

## Transcatheter Aortic Valve Replacement: Interventional Program on Nurses' Knowledge and Practice

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### Abstract:

**Background:** Transcatheter aortic valve replacement (TAVR) is a minimally invasive heart procedure to replace a thickened aortic valve that not fully opens (aortic valve stenosis). Nurses have a holistic view point on patient care and can play a key role in the prevention of complications by using a guidelines of care that is based upon the different educational needs of nurses and considers other relevant factors, as well as addressing the immediate concerns of the patients and helping them cope successfully with their condition. **Aim:** The aim of this study is to evaluate the effect of interventional program on nurses' knowledge and practice toward care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR). **Design:** A quasi experimental design. **Setting:** The study was conducted at cardiac catheterization units affiliated to Ain Shams University Hospitals Cairo, Egypt. **Subjects:** A convenient sample of all available nurses (30) from the previous mentioned settings willing to participate in the study. **Tools of data collection:** Tool (I) Nurses self-administered structured knowledge questionnaire. It involved two parts: Part (A): Nurses' demographic characteristics and Part (B): Transcatheter Aortic Valve Replacement knowledge questionnaire. Tool (II) Nurses' practice observational checklist. **Results:** there were a statistically significant differences between mean scores of total knowledge, practice and demographic characteristics pre and post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement also a positive correlation between total knowledge, practice post program implementation have found. **Conclusion:** Implementation of interventional program for nurses caring of patients undergoing Transcatheter Aortic Valve Replacement (TAVR) had a positive effect on improving their knowledge and practical Level. **Recommendations:** Availability of nursing interventional booklet regarding care of patients undergoing Transcatheter Aortic Valve Replacement is essential in all cardiac catheterization lab as well as a Transcatheter Aortic Valve Replacement (TAVR) care training program should be provided for nurses.

**Key words:** Transcatheter Aortic Valve Replacement, Interventional program.

### Introduction:

For several years, valve replacement surgeries was the key standard management for severe, aortic stenosis (AS) which caused by progressive calcification of the valve and is the most common reason of left ventricular outflow tract obstruction. For patients, this technique can improve symptoms and extend life. But it has a major complications neither the surgery is open (using a full sternotomy) or less invasive (using a ministernotomy or minithoracotomy), as it requires cross-clamping of the aorta and cardiopulmonary bypass. (Kelly, 2017)

Transcatheter aortic valve replacement (TAVR) is a minimally invasive heart procedure to substitute a thickened aortic valve that not fully opens (aortic valve stenosis). TAVR, which involves a prosthetic valve positioned directly over the original diseased valve, can help restore blood flow and lessen the

signs and symptoms of aortic valve stenosis; such as chest pain, shortness of breath, fainting and fatigue. (Hadi et al.,2021)

A guide wire is go through the aorta; then a catheter with a prosthetic valve on the end is place in over the wire and placed over the aortic valve. The prosthetic valve can be inserted percutaneously or through a small incision in the chest wall. The procedure takes 4 to 5 hours and is done in a cardiac catheterization unit. It is also called transcatheter aortic valve implantation (TAVI). (Lateef et al.,2019)

Nurses are engaged in the management of patients from the preoperative until discharge as part of the multidisciplinary team. They provide direct care, observation, assessment and collaborate with other health care specialists to ensure quality of care (Krishnamoorthy, 2020). Nursing care begins by assessing the degree of cardiac symptoms going by

perioperative and then rehabilitation period based on the nursing guidelines and evidence base. Nursing care concentrations mainly on patient monitoring, assessment and on educating patients about activity, diet, medications, and pain management. **(Butcher et al., 2018).**

Monitoring, instructing, and teaching the patient are duties of the nurses. The nurses gives preoperative training programs containing, health-related information for patients which prepares them for surgery and helps to reduce the development of complications through the pre and post-operative period **(Lauck & Hawkey, 2020).** TAVR techniques include percutaneous technique (trans-femoral [TF] and trans-axillary/subclavian [TAX]) and traditional open surgery (transapical [TA] and transaortic [TAo]), which require small surgical incisions. Minimally invasive percutaneous technique (such as TF and TAX) are the most common. **(Henn et al., 2019).**

About 90% of TAVRs use the TF procedure. A sheath is inserted into the femoral artery, through which the guidewire and catheter are drive through the aorta into the heart. The arterial insertion site is classically closed using a vascular closure device, such as a vessel plug, clip, or internal suture. The TF technique may not be suitable for patients with peripheral vascular disease because of potential narrowing of the vessel. In the TAX technique, access is done through the subclavian artery, with a sheath catheter introduced into the aortic arch to the aortic valve. Although this technique offers a shorter catheter-insertion path, the smaller vessel can cause difficulty with maneuvering the catheter and may cause a brachial-nerve injury **(Edelman & Thourani, 2018)**

Benefits of the trans-apical technique is to avoiding a diseased aorta or femoral artery, unlimited delivery system size, and easier valve delivery. But it includes several obstacles as myocardial injury, wall-motion abnormalities, apical bleeding, and incision pain. Additionally, this technique needs a surgical incision through the chest wall and intubation, increasing patient complications and pain. **(Spaziano et al., 2018).**

Vascular complications related to femoral access include hematomas, retroperitoneal bleeding, and arterial occlusion. Hematomas, the most common vascular access complication, develop when blood leaks from the puncture site into the soft tissue. The affected area may be firm, swollen, and discolored, and the patient may complain of

tenderness and pain. Nurse should applying pressure 1 to 2 cm above the puncture site until hemostasis is occurred. Report the findings to the physician, mark the bandage of the area, and evaluate the site for changes such as thigh enlargement, discoloration outside the marked bandage, and changes in vital signs and pain level or location. **(Hadaya, et al., 2020).**

Nurses must notice signs of bleeding which is more likely to occur when the femoral artery is punctured above the inguinal ligament that include back, flank, or abdominal pain; falls in blood pressure, hemoglobin, and hematocrit; and increased heart rate. Nurses may not detect obvious signs of bleeding so must report suspected retroperitoneal bleeding to the physician, who will order computed tomography to diagnose the problem. Patients with this problem must remain on bed rest. Administer I.V. fluids and blood transfusions, as ordered. Surgical repair may be essential. Also, nurses may suspect an arterial occlusion if the patient has pain, paresthesia, pallor, absent pulses in the affected extremity, and inability to move the limb. **(Gillam & Marcoff, 2019)**

Postoperative nursing care arises with assessment, including vital signs, medications administered during the procedure, current level of alertness, access difficulties, and overall procedure complications such as arrhythmias or other cardiac complain , or difficulties with placement. As ordered, place the patient on continuous telemetry monitoring and observe for heart rate and rhythm changes. **(Chetcuti et al., 2019).**

Nurses have a holistic viewpoint on patient care and can play a key role in the prevention of complications by using an guidelines of care that is based upon the different educational needs of nurses and considers other relevant factors, as well as addressing the immediate concerns of the patients and helping them cope successfully with their condition **(O'Connor, et al., 2021).** A planned and systematic approach to instruct the patient and family about TAVR is an important part of nursing care begins when the decision is made for cardiac device insertion **Christina, C. (2020).**

#### **Significant of the study**

Up to one-third of patients have complications after TAVR especially pulmonary complications which considered a term for adverse changes in the respiratory system among patients that occur

within 48 – 72 hrs. Post-surgery. It has a negative effect on postoperative outcomes as increased morbidity, mortality, increase costs length of hospital stay, and particularly within the first-week post-cardiac surgery. It occurs in 6.2% of patients' post-cardiac surgery, with 8.0% only in valve surgery. Atelectasis, pleural effusion, pneumonia, bronchospasm, and acute respiratory failure (ARF) are pulmonary complications that occurs in 30 - 72% of patients' post-valve surgery (Kodra et al., 2016; Kelly ,2017;Naveed et al., 2017 and Pramanik et al., 2020).

According to the statistical department in the cardiovascular units in 2021, there were 2132 adult patients who had cardiothoracic surgeries and 1500 patients from them had valve surgeries with 3.6% mortality rate. The development of Trans catheter aortic valve replacement (TAVR) has emerged as a support for patients considered being inoperable providing both enhancement in symptoms and statistically significant mortality benefit. Also, it becomes an option for individuals who are at risk of complications from aortic valve replacement surgery as it is a minimally invasive heart technique (Frownfelter et al., 2020).

## Subject and Methods

### 2.1 Aim of the study:

#### Aim

The aim of this study is to evaluate the effect of interventional program on nurses' knowledge and practice toward care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR) through the following:

- Assess nurses' level of knowledge toward care of patients undergoing Transcatheter Aortic Valve Replacement
- Assess nurses' level of practice toward care of patients undergoing Transcatheter Aortic Valve Replacement
- Implement an interventional program toward care of patients undergoing Transcatheter Aortic Valve Replacement

**Research Hypothesis:** This study hypothesized that: implementation of interventional program for nurses caring of Patients undergoing Transcatheter Aortic Valve Replacement (TAVR) will have a positive effect on improving their knowledge and practical Level.

**Research design:** To perform this study, a quasi-experimental (pretest-posttest) design was used to evaluate the effect of interventional program on

nurses' knowledge and practice level toward care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR).

**Setting:** The study was conducted at cardiac catheterization units affiliated to Ain Shams University Hospitals Cairo. Egypt.

**Subjects:** A convenient sample of all available nurses (30) from the previous mentioned settings willing to participate in the study.

#### Tools of Data Collection:

- **Tool (I) Nurses' self-administered structured knowledge questionnaire.** This tool was developed by the researchers after reviewing the recent related literatures (Zoltowska et al., 2019; Krishnamoorthy,2020 ). It involved two parts:

#### Part (A): Nurses' demographic characteristics:

It was used to collect data about studied nurses regarding; age, gender, qualifications, training courses and years of experience.

#### Part (B): Transcatheter Aortic Valve Replacement knowledge questionnaire.

This part was designed to assess nurses' level of knowledge toward care of patient undergoing Transcatheter Aortic Valve Replacement procedure. It was consisted of anatomy and physiology of the heart (six MCQ questions), definition (one MCQ question), indications (three true and false questions), contraindications (three MCQ questions), complications (four true and false questions) and nursing care; pre (educating patients about activity of daily living, diet, medications, and pain management) and post procedures of Transcatheter Aortic Valve Replacement (18 MCQ questions) with total questions number of 35.

**Scoring system:** The correct answer of nurses' knowledge scored by one, while the incorrect answer scored by zero. Total score was 35 degree, and it was considered that:  $\geq 90\%$  ( $\geq 31.5$  grades) was satisfactory while  $< 90\%$  ( $< 31.5$  grades) was unsatisfactory.

**Tool (II) Nurses' practice observational checklist:** It was developed by the researchers based on the related literature (Gillam & Marcoff, 2019; Lauck & Hawkey, 2020) to assess nurses' level of practice toward care of patients undergoing Transcatheter Aortic Valve Replacement procedure. It included procedures regarding patient assessment **pre procedure** (20 steps). **Post procedure care** begins with the handoff report. Obtain pertinent information, including vital signs (30 steps), medications administered (22 steps), level of consciousness using Glasgow coma scale (15 steps), access difficulties and overall procedure, such as complications (12 steps)

and arrhythmias (five steps). Perform neurovascular assessment of the affected extremity (12 steps), surgical dressings (18 steps) after the procedure, monitor routine laboratory results (three steps), carefully monitor fluid balance for increased preload, which may cause pulmonary congestion, and decreased preload, which may impair cardiac output and reduce perfusion to extremities (four steps) with total steps number of 141.

**Scoring system:** If the step was done correctly, it scored one, while if the step wasn't done or done incorrectly it scored zero. The total score was 141 grades. It was considered that:  $\geq 90\%$  ( $\geq 126.9$  grades) was satisfactory, while  $< 90\%$  ( $< 126.9$  grades) was unsatisfactory.

#### **Operational design:**

The operational design includes preparatory phase, pilot study and field work

**Preparatory phase:** It included reviewing of the related literature, and theoretical knowledge of various aspects of the study using books, articles, websites and magazines to develop tools for data collection.

**Content validity and reliability:** Content validity attained by five experts; four professors, assistant professors from critical care nursing department, faculty of Nursing, and one cardiologist at faculty of medicine Ain Shams University and according to their opinion, modifications were done. Reliability was assessed statistically for the developed tools by alpha cronbach test (0.98) for tool I, while tool II was (0.964).

**Ethical considerations:** The researchers explained the aim of the study to the nurses included. Nurses were permitted to choose to participate or not and they were informed that they have the right to withdrawal from the study at any time.

**Pilot study:** A pilot study was conducted on 10% of subjects; nurses (three nurses) to test the applicability and feasibility of the study tools as well as time needed to fill these tools. The tools were used as it is as there was no modification.

**Field work:** The field work of this study took three months; started from the beginning of September 2020 and had been completed by the end of December 2020.

#### **Implementation phase:**

Nurses were distributed into six groups (five nurse) in each group following the precautionary measures during COVID-19 pandemic.

The researchers collected data during the morning and afternoon shifts, two days/week to assess nurses' level of knowledge and practice as a pre-test.

Nurses were given **Tool (I): Nurses' self-administered structured knowledge questionnaire** that took about 30 minutes to be collected. Then, the researchers began to assess nurses' practice toward care of patients undergoing Transcatheter Aortic Valve Replacement procedure using **Tool (II): nurses' practice observational checklist** during their routine work.

According to the pre-test result that showed unsatisfactory level of knowledge and practice of nurses toward care of patients undergoing Transcatheter Aortic Valve Replacement procedure, an intervention program was designed based on recent books and periodicals (Marcoff, & Gillam 2019; Zoltowska et al., 2019; Krishnamoorthy, 2020; Lauck & Hawkey, 2020) and implemented that included 2 parts; first part concerned with knowledge regarding (anatomy and physiology of the heart, definition, indications, contraindications, complications and nursing care; pre and post procedure of Transcatheter Aortic Valve Replacement). The second part was concerned with practice, it included procedures regarding patient monitoring, assessment and educating patients about activity of daily living, diet, medications, and pain management. **Post procedure care** begins with the handoff report. Obtain pertinent information, including vital signs, medications administered, current level of consciousness using Glasgow coma scale, access difficulties (including placement of the access point), and overall procedure, such as complications, arrhythmias with placement. Perform neurovascular assessment of the affected extremity, surgical dressings after the procedure, monitor routine laboratory results, carefully monitor fluid balance for increased preload, which may cause pulmonary congestion, and decreased preload, which may impair cardiac output and reduce perfusion to extremities.

The intervention program was presented in theoretical and practical sessions then, the studied nurses were divided into six groups; each group included five nurses that received three session as following: first session (theoretical session) that took about 30 minutes using lectures, and group discussion and poster as a media.

While the second and third sessions (practical sessions) using demonstration, re-demonstration, through real materials and videos, each session took about 60 minutes and concerned with pre and post procedure nursing care.

The researchers created WhatsApp group and added all of the studied nurses for discussion and explanation of their questions related to knowledge and practice toward care of patients undergoing in addition to uploading all media and materials of the program.

#### Evaluation phase:

After one week from finishing the explanation and demonstration of the interventional program, the researchers began to evaluate the effect of the interventional program on nurses' knowledge and practice toward care of patients undergoing Transcatheter Aortic Valve Replacement using tool (I) **Nurses' self-administered structured knowledge questionnaire** and tool (II) **nurses' practice observational checklist** during their routine work and this phase took about three weeks.

**Statistical design:** The statistical analysis involved percentage (%), mean and standard deviation (SD), range, ANOVA test (F-test), independent (t test) and Pearson coefficient (r). The observed differences, and associations were considered statistically significant at  $P < 0.05$ . Statistical analysis was performed with IBM SPSS Statistics Version 22.

#### Results:

Concerning demographic characteristics of the studied nurses, **Table 1** revealed that, mean age of the studied nurses was  $39.8 \pm 7.9$ . Regarding their gender, it was found that, 86.7% of them were females. As regard to their educational level, 80.0% of the studied nurses had bachelor nurse. In addition 60% of the

studied nurses had years of experience less than 10 years.

**Figure (1)** exemplifies an improvement between nurses' total satisfactory level of knowledge and practice after implementing an interventional program regarding care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR) as following, regarding total knowledge level ; pre interventional program implementation was (17.8%) and post interventional program implementation was (88.9%) while for their practical level pre interventional program implementation was (35%) and post interventional program implementation was (92%).

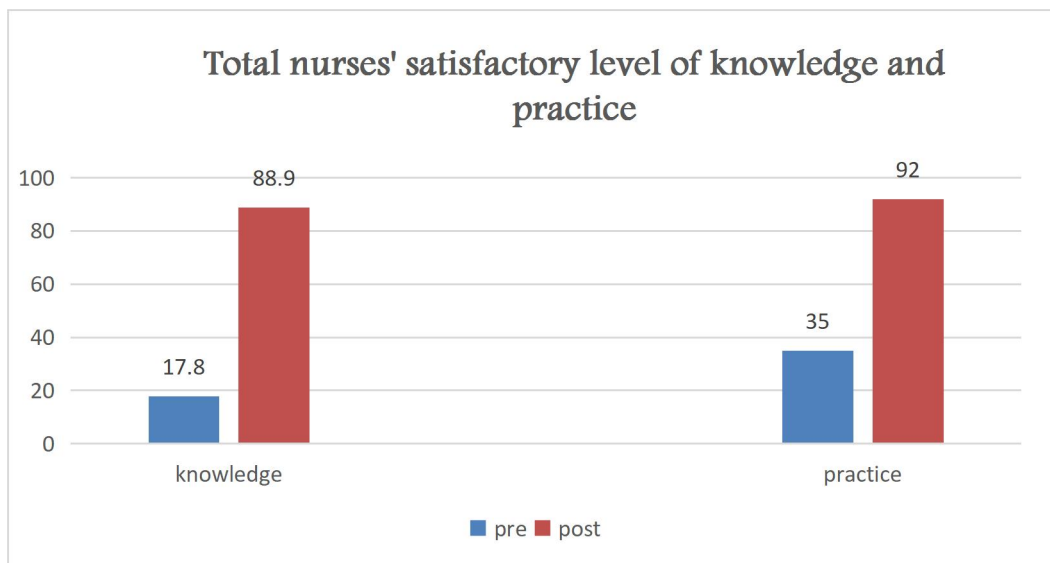
**Table (2)** illustrates that, there were statistically significant differences between mean scores of total knowledge and demographic characteristics pre and post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement.

**Table (3)** represents that, there were statistically significant differences between mean scores of total practice and demographic characteristics pre and post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement.

As for correlations between total satisfactory mean score of nurses' knowledge and practice post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement, **table (4)** signifies a positive correlation between them.

**Table 1: Frequency and percentage distribution of the studied nurses regarding their demographic characteristics (n=30 nurses).**

Demographic characteristics	N (30)	%
<b>Age (Years)</b>		
18<30	4	13.3
30<40	6	20
≥40	20	66.7
<b>Mean ± SD</b>	39.8±7.9	
<b>Gender</b>		
Male	4	13.3
Female	26	86.7
<b>Education</b>		
Diploma nurse	3	10
High institute nurse	3	10
Bachelor nurse	24	80
<b>Years of experience</b>		
<10	18	60
≥10	12	40



**Figure 1: Difference between nurses' total satisfactory level of knowledge and practice pre and post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement (n=30 nurses)**

**Table (2): Relations between total satisfactory mean score of nurses' knowledge and demographic characteristics pre and post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement**

Demographic characteristics	Total satisfactory mean score of nurses' knowledge					
	Pre interventional program			Post interventional program		
	Mean ± SD	Test of significance	P value	Mean ± SD	Test of significance	P value
<b>Age (Years)</b> 18 < 30 30 < 40 ≥ 40	17.50±1.19 17.00±4.97 19.80±4.71	F1 test =0.740	0.705	29.75±1.03 31.58±1.31 30.40±0.89	F2 test =4.471	0.048*
<b>Education</b> Diploma nurse High institute nurse Bachelor nurse	16.78±3.95 21.20±4.96 21.00±0.00	F1 test =0.456	0.767	28.52±1.12 30.40±0.54 32.00±1.41	F2 test t=7.221	0.018*
<b>Years of experience</b> <10 ≥10	16.61±4.27 20.00±1.82	t1 test =0.762	0.686	30.38±1.09 32.12±0.64	t2 test =3.112	0.056*

\* A statistical significant difference  $P \leq 0.05$ ,  $t_1/F$  Pre-Program,  $t_2/F$  Post-Program

**Table (3): Relations between total satisfactory mean score of nurses' practice and demographic characteristics pre and post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement**

Demographic characteristics	Total satisfactory mean score of nurses' practice					
	Pre interventional program			Post interventional program		
	Mean ± SD	Test of significance	P value	Mean ± SD	Test of significance	P value
<b>Age (Years)</b> 18 < 30 30 < 40 ≥ 40	83.83±1.69 83.80±0.83 84.20±2.04	F1 test = 0.868	0.590	129.94±1.69 133.80±0.83 128.20±2.04	F2 test = 5.425	0.028*
<b>Education</b> Diploma nurse High institute nurse Bachelor nurse	82.52±1.62 85.40±0.54 86.50±2.12	F1 test =0.273	0.947	129.52±1.12 130.40±0.54 132.00±1.41	F2 test t=6.121	0.049*
<b>Years of experience</b> <10 ≥10	82.60±1.29 85.12±2.64	t1 test = 1.438	0.237	133.50±1.29 136.12±1.64	t2 test =5.363	0.011*

\* A statistical significant difference  $P \leq 0.05$ ,  $t_1/F$  Pre-Program,  $t_2/F$  Post-Program

**Table 4: Correlations between total satisfactory level of knowledge and practice post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement**

Item	Total satisfactory level of Knowledge (post)	
	r test	P value
Total satisfactory level of Practice (post)	0.502	0.002*

## Discussion

The discussion of this study finding will prove the researchers' hypothesis expected that implementation of interventional program for nurses caring of patients undergoing Transcatheter Aortic Valve Replacement (TAVR) had a positive improvement on their knowledge and practical Level.

Regarding demographic characteristics of the studied nurses, the present study presented that; the mean age (Mean  $\pm$ SD) of the study was  $39.8 \pm 7.9$ . Also, more than three quarters of the study were females. And about their educational level, more than two thirds of the study had bachelor degree of nursing. And, more than half of the studied nurses had less than ten years of experience. These findings are consistent with (Elshal, et al., 2020), in their study entitled: Knowledge and Practice of Nurses Regarding Safety of Patients with Temporary Cardiac Pacemakers in the Critical Care Units. Which revealed that, more than half of studied nurses were females. About three quarter of studied subjects had years of experience more than five years.

From the researchers' point of view, this might explain that majority of those nurses were fresh graduated and so, had no more years of experience.

In relation to, attending the training courses related to care of patients undergoing Transcatheter Aortic Valve Replacement, the all nurses under the study did not receive any training courses related to care of patients undergoing TAVR. These findings are in contrast with (Christina, 2020), in her study entitled: Transcatheter Aortic Valve Replacement: Clinical Update for Nurse Practitioners, who focused that training practitioners' nurses in multiple practice settings about TVAR play a vital role in the care of these patients. In the point of researchers' view, most of studied nurses requires improvement in their skills

and knowledge regarding caring patients undergoing Transcatheter Aortic Valve Replacement (TAVR) to prevent errors and prompting comprehensive care.

Relating to total satisfactory level of knowledge and practice of the studied nurses' pre and post implementation of interventional program regarding care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR), the study revealed that, more than three quarters of them had a satisfactory level of knowledge and practice post implementing the interventional program regarding care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR) comparing with one third and less of them had unsatisfactory level pre implementing the interventional program. This finding is supported by (Patricia, 2020), in his study entitled: Adaptation of Transcatheter Aortic Valve Replacement in Nursing. Who stated that; nurses have a vital role in the care of patients undergoing TAVR and having skills and knowledge about the procedure are important for giving suitable care. These knowledge and skills usually improved by guidance and continuous education of nurses.

From the researchers' point of view, the continuous training, and supervising nurses' knowledge is the key of enhancing their awareness about caring TVAR patients.

As regards to the relations between total satisfactory mean score of nurses' knowledge and demographic characteristics post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement(TAVR). The study clarified that, there were statistically significant differences between mean scores of total knowledge and demographic characteristics post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR).

This finding is consistent with (Lauck, et al., 2020), in their study; Facilitating transcatheter aortic valve implantation in the era of COVID-19: Recommendations for programs, which the study revealed that the TAVI programs must facilitate access



to care without compromising patient safety, enable hospitals to manage the competing demands. There is significant heterogeneity in practice across programs and regions related to the PPE protocols. The European Society of Cardiology recommends that health care providers should have adequate supply and training in proper techniques for donning and removing PPE.

Regarding the relations between total satisfactory mean score of nurses' practice and demographic characteristics post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR). The study revealed that, there were statistically significant differences between mean scores of total practice and demographic characteristics post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement.

This finding is related to (Berger, 2019), in his study; Evolution of a TAVR Program, who stated that, a cohesive commitment of team which include nurses to the achievement of the program ensures good processes and outcomes. Collegial relationships developed from the TAVR program have improved patient care delivery across the continuum. Also, (Karycki, 2019), in his study; Transcatheter aortic valve replacement mentioned that post procedure nursing concerns include frequent monitoring for complications required skilled nurses with good knowledge.

From the researchers' point of view, the improvement in the nurses' practices level depends mainly on their years of experiences in hospitals or care settings for caring patients with cardiac diseases or undergoing surgeries as TVAR.

As for the correlations between total satisfactory level of nurses' knowledge and practice post interventional program implementation regarding care of patients undergoing Transcatheter Aortic Valve Replacement (TAVR), there were a positive correlation between level of knowledge and practice. This is consistent with

(Regan, Laschinger, & Wong, 2016), in their study The influence of empowerment, authentic leadership, and professional practice environments on nurses' perceived interprofessional collaboration, who found a significant relation between knowledge and practice.

### Conclusion

In the light of the findings, the researches hypothesis has been proved as an implementation of

interventional program for nurses caring of patients undergoing Transcatheter Aortic Valve Replacement had a subsequently positive improvement on their knowledge and practical Level comparing with pre implementation of the interventional program.

### Recommendations:

- Availability of nursing interventional booklet regarding care of patients undergoing Transcatheter Aortic Valve Replacement is essential in all lab cardiac catheterization.
- Transcatheter Aortic Valve Replacement care training program should be provided for nurses in lab cardiac catheterization.
- Further researches should be done to assess and evaluate the clinical outcomes for patients with Transcatheter Aortic Valve Replacement.

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