

The Outcome of Teaching Safety Procedure Program for Nurses on Patients Undergoing Cardiac Catheterization

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ABSTRACT

Abstract: Cardiac nurse is responsible for providing patient's safety and minimizing vascular complications after cardiac catheterization procedure. **Aim:** To evaluate the outcome of teaching safety procedure program for nurses on patients undergoing cardiac catheterization. **Design:** A quasi-experimental. **Setting:** Outpatient Clinic and Catheter Lab. **Sample:** A purposive sample and included one hundred patients (study & control), all available nurses (24). **Tools:** 1)- Patient's interviewing sheet including a)- Patient's characteristics b)- Patient's risk factors c)- Patient's adverse effects c)- Patient's care satisfaction and e)- Patient's anxiety II - Nurses' administered sheet including a) Demographic data b)- Level of nurses' knowledge, c)- Nurses' observation check list. **Results:** There were highly statistically significant differences as regards total score level of nurses' knowledge pre/post **TSPP** and during follow-up period as well, regarding total score level of nurses' practice. No statistically significant differences were found as regards risk factors in both groups pre the **TSPP**, and there was a statistically significant difference between the two groups related to the adverse effects post **TSPP**. As well, there were a highly statistically significant differences between the two groups regarding total score level of patients' care satisfaction and in relation to anxiety levels post **TSPP**. There were highly statistically significant differences between both groups in relation to length of hospital stay post **TSPP**. In addition there were statistically significant differences correlations between level of total nurses' knowledge and practices and total adverse effects. **Conclusion:** The nurses' level of knowledge and practices significantly improved post the **TSPP**. The patients' care satisfaction significantly increased post the **TSPP**. Adverse effects of cardiac catheterization and the length of hospital stay significantly decreased after the **TSPP**. **Recommendations:** An orientation program should be available for newly appointed nurses and those assigned to care for patients undergoing cardiac procedure.

Key words: Safety Procedure-Cardiac Catheterization.

INTRODUCTION

Cardiac catheterization is the insertion of a hollow flexible tube called catheter into cardiac chambers or coronary arteries, and valves of the heart. It is performed for both investigation and intervention purposes. The

catheter allows injection of fluid (Arathy, 2011).

Since catheterization is an invasive procedure, associated with complications, and although the diagnostic ones are done by skin puncture, under local anesthesia, either diagnostic or therapeutic, it is associated with

some risk, the decision to perform it must be based on a careful balance of procedure risk against the anticipated benefit to the patient (**Dubey, & Sharma. 2012**).

Cardiac catheterization is an invasive procedure which may lead to several major complications which contribute to morbidity and mortality. Otherwise the most serious complications of cardiac catheterization include stroke and myocardial infarction and others include cardiac arrhythmias, pericardial tamponed vessel injury, and renal failure as well, may have several minor complications or adverse effects such as; contrast allergy, bleeding, hematoma, temporary pain, nausea and vomiting. In recent years, because of advanced catheter technologies, complication rate is being significantly lower (**Dubey & Sharma, 2012; Al Sadiet al. 2014**).

In a coronary care unit, patient's safety in minimizing vascular complications after catheterization procedure is essential in practice, which is the role of cardiac nurse, who should be aware about safety guidelines. The cardiac nurse should first assess patients, assigned for catheterization, to detect the high risky ones and use safe practices for handling and maintenance of homeostasis. The investigators through their experience in coronary care units, found that some of the newly joined staff in cardiology departments are lacking awareness in this issue . Hence the investigators planned to carry out a study to assess the cardiac nurses' knowledge of on safety practices after cardiac catheterization procedures in cardiac unit (**Carrozza, 2012**).

Significance of the study

An increased rate of patients with cardiac diseases are undergoing cardiac catheterization for treatment and diagnosis, in which 3210 cases were admitted in 2013 at in Ain Shams University Specialized Hospital (Statistical Department, Ain Shams University Specialized Hospital, 2013). So, nurses should be familiar with how to

properly care for patients receiving this treatment. With appropriate nursing care, patients will have a safer and more comfortable cardiac catheterization procedure.

The study result of **Baim and Grossman, (2012)**, demonstrated that a risk of major complications represented 2% for patients. The risk of death from cardiac catheterization has been demonstrated at 0.11%.As well, the most common complications resulting from cardiac catheterization are vascular related, including external bleeding at the arterial puncture site, hematomas, and pseudo aneurysms. So, the aim of this study was to evaluate the outcome of teaching safety procedure program for nurses on patients undergoing cardiac catheterization through:

1. Assessing nurses' level of knowledge and practices in relation to safety procedure on patients undergoing cardiac catheterization pre/post teaching program.

2. Developing and implementing of the teaching safety procedure program (TSPP) for nurses on patients undergoing cardiac catheterization.

3. Evaluating the outcome of TSPP on:

a) Nurses' performance (knowledge& practice).

b) Patients' care satisfaction in both groups (study & control).

c) Patients' level of anxiety in both groups (study & control).

d) Number of patients' exposure to adverse effects of cardiac procedure in both groups (study & control).

Research hypotheses:

1- Nurses' level of knowledge and practices will significantly be

improved post implementation of the TSPP in the study group versus the control group.

- 2- Level of patient's care satisfaction as regards cardiac procedure will significantly be increased post the implementation of the TSPP in the study group versus the control group.
- 3- Adverse effects of cardiac procedure will significantly be decreased in the study group versus the control group post implementation of the TSPP.

Operational definitions:

Safety procedure: It means a particular way of accomplishing something or of acting without harmfully or -A series of steps followed in a regular definite order without harmfully to the object.

(TSPP)=Teaching Safety Procedure Program

Research design

A quasi-experimental design was used to conduct this study.

Research setting

This study was conducted at the Cardiac Outpatient Clinic and Cardiac Catheterization Laboratory in Ain Shams University Specialized Hospital affiliated to Ain Shams University.

Sample: Two samples were used in the current study:

1-A purposeful one hundred patients undergoing cardiac catheterization procedure. The studied patients were divided randomly into 2 equal homogenous groups (study& control) in the previously mentioned setting. The sample was calculated by power analysis and sample size calculation program to give power of 87% according to the following

inclusion criteria; patients attending the outpatient clinic with regular follow-up and stable condition.

- 1- All available nurses (24) as a convenience sample working at Cardiac Laboratory and Coronary Care Unit and haven't any attended training program about the study procedure.

Tools of data collection:

Three tools were used to collect data:

- 1- **Patient's interviewing questionnaire sheet** :divided into three parts as the following:

A- **Patient's demographic characteristics:** It included age, sex, level of education, patient's weight, reason and previous patient's history of cardiac catheterization.

B- **Patient's risk factors:** Adopted from **Fukumoto et al. (2011) and Carrozza (2012)**and modified by the researchers, it was used to assess the risk factors in both groups (study & control) pre-implementation of teaching safety procedure program(**TSPP**).It includes the patient's history about, hypertension, diabetes mellitus, hypercholesterolemia, received contrast or dye, bleeding tendency and clots formation, and smoking. Scoring system depending on number of patients' exposure of risk factors pre-implementation of the teaching program questions answered by "Yes or No."

C- **Patient's adverse effects:** Adopted from **Arathy (2011)**, and modified by the researchers, it was used to assess the adverse effect of cardiac procedure post teaching program in both groups (study& control).It included; bleeding occurrence and hematoma, reaction of medications intake and

contrast media (renal insufficiency), allergic skin reaction of tape and dressing, or latex, abnormal heart beat, minor infections, nausea and vomiting, and minor pain in the site of catheter insertion. **Scoring system:** Depending on number of patients' exposure to procedure adverse effects post implementation of teaching program questions were answered by "Present or Absent".

D- Patient's care satisfaction: Adopted from Makary (2013), and modified by the researchers, it was used to assess patient's level of care satisfaction were received in both groups (study & control) post implementation of TSPP. It measure four dimensions of patient's satisfaction with quality of nursing care: technical competence, information giving, assurance and empathy. It consisted of 29 items. **Scoring system:** It was as follows: an agree answer scores (3), while uncertain answer (2), and disagree answer (1). Total score equals 87 marks.

E- Patient's anxiety: Adopted from, Zung, (1997), and developed by the researchers it was used to measures the severity of anxiety symptoms, it was used to assess patient's level of anxiety for both groups (study & control) pre/post of TSPP. The scale consists of 12 items, each defined by a series of symptoms, to measure both psychic anxiety (mental agitation & psychological distress) and somatic anxiety (physical complaints related to anxiety). Scoring system: Each item was scored as follows: mild=1, moderate=2, severe=3. Determined level of anxiety was evaluated as follows: mild less than 17 scores, moderate from 18–24 scores and sever from 25–30 scores.

II- Nurses' self-administered sheet: It designed by the researchers to assess the following:

A- Demographic data: This includes nurse's age, sex, level of education, years of experience in cardiac units(ICU& CCU)and cardiac catheterization lab

B- Level of knowledge: Adopted from Arathy, (2011) and modified by the researchers after reviewing the related literature ,it was used to assess nurse's knowledge regarding cardiac catheterization pre/post and during follow-up period of TSPP in both groups (study& control).The nurse's questionnaire sheet includes; anatomy and physiology of the heart (11 items) and cardiac catheterization procedures' knowledge about definition (one item), indications and contraindications (10 items),as well, procedure complications and adverse effects. Also, includes; role of nurse at pre, during and post cardiac procedure(total16 items) and role of nurse during discharge period (9 items). **Scoring system:** The total score of questionnaire sheet is 100marks .level of nurses' knowledge was evaluated satisfactory when $\geq 70\%$, while unsatisfactory when $<70\%$.

III –Nurses' observational checklist: Adopted from Hopkins (2015) and Cahill, et al. (2015), and modified by the researchers, it was used to assess the nurses' level of practices during three phases of cardiac catheterization, pre/post and during discharge period of TSPP.**Pre-procedure** included; 1)- Explaining patient procedure. 2)- Preparation of patient before cardiac procedure. 3)- Patient history (cardiac disease, allergic medication or contrast dye blood dynamic stability). **During the procedure** included; 1)- Monitor ECG and, and vital signs. 2)-Preparing crash care bedside the patient. 3) - Patient' careful observation (dyspnea, sweating, numbness, nausea and/or vomiting, chills, itching, or heart palpitations) 3- Site insertion' care (groin or arm, leg). Post procedure of nurse intervention included; 1)-Patient positioning and rest. 2)- Monitoring of vital signs or abnormal signs and symptoms. 3)-Guidance of medication intake. 4)- Monitor fluid and

water intake (renal insufficiency). **Scoring system:** Total items in the three stages of procedure were scored by done correctly = 1 or not done= zero. Evaluation of practice was considered to be competent level when $\geq 80\%$, while incompetent level was $< 80\%$.

Content validity

It was established by a panel of nine experts from the medical surgical nursing specialty and cardiologists, who reviewed the instruments for clarity, relevance, comprehensiveness, understanding, logical and easiness for administration.

Reliability

Alpha Cronbach test was used to measure the internal consistency of tools (reliability of the used tools). These showed high reliability scores for the following tools: Nurse's knowledge questionnaire = 0.84, observational checklist = 0.88, patient's satisfaction questionnaire = 0.86, and patient's anxiety scale = 0.90

Ethical considerations and protection of human rights:

The research approval was obtained from the Ethical Committee of the Faculty of Nursing Ain Shams University before starting the study. At the initial interview, a synopsis about the nature, purpose and benefits of the study, was given for each subject. Nurses and patients were informed that their participation is voluntary and that confidentiality and anonymity of the information given are assured through coding of all data. Nurses and patients were also informed about their right to withdraw from the study at any time without giving any reason.

Pilot study:

A pilot study was conducted on 3 of the nurses and 10 patients (10%) to test the

feasibility and applicability of the study tools, as well as to estimate the time needed for each sheet to be filled in. The obtained results were used as a guide to reconstruct the data collection tools with modifications needed on them. Nurses who shared in the pilot study were excluded from the main study sample. Finally, the final forms were developed.

Field work:

The study was implemented during the period from the beginning of February 2015 to the end of January 2016.

- Approval was taken upon an official letter issued from the Faculty of Nursing, Ain Shams University to the Director of Ain Shams University Specialized Hospital to conduct the study.

- Reliability and validity was done before starting of data collection and a teaching program was designed based on analysis of the actual patients and nurses' needs.

-The researchers were available 2 days/week according to cardiac catheterization schedule (at the morning & afternoon shifts)

Construction of the teaching program:

It was divided into four phases:

A- Preparatory phase: It includes reviewing of the local and international, previous and current related literature and the theoretical knowledge to be acquainted with the various aspects of teaching program using books, articles, periodicals, magazines, and internet search, in order to develop the tools for data collection. Before starting cardiac catheterization procedure, the researcher interviewed each patient individually at the outpatient clinic for 10-15 minutes and explained the aim of this study, then asked each one to (both groups) answer anxiety

sheet and predisposing factors' sheet before teaching program implementation as a pre/test. The researchers interviewed each nurse individually for 20 -30 minutes according to their readiness and asked each one of them to answer and fill in the questionnaire sheet about their knowledge regarding cardiac catheterization after orienting them about the content and purpose of the study , also evaluated their practices through the observation checklist.

N.B. Data of control group were reserved to be compared with those of the study group at the end of study process (anxiety level, care satisfaction, length of hospital stay & adverse effects).

B- Planning phase:The teaching program was designed according to the predetermined actual patients' and nurses' needs regarding cardiac catheterization (before, during& after). As well, it was also based on the studied nurses' levels of knowledge and practices in relation to cardiac catheterization procedure. The teaching program consisted of two parts (theoretical &practical) as follows:

Theoretical Part: it contains the following items related to:

Nurses' knowledge about:

- Anatomy& physiology of the heart
- **Cardiac catheterization procedure:**
- Definition
- Indications &contraindications
- Complications &adverse effects
- **Nurses' knowledge :**
- Pre- cardiac procedure
- During cardiac procedure

- Post- cardiac procedure
- During discharge period .
- **Practical Part:** it contains the following items dealing with:
- Nurses' practices before cardiac procedure
- Nurses' practices during and after cardiac procedure

Methods of teaching

- Presentation.
- Group discussion.

Media of teaching:

- A booklet with illustrated instructions .
- Computer and board.
- Observation checklist.

C- Implementation phase:

Through 20 weeks in the morning and afternoon shifts and according to the studied nurses' readiness, and cardiac catheterization schedule, the individualized or small group sessions were done (theory &practice). The researchers explained the content of the teaching program and clarified each item. The number of theoretical sessions was five and each session's duration lasting from 40 – 50 minutes. The content of each lecture was handled for the studied nurses at the end of each session. The practical sessions were five.

D- Evaluation phase (for nurses):

Evaluation of nurse's knowledge was done at the end of the theoretical sessions through filling in the same knowledge sheet as a post/test according to their proper time. While regarding the practical part, evaluation was done through the same observation

checklist. Then the same tools were used to evaluate the nurses' knowledge and practices after four weeks as follow-up test.

Evaluation phase (for patients):

Evaluation of the studied patients in both groups (study & control) was done through filling in the questionnaire after cardiac catheterization procedure according their readiness patients through adverse questionnaire, level of anxiety and patient's care satisfaction as well, length of hospital stay sheet then compared between the both groups as a post/test.

Statistical Design:

The collected data were organized, categorized, tabulated and statistically analyzed using the Statistical Package for Social Sciences (SPSS), version17. The statistical analysis included percentage (%) mean and standard deviation (SD), Chi-Square (χ^2), t- test and Pearson coefficient (r). The observed differences, and associations were considered statistically significant at P < 0.05.

Table (1): Demographic characteristics of the studied nurses (n=24)

Variables	No	%
Age (in years):		
<25	4	16.7
25-<35	18	75.0
35+	2	8.3
Mean \pm SD	29.6 \pm 4.4	
Sex:		
- Female	24	100
Qualifications:		
- Technical school of nursing	18	75.0
- Technical institute	6	25.0
X ² =3.85		P<0.05
Years of experience (in years)		
≤ 3	4	16.7
3-<5	4	16.7
5+	16	66.6
X ² =2.70		P<0.05

Table (2): Total score level of nurses' knowledge of cardiac catheterization pre/post TSPP and during follow-up period (n=24)

Variables	Level of Nurses` Knowledge				
	Pre-TSPP	Post-TSPP	Follow-up Period	X ² test	P value
	No	No	No		
Nurses' knowledge about:					
Anatomy& physiology of the heart	4	24	20	27.3	<0.001
Cardiac catheterization procedure:	2	24	18	27.1	<0.001
Definition					
Indications &contraindications	6	24	24	27.0	<0.001
Complications &adverse effect	4	24	24	28.0	<0.001
Nurses' knowledge:					
Pre- cardiacprocedure)	6	24	24	27.1	<0.001
During cardiac procedure	0	24	20	32.9	<0.001
Post- cardiac procedure	2	24	24	29.7	<0.001
During discharge period	0	24	20	28.3	<0.001

P<0.001 Highly significant

Table (3): Total score level of studied nurses' practices as regards cardiac catheterization pre/post TSPP and during follow-up period. (n=12)

Variables	Level of Nurses` Practice				
	Pre-TSPP	Post-TSPP	Follow-up TSPP	t X ²	P value
	No	No	No		
Pre-procedure:					
Explaining patient procedure - Preparation of patient before cardiac procedure. - Patient history -	0	24	20	28.1	<0.01
During the procedure:(catheter lab:					
- Monitor ECG and, and vital signs Preparing crash car bedside the patient- Patient's careful observation-	16	24	20	2.3	>0.05
Post-procedure					
-Monitor of vital signs or abnormal signs & symptoms - Patient positioning and rest Site insertion care- Guidance of medication and fluid &water intake	6	24	24	27.1	<0.01

P<0.01 Highly significant P>0 05 insignificant

Table (4): Bio-socio demographic characteristics of studied patients in both groups (study& control) (n=100).

Variables	Study Group(n=50)	Control Group (n=50)
	%	%
- Age (in years) :		
- 50 - < 60	68	58
- 60 ≤65	32	42
Mean ±SD=60.0±2.4		
- Sex :		
- Male	80	82
- Female	20	18
- Educational level:		
- Elementary	52	56
- Secondary	40	32
- University	8	12
- Weight(in Kg):		
- 65<75	80	82
- 75≥85	20	18
Mean ±SD=68.8±2.1		
- Reason of cardiac catheterization:		
- Therapeutic	36	39
- Diagnosis	64	61
- History of previous catheterization	10	15

Table (5): Distribution of predisposing risk factors in both group (study & control) (n=100).

Variables	Study Group(no=50)	Control Group (no=50)	Test	
			X ²	P value
Medical history about:	%	%		
Hypertension	16	20	0.3	>0.05
Diabetes Mellitus	26	38	1.7	>0.05
Hypercholesterolemia	16	17	0.2	>0.05
Received contrast or dye	0	2	1.1	>0.05
Renal insufficiency:				
Creatinine clearance >1.5mg/dl	5	6	0.2	>0.05
Bleeding tendency & clots formation	16	14	0.08	>0.05
Smoking	40	42	0.01	>0.05

P >0.05 insignificant

Table (6): Distribution of adverse effects of cardiac catheterization in both groups (study & control) post implementation of TSPP (n=100).

Variables	Study Group		Control Group		Test	
	Mean	SD	Mean	SD	T	P value
Bleeding occurrence & hematoma	1.1	0.4	1.0	0.2	1.7	>0.05
Reaction of medication intake or dye	0.2	0.4	1.4	0.9	4.5	<0.05
Allergic skin reaction of tape	1.0	0.3	1.6	0.9	4.2	<0.05
Allergic to dressing, or latex	1.0	0.3	1.6	0.9	4.2	<0.05
Abnormal heart beat	1.2	0.3	0.9	0.5	5.1	<0.05
Minor wound infection	0.8	0.7	1.2	1.1	2.1	>0.05
Nausea and vomiting	1.0	0.4	1.4	0.9	2.5	<0.05
Minor pain in the site of catheter insertion	0.1	0.4	0.7	0.4	1.2	>0.05

P<0.05 significant P>0.05 insignificant

Table (7): Total score level of patients' satisfaction in both groups (study & control) as regards nursing care were received post TSPP (n=100)

Variables	Patient's Satisfaction				
	Study Group	Control Group	Test		
	(No)%	(No)%	X ²	P	Sig
- Technical competence	(32) 64	(2) 4	43.5	< 0.01	HS
- Information giving	(42) 84	(20) 40	17.6	< 0.01	HS
- Assurance	(35) 70	(18) 36	17.7	< 0.01	HS
- Empathy	(32) 64	(0) 0.0	47.1	< 0.01	HS

P<0.01 Highly significant

Table (8): Total score level of anxiety in the study and control groups pre/post TSPP (n=100)

Variables	Study Group	Control Group	Study Group	Control Group
	Pre-TSPP (n=50)		Post-TSPP (n=50)	
	(No) %		(No) %	
- Mild	(28) 56	(30) 60	(35) 70	(7) 14
- Moderate	(22) 44	(18) 36	(19) 38	(29) 58
- Sever	(8) 16	(7) 14	(0) 0.0	(20) 40
X ² = 1.9 P>0.05		X ² =29.4 P=<0.01		

P<0.01 Highly significant P>0.05 insignificant

Table (9):Percentage distribution regarding length of hospital stay in the study and control groups (n=100).

Length of Stay	Study Group	Control Group	Test X ²	P value	Sig.
<6 hrs.	28	5	25.1	<0.001	HS
6<24hrs.	17	27			
≥24hrs.	5	18			

Table (10): Correlation between total nurses' knowledge & practices and total adverse effects in relation to the cardiac safety procedure.

Variables	Total Adverse Effects
	r - test
- Total nurses' knowledge scores	0.620
- Total nurses' practice scores	0.911

Results:

Table (1): shows the demographic characteristics of the studied nurses. As regards their age, three quarter of them (75.0%) were in the age groups 25 - < 35 with a mean age of 29.6 ±4.4. As well all of them (100%) were females , 75% have technical school of nursing certificate and 66.6% have more than five years of experience.

Table (2) indicates that there were highly statistically significant differences as regards total score level of nurses' knowledge pre/post TSPP and during follow-up period regarding cardiac catheterization about, anatomy and physiology of the heart, definition, indications and contraindications as well, complications and adverse effects and nurses' knowledge at pre/post cardiac catheterization procedure and during discharge period (X²=27.3,27.1,27.0,28.0,27.1,32.9,29.7&38.3 respectively at p<0.001).

Table (3) demonstrates the total score level of studied nurses' practices regarding cardiac catheterization pre/post Total score level of studied nurses' practices as regards cardiac catheterization pre /post TSPP and during follow -up period . There was highly

statistically significant difference regarding nurses' practices before , and after of cardiac catheterization procedure (X²=28.1 & 27.1 respectively at p <0.01). Meanwhile there were no statistically significant differences in relation to nurses' practice during cardiac procedure (X² =2.3 at p >0.05).

Concerning the bio-socio demographic characteristics of patients in the study and control groups, table (4) indicates that, for the highest percentages(68% & 58% respectively) ranged between with a mean age 50 - < 60 of 60.0 ±2.4. As well the majority of them (80% & 82% respectively) were males and more than half of them (52.0% & 56.0% respectively) have elementary level of education. Regarding to the mean of weight in the studied patients (study & control) , it was 68.8 ±2.1. As well the reasons of cardiac catheterization in both groups were between therapeutic and diagnostic representing 36.0 % & 39.0%, 64.0% & 61.0% respectively. In addition, the previous history of catheterization represented 10% in the study group and 15% in the control group.

Table (5) shows distribution of predisposing risk factors of the studied patients (study & control). No statistically significant differences were found as regards hypertension, diabetes mellitus,

hypercholesterolemia, received contrast or dye, renal insufficiency, bleeding tendency and clots formation and smoking ($X^2=0.3$, 1.7, 0.2, 1.1, 0.2, 0.08, & 0.01 respectively at $p>0.05$).

Table (6) displays the indicators of the adverse effects of cardiac procedure in both groups (study & control) post implementation of teaching program. There were a statistically significant differences between the two groups related to the adverse effects represented with reaction of medication intake or dye, allergic skin reaction of tape and dressing or latex, and abnormal heart beat as well, nausea and vomiting ($X^2= 4.5$, 4.2, 4.2, 5.1 & 2.5 at $p <0.05$ respectively). Meanwhile, there were no statistically significant differences in relation to bleeding occurrence and hematoma, minor wound infection as well, minor pain in the catheter care ($X^2=1.7, 2.1 & 1.2$ at $p >0.05$).

Table (7) shows the total level of patients' satisfaction in both groups (study & control) as regards nursing care were received post TSPP. There was a highly statistically significant difference between the two groups regarding technical competence, information giving, assurance, and empathy ($X^2=43.5$, 17.6, 17.7, & 47.1 respectively at $p<0.01$).

The total of patients' level of anxiety in both groups (study & control) as regards cardiac catheterization pre/ post implementation of the TSPP in table (8) which revealed that, there was highly statistically significant difference post teaching program in both groups in relation to three levels of anxiety according to mild, moderate and severe ($\chi^2=29.4$ at $P <0.01$). Meanwhile, no statistically significant difference was found pre teaching program ($\chi^2= 1.9$ at $P>0.05$).

Table (9) displays the distribution regarding to length of hospital stay in the study and control groups post teaching

program. There was a highly statistically significant difference between the two groups in relation to cardiac catheterization ($X^2=25.1$ at $P <0.001$).

The correlations between total nurses' knowledge and practices and total adverse effects related to cardiac catheterization procedure, shows in table (10) revealed that there were statistically significant differences between the three variables ($r=0.620$ & 0.911 respectively).

Discussion:

Monitoring of the patient after cardiac catheterization is fundamental for early identification and management of complications. Nurses who are able to promptly identify complications are in the optimal position to prompt critical action and improve patient's outcomes. Thus, nurses that are competent in the care of a patient post cardiac catheterization are able to minimize mortality and morbidity rates for these patients within the post-operative period (**Baim & Grossman (2012)**). There fore, the study aim was to evaluate the outcome of safety procedure program for nurses on patients undergoing cardiac catheterization.

The demographic characteristics of the studied nurses revealed that, the three quarter of them their age were ranged from 25 - < 35 and have technical school of nursing certificate. All of them were females. Slightly more than two third of them their experience exceeded five years in the cardiac catheterization lab. This result goes on line with that of the **Ministry of Health and Population (MOHP) (2008)**, which estimated that the majority of nurses in Egypt are from high school level of nurses. In the same line, **El-Karmalawy (2010)** pointed out that the majority of nurses in Egypt had technical nursing school certificate. These results may indicate that the university nursing graduates couldn't cover all

different nursing specialties in Egypt. The years of experience in a special procedure couldn't be enough for providing patients' best care.

The present study findings revealed that there were highly statistically significant differences concerning the nurses' level of knowledge pre/post teaching program and during follow-up period regarding cardiac catheterization in relation to; anatomy and physiology of the heart, definition, indications and contraindications as well, complications and adverse effects and nurses' knowledge at pre, during and at post cardiac catheterization procedure and during discharge period. In a similar study carried out by **Kalyani et al. (2013)** they emphasized that the expectations from patients undergoing cardiac catheterization towards their nurses' to have sufficient knowledge and experience for performing angiography procedure. This result indicated that the increased level of the studied nurses' knowledge after implementation of the teaching program could help support them and by increasing their self-confidence during performing the cardiac procedure.

The current study results indicated that, the level of the studied nurses' practices about the cardiac catheterization procedure showed highly statistically significant differences pre/post teaching program implementation, at pre- cardiac procedure including , explaining patient procedure, preparation of patient before procedure ,taking patient history in relation to cardiac disease, allergic medication and contrast dye and blood dynamic stability. As well, post implementation of teaching program represented with nurses' practices in relation to patient positioning and rest, monitoring vital signs or abnormal signs and symptoms, also guidance of medication intake and monitor fluid and water intake to protect patient from renal insufficiency. Mean while, there was no statistically significant

difference in the nurses' practices during cardiac catheter procedure.

In the same issue a study conducted by **Camerini and Cruz (2010)** indicated that patients under cardiac catheterization can develop to acute renal failure due to the use of iodized contrast during cardiac catheterization procedure , so the nurses have a fundamental and irreplaceable role in the pre- cardiac procedure, through identifying the patients with potential risk to develop acute renal failure, managing the contrast with the volume and the correct osmolality, and in the post-cardiac catheterization, identifying early signs of declining renal function. This means that the nurse acts in the prevention, and protecting of the patient from renal insufficiency.

This result may indicate that the role of teaching program succeed in acquiring best care during cardiac procedure through good preparation of nurses which contributed to avoid renal failure due to the side effects of contrast media uses during cardiac catheterization's procedure. As well, the result of the study revealed that there was no a statistically significant difference in the nurses' practices during cardiac catheterization's procedure which may be due to repetitive procedure steps and through acquired personal experience.

In the same point, and in a very recent study carried out by **Abdollahi, et al. (2015)** revealed that it is safe and feasible to change the patient's position and to permit early ambulation after coronary angiography. In addition, body change position prevents backache and reduces its intensity, and consequently increases a physical comfort as well, associated with no increase in hematoma and bleeding tendencies. Moreover, avoiding wasting nurses' time on explaining the reason of patient's complete bed-rest, prescribing analgesics as well as massaging the patient's back in order to relieve the pain. Many complications may be

associated to cardiac procedure in the studied patients but when the cardiac nurses have competence level of practices, regarding the cardiac procedure most of these complications can be avoided.

The demographic characteristics of patients in the study and control groups, indicated that for the highest percentages,, their age ranged between fifty and less than sixty years. A swell ,the majority of them were males and more than half of them have elementary level of education. The mean of weight in the studied patients was 68.8 ± 2.1 . The reasons of cardiac catheterization in both groups were between therapeutic and diagnostic. These results indicated that the studied patients were in need to comprehensive care. In the same time, results reflect the responsibility of nurses to support their patients through health teaching regarding post procedure care and during discharge period. As well, the use of cardiac catheterization for diagnostic and therapeutic reasons may involve coronary angiography, peripheral angiography, carotid angiography, temporary pacemaker insertion, and percutaneous trans- luminal coronary angioplasty with stenting.

Distribution of predisposing risk factors of the studied patients (study & control) revealed that there were no statistically significant differences as regards patients' history in relation to hypertension, diabetes mellitus, hypercholesterolemia, received contrast or dye as well, renal insufficiency, bleeding tendency and clots' formation, and smoking. The study results were congruent with **Kassem et al. (2013)** who reported that the following data must be collected as baseline clinical data of patients requesting cardiac catheterization procedure as age, gender, traditional risk factors of atherosclerosis as diabetes, hypertension, obesity and smoking. This result revealed that all the patients in the current study were liable to cardiac procedure complications.

Indicators of the adverse effects of cardiac procedure in both groups (study & control) post implementation of the teaching program revealed that there were a statistically significant differences between the two groups related to the adverse effects in relation to reaction of medication intake or dye, allergic skin reaction of tape and dressing or latex, abnormal heart beat as well, nausea and vomiting. These results may be positive indicators of teaching program on the nurses' practices post cardiac procedure in the study group versus the control group.

On the other hand, there were no statistically significant differences in relation to bleeding occurrence and hematoma, minor wound infection, and minor pain in the catheter site. In the same point the study results by **Suggs et al. (2013)** reported that a hematoma is one of the major adverse effects of cardiac catheterization and it can occur if the sheath is removed prior to proper hand positioning and timely compression or prior to sheath removal if multiple attempts were made for vascular access. If bleeding from the hematoma is controlled by manual compression, the hematoma will usually resolve within 1-2 weeks as the blood is reabsorbed from the soft tissues, but this approach requires a nurse to be at the bedside consistently. This result may be due to risk factors in both groups such as; diabetes mellitus, bleeding tendency and clots formation, and smoking which led to delay the wound healing and these patients were in need to medical support or the site of the catheter r insertion needed time to heal.

Regarding patients' satisfaction in both groups (study & control) about cardiac catheterization procedure, post teaching program, there were statistically significant differences between the two groups regarding technical competence, information giving, assurance, and empathy. In the same issue, a study done by **Abdollahzadeh et al. (2014)** highlighted on the lack of patients' awareness of how the angiography is going

to be done and necessary cares before and immediately after that leads to patients' sadness and dissatisfaction and the patients can't tolerate adhering to necessary cares and at the end it leads to increase vascular complications. Preparing of patient and explaining the cardiac procedure in the current study led to build of trust between nurse and patient during nursing care process.

In the same line **Ahmed and Goldberg (2012)** found that providing verbal information to patients is important in order to give accurate information about the procedure, which facilitates patients' compliance, increases satisfaction, helps the patient feel better and better understanding the procedure, and increases the feeling of trust. In the same issue, **Flor, and Gelbak, (2013)** added that the provided information about procedure by the cardiac nurse will reduce the patient's anxiety and facilitate his/her compliance with the procedure. This finding revealed that when the patient level of anxiety decreases, it may give chance to increase the level of care satisfaction.

In relation to the total of patients' level of anxiety in both groups (study & control) about cardiac catheterization procedure pre/post implementation of the teaching program, there was a highly statistically significant difference post teaching program in both groups in relation to the three levels of anxiety according to mild, moderate and severe. Similarly, these results are supported by **Pehlivan et al. (2011)**, who indicated that, providing information is the most important and effective intervention in reducing a patient's anxiety and stress. It has been demonstrated in previous studies that providing information before surgery reduces pain and stress induced by the surgical intervention and reduces the anxiety level before the application of cardiac procedure. The integration among patient's care, care satisfaction and the level of patient's anxiety may justify the results of the current study.

On the other hand, a study carried out by **Aghaei and Nesami (2013)** reported that, patients have a moderate or severe level of anxiety due to not being familiar with the nature of surgical procedure intervention. This finding may reflect the importance of patient support before implementation of cardiac catheterization procedure through discussions and answers given by the cardiac nurse, which may contribute to patient's care satisfaction and can indirectly alleviate the level of patient anxiety.

Regarding length of hospital stay in the study and control groups post teaching program, there was a highly statistically significant difference between the two groups in relation to cardiac catheterization. This result indicated that the competent level of cardiac nurse in cardiac catheterization procedure may contribute to avoid complications and decrease length of hospital stay in the study group versus the control group.

Correlations between total score of nurses' knowledge and practices and total adverse effects of cardiac catheterization procedure revealed that there were highly statistically significant differences between the three variables. This result reflected that the teaching program succeeded to link between the increase in the level of studied nurses' knowledge and their practices and decrease in the level of adverse effects and revealed that there were direct relations between safe care of patients and level of nurses' knowledge and their practices.

Conclusion:

In view of the study results and research hypotheses, it can be concluded that the nurses' level of knowledge and practices significantly improved post implementation of the TSPP in the study group versus the control group. The level of patients' care satisfaction as regards cardiac catheterization

significantly increased post implementation of the TSPP versus the control group. As well, adverse effects of cardiac catheterization and the length of hospital stay in the study group significantly decreased after the TSPP implementations versus the control group. There were highly statistically significant differences between the level of nurses' knowledge & practice and the studied patients' adverse effects as regards cardiac catheterization procedure at the end of the study.

Recommendations:

- An orientation program should be available for newly appointed nurses and those assigned to care for patients undergoing cardiac procedure to improve their knowledge and gain competent skills in this field.
- Patients' guidance through explanation needed and answering all their questions should be given by nurses to patients about cardiac procedure to decrease their anxiety.
- Measurement of patient's satisfaction about nursing care and services received should be done in order to improve and develop quality of health services.
- A model discharge plan for a patient undergoing cardiac catheterization, which includes signs and symptoms of complications and site of referral when any complications occur should be available for such group of patients.
- Replication of this study in different geographical areas of other hospitals in Egypt, will give more information to provide quality care.

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