (10 true & false questions).

Scoring system of nurses' knowledge

Scoring system: one point was given for the correct answer and zero for incorrect one

The total score for all test was 56 grades, the scoring system were used as following

- Satisfactory level: $\geq 80\%$ (≥ 45 grades).
- Unsatisfactory level: $< 80\%$ (< 45 grades).

Part three: It was meaning with assessment of the factors affecting the nurses' performance regarding patients' safety after CC. It was adopted from (Mohamed, 2018) ^[18], it included 5 parts:

- The 1st part: nursing related factors (6 items).
- The 2nd part: professional support related factors (5 items).
- The 3rd part: job satisfaction related factors (13 items).
- The 4th part: safety measures related factors (7 items).
- The 5th part: work environment related factors (7items).

Scoring system: The nurse responds for each item with two options (no or yes) as if the response is No, it means the factors affecting negatively on their performance and it was scored zero. If the response is yes, it means the factors affecting positively on their performance and it was scored one. The total score of 38 grades was classified as the following:

- $\geq 80\%$ (≥ 30 grades) of the positive factors was regarded

positive affection on the nurses' performance.

- <80% (<30 grades) of the positive factors was regarded negative affection on the nurses' performance.

Tool II: Nurses' attitude likert scale (Appendix II)

It was meaning with assessment of nurses' attitude toward patients' safety after CC (based on Safety Attitudes Questionnaire) and it was adopted from (Mohamed, 2018) [18]. It consisted of (22) sentences and answers are grading according to 5 likert scale (strongly agree, agree, neutral, disagree and strongly disagree).

Scoring system: the total score was classified as the following:

- $\geq 80\%$ (≥ 70 grades) was regarded Positive attitude.
- $< 80\%$ (< 70 grades) was regarded negative attitude.

Tool III: Nurses' practice observational checklist (Appendix III)

It was meaning with assessment of nurses' practice regarding pt. safety after CC. It was adopted from (Mohamed, 2018) [18]. It comprised the following:

1. Relieving anxiety (9 items).
2. Relieving acute pain (8 items).
3. Increasing activity tolerance (5 items).
4. Prevention and management of potential complications if occur (48 items).
5. Providing information regarding the therapeutic regimen to be followed after the invasive procedure (11 items).

Scoring system: total score was (82) classified as the following:-

- $\geq 80\%$ (≥ 66 grades) was regarded competence level of nursing practice.
- $< 80\%$ (< 66 grades) was regarded incompetence level of nursing practice.

(II) Operational item

It involves the preparatory phase, content validity, reliability, ethical consideration, pilot study and field work.

Preparatory phase: It included audits of related literature, and theoretical knowledge of different aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection.

Pilot study: was carried out on 10% of nurses under study to test the applicability, clarity and efficiency of the tools.

Tools validity and reliability: (appendix V)

- **Content validity:** The tools were redacted for content validity by a jury of 5 experts, three were professors' assistants and two of them were lecturer of medical surgical nursing at faculty of nursing, Helwan University. Required modifications were done.

- **Testing reliability** of suggested tools was done statistically by Cronbach's alpha reliability test, the reliability was scaled as follows: < 0.25 weak reliability, $0.25-0.75$ moderate reliability, $0.75-1$ strong reliability and 1 is optimum. The reliability for this questionnaire was 0.81.

Field work

A written approval was obtained from national heart institute directors and nursing staff; orally approval was obtained for each tool to be filled in by the investigator- The preparation of the written tools for data collection, took about 2 months, starting from April 2020 to end of June 2020. Data collection started and was completed within 6 months from August 2020 to January 2021. The purpose of the study was simply clarified to all nurses that were included and agreed to involve in the study prior to any data collection. The observational checklist was used prior to administration of questionnaire to ensure the maximal realistic observations of the nurses' performance and minimize the possibility of bias.

Ethical considerations

The ethical research considerations in this study included the following:

- a. The research approval was obtained from the scientific ethical commission in faculty of nursing at Helwan University.
- b. The investigator clarified the objective and aim of the study to the nurses included in the study.
- c. The investigator assured maintaining secrecy and covertly of the subject data.
- d. Nurses were informed about their rights to involved or withdraw from the study at any time.

(III) Administrative item

An official permission was obtained from the general manger of National Heart Institute Hospital in which the study was conducted. A letter was issued to them from the faculty of nursing, Helwan University, clarified the aim of the study to obtain license for data collection.

(IV) Statistical item

Data analysis: All data collected were organized, entered and analyzed using appropriate statistical significance tests. The data were collected, coded and entered to personal computer (PC).

Statistical submission and analysis of the present study was conducted, using the mean, standered deviation, chi-square test was used to compare between groups in qualitative and linear correlation coefficient was used for detection of correlation between two quantitative variable in one group by (IBM SPSS Statistics for Windows, Version 20.0.Armonk, NY: IBM Corp.).

Significant level

- > 0.05 Non significant
- < 0.05 significant
- < 0.001 highly significant

Results**Part I: Demographic data****Table 1:** Percentage distribution of nurses under study according to their demographic characteristics (n=55).

Variables	The studied Patients (n=55)	
	NO	%
Age (years)		
20<30	34	61.8
30<40	11	20.0
40 or more	10	18.2
Mean ± SD	32.56 ± 8.14	
Gender		
Male	19	34.5
Female	36	65.5
Marital status		
Single	16	29.1
Married	37	67.3
Divorced	2	3.6
Widow	0	
Qualification		
Diploma/ technical institute	20	36.4
Bachelor’s degree	32	58.2
Postgraduate	3	5.5
General years of experience		
1<5	16	29.1
5<10	20	36.4
10 or more	19	34.5
Mean ± SD	11.01±6.9	
Years of experience in CCU		
<10	32	76.4
10 or more	13	23.6
Mean ± SD	8.6 ± 4.16	
Attendance of training courses regarding safety of the patients undergoing CC.		
Yes	18	32.7
No	37	67.3

As observed from this table, the mean age of the study nurses was 32.56 \pm 8.14 years, about two third of them were females, married and no attendance of training courses regarding safety of the patients undergoing CC.(65.5%,67.3% respectively).

As regard qualification of nurses under study sample, about half (58.2%) had Bachelor's degree and about two fifth (36.4%) had 5<10 general years of experience while more than three quarter of them (76.4%) were <10 years of experience in CC with mean \pm SD 8.6 \pm 4.16

Table 2: Total Level of understudy nurses knowledge (N=55).

Total to Levels of knowledge	Satisfactory \geq 80%		Un satisfactory \leq 80%	
	N	%	N	%
A- Nursing knowledge on the anatomy of the heart and coronary arteries :	35	63.6	20	36.4
B- Nursing knowledge related to cardiac catheterization:	33	60.0	22	40.0
C- Nursing information regarding preparations for the CC procedure:	36	65.5	19	34.5
D- Nursing information about possible complications after cardiac catheterization and how to know them:	32	58.2	23	41.8
E- Information about the nursing role in relation to patient safety to prevent possible complications after cardiac catheterization:	33	60.0	22	40.0
H- Instructions should a nurse give to a cardiac catheter patient before leaving the hospital :	42	76.4	13	23.6
Total	35	63.6	20	36.4

This Table shows that (76.4%, 65.5%, 63.6% & 60%) respectively of the studied nurses had got satisfactory level regarding the following items: Instructions should a nurse give to a cardiac catheter patient before leaving the hospital, Nursing information regarding preparations for the CC procedure, Nursing knowledge on the anatomy of the heart and coronary arteries, Nursing knowledge related to cardiac catheterization. While (41.8%, 40.0% & 36.4%)

respectively of them had got unsatisfactory level of knowledge regarding; Nursing information about possible complications after cardiac catheterization and how to know them, Information about the nursing role in relation to patient safety to prevent possible complications after cardiac catheterization, Nursing knowledge on the anatomy of the heart and coronary arteries.

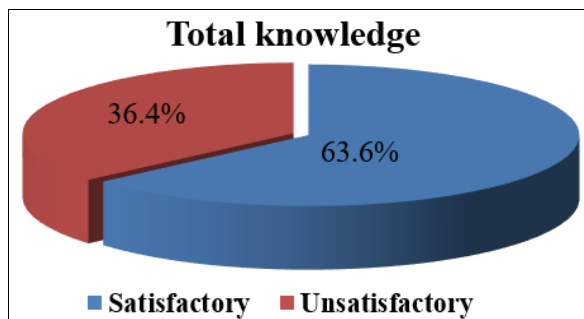


Fig 1: Distribution of the studied nurses according to their total level of knowledge regarding the patients' safety after CC (n=55).

Figure (1) Illustrates that (63.6%) of the studied nurses were having satisfactory level of total knowledge and (36.4%)

were having unsatisfactory level of total knowledge regarding the patients' safety after C.

Table 3: Total level of practice regarding patients' safety after CC (55)

Item	Competence $\geq 80\%$		Incompetence $\leq 80\%$	
	N	%	N	%
1-Relieving anxiety	41	74.5	14	25.5
2-Relieving acute pain	48	87.3	7	12.7
3-Increasing activity tolerance	36	65.5	19	34.5
4-prevention & management of potential complication if occur	50	90.9	5	9.1
5-Providing information regarding the therapeutic regimen to be followed after the invasive procedure	46	83.6	9	16.4
Total	44	80.0	11	20.0

This Table illustrates that the majority of studied nurses were having competent level of practice regarding prevention and management of potential complications. In addition to relieving acute pain and providing information regarding the therapeutic regimen to be followed after the invasive procedure (90.9%, 87.3% & 83.6%) respectively. While more than a quarter of the studied nurses was having incompetent level of practice regarding: Increasing activity tolerance, relieving anxiety (34.5% & 25.5) respectively.

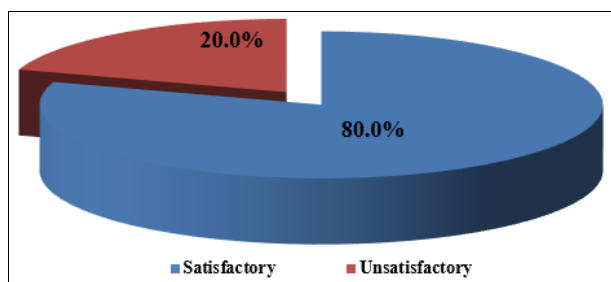


Fig 2: Distribution of the studied nurses according to their total level of practice.

Figure (2): show that the majority of studied nurses under study (80%) were having competent level of total practice and (20%) were having incompetent level regarding the patients' safety after CC.

Table 4: Total attitude of the studied nurses regarding the patients' safety after CC

Total attitude	N	%
Positive	47	85.5
Negative	8	14.5
Total	55	80.0

This table shows that the total level of nurses' positive attitude regarding patients' safety after CC, which are representing as either strongly agree or agree were (85.5%).

while the total level of nurses' negative attitude regarding patients' safety after CC, which are representing as either strongly disagree, disagree or neutral were (14.5%).

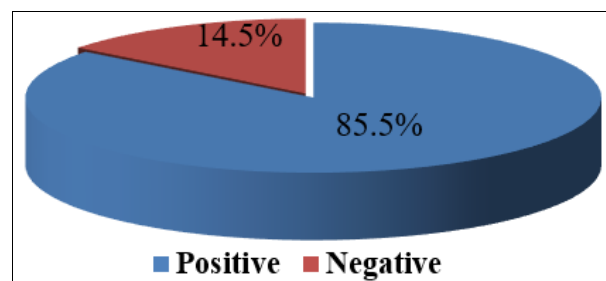


Fig 3: Distribution of the studied nurses according to their total level of attitude (n=55).

Figure (3) shows that (85.5%) of the studied nurses were having positive attitude regarding the patients' safety after CC while 14.5% have negative attitude.

Table 5: Total Levels of factors affected to under study nurses performance

Total Levels of factors	positive		negative	
	N	%	N	%
A-Nursing related factors	35	63.6	20	36.4
B-Professional support related factors	34	61.8	21	38.2
C-Job satisfaction related factors	26	47.3	29	52.7
D-Safety measures related factors	41	74.5	14	25.5
H-Work environment related factors	43	78.2	12	21.8
Total	36	65.5	19	34.5

This Table shows that less than four fifths of nurses under study (78.2%) agree about Work environment related factors that affecting on nurses' performance, while above half of the study sample (52.7%) agree about Job satisfaction related factors affecting negatively about nurses' performance.

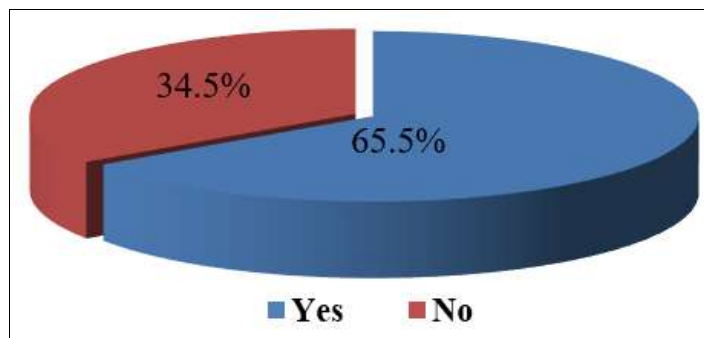


Fig 4: Distribution of the studied nurses according to their factors affecting on nursing performance regarding pt. safety after CC (n=55).

Figure (4) show that (65.5%) of the studied nurses were having factors affecting on performance regarding pt. safety after cardiac catheterization CC (n=55).

Table 6: Relation between nurses' demographic characteristics and their total level of knowledge regarding the patients' safety after CC (n=55).

Item	Total knowledge						
	Satisfactory		Unsatisfactory		Total	Chi-square	
	N	%	N	%		X ²	P-value
Age (years)							
20<30	16	47.1	18	52.9	34	11.324	0.003*
30<40	9	81.8	2	18.2	11		
40 or more	10	100.0	0	0.0	10		
Gender							
Male	11	57.9	8	42.1	19	0.414	0.520
Female	24	66.7	12	33.3	36		
Marital status							
Single	8	50.0	8	50.0	16	2.150	0.341
Married	26	70.3	11	29.7	37		
Divorced	1	50.0	1	50.0	2		
Qualification							
Diploma/ technical institute	9	45.0	11	55.0	20	5.655	0.059
Bachelor degree	23	71.9	9	28.1	32		
Postgraduate	3	100.0	0	0.0	3		
General years of experience							
1<5	3	18.7	13	81.3	16	22.313	<0.001**
5-10	14	70.0	6	30.0	20		
10 or more	18	94.7	1	5.3	19		
Years of experience in CCU							
1<5	13	43.3	17	56.7	30	12.530	0.006*
5-10	10	83.3	2	16.7	12		
10 or more	12	92.3	1	7.7	13		
Attendance of training courses regarding safety of the patients undergoing CC. :							
Yes	15	83.3	3	16.7	18	4.486	0.034*
No	20	54.1	17	45.9	37		

No Significant >0.05, Significant <0.05, Highly Significant = <0.001

This table show highly statistically significant positive relation between total knowledge with general years of experience. $p = <0.001$ and show statistically significant positive relation between total knowledge with age, years of

experience in CCU and attendance of training courses regarding safety of the patients undergoing CC ($p=0.003$, 0.006 & 0.034 respectively).

Table 7: Relation between nurses' demographic characteristics and their total level of practice regarding the patients' safety after CC (n=55).

Item	Total practice						
	Competence >80%		Incompetence <80%		Total	Chi-square	
	N	%	N	%		X ²	P-value
Age (years) :							
20<30	24	70.6	10	29.4	34	5.201	0.074
30<40	10	90.9	1	9.1	11		
40 or more	10	100.0	0	0.0	10		
Gender :							
Male	13	68.4	6	31.6	19	2.432	0.119

Female	31	86.1	5	13.9	36		
Marital status :							
Single	11	68.8	5	31.3	16	3.364	0.186
Married	32	86.5	5	13.5	37		
Divorced	1	50.0	1	50.0	2		
Qualification :							
Diploma/ technical institute	13	65.0	7	35.0	20	4.688	0.096
Bachelor degree	28	87.5	4	12.5	32		
Postgraduate	3	100.0	0	0.0	3		
General years of experience. :							
1<5	7	43.7	9	56.3	16	19.271	<0.001**
5-10	18	90.0	2	10.0	20		
10 or more	19	100.0	0	0.0	19		
Years of experience in CCU. :							
1<5	19	63.3	11	36.7	30	11.944	0.008*
5-10	12	100.0	0	0.0	12		
10 or more	13	100.0	0	0.0	13		
Attendance of training courses regarding safety of the patients undergoing CC. :							
Yes	16	88.9	2	11.1	18	1.321	0.250
No	28	75.7	9	24.3	37		

No Significant >0.05, Significant <0.05, Highly Significant = <0.001

This table show statistically significant positive relation between total practice with general years of experience p=<0.001 also show statistically significant positive relation

between total knowledge with years of experience in CCU p=0.008.

Table 8: Relation between nurses' demographic characteristics and their total level of attitude regarding the patients' safety after CC (n=55).

Item	Total attitude						Chi-square	
	Positive		Negative		Total	X ²		
	N	%	N	%				
Age (years) :								
<30	27	79.4	7	20.6	34	2.964	0.227	
<40	10	90.9	1	9.1	11			
40 or more	10	100.0	0	0.0	10			
Gender :								
Male	13	68.4	6	31.6	19	6.776	0.009*	
Female	34	94.4	2	5.6	36			
Marital status :								
Single	12	75.0	4	25.0	16	2.163	0.339	
Married	33	89.2	4	10.8	37			
Divorced	2	100.0	0	0.0	2			
Qualification :								
Diploma/ technical institute	14	70.0	6	30.0	20	6.125	0.047*	
Bachelor degree	30	93.8	2	6.3	32			
Postgraduate	3	100.0	0	0.0	3			
General years of experience:								
1<5	10	62.5	6	37.5	16	10.236	0.017*	
5-10	19	95.0	1	5.0	20			
10 or more	18	94.7	1	5.3	19			
Years of experience in CCU:								
1<5	23	76.7	7	23.3	30	5.432	0.143	
5-10	12	100.0	0	0.0	12			
10 or more	12	92.3	1	7.7	13			
Attendance of training courses regarding safety of the patients undergoing CC. :								
Yes	16	88.9	2	11.1	18	0.254	0.614	
No	31	83.8	6	16.2	37			

No Significant >0.05, Significant <0.05, Highly Significant = <0.001

This table show statistically significant positive relation between total attitude with gender, qualification and general years of experience p= 0.009, 0.047&0.017 respectively.

Table 9: Correlation between total level of the studied nurses' knowledge, practice and attitude (n=55)

Item	Total knowledge		Total practice	
	r	P-value	r	P-value
Total practice	0.656	<0.001**		
Total attitude	0.632	<0.001**	0.574	<0.001**

No Significant >0.05, Significant <0.05, Highly Significant = <0.001

This table show highly statistically significant positive relation between total level of the studied nurses' knowledge and practice, and attitude $p < 0.001$.

Discussion

The discussion of the finding covered six main parts

First Part displays the nurses' demographic characteristics. The second Part revealed the nurses' level of knowledge regarding patients' safety after CC. Third Part showed the nurses' level of practice regarding patients' safety after CC. Fourth Part revealed the nurses level of attitude regarding patients' safety after CC. Fifth Part concerned with the factors affecting nurses' knowledge, practice, and attitude regarding patients' safety after CC. Sixth Part deal with the relation between nurse's demographic characteristic and their level of knowledge, practice and attitude. In addition to the correlation between nurses' knowledge, practice and attitude.

First Part nurses' demographic characteristics

The mean age of the study nurses was 32.56 ± 8.14 years, about two third of them were females, married and didn't attend any training courses regarding safety of the patients undergoing CC. (65.5%, 67.3% respectively). As regard qualification of nurses under study sample, about half (58.2%) had Bachelor's degree and about two fifth (36.4%) had 5 < 10 general years of experience while more than three quarter of them (76.4%) were < 10 years of experience in CC with mean \pm SD 8.6 ± 4.16

Second Part Nurses' knowledge regarding patients' safety after cardiac catheterization

The current study unraveled that, the majority of nurses under study had satisfactory level of knowledge about anatomy of the heart, signs and symptoms of potential complications and their role to maintain patients' safety after CC. This might be appertain level of qualification of the nurses under study as majority of them were got bachelor degree and approval of procedure book, protocol & policy regarding patients' safety after CC in CCU. This finding is supported by Bakr (2020) [6] study about "assessment of nurses' performance regarding care of patients undergoing cardiac catheterization." and found that their knowledge was satisfactory, While, Sajila, (2013) [26] who conducted a study about "Assessment of nurses knowledge regarding the care of patients undergoing CC among nurses in selected hospital in Bangalore " and found that their knowledge was moderately adequate.

Concerning the nurses' knowledge regarding post CC complications, this study finding unraveled that the majority of them had got satisfactory level of knowledge regarding signs and symptoms of potential complications as wound infection, dye allergy, retroperitoneal bleeding, cardiac arrhythmia, bleeding and hematoma and its management. This study finding is supported by Feroze (2017) [8] who conducted a study about "Assess Knowledge and Practice of Registered Nurses about Patient Safety after Cardiac Catheterization in Punjab Institute of Cardiology Hospital" and found that the nurses have adequate knowledge about CC complications.

Concerning the nurses knowledge about their role toward patients' safety after CC, the majority of nurses were having satisfactory level of knowledge regarding post-operative care including; the optimal frequency of vital signs

measurement after CC, ambulation time and importance of early ambulation, and instructions that should be avoided during six hours following CC. According to Abbas, (2014) [1] who research study about "Effect of implementing a clinical pathway on health outcome of patients undergoing (PCI)" and reported that monitoring vital signs as the mean pulse rate, body temperature, RR, BP and oxygen saturation is an important aspect of PCI care to monitor major complications.

Part III Nurses practice regarding patients' safety after CC

Nurses should demonstrate competencies throughout their professional careers: Thus nurses' practice in CC must be appraised in order to ascertain the level of competency. The nurses' practice regarding patients' safety after CC care categorized into; relieving anxiety, relieving acute pain, increasing activity tolerance, prevention and management of potential complications and discharge instructions for pt. after CC.

The present study depicted that the majority of the studied nurses had got satisfactory level of practice regarding the patients' safety after CC. This may be due to supervision from senior staff, highly qualified nurses work bedside, working a lot of emergency and complicated cases. This finding is corresponding with Henedy & El-Sayad 2020) [11] who conducted a study about "Nurses' Knowledge & practice regarding patient's safety Post CC." They found that CC nurses practice was good with degree of study and years of experience. While the study finding is in contrast with Yaqoob, Barolia, Noor & Nazar (2019) who assessed nurse's practices Regarding Patients' Care Following CC and found that nurse's practice was unsatisfactory. Moreover, the findings of the current study illustrate that majority of nurses were having competency level of practice regarding the patient's safety after CC namely:

Relieving acute pain; included administer prescribed medications, monitor vital signs and note any changes. Increase activity tolerance: encourage early mobilization as early, several studies supported early mobilization & reducing the duration of bed rest. in this cortex Johan, Ulf stenestrands, Tim and Johansson (2017) [12] who conducted a study about "Effect of early mobilization for patients undergoing coronary angiography" and found that changing position and early ambulation after CC are associated with increased comfort and satisfaction levels, decreased hospital length of stay and reduced level of fatigue with decreased risk of bleeding and hematoma and suggested that the required time in bed after CC can be safely decreased from six to four hours for cardiac patients with angina or valvular heart diseases.

Similarly, Mohammedy, *et al.* (2014) [19] who conducted a study about "Early ambulation after diagnostic trans femoral catheterization" found that ambulating the patient 2-3 hour after diagnostic CC is safe and is associated with low rates of vascular complications, back pain and urinary discomfort Finally, early ambulation activates circulation and improves blood supply to the extremity. This comes in line with Mousa, *et al.* (2018) who conducted a study about "Effect of Early Ambulation on Post Diagnostic CC Patient's Outcomes" and found that feet and leg exercises during rest hours stimulate the circulation and improve the blood supply to extremity which consequently improves the color,

temperature, sensation and the peripheral pulse of the operated limb.

Concerning prevention of circulatory complications, the majority of nurses had got competence level of practice regarding assessing distal extremity pulse, color & monitoring activated clotting time before sheath removal. This is in line with Abbas, (2014) ^[1] who reported that clotting time was done for patients 4 hours after PCI to ensure safety of sheath removal, which helps decrease the risk of access site complications.

Concerning prevention of renal complications, most of nurses had got competence level of practice regarding document findings in-patient chart, instructing the patient to increase fluid intake after CC this is may be due to the qualification and general year of experience. This is in line with Altioik, Yurtserver, and Kuyurtar, (2012) ^[4s] who conducted a study about "Review of the method to prevent femoral arteriotomy complications and contrast nephropathy in patients undergoing CC" and recommended giving oral fluids to patients immediately after CC procedure to prevent dehydration which may occur as a result of the diuretic effect of contrast media. This is in line with Mereten, Burgess, Rittase, and Kennedy, (2014) ^[15] who conducted a study about "Prevention of contrast induced nephropathy with sodium bicarbonate" and reported that oral fluids must be started during the immediate post procedure hours to prevent dehydration and decrease renal injury resulting from contrast exposure.

Concerning providing information to the patients after CC about the therapeutic regimen including medication, incision site care, activity, warning signs and symptoms and follow-up care. The current study unraveled that most of the nurses under the study were having satisfactory level of practice. The nurses should consider patients education as a part of their care plan. As providing the patients with information increases their comfort, post-operative adaptation and facilitates prevention, early detection and management of complications that may occur at home. This is consistent with Rao & Agasthi (2020) ^[22] who study about "Femoral Vascular Closure Devices after Catheterization Procedure" and found that post CC instructions are necessary to ensure safe and effective care to patients after CC.

Part IV: As regards to nurses' attitude regarding patients' safety after CC

The study unraveled that, the majority of nurses agreed that meeting the patients' needs (physical and psychological) contribute significantly to their safety. This result might be related to their feeling that occurrence of complications for such group of patients as a result of their neglecting to their needs could be attributed to many factors as represented in this study that may effect on their abilities to meet such needs. This finding is supported by Saberi, Jamshidi, Rajabi, Seydali and Bairami (2017) ^[25] who conducted a study about "Nurses attitude toward patient safety culture" found that, the majority of nurses had positive attitude regarding availability of nurse all time enhances meeting patients' needs therefore increases their comfort and safety.

The study unraveled that, the majority of nurse's dis agreed with the reporting process of complications for patient after CC This result might be related to their feeling about punishment from administrative and controlling the complication. This finding is supported by (Hasballah, *et al.* 2019) ^[9] who conducted a study about "Assess Nurses'

Knowledge and Attitude for Patient Safety in Cardiac Catheterization Unit" found that major of nurses had negative attitude toward patient safety in cardiac catheterization unit.

Part V: factors affecting nurses' performance regarding patients' safety after CC

The study unraveled many factors affecting on nurses performance mainly nursing related factors, professional support related factors, job satisfaction related factors, and Safety measures related factors and work environment related factors. Regarding nursing related factors; the present study revealed that most of nurses under study mentioned that, there is no ongoing training on how to perform better care after CC. This may be due to the overload of work in CCUs may reduce the nurses chance of attending and participating in such in-service training program, courses, workshops or conferences. This finding is in agreement with Mohan & Kumar (2015) ^[20] who cited that attending training courses improves skills and knowledge as it stressed on practical training to change nurses' practice using adequate sessions, demonstration and re-demonstration

As Regards professional support related factors; the present study unraveled that most of nurses under study mentioned that, there is no booklet for nursing skills in CCU; this might be due to the routine design in the government hospital and availability of technology, guideline reference this reflected on knowledge and practice among nurses under study relate the patients' safety after CC. This finding is in agreement with (Melnik, *et al.* 2018) ^[14], who mentioned that availability of procedure books and implementation of evidence-based practice (EBP) improve the nurses' practice and ensure the patients' quality safe nursing care.

Regarding job satisfaction related factors, current study unraveled that more than three quarter of nurses reported that unsuitable salaries for the pressure produced within the work environment considered barriers affecting negatively on their performance. This finding effect on their achievement that effect on their performance regarding patients' safety after CC. This was supported by El Fequi, (2013), who reported that, nurses spent more than third of their time in the work and had insufficient salaries and benefits.

The current study unraveled that more than three quarter of nurses reported that unsuitable encouraging rewards from management staff to nurses within CCU this considered barriers affecting negatively on their performance. This finding effect on their achievement that effect on their performance regarding patients' safety after CC. This was supported by (Rizzo, 2019) ^[23] who conducted a study about reward and recognition strategies to improve employee engagement.

Considering safety measures related factors, current study unraveled that, there are written protocols regarding nursing practice for patients' safety after CC that affect positively on their performance. This finding was supported by Thabet, *et al.* (2019) ^[29] and Melnik, *et al.* (2018) ^[14] that say guided protocol affect positively in pt. safety. The study finding is not similar with Gafer, (2015), who found that there is no any polices or guidelines in CCU which affect patient safety.

The current study unraveled that more than quarter of nurses

reported that, there is no clear no well-known records and continuous recording of any type of nursing care provided to the patients after CC. This finding is in agreeing with (Havaei & MacPhee 2020) ^[10] who study about "The impact of heavy nurse workload and patient/family complaints on workplace violence" who mentioned that the impact of a heavy nurse workload.

Regarding work environment related factors, the current study unraveled that the majority of nurses reported their cooperation between the health team members in setting the objectives of CCU and its working system. These factors could reflect positively on their knowledge and practice. This is supported with Copanitsanou, Fotos & Brokalaki (2017) ^[7] who study "Effects of work environment on patient and nurse outcomes"; this is inconsistent with Abd-Elaty (2015) ^[3] who study about "safety nursing measures for patients undergoing upper gastrointestinal endoscopy". Found that nurse's performance was unsatisfactory due to a combination of several factors related to nurses, hospital system and policies.

The current study unraveled that the majority of nurses reported their cooperation between the health team members in CCU to help in mastering some skills have not yet acquired. These factors could reflect positively on their knowledge, practice and pt. outcome. This is supported with Mlambo, Silén & McGrath (2021) ^[17] who study "Lifelong learning and nurses' continue professional development, a met synthesis of the literature" found a continuous education affect positively on nurses knowledge and pt. outcome.

The current study unraveled that more half of nurses agree about job satisfaction related factors affecting negatively about nurses performance regarding unsuitable salary for the resulting stress, no encouraging rewards from management staff, the work climate no encouragement you to make innovative suggestions regarding patients' safety after CC., daily working hours. This is due to the routine government policy and hard workload.

Part VI: The relations between nurses' demographic characteristic and their level of knowledge, practice and attitude

Regarding the relation between nurses' knowledge their age and years of experience. The study showed that significant relation. This may be due to the older nurses had got administrative duties beside the direct patients care, that is reflected the strong relation between age, years of experience and knowledge improvement, this finding is supported with Elsayed, Wala. (2020) who conducted study about "evaluate Nurses' Performance Regarding Safety Measures In Cardiac Catheterization Unit " those finding similar to Abd ElAziz, El-prince, Sleem & Shehab, (2011) ^[2] who conducted study about "Assessment the nurses' performance in Providing care to patients undergoing nasogastric Tube in Suez Canal university Hospitals" and revealed that there was positive correlation between nurses' knowledge, age and experience.

Concerning the correlation between nurses' demographic characteristics and their total level of practice regarding the patients' safety after CC

The result of the study indicated that a highly statistically significant correlation. This may be due to the Qualification and general years of experience. This is reflected the strong relation between age, years of experience and level of

practice regarding the patients' safety, this finding is supported with Al Oyce, Leshabari and Brysiewicz, (2014) who a study about "Assessment of knowledge and skills of triage among nurses working in emergency centers in " Dare salaam, Tanzania" and find that, majority of nurses had 1-10 years' experience.

Conclusion

Based on the findings of current study, it can be included that about more than half of the nurses were having satisfactory level of knowledge & most of them had got satisfactory level of practice, while more than three quarter had positive attitude regarding the patients' safety after CC. Many factors affecting negatively on their performance as reported by less than two thirds of the nurses' under the study namely nursing related factors, professional support related factors, job satisfaction related factors, safety measures related factors and work environment related factors.

Recommendation

Based on the results of present study, the following recommendations can be suggested:

1. Continuous evaluation of nurses' knowledge, practice and attitude regarding the patients' safety after CC is essential to identify their needs.
2. Availability of standardized nursing care protocol is recommended to guide the nurses in caring of patients after CC procedure for enhancing their safety.
3. Further research is conducted to evaluate the effect of training program regarding the patients' safety after CC on nurse's performance and patients' outcome

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