

Nurses' Knowledge and practice regarding patient's safety Post Cardiac Catheterization

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Abstract : **Background :** Cardiac catheterization is a diagnostic and interventional tool available to the cardiologist today. It may lead to several minor and more serious complications which may contribute to morbidity and mortality. The responsibility of the cardiac catheterization team is ensuring good patient care, safety without accidental harm as a result of a health care encounter. **Aim :** This study was conducted to assess cardiac nurses knowledge and practice regarding patient's safety post cardiac catheterization. **Design :** A descriptive-correlational design was used. **Setting :** This study was conducted at cardiac care units, intermediate cardiac care unit and cardiac and chest surgery department at University Hospital, at Shebien El koom, Menoufia Governorate, Egypt. **Sample :** A convenience sample of 40 cardiac nurses were involved in the present study. **Tools :** Semi - structured questionnaire and observational checklist were developed to assess the knowledge and practice of cardiac nurses. **Results :** This study revealed that the mean score of knowledge of nurses more than five years of experience (6.85 ± 0.99) was better than those less than five years of experience (3.26 ± 0.57). The mean practice score of nurses more than five years of experience (31.63 ± 3.77) was better than those less than five years of experience (23.82 ± 2.45). Baccalaureate nurses had higher mean score of knowledge (6.76 ± 1.98) than that of diploma and technical institute nurses (3.17 ± 3.31) also the mean practice score of Baccalaureate nurses (31.7 ± 5.84) was better than institute and diploma nurses (23.91 ± 6.00). There was relationship between staff nurses practice and knowledge with their years of experience ($r = 0.960$ and $p = 0.000$ and $r = .936$ with $p = 0,000$ respectively). **Conclusion :** knowledge level and practice of cardiac catheterization staff nurses regarding patient's safety increase with years of experience. **Recommendations :** Administrative and nursing leaders can provide relevant educational seminars, offer a standardized protocol for caring of patient in simulation labs, and assess the competency of newly staff nurses caring for patients after cardiac catheterization to ensure high-quality nursing care.

Key words: Cardiac Catheterization, Knowledge, Practices. And patient's safety

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I. Introduction

Cardiac catheterization is one of the most diagnostic and interventional tools available to the cardiologist today that involves insertion of a catheter into a vein or artery, usually from a groin or jugular access site, which is then guided into the heart with x-ray guidance. The adequacy of blood supply through the coronary arteries, blood pressures, blood flow throughout heart chambers, and obtaining minute information about the structure and function of the cardiac chambers, valves and coronary arteries all assessed through diagnostic catheter. Therapeutic one is an alternative to open-heart surgery for closure of septal defects, expansion of narrowed passages as pulmonary stenosis, stent placement and opening of new passages as foramen ovale (Chair, Choi, Wong, Sit, & Ip, 2012).

Cardiac patient is critically ill patient because of a limited cardiac output, poor myocardial perfusion, abnormal cardiac rhythm, and severe valvular lesions. This patient requires continuous assessment and intervention to diagnose and manage their complex medical conditions (Morton & Fontaine, 2012).

The steadiness of the patient post cardiac catheterization should be established initially. This will comprise, but is not limited to, vital signs, ECG, oxygenation saturation, urine output, cardiac, respiratory, pulmonary, gastrointestinal, and gentle urinary assessment. Frequently the patient may return from the cardiac catheterization laboratory with a sheath in place, an ACT may be essential to check the patient's clotting time prior to sheath removal. Generally, the cardiac nurse should monitor vital signs and distal pulses every 15 minutes X 4, every 30 minutes X 2, every hour X 2, then routine. If there is any alteration in the patient's neurovascular status the physician should be notified immediately (Keeling, Knight, Taylor, & Nordt, 2011 and Kausha, 2015).

Before the patient returns to the unit, the nurse should confirm that all equipment is accessible to evaluate and maintain the patient once he arrives, such as, intravenous pole with plump, pulse oximetry, blood

pressure cuff, telemetry if ordered, and sand bag. The patient placed on bed rest with the head of the bed no more than 30 degrees. affected extremity kept straight, hourly intake and output chart should be maintained when he returned from cardiac catheterization lab. If the patient starts to bleed at the puncture site, hold pressure above the insertion site until the bleeding is stopped and notify the physician (Kausha, 2015).

The important part of the clinical performance is decannulation of sheath (insertor) from either the femoral or radial approach takes place outside the catheterization room and done by doctor or nurse. procedure of the decannulation of sheath from arterial basin can influence the final effect of catheterization. Safe process of sheath decannulation requires specific standardized health care professional and provision of highly specialized compression aids to allow rapid mobilization of patient after procedure and reduction of complications as well(Klemsová,L and Žiaková, K 2014).

The overall prevalence of complications post cardiac catheterization is 1.5-9%. These complications are usually temporary and may comprise minor complication as bleeding, reaction to medications or dye, allergic skin reaction to latex ortape, bruising, abnormal heartbeats, temporary pain, minor infections, nausea and vomiting. There is also a possibility of more severe but infrequent complications which include serious bleeding, hematoma, heart or lung problems such as irregular heart rhythms and lung or heart failure, stroke, heart attack, blood vessel or nerve damage, blood clots in the legs or lungs, failure of medical equipment, and renal failure, with possible dialysis needed. Increased risk for vascular complications was found in patients who were older than 70 years, female, and had renal failure (Anderson, Bregendahl, Kaestel, Skriver, and Ravkilde, 2013).

Nurse plays a key and holistic role on providing care for patient with cardiac problems as well as patient undergone cardiac catheterizations procedures. Nurse also responsible for assessing patient for any negative signs of a change in condition, safe transport, administering medication, helping with basic personal care needs, controlling of bleeding, maintenance of hemostasis. Using an approved protocol of care that is based upon the different educational needs of nurses and considers other relevant factors will help the patients to cope successfully with their condition and minimizing their vascular complications (Ali et al., 2015).

It is the responsibility of the cardiac catheterization team ensure that patient is free from accidental harm as a result of a health care encounter Therefore, improving patient safety is at the front of policy and practice. Consciousness and skillfulness regarding patient safety have an impact on risk to patient safety, especially when health care provider have a deficit level of safety knowledge and skillfulness to provide safe care for their patients. Hence, the proficiencies of the cardiac nurses is imperative. Caring of patients post cardiac catheterization requires knowledge about its complications and the related factors. Moreover, nurses should be knowledgeable when preparing patients for the procedure and when providing care after procedure that includes close observation, continuous monitoring, and maintenance of hemodynamic stability. A well-functioning unit with a culture of safety, demonstrated clinical quality results, and high internal/external client satisfaction scores to evade the dangers associated with a less reliable unit (Arathy, 2011&Ahmed, Intessar Mohamed 2015).

Though, the nurse must be talented to recognize and interpret significant potential and/or existing post-catheterization complications. Nursing care of the patient post this procedure is vital to the successful completion of the test. Since any invasive procedure can lead to complications, quick and accurate nursing assessment and action are essential (Arathy, 2011).

1.1 Significance of the study:

Cardiac catheterization is a valuable diagnostic procedure which does a comprehensive examination of how the heart and its blood vessels function (Arathy, 2011). The overall incidence of vascular access complications alone has been reported to be ranged from 1.5 % to 9%, depending on the type of procedure, anticoagulation, closure devices, age, sex, and co morbidities. (Anderson, Bregendahl, Kaestel, Skriver, and Ravkilde, 2013and Ahmed, 2015). The investigator empirical observation showed that some of the newly joined staff nurses in cardiology department are less aware about safe practices. Patients' outcomes and self-care abilities were influenced to some extent, and there was readmission of some patients suffering from different complications. Majority of these complications were dangerous. Hence the investigator planned to conduct a study to assess cardiac nurse's knowledge and practice regarding patient's safety after cardiac catheterization procedures in cardiac unit.

1.2. Aim of the study

to assess cardiac nurse's knowledge and practice regarding patient's safety after cardiac catheterization procedures in cardiac units.

1.3. Research questions:

To achieve the aim of this study, the following research questions were established:

1. What is the level of cardiac nurses' knowledge regarding patient's safety after cardiac catheterization?
2. What is the level of cardiac nurses' practice regarding patient's safety after cardiac catheterization?
3. What is the relationship between cardiac nurses' level of knowledge regarding patient's safety after cardiac catheterization and years of experience?
4. What is the relationship between cardiac nurses' level of practice regarding patient's safety after cardiac catheterization and years of experience?
5. Is there a relationship between cardiac nurses' level of knowledge regarding patient's safety after cardiac catheterization and their educational level?
6. Is there a relationship between cardiac nurses' level of practice regarding patient's safety after cardiac catheterization and their educational level?

II. Methods

2.1. Research design:

A descriptive-correlational design was utilized to attain the aim of the study.

2.2. Research setting:

This study was conducted at cardiac care units, intermediate cardiac care unit and cardiac and chest surgery department at University Hospital, Shebien El koom, Menoufia Governorate, Egypt.

2.3. Research sample:

A convenience sample of 40 cardiac nurses who working in cardiac care units, intermediate cardiac care unit and chest surgery department at University Hospital, Shebien El koom, Menoufia Governorate, Egypt. were involved in the present study

2.4. Tool of the study:

Semi - structured questionnaire was developed by (Arathy, 2011) to assess knowledge of cardiac nurses about patient's safety post cardiac catheterization and involved the subsequent:

1. Socio demographic data: such as nurse's age, sex, qualification, place of work and total years of experience in cardiac units

2. Questions about the development of complications after cardiac catheterization: it included 10 multiple choice questions about local complications regarding detection of pseudo aneurysm, checking serum creatinine level, complication of delayed sheath removal, Development of contrast-induced nephropathy, risk for developing renal failure, sign of thrombus formation, immobilization of affected extremity, risk for developing pulmonary edema and detection of hematoma at the puncture site after cardiac catheterization. Scoring system: Each item was given a score 0 for incorrect answer or a score 1 for correct answer. All items scores were summed up to give a total score ranging from 0-10. The scores less than 5 (<50%) was considered a poor level of knowledge and the scores equal 5 or less than 8 (50- < 80 %) considered fair level of knowledge and the scores equal or more than 8 (≥ 80 %) considered a good level of knowledge. This percentage was decided by statistics personnel

II- Observational checklist was developed by researchers guided by (Arathy, 2011 & Feroze, Afzal, Sarwar, Galani, & Afshan, 2017) to assess practice of cardiac nurses about patient's safety post cardiac catheterization and involved the subsequent:

Nursing care after cardiac catheterization: this include 23 items regarding transfer of patient to bed, Places the patient in a supine position, explain the post catheterization care to the patient, checking distal pulse, frequency of checking pulse, assess the skin color or temperature of affected extremity, assess the vital sign for 15- 30 minutes for 2 hours initially and less frequently, assessing the puncture site, frequency of assessing the puncture site, assess for stability of pain, connected to cardiac monitor, checked for ECG, and SPO2, administering IV fluids, compression given to puncture site after sheath removal, immobilizing the affected limb after sheath removal, checking of untoward symptoms, maintenance of intake and output chart, intervention done if urine not passed, administered fluid and soft diet, administering medication, ambulation done in correct duration depending on type of cardiac catheterization and finally instruct the patient for self-management at home, before discharge. Scoring system: each item is given 2 score if done correctly, 1 score if done but incorrect or incomplete and zero score if not done. Participants' items scores were gathered to arrive at a whole score ranging from 0-46. The scores less than 60% (< 28) was considered a poor level of practice and the scores equal or more than 60% (≥ 28) considered a good level of practice. This percentage was decided by a panel of experts, who felt that 60% was a high level in an area of a critical nature.

2.6. Validity and reliability of the tool:

The two tools were examined for face and content validity by doing jury with academic staff of five professors of nursing and medical field had good experience in providing care for cardiac patients 'adjustments were done to confirm application and completeness. The reliability of the tool was done to determine the extent to which items in the tool were related to each other by Cronbach's co-efficiency Alpha ($\alpha = .70$). For nursing care post cardiac catheterization, the reliability of the tool was done to locate the degree to which items in the tool were related to each other by Cronbach's co-efficiency Alpha ($\alpha = .74$).

2.7. Pilot study:

A pilot study was carried out on 10% of nurses worked at cardiac care units and chest surgery department to assess clarity and applicability of the tool and estimate the time needed to fill each part. The necessary modification was done as revealed from the pilot study. The sample of the pilot study was excepted from the total sample to reassure the steadiness and strength of the result.

2.8. Ethical considerations:

Necessary permission was obtained from directors of university hospital after issuing letters to them from the Faculty of Nursing, Menoufia University explaining the aim of the study in order to obtain permission and help. Written informed consent was obtained from the cardiac nurses who were agreeable to participate in the current study. The participants were informed that participation in this study was voluntary, secrecy and obscurity of each subject was assured through coding of all data. All subjects had the right to withdraw from the study at any time without any reasoning. The researchers clarified the aim of the study to all nurses in the study sample.

2.9. Data collection procedure:

- Data collection for this study was carried out from the end of December 2017 to end of March 2018. After permission was granted to conduct the study, the researchers were initiated data collection.
- The researchers visited the selected settings during the morning and afternoon shifts. The average number of nurses who answered the questionnaire was two to three nurses per day.
- Before distributing the questionnaire, the researchers introduced themselves and a brief explanation about the objective of the study was given to the nurses. Questionnaires were distributed to the nurses who decided to participate in the study.
- The data was collected from the subjects by using semi- structured questionnaires to assess their knowledge regarding patient's safety after cardiac catheterization. The average time taken for completing questionnaires was about 30 minutes.
- The researchers were presented during data collection to make any required clarifications about questionnaires to the subjects, answer any questions or explanations and to check each questionnaire after its completion to be sure that questionnaires were being filled fully and there were no missed items.
- Each nurse was observed by researchers while performing each step of the procedure by using the observational checklist to assess their practice regarding, patient's safety after cardiac catheterization.

2.10. Statistical analysis:

- Data were statistically analyzed by SPSS version 19. The data obtained from the samples was analyzed by using descriptive statistics Student's t-test was used for parametric data.
- Pearson correlation was used for explaining relationship between normally distributed quantitative variable.
- Descriptive statistics: were expressed as mean and standard deviation ($\bar{X} \pm SD$) for quantitative data or number and percentage (No & %) for qualitative data.

P-value at 0.05 was used to determine significance regarding:

- P-value > 0.05 to be statistically insignificant.
- P-value ≤ 0.05 to be statistically significant.
- P-value ≤ 0.001 to be high statistically significant.

III. Results

Table (1): shows socio-demographic data of studied sample. It was found that, the mean age of the sample was 31.97 ± 3.99 years. The majority of the sample were female (80.0%), and their educational level were technical institute degree of nursing (45.0%) and Bachelor degree of nursing (43.0 %) It was also observed that, (42.5%) of the sample worked at chest surgery department and more than half (55.0%) of them had more than 5 years of experience.

Figure (1): illustrates that, (45% and 43%) of studied sample had technical institute degree of nursing and bachelor degree of nursing respectively

Table (2): Reveals that, (45%) of the sample had poor level of knowledge and 32.5% had good level of knowledge while 22.5% had fair level of knowledge about development of complications after cardiac catheterization

Table (3): Shows that more than half (55%) of sample had poor practice level and (45%) had good level of practice regarding procedure performed to maintain patient's safety post cardiac catheterization

Figure (2): It is observed that, more than half (55%) of the sample more than five years of experience

Table (4): Shows that, the mean score of knowledge of nurses more than five years of experience ($6.85 \pm .99$) was better than those less than five years of experience ($3.26 \pm .57$). The mean score of practice of nurses more than five years of experience (31.63 ± 3.77) was better than those less than five years of experience (23.82 ± 2.45). There was high statistically significant difference of knowledge and practice of the sample regarding years of experience (p-value is <0.001)

Table (5): Illustrates that, there was high statistically significant difference between nurses who had Technical institute and diploma degree of nursing and those who had bachelor degree of nursing regarding to total score of knowledge. And practice p-value is 0.000.

Table (6): illustrated that Pearson correlation between total score of knowledge & practice and years of experience of studied sample. There was a positive relationship between total score of knowledge and years of experience of studied sample ($r= 0.960$ with p-value=0.000). Also there was appositve relationship between total score of practice and years of experience of studied sample ($r= 0.936$ and p-value=0.000).

Table (1): distribution of the studied sample according to their socio-demographic data (n=40)

Socio-demographic	No	%
Age		
X ± SD	31.97± 3.99	
Range	13.00	
Minimum	26.00	
Maximum	39.00	
Gender		
Male	8	20.0
Female	32	80.0
Educational level		
diploma degree of nursing	5	12.0
technical institute degree of nursing	18	45.0
Bachelor degree of nursing	17	43.0
place of work		
cardiac care unit (CCU)	15	37.5
intermediate cardiac care unit (ICCU)	8	20.0
Cardiac and chest surgery department	17	42.5
total years of experience in cardiac unit		
<5years	18	45.0
>5years	22	55.0
total years of experience		
X ± SD	5.62±2.61	
Range	8.00	
Minimum	1.00	
Maximum	9.00	

Fig 1: educational level of studied sample

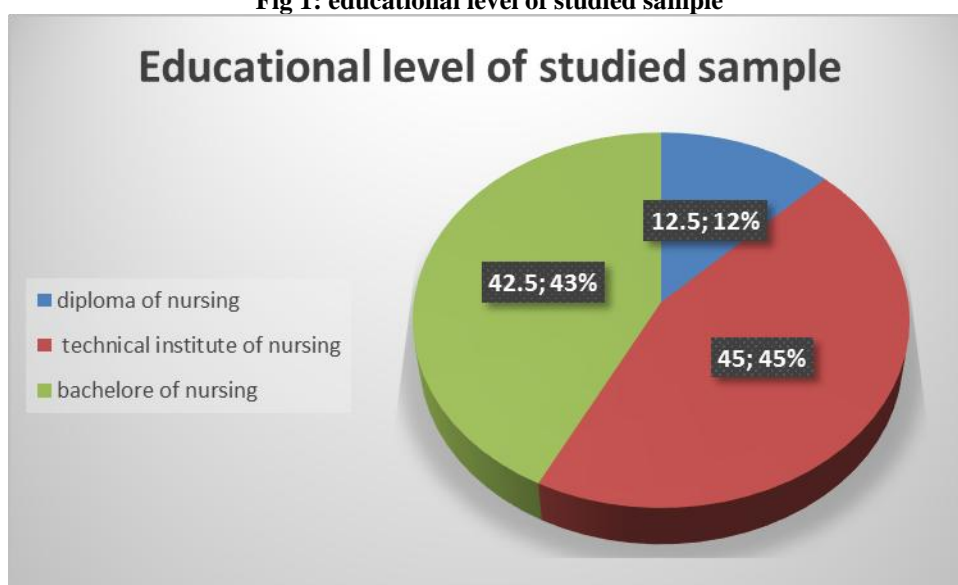


Fig 2: Total years of experience of studied sample in cardiac units

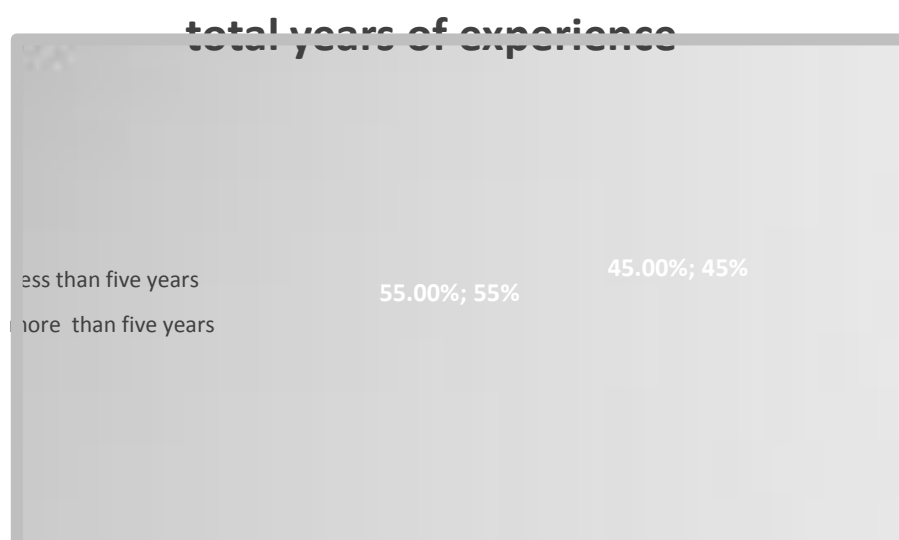


Table (2): Distribution of the sample according to their knowledge about development of complications after cardiac catheterization (n=40)

Items	Correct answer		Incorrect answer	
	N	%	N	%
What are the local complication occurring in patient after cardiac catheterization?	24	60	16	40
How will you detect pseudo aneurysm after cardiac catechization?	13	32.5	27	67.5
When should you check the serum creatinine level of the patient after cardiac catheterization?	12	30	28	70
What is the complication of delayed sheath removal?	30	75	10	25
When does development of contrast induced nephropathy occur?	11	27.5	29	72.5
Who is at risk for developing renal failure after cardiac catheterization?	10	25	30	75
What are the signs of thrombus formation after cardiac catheterization?	25	62.5	15	37.5
How long should the patient's affected extremity to be kept immobilized after cardiac catheterization?	22	55	18	45
Who is at risk for developing pulmonary edema after cardiac catheterization?	23	57.5	17	42.5

when you detect hematoma at the puncture site after cardiac catheterization, you should not	19	47.5	21	52.5
Total score:	18		45	
Poor (<50%) <5	9		22.5	
Fair(50%- <80%) >5-<8	13		32.5	
Good ≥80% ≥ 8				
Total score: (10) Mean ±SD	4.87 ±3.51			

Table (3): Distribution of studied sample according to their nursing care after cardiac catheterization to maintain patient's safety (observational check list) (n=40):

Nursing practice	Correctly done		In correctly done		Not done	
	No	%	No	%	No	%
1-Transfer to bed	27	67.5	10	25	3	7.5
2-Places the patient in a supine position	26	65	14	35	-	-
3-- Explain the post catheterization care to the patient	14	35	-	-	26	65
4-Keepthe extremity in which catheter inserted straight	16	40	17	42.5	7	17.5
5-Checking distal pulse	15	37.5	16	40	9	22.5
6-frequency of checking pulse	15	37.5	16	40	9	22.5
7-Assess the skin color or temperature of affected extremity	19	47.5	15	37.5	6	15
8-Assess the vital sign for (15- 30) minutes for (2) hours initially	22	55	18	45	-	-
9-Assessing puncture site for bleeding or hematoma	23	57.5	9	22.5	8	20-
10-Frequency of assessing puncture site	19	47.5	13	32.5	8	20-
11-Assess for stability of pain	15	37.5	15	37.5	10	25
12-Connected to cardiac monitor	40	100	-	-	-	-
13-Checked for ECG ,and SPO2	15	37.5	14	35	11	27.5
14-Administering IV fluid	18	45	22	55	-	-
15- Compression given to puncture site after sheath removal	28	70	12	30	-	-
16- Immobilizing the affected limb after sheath removal	30	75	10	25	-	-
17- Checked for untoward symptoms and signs	20	50	12	30	8	20
18-Maintained intake output chart	28	70	12	30	-	-
19- If urine not passed, intervention done	14	35	16	40	10	25
20- Administered fluid and soft diet	27	67.5	7	17.5	6	15
21- Due medicines given	40	100	-	-	-	-
22- Ambulation done in correct duration	19	47.5	21	52.5	-	-
23-Instruct the patient for self-management at home, before discharge	22	55	10	25	8	20

Continues table (3): Distribution of studied sample according to their nursing care after cardiac catheterization to maintain patient's safety (observational check list) (n=40):

Total score: (46)	22	55
Poor practice (<60%) <28	18	45
Good practice (≥60%) ≥28		
Total score: (46) Mean ±SD	27.95 ± 7.85	

Table (4): The mean score of total knowledge and practice of studied sample according to their years of experience (n=40).

Items	Subjects <5 years of experience n= (18)	Subjects >5 years of experience n= (22)	t-test	p-value
	X ± SD	X ± SD		
Total score of knowledge	3.26±.57	6.85±.99	6.49-	.000
Total score of practice	23.82 ± 2.45	31.63 ± 3.77	10.47-	.000

* p < 0.05 significance value

Table (5): The mean score of total knowledge and practice of studied sample according to their educational level (n=40).

Items	Technical institute and diploma degree of nursing n= (23)	B.Sc (N) n= (17)	t-test	p-value
	$\bar{X} \pm SD$	$\bar{X} \pm SD$		
Total score of knowledge	3.17±3.31	6.76± 1.98	9.04	.000
Total score of practice	23.91± 6.00	31.7±5.84	8.22	.000

* p< 0.05 significance value

Table (6) Pearson correlation between total score of knowledge & practice and years of experience of studied sample (n=40)

Items	Years of experience	
	R	P -value
total knowledge	0.960	0.000
total practice	0.936	0.000

*Correlation is significant at the 0.05 level(2-tailed).

IV. Discussion

Although cardiac catheterization is considered the most relevant standardized protocol of diagnosis, evaluation, and treatment of many cardiovascular diseases, it may lead to several minor and serious complications which may lead to morbidity and mortality. Nurses need to advance their knowledge and evidence based practice when providing care for patients after cardiac catheterization (Ahmed, 2015).

Regarding to Socio demographic data, the present study showed that the mean age of the sample was about thirty-two years old. This result agreed with Ali et al., (2015) who studied nurses' knowledge and practice regarding implantable device in Egypt and found that most of the participants were aged between 31 and 35 years old with a mean age of 34.85 + 5.385 but these findings disagreed with Al-Ftlawy (2014) who studied nurses' knowledge toward care provided to patients with acute myocardial infarction in Al-Najaf City and found that 49% of the age group was (23-27) years old. Regarding the gender, the present study revealed that highest percentage (80.0%) of the study sample were female and remaining (20.0%) were male. This results disagreed with the finding of many studies Al-Janabi (2012); Salah (2012) and Al-Ftlawy (2014) who concluded that the majority of study nurses were male but agreed with the finding of Parajulee and Selvaraj (2011) and Ali et al., (2015) showed in their studies most nurses were female gender. From the researchers' point of view nursing in Egypt is principally a female profession and very few men are self-confessed to nursing programs in the university sector

Regarding to educational level the majority of sample had technical institute degree of nursing and bachelor degree of nursing. This result agreed with Ali et al., (2015) who studied nurses' knowledge and practice regarding implantable device in Egypt and found majority of the sample had bachelor and technical institute degree of nursing but contradicted with El Feky, & Ali, (2013) and Abudahi, Fekry, & Abd elwahab, (2012) who revealed that the great majority of their studied samples were diploma nurses. Also Al-Ftlawy (2014) who studied nurses' knowledge toward care provided to patients with acute myocardial infarction in Al-Najaf City and Mohammed and Atiyah (2015) who studied nurses' knowledge concerning an implantation pacemaker for adult patients with cardiac rhythm disorder at Al-Nassirrhya Heart Center and found the highest percentage of nurses were secondary school nursing. From researcher point of view this contradiction is related to the policy of university hospital at Menoufia governorate is placing high quality nurses at intensive care units and special units.

Regarding to years of experience the present study revealed that more than half of the sample had more than five years of experience this finding agreed with Arathy (2011) who evaluate knowledge and practice among cardiac nurses about patient safety post cardiac catheterization and mentioned that all respondents were registered nurses with 1-10 years of clinical experience in the cardiovascular setting but disagreed with Feroze, M. et al (2017) who studied Knowledge and Practice of Registered Nurses about Patient Safety after Cardiac Catheterization in Punjab Institute of Cardiology Hospital in Lahore, Pakistan and found that most of nurses less than five years of experience.

In relation to cardiac nurses' knowledge regarding post cardiac catheterization complications was assessed it found that about half (45%) of the sample had poor level of total knowledge. The investigator interpreted that the reason for lack of knowledge about post cardiac catheterizations complications was that this topic is not incorporated in the curriculum of critical care medicine and nursing, which negatively affected nurses' knowledge. The investigators' point of view is supported by Degavi (2013) who studied the

effectiveness of planned teaching programs on knowledge regarding cardiac rehabilitation among staff nurses working in critical care and revealed that half of the subjects had poor knowledge levels pretest while all had satisfactory knowledge scores posttest. The finding of present study also agreed with Ali et al., (2015) who studied nurses' knowledge and practice regarding implantable device in Egypt and revealed that the majority have an unsatisfactory knowledge level with the mean 20.927 ± 3.696 out of 34 scores and Faisal (2018) who said that The knowledge of nurses regarding Patient Safety After diagnostic Cardiac Catheterization was far from optimal. And disagree with Feroze et al., (2017) who stated that Nurses' knowledge was good and adequate about cardiac catheterization procedure.

In relation to cardiac nurses' practices regarding to patient's safety post cardiac catheterization it found that more than half of cardiac nurses had poor level of practice. This findings coincide with Nahla Shaaban,, Warda,, Abdo., & Ali, (2015) who reported that nurses have low knowledge and practice scores regarding implantable cardiac devices. Also Feroze.etal (2017) Who said although the knowledge of registered nurses regarding cardiac catheterization is good. However the nurses' practice was not satisfactory Beside that Rushdy, Youssef, & Elfeky,. (2015) reported that the majority of the studied sample had unsatisfactory practice and knowledge level concerning care of patients connected to intra-aortic balloon pump at Cairo university hospitals

From researchers' point of view This low practice level may berelated to low knowledge levels in addition to increased number of patients and workload. In addition to lack of training sessions, supervision, evaluation of performance, cooperation between multidisciplinary team members and standard guidelines were part of the cause

The study findings revealed that there were significant statistical differences among nurses' educational levels regarding knowledge and practice ($t=9.04$; $p=0.000$; $t=8.22$; $p=0.000$ respectively), as baccalaureate nurses had higher knowledge and practice scores than diploma and technical institute nurses. This is reflected in Al-Ftlawy's (2014) study on nurses' knowledge towards care provided to patients with acute myocardial infarction in Al-NajafCity, which revealed a significant relationship between nurses' level of knowledge and education. Alternatively, the present study finding contradicts Thomas' (2013) findings which revealed that there was no significant association between pre-test knowledge scores, pre-test practice scores and educational qualifications. This is also contradicted by Degavi (2013) who found no significant association between pre-test knowledge scores and educational qualifications. From the researchers' point of view high qualified nurses in menoufia university hospital started to develop themselves For the latest developments in nursing sciences

With nurses' years of experience, there was a significant statistical difference with total mean knowledge and practice scores. This finding is consistent with Thomas' (2013) study, which revealed that there is a highly significant association between practice scores and work experience. This is also in accordance with Aziz (2014) who evaluated nurses' care practices provided to patients who undergo open heart surgery in the Suleiman Center of Heart Diseases, and revealed that there was significant statistical association between nurses' practice and their years of experience. In addition, Arathy (2011) reported that The knowledge level is higher in staff nurses who has experience more than 5 years compared to those whose years of experience is less than 5 years. Finally, Feroze.etal (2017) Found that there was a significant relationship between knowledge and practice, knowledge and qualification, this result showed that qualification has great effect on the nurse's knowledge and nurses can develop their knowledge through experience.

V. Conclusion

The current study concluded that the knowledge level and practice of cardiac catheterization staff nurses increased with years of experience. Bachelor nurses had good level of knowledge and practice than institute and diploma nurses

Recommendations

1. Administrative and nursing leaders should provide relevant educational seminars, offer a standardized protocol for caring of patient in simulation labs, and assess the competency of newly staff nurses caring for patients after cardiac catheterization to ensure high-quality nursing care.
2. Replication of the study on larger probability sample must be considered to allow greater generalization of the results.

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