

Vascular Complications and Risk factors regarding Patient Undergoing Cardiac Catheterization

Eman Mahmoud Jabr¹, Nadia Mohamed Taha², Eman Ali Metwaly³

¹B.Sc. Nursing, Faculty of Nursing, Zagazig University, Egypt

²Professor of Medical Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt

³Lecturer of Medical Surgical Nursing, Faculty of Nursing, Zagazig University, Egypt

Corresponding to :Eman Mahmoud Jabr

Email:emanjabr22@gmail.comTel:01220656650

Abstract

Risk factors for patients undergoing cardiac catheterization are being older, small stature, obese, coexisting condition of hypertension, and or renal failure, use of large sheath, prolonged sheath time and excessive coagulation. Cardiac catheterization had several complications that embrace the following: infection, injury and pain at the Intra Venous site (IV) or sheath insertion site, blood clots and harming urinary organ may be occur because of the distinction dye that common in kidney disease and patients with Diabetes Mellitus (DM). **Aim of the study:** was to assess vascular complications and risk factors regarding patients undergoing cardiac catheterization. **Design:** A descriptive design was used. **Setting:** The study was conducted in Cardiac Care Units at Zagazig University Hospitals. **Subjects:** A convenient sample of 50 nurses and 50 patients were included in this study. **Tools of data collection:** Three tools were used; Interviewing questionnaire for nurses, observational checklist and Interviewing questionnaire for patients. **Results:** The present study clarified that 78% of the studied nurses had un satisfactory level of knowledge, and 66% of the studied nurses had satisfactory level of practice regarding cardiac catheterization. The present study clarified that 100% of the studied patients were hypertensive, 90 % were MI, 88% were Diabetic and had high cholesterol level, 74% were smokers and 48 % of studied patients were obese, the present study clarified that 54% of patients had arterial occlusion before sheath removal and 12% of the studied patients had pseudoaneurysm after sheath removal. **Conclusion:** It can be concluded that more than three quarter of the studied nurses had un satisfactory level of knowledge regarding vascular complications and risk factors for patients undergoing cardiac catheterization, more than two third of them had satisfactory level of practice regarding care of patients undergoing cardiac catheterization. The most common risk factors for studied patients were hypertension, MI, high cholesterol level, DM, smoking and obesity. The most common vascular complications for studied patients were arterial occlusion, heart attack, stroke, arrhythmias, hematoma, femoral hematoma, pseudoaneurysm, and groin infection before sheath removal. **Recommendation:** Updating knowledge and practice of ICU nurses through carrying out continuing educational programs regarding complications & risk factors for patients undergoing cardiac catheterization.

Key words: Cardiac catheterization, , Risk factors, Vascular Complications.

Introduction

Cardiac catheterization is an invasive procedure indicated in a wide variety of circumstances. It is used for diagnostic evaluation and therapeutic intervention in the management of patients with cardiac diseases (**Demir et al., 2017**).

In Egypt, (2010) cardiac catheterization complications varies from vascular complications (2.2%), arrhythmias (1.8%), heart failure (0.8%) and myocardium infarction(2.2%), in addition to the unpleasant experience for the patients.

Risk factors for patients undergoing cardiac catheterization are being older, small stature, obese, coexisting condition of hypertension, and or renal failure, use of large sheath, prolonged sheath time and excessive coagulation (**Taha, 2017**).

Vascular complications of cardiac catheterization include bleeding at the access site, hematoma, retroperitoneal bleeding, and pseudoaneurysms or arteriovenous fistula formation. Local complications at the sheath introduction site are among the most common problems seen after cardiac catheterization procedures. Bleeding due to perforation of a transversed artery or vein requiring transfusion and it prolongs the hospital stay. A hematoma is a collection of blood within the soft tissue of the upper thigh or lower abdomen (**Folami and Odeyme , 2019**).

Nurses usually offer care for patient before, during, and after any procedure such as cardiac catheterization and have different roles and functions related to care of such patients. Nurse has a specialized role wherever works as a team member of different surgical health care professionals. Therefore, Absence or limitation of good teaching and preparation pre-operative will increase the necessity for more surgical support to managing underlying medical conditions expected to occur (**Xenogiannis et al., 2019**).

Significance of the study: The American College of Cardiology's benchmark for the incidence of all complications, major adverse cardiac events, stroke, death, renal failure, and vascular complications is no more than 1% for diagnostic cardiac catheterization and 3% for Percutaneous coronary intervention (PCI). However, the incidences of vascular access complications alone have been reported to be anywhere from 0.1% to 61%, depending on the definition of complications and covariates, including the type of procedure, anticoagulation, closure devices, age, sex, and comorbidities (**Urden et al., 2018**).

The complications associated with cardiac catheterization procedures increase the morbidity rate and reduce patient outcomes. Thus, the nurses play a vital role to prevent, early detect and manage these complications. Vascular access complications may be a cause of discomfort, prolonged hospital stay and impaired outcomes in patients undergoing cardiac catheterization procedures. The removal of femoral sheaths and management of related complications after cardiac catheterization procedures are predominantly the responsibilities of nurses in many acute and critical care settings. Thus, it is essential for nurses to understand the causes of and predisposing risk factors for vascular complications (**Ebeed, Khalil, and Ismaeel, 2017**).

Aim of the study

The study was aimed to assess vascular complications and risk factors regarding patients undergoing cardiac catheterization.

Research questions:

What is the level of nurses' performance regarding patients undergoing cardiac catheterization?

What are the common vascular complications and risk factors among patients undergoing cardiac catheterization?

Research design: A descriptive design was selected

Setting:

The present study was conducted in cardiac care units at Zagazig University hospitals, one is located the third floor of cardiac and thoracic hospital, Sednawy Hospital and other in fourth floor in the same building. There is also one in the ground floor of general Medical Hospital, each one consists of 10 beds, one ventilator and one monitor for each bed.

Subjects:

- Convenient sample of 50 nurses who receive patients undergoing cardiac catheterization and accept to participate in the study.

- Convenient sample of 50 patients undergoing cardiac catheterization during study period (6months) from July 2019 to December 2019.

Tools of data collection:

The data of this study were collected using the following tools:

First Tool: Interviewing questionnaire for nurses

It was designed in Arabic form to avoid misunderstanding. It was designed by the researcher after reviewing of related literature (**Chen & Croizer, 2014**) to assess nurses' knowledge regarding patients undergoing cardiac catheterization.

The scoring system:

Scoring system for the knowledge items, score one for the correct answer and score zero for the incorrect answer. The total score was calculated for each nurse by adding the score items of questionnaire. The nurse had satisfactory level of knowledge when the total score equal or above 60% and unsatisfactory if below 60% based on statistical analysis.

Second tool: An observational checklist: To assess the nurses' practice regarding care of patients undergoing cardiac catheterization. Adopted from **Eisen et al., (2013)**.

The scoring system:

For observational checklist consisted of given score one for done step and score zero for thenot done. The scores of items were summed up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into percent scores. The nurse had satisfactory level of practice when the total score equal or above 80% and unsatisfactory if it below 80% based on statistical analysis.

Third tool: Interviewing questionnaire for patients : Included Interviewing structured questionnaire: It was designed by the researcher in Arabic form to avoid misunderstanding consisted of 35 questions divided into three parts:

Part 1: Personal characteristics of studied patients: included five close end questions about patient's age, sex, level of education, job, and causes of catheter insertion.

Part 2: Medical history and Risk factors : It consisted of five Yes or No questions about smoking, high blood pressure, high cholesterol level, history of chronic diseases as diabetes Mellitus, and myocardial infarction and three Multiple Choice Question about risk factors of vascular complication for patients undergoing cardiac catheterization such as wt, hight determined by Body Mass Index (BMI) as $BMI = \frac{wt/kg}{l/m^2}$ (**Eisen et al., 2013**), type of catheter, artery of catheter. Seven open end questions about french sheath size, number of catheters, dressing used, and time of pressure on puncture site

Part 3: Vascular complications assessment questionnaire before and after sheath removal. Consisted of 15 Yes or No questions about vascular complications for patient undergoing cardiac catheterization, divided into nine Local complications as hematoma, retro peritoneal hematoma, femoral oozing, femoral hematoma, femoral ecchymosis, pseudo aneurysm, arterial occlusion, arteriovenous fistula, groin infection, and six general complications such as heart attack, stroke, damage to the artery, heart or the area where the catheter was inserted, arrhythmias, kidney damage, and allergic reaction to the dye or medication.

Scoring System:

For Vascular Complications consisted of given score one for Yes answer and score zero for No answer.

Administrative design and Ethical consideration:

Submission of a formal letter was obtained from the Dean of the Faculty. Meeting and discussion were held between the researcher and the nursing administrative personnel to make nursing administrative personnel aware about the aims and objectives of the study as well as, to get better cooperation during the implementation of the study also oral consent from nurses and patients were obtained before starting data collection. The reactions of the administrative personnel were very supportive for the study. At the interview, each nurse and patient were informed about the purpose, benefits of the study, and nurses and patients were informed that their participation is voluntary and have the right to withdraw from the study at any time without giving any reason. In addition, confidentiality, and anonymity of the subjects were assured through coding of all data.

Pilot study:

A pilot study for tools of data collection was carried out in order to test where they are clear, understandable and feasible and applicability. For this study, the researcher randomly selected five nurses and five patients (10% of study sample to participate in the pilot testing of the questionnaire and checklist, and the sample who shared in the pilot study not excluded from the study sample because of no modifications in the tool.

Field work

Field work of this study was executed in six months from July 2019 to December, 2019. During this stage all the data were collected from the study nurses and patients

- The first phase of the work is the preparatory phase that done by meeting with head of units to clarify the objective of the study and applied methodology. A nurses' time schedule and the nurse's assignments were obtained in order to plan data collection.

- The second phase done by meeting study nurses and patients to give them instructions. The researcher met personally with each patient and explained the purpose of the study, then giving the questionnaire to nurses to fill it. Distribution of the questionnaire was done every day at the end of morning shift for nurses working at morning shift and gave the afternoon nurses before starting their work.

Statistical analysis:

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean \pm SD. **Content validity and Reliability:**

It was established for assure of content validity by a panel of seven expertise' from medical & Nursing staff member who revised the tools for clarity, relevance, comprehensiveness, understanding and ease for implementation and according to their opinion, minor modifications were applied.

Reliability statistics of the tool 5, Cronbach's Alpha test was (0. 87) for all tools.

Results

Table 1 Indicated that 62 % of studied nurses their age more than 30 years old with mean \pm SD 33.78 \pm 6.0 and range 25-45. Also 100% of studied nurses were females, 82% of studied nurses were married and 74% of studied nurses had diploma degree. While, only 30 % of studied nurses received training courses about cardiac catheterizations. Moreover, the table illustrated that 60% of studied nurses had more than 10 years of experience in hospitals with mean \pm SD 12.85 \pm 4.21, while 56% of studied nurses had more than 10 years of experience in ICU with mean \pm SD 8.88 \pm 3.77

Table 2 Revealed 78% of the studied nurses had unsatisfactory level of knowledge. Mean whiles 22% of studied nurses had satisfactory level of knowledge regarding patients undergoing cardiac catheterizations with Mean \pm SD 5.84 \pm 2.8.

Table 3 Clarified that 66% of studied nurses had satisfactory level of practice regarding care of patients undergoing cardiac catheterization, while 34 % of studied nurses had unsatisfactory level of practice with Mean \pm SD14.54 \pm 2.49.

Table 4 Revealed that 70% of studied patients their age less than 60 years old with mean age 53.22 \pm 8.9 . 56% were male and 60% were not educated. In addition, 60 % of studied patients were not worked and 72% of studied patients undergoing cardiac catheterization as a result of myocardial infarction (MI).

Table 5Mentioned that 100% of the studied patients were hypertensive, 90% were MI, 88% of the studied patients were diabetic mellitus and high cholesterol, 74% of studied patients were smokers and 48% of studied patients were obese, in addition to 50 % of studied patients underwent PCI operation. Also, 62% of the studied patients didn't know

the artery in which the catheter inserted. Moreover, 60% of the studied patients used one dressing and 72% of the studied patients used two catheters. Also, 62% of studied patients the catheter inserted through 10-14 minutes.

Table 6 Identified that 54 % of studied patients had arterial occlusion before sheath removal and only 16% and 18% of the studied patients had kidney damage before and after sheath removal. Meanwhile, only 12% of the studied patients had Pseudo aneurysm after sheath removal.

Table 7 Illustrated that, there was a statistically significant positive correlation between knowledge score and practice score .

Table 8 illustrated that there was statistically non-significant relation between complications before sheath removal, nurses' knowledge (P= 0.595). Also, there was No statistical significant relation between complications before sheath removal and nurses' practice (P=0.280).

Discussion

The result of the current study revealed that about two third of studied nurses, their age more than 30 years old ranged from 25-45 years with mean \pm SD 33.78 \pm 6.0. All study nurses were females, more than three quarter of them were married and about three quarter of them had diploma in nursing. This may be due to the most student in faculty of Nursing in Egypt were females Less than two third of studied nurses had more than 10 years of experience in hospitals and more than half of them had more than 10 years of experience in ICU.

This finding agreed with **Ali & Ali, (2019)** who reported in thesis entitled "Effect of designed teaching protocol regarding patients' safety after cardiac catheterization on Nurses' performance and patients' incidence of vascular complications "at Benha university hospital, that more than three quarter of nurses were female with mean age 30.60 \pm 7.96, and more than three quarter of them were married.

This finding was not in accordance with **Ahmed, (2015)** "Predictors of post cardiac catheterization, femoral artery hematoma and bleeding "in Alexandria university that less than half of nurses their age more than 30 years old and about two thirds of them had diploma degree.

The result of the current study clarified that more than three quarter of the studied nurses had un satisfactory total level of knowledge regarding cardiac catheterization, this obligation of nurses' knowledge might be as the result of lack of refreshment of the nurses' knowledge.

This study result agreed with **Hassan et al., (2015)** who reported in thesis entitled " Early sheath removal after percutaneous coronary intervention using Assuit Femoral Compression Device is feasible and safe. Results of a randomized controlled trial" at Assuit University hospital that less than half of nurses had un satisfactory knowledge regarding cardiac catheterization.

The present study revealed that more than two third of studied nurses had total satisfactory level of practice regarding cardiac catheterization. This could be due to Increase years of experience in ICU which is always required in such crucial and vital units. In addition to some nurses worked by repetition and imitation . This agreed with **Ali and Ali, (2019)** who reported that more than half of studied nurses had satisfactory level of practice.In contrary with **Sameen, (2018)** who reported that three quarter of studied nurses had un satisfactory level of practice.

The result of the present study revealed that studied patients their age ranged between 35- 70 years old with mean \pm SD 53.22 This agreed with **Ahmed, (2015)** who found that the age of the majority of the studied patients was between 40- 50 years old, more than two thirds of them were male. In congruent with **Ebeed, Nahil and Ismail, (2017)** who reported in thesis entitled " Vascular complications and risk factors undergoing cardiac catheterization " at National institute of heart in Embaba – Cairo that the ages of the most of the studied patients ranged between 50 and 59 years old, with a mean age of 53.22 \pm 8.9 years and that more than half of them were men, and less than half of them were illiterate.

The result of the present study revealed that about three quarter of the studied patients were smokers and all of them were hypertensive due to smoking lead to vasoconstriction of blood vessels . This study result was in the same line with **Kim, (2014)** who reported in thesis entitled "Psychological adjustment and quality of life of adolescent and adult with congenital heart disease" in South korea that most of patients were smokers, hypertensive, low body weight

The study result revealed that the majority of the studied nurses were diabetic and had high cholesterol due to medical history of their family . This agreed with **Kotowycz et al., (2014)** who reported in thesis entitled " Predictors of radial artery size in patients undergoing cardiac catheterization " at the peter munk cardiac centre in Toronto, Canada, that risk factors were hypertension, diabetes, smoking and high cholesterol .

This contradicted with **Ahmed, (2015)** who found that more than two thirds of them were not smoking, more than two thirds of patients were hypertensive and had low cholesterol .

The result of the current study identified, less than half of them had hematoma before and after sheath removal, Meanwhile only little of them had Pseudo aneurysm after cardiac catheterization after sheath removal and less than half of them had femoral ecchymosis before and after sheath removal due to vascular thrombus in the pulmonary artery after Glenn shunt. This agreed with **Kassem et al., (2013)** who illustrated in thesis as " Incidence and predictors of post catheterization femoral artery pseudo aneurysms" in Al- Hussein university hospital, Cairo that pseudoaneurysm isn't un common vascular complications following diagnostic or interventional cardiac catheterization

The current finding was contradicted by **Augustin et al., (2010)** who reported in thesis entitled “ Early sheath removal and ambulation in 172 patients submitted to Percutaneous Coronary “ in Cairo university, Giza that the incidence of hematoma less than 10 cm before sheath removal was 2.3% and after sheath removal was 7.5%.

The result of the study showed that there was a highly statistical significant relation between un satisfactory level of nurses’ knowledge and marital status, total years of experience and experience at cardiac ICU. This could be attributed to that the majority of the studied nurses had diploma degree.

This result was in the same line with **Omran, (2010)** who reported in his thesis entitled “A study of nurses performance, management and prevention of complication for patient undergoing cardiac catheterization” at Benha University hospital that there was a statistically significant relation between level of nurses’ knowledge and their sociodemographic characteristics.

This was in contrary with **Yassin, (2014)** who reported in thesis entitled “Assessment of nurses compliance with standard of care for patients undergoing cardiac catheterization at Port Said general hospital and Al Azhar university hospital in new Damietta city” that there was no significant difference between un satisfactory level of nurses’ knowledge and their sociodemographic characteristic.

Concerning relation between nurses’ knowledge and total practice regarding cardiac catheterization, the result of the present study revealed that there was a statistical significant positive correlation between knowledge score and practice score.

This agreed with **Rolley et al, (2010)** who reported that there is positive correlation between knowledge and practice of studied nurses .

This was not agreed with **Longo et al, (2015)** who reported in thesis entitled “Diagnostic cardiac catheterization and coronary angiography in the United States “that there was no significant relation between

The result of the study showed that there was statistically non-significant relation between complications before sheath removal, nurses’ knowledge (P= 0.595). Also, there was No statistical significant relation between complications before sheath removal and nurses’ practice (P=0.280).

This was in the same line with **Badr et al,(2014)** who reported in thesis entitled “ incidence and correlates in the development of iatrogenic femoral pseudoaneurysms after percutaneous coronary interventions “ in Amman that there was appositive significant relationship between female gender , renal failure and the development of groin complications. Conversely with **Haj- Hassan et al., (2013)** who reported that there was no significant association between age and post catheterization complications .

Conclusion

According to the results and the present study, it can be concluded that more than three quarter of the studied nurses had un satisfactory level of knowledge regarding vascular complications and risk factors for patients undergoing cardiac catheterization. Also, more than two third of them had satisfactory level of practice regarding care of patients undergoing cardiac catheterization. The most common risk factors for studied patients were hypertension, MI, high cholesterol level, DM, smoking and obesity. The most common complications for studied patients were arterial occlusion, heart attack, stroke, arrhythmias, hematoma, femoral hematoma, pseudoaneurysm, and groin infection before sheath removal. Hematoma was common complications after sheath removal.

Recommendation:

Based on the results of the present study the following recommendations are suggested: **For Nurses:**

- 1- Updating knowledge and practice of ICU nurses through carrying out continuing educational programs regarding complications & risk factors for patients undergoing cardiac catheterization.
- 2- Continous evaluation of nurses’ knowledge and practice to identify nurses’ needs.
- 3- Encourage and help nurses to attend national and international conferences, workshops and training courses related to nursing care for patients undergoing cardiac catheterization.
- 4- Educational program for nurses in cardiac catheterization unit to improve knowledge about patient safety and avoid complications after cardiac catheterization.

For patients:

- 1- Patients should be provided with sufficient information about cardiac catheterization, risk factors and complications before discharge from the hospital .
- 2- Training program about complications and risk factors for patients undergoing cardiac catheterization. study should replicated on large sample to generalize the results

Table 1: Frequency distribution of demographic characteristics for studied nurses (n = 50)

Demographic characteristics for studied nurses	No	%
Age		
≤ 30	19	38.0
> 30	31	62.0
Mean± SD (Range)	33.78±6.0 (25-45)	
Sex		
Female	50	100.0
Marital Status		
Married	41	82.0
Single	6	12.0
Widow	0	0.0
Education		
Diploma	37	74.0
Bachelors	7	14.0
Master	4	8.0
Institute	2	4.0
Experience (total) years		
≤ 10	20	40%
> 10	30	60%
Mean± SD (Range)	12.85±4.21	
Experience in CCU		
≤ 10	22	44%
> 10	28	56%
Mean± SD (Range)	8.88±3.77(2-20)	
Training		
Yes	15	30.0
No	35	70.0
Total	50	100.0

Table 2: Total nurses' knowledge regarding patients undergoing cardiac catheterization (n=50)

Total Nurses Knowledge	No	%
- Knowledge	39	78.0
- Un satisfactory <60%		
- Satisfactory ≥60%	11	22.0
Mean ±SD	5.84±2.8	

Table 3: Total nurses' practice regarding care of patients undergoing cardiac catheterization (n= 50)

Total Nurses Practice	No	%
- Un satisfactory <80%	17	34.0
- Satisfactory ≥80%	33	66.0
- Mean ±SD	14.54±2.49	

Table 4: Frequency distribution of personal characteristics for studied patients (n= 50).

Personal characteristics for studied patients	No.	%
Age		
- <60	35	70.0
- ≥60	15	30.0
- Mean ±SD (Range)	53.22± 8.9 (35-70)	
Sex		
- Male	28	56.0
- Female	22	44.0
Education		
- Educated	20	40.0
- Not educated	30	60.0
Occupation		
- Working	20	40.0
- Not working	30	60.0
Cause		
- MI	36	72.0
- Valve	14	28.0

Table 5: Frequency distribution of medical history and risk factors for studied patients (n= 50).

Medical history & risk factors	Yes	
	No	%
Smoking	37	74.0
Hypertension	50	100.0
Diabetes Mellitus (DM)	44	88.0
High Cholesterol	44	88.0
Myocardial infarction (MI)	45	90.0
Body Mass index (BMI)	No	%
- Low	7	14.0
- Normal	10	20.0
- Obese	24	48.0
- Morbid obese	9	18.0
Catheter		
- CA	12	24.0
- PCI	25	50.0
- CABG	13	26.0
- Artery		
- Don't know	31	62.0
- Femoral	7	14.0
- Neck	3	6.0
- Arm	9	18.0
- Number of Dressing		
- 1	30	60.0
- 2	20	40.0
- Number of catheters		
- 1	10	20.0
- 2	36	72.0
- 3	4	8.0
- Time catheter		
- 7-9	16	32.0
- 10-14	31	62.0
- 15-30	3	6.0

Table 6: Frequency distribution of vascular complications for studied patients (n= 50).

Complication iLocal Complications	Before sheath removal				After sheath removal			
	Yes		No		Yes		No	
	No	%	No	%	No	%	No	%
Hematoma	19	38.0	31	62.0	19	38.0	31	62.0
Retro-peritoneal hematoma	16	32.0	34	68.0	16	32.0	34	68.0
Femoral oozing	15	30.0	35	70.0	13	26.0	37	74.0
Femoral hematoma	19	38.0	31	62.0	17	34.0	33	66.0
Femoral ecchymosis	15	30.0	35	70.0	17	34.0	33	66.0
Pseudo aneurysm	19	38.0	31	62.0	6	12.0	44	88.0
Arterial occlusion	27	54.0	23	46.0	9	18.0	41	82.0
Arterio-venous fistula	17	34.0	33	66.0	8	16.0	42	84.0
General Complications								
Groin infection	19	38.0	31	62.0	11	22.0	39	78.0
Heart attack	22	44.0	28	56.0	9	18.0	41	82.0
Stroke	20	40.0	30	60.0	6	12.0	44	88.0
Damage of artery insertion	15	30.0	35	70.0	9	18.0	41	82.0
Arrhythmia	20	40.0	30	60.0	4	8.0	46	92.0
Kidney damage	8	16.0	42	84.0	9	18.0	41	82.0
Allergy	12	24.0	38	76.0	8	16.0	42	84.0

Table 7: Correlation between Total knowledge score and Total practice score

		Total knowledge score
Total Practice score		
R		0.363*
P		0.010*

Table 8: Relation between complications before sheath removal, nurses' knowledge and practice

Nurses' knowledge and practice	Complication before sheath removal				Total	X2	P	
	No		Yes					
	No	%	No	%	No	%		
Nurses' knowledge								
- Un satisfactory	15	78.9	24	77.4	39	78.0	FET	0.595
- Satisfactory	4	21.1	7	22.6	11	22.0		
- Nurses' practice								
- Un satisfactory	5	26.3	12	38.7	17	34.0	FET	0.280
- Satisfactory	14	73.7	19	61.3	33	66.0		

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