



# Effect of Nursing Management Protocol on Postoperative Care Children with Cardiac Surgery

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**Abstract:** Cardiac surgery places children at risk for numerous significant health problems and complications. Systematic nursing intervention is vital during the post-operative period to identify rapidly any complication and deterioration in children condition. **Aim:** This study aimed to evaluate the effect of nursing management protocol on postoperative care among children with cardiac surgery. **Design:** A quasi-experimental design was used. **Setting:** The study was carried out at the Pediatric Intensive Care Units for postoperative heart surgery at Cardiac Surgery Academy. **Subject:** A purposive sample composed of 76 working at the previously mentioned setting and giving care for children with cardiac surgery. **Tools:** It included two tools; a pre designed interviewing questionnaire and observation checklists. **Results:** less than one quartet of the studied nurses had satisfactory total knowledge about care of the children undergoing cardiac surgery pre implementation of the nursing protocol compared to less than three quarters of them post implementation with a statistically significant difference. Nurses' practices were statistically improved post implementation of the nursing protocol. **Conclusion:** It can be concluded that, the nursing protocol led to significant improvements in nurses' knowledge and practices related to postoperative care among children with cardiac surgery. **Recommendations:** Implementing nursing intervention protocol should be provided to all PICUs nurses to improve and update their knowledge and skills concerning cardiac surgery. Further research is proposed to examine the effect of the implementation of this protocol on reducing the incidence of post-operative complications.

**Keywords:** Cardiac Surgery, Nursing Intervention protocol, Nurses' Performance. Practice, Skills, Children

## I. INTRODUCTION

Cardiovascular diseases account for 30% of all global deaths worldwide; the majority of cardiovascular deaths are related to coronary heart disease. (WHO, 2016). Heart surgery plays an important role in the management of wide range of cardiovascular diseases (CVD) and encompasses the care of a patient with greater acuity and complexity. Cardiac surgery, including coronary artery bypass grafting (CABG) and heart valve surgery represent the most common classes of surgical procedure performed globally (Abdallah, 2012).

Open heart surgery is any surgery where the chest is opened and surgery is performed on the heart muscles, valves, arteries or other heart structure. The term open refers to the chest not the heart itself. The heart may or may not be opened depending on the type of the surgery. Heart lung machine (cardiopulmonary bypass) is used during conventional open heart surgery (Abdelnabey, et al., 2014).

After surgery, the child generally will spend at least an hour in the recovery room until the anesthesia has worn off. Occasionally, the child is taken to the PCICU for recovery. The child must stay in PCICU at least a few days to recover. Pain medications are given to relieve pain. The child will be assisted out of bed for increasingly longer periods, beginning 24-48 hours after surgery. The early activity helps to prevent post-operative problems such as pneumonia (Arthur, et al, 2010).

Ideally, the postoperative ICU is located adjacent to the cardiac surgical operating room. The cardiac ICU has a pivotal role in a multi-disciplinary and collaborative pediatric and congenital cardio-vascular program. It is essential for children with CHD to be managed by an experienced, knowledgeable and dedicated team of physicians and nurses (**Perkins et al., 2009**).

Nursing-led research on PICU ethical concerns has highlighted that PICU staff struggle with moral distress; this is a malaise that results when situational constraints prevent clinicians from doing what they believe is the right thing to do. Other ethics research has examined PICU decision-making, parental roles, communication, as well as concerns relating to the long-term care of PICU “survivors” with complex continuing care needs (**Patrizio et al., 2019**).

Typically, entry-level nursing education programs provide some basic exposure to general pediatric nursing, but little direct experience in critical care is offered. Academic programs in critical care nursing or PCCN are generally restricted to graduate advanced practice programs for clinical nurse specialists or nurse practitioners. Every PICU needs to maintain an orientation program for new staff that can be readily tailored to the variable needs of new staff (**Ni-Z et al., 2019**).

The nursing protocol must include the minimal level of policies, procedures, and nursing activities which are needed in certain situations to improve the quality of care. On the other hand, the nursing protocol is detailed plans that describe a care plan for nurses for a particular condition or disease. Writing nursing protocols might seem like a task, but the format is essentially the same across nursing practices and institutions. Nursing management protocols are guidelines, formatting tips and templates which are readily available. Nursing protocols must be tested to be valid and reliable (**Wong, et al., 2010**).

## II. AIM OF THE RESEARCH

This research aimed to evaluate the effect of nursing management protocol on postoperative care among children with cardiac surgery. This aim was achieved by:

1. Assessing nurses' knowledge and practice regarding postoperative care among children with cardiac surgery.
2. Designing and implementing nursing protocol regarding postoperative care among children with cardiac surgery.
3. Evaluating the effect of nursing protocol regarding postoperative care among children with cardiac surgery.

### Research hypothesis:

Nursing management protocol will have significant effect on postoperative care among children with cardiac surgery.

## III. LITERATURE REVIEW

Cardiovascular system is an organ system that conveys blood through vessels to and from all parts of the body, carrying nutrients and oxygen to tissues and removing carbon dioxide and other wastes. It is a closed tubular system in which the blood is propelled by a muscular heart. Two circuits, the pulmonary and the systemic, consist of arterial, capillary, and venous components. The vascular system is a network of arteries, veins, and capillaries. The primary function of the heart is to serve as a muscular pump propelling blood into and through vessels to and from all parts of the body (**Kobylnska et al., 2013**).

Congenital heart defect (CHD) or congenital heart anomaly is a defect in the structure of the heart and great vessels which is present at birth. Many types of heart defects exist, most of which either obstruct blood flow in the heart or vessels near it, or cause blood to flow through the heart in an abnormal pattern. Other defects, such as long QT syndrome, affect the heart's rhythm. Heart defects are among the most common birth defects and are the leading cause of birth defect-related deaths. Approximately 9 people in 1000 are born with a congenital heart defect. Many defects don't need treatment, but some complex congenital heart defects require medication or surgery (**Lozano, 2012**).

The cause of a congenital heart defect is often unknown. However, several risk factors are associated with a higher incidence. These include prenatal factors such as maternal uncontrolled diabetes mellitus, maternal viral infection during pregnancy (rubella), maternal alcoholism or tobacco smoking, maternal age over 40 years, maternal obesity, and maternal exposure to chemicals and pollutants. Drugs such as phenytoin or retinoic acid for acne and x-ray exposure during pregnancy can contribute to some congenital heart problems. Both low or high birth weight infants are more likely to have an increased incidence of heart disease (**Wong, et al., 2013, Nazari, et al., 2016**).

Congenital heart defects can be classified according to structural abnormalities, functional alterations, or both. Historically, defects were simply classified according to whether they were cyanotic or acyanotic (**Rohit, et al., 2018**). Congenital heart defects. If the defect lowers the amount of oxygen in the body, it is called cyanotic. If the defect doesn't affect oxygen in the body, it is called acyanotic (**John et al., 2014**).

Management of CHD requires prior orientation of the type and severity of the lesion as well as the nature and severity of possible associated complications. The major goal in treatment is to prevent chronic or irreversible heart damage. Asymptomatic heart defects are monitored but not aggressively treated. Management of heart defects may involve medical treatment, catheterization, surgical intervention and heart transplantation (**Syamasundar et al., 2019**).

Cardiac surgery may be necessary to correct a congenital defect or to provide symptomatic relief. Surgical procedures seek to repair the defect as much as possible and restore the circulation to as close to normal as possible. The surgery may be planned as an elective procedure or done as an emergency (**Kimberly et al., 2017**).

Cardiac surgery is a well-established procedure worldwide with excellent results for efficacy and safety in treating heart patients. Cardiac surgery, including coronary artery bypass, valve surgery, and congenital defect repair, is among the most common classes of surgical procedures performed worldwide. Successful outcomes after cardiac surgery depend on optimum postoperative critical care. (**da Costa Torres et al., 2016**)

Open-heart surgery places children at risk for numerous significant health problems and complications such as cardiac arrest that resulting from late recognition and identifications of these risks therefore, those children with this surgical procedure require an earlier intervention to improves their out-comes. Systematic nursing assessment is vital during the post-operative period to identify rapidly any complications and effectiveness of early warning sign's detection educational sessions for nurses on clinical deterioration in children condition and include monitoring cardiovascular status, ventilator parameters, fluid balance and neurological status. (Tucker, et al, 2019).

The system of assessment should be completed within the first few minutes of arrival in the PICU. A report should be received from the operating room personnel accompanying the patient to the PICU. A plan of care can be developed to ensure the safety and rapid recovery of the postsurgical patient. Reassessment should be performed on a regular, ongoing basis to ensure that changes in child condition are recognized and treated early (Jane and Chris, 2012).

Ideally, the postoperative ICU is located adjacent to the cardiac surgical operating room. The cardiac ICU has a pivotal role in a multi- disciplinary and collaborative pediatric and congenital cardio-vascular program. It is essential for children with CHD to be managed by an experienced, knowledgeable and dedicated team of physicians and nurses (Perkin et, al., 2009).

The protocol for open-heart surgery children is to have an integrative service coordinator, also a nurse, provide healing touch. The nurse prepares the children psychologically and emotionally for the upcoming cardiac surgery. When the child returns to the PCICU, the nurse must apply certain nursing protocol to help child to deal with the new stressful situation. The integrative service coordinator then follows the child with the cardiac surgery team until discharge. Clinical Protocol is a set of directions or principles to assist the health care provider; it provides decisions about appropriate diagnostic, therapeutic, or other clinical Procedures for specific clinical circumstances. It is the description of the steps taken to care for and treat a child, sometimes called the integrated pathway (Ruppet, et al., 2010)

## II. RESEARCH DESIGN:

A quasi-experimental design was adopted to conduct the study.

## III. RESEARCH METHODOLOGY:

The subjects and methods of the current study were discussed under the following four (4) designs:

### 1.1. Technical Design.

It included research design, setting, subjects and tools for data collection.

#### Research Design :

A quasi-experimental design was adopted to conduct the study.

#### Research Setting:

The study was conducted in Pediatric Intensive Care Units (PICUs) for postoperative heart surgery at Cardiac Surgery Academy affiliated to Ain Shams University.

#### Research Subjects:

A purposive sample consisted of 76 nurses who works in the previously mentioned setting accompanying all children undergoing cardiac surgery at the time of caring out the study, was recruited under the following inclusion criteria; Nurses working all time at the previously mentioned settings and giving care for children with cardiac surgery regardless their age, their level of education and years of experiences, children ages more 40 days -16 years from both gender undergoing cardiac surgery for the first time.

#### Tools of data collection:

Data were collected through the using of the following tools twice:

#### 1- A structure interview questionnaire (pre\_ post Protocol)

It was designed by the researcher after reviewing related literature and was written in simple Arabic language and revised by the supervisors. This tool was divided into two parts:

**Part I:** This part was concerned with the characteristics of study subject:

**Part A:** This part was concerned with the characteristics of:

Nurses: age, sex, level of education, years of experience, qualifications, and attendance training program.

**Part B:** This part dealt with knowledge of nurses related to cardiac surgery (anatomy and physiology of the heart, the circulatory system, congenital heart diseases, cardiac surgery, and post-operative nursing management for children undergoing cardiac surgery).

**Scoring system:** according to the answers obtained from the studied nurses, a scoring system was followed to assess the nurses knowledge, each question scored two marks for a correct and complete answer, one mark for correct and incomplete answer and zero for an incorrect answer or no answer, and accordingly the nurses' knowledge was categorized into; Unsatisfactory knowledge less than 60% and Satisfactory knowledge 60% and more.

#### 2- Observational Checklists:

It were adopted from different references to assess nurses' practice regarding care for children with cardiac surgery; from Lynn (2015) to assess nurse's practice measuring vital signs, Taylor et al. (2011) to assess pulse oximetry, Taylor et al. (2011) to assess central venous pressure, Ethel and Toby (2006) to assess nursing care provided to naso/ oropharyngeal suctioning, Gibbs (2010) to assess nursing practice regarding wound dressing, Coffin et al. (2014) to assess nursing practice regarding urinary catheter care, Vicky and Cindy (2016) to assess nursing practice regarding care of chest tube.

**Scoring system:** As regards the scoring system for nurses' practices, a score one was given to the nurses for each step done correctly and zero for each step done incorrectly or not done, the nurses' scores were summed up and converted to percentage and accordingly the nurses' total practices were categorized into :competent level was 80% and more and Incompetent level was Less than 80%.

**3- Medical record :**It was used to assess the child's disease as diagnosis, duration of illness, clinical manifestations, times of hospital admission and medications.

**Validity and reliability:**

The tools were tested for their content validity by a jury of five expertise in in the field of pediatric medicine and pediatric nursing. The required modifications were carried out accordingly. Testing reliability of the study tools was done by Cronbach alpha, the results was 0.78 for questionnaire, 0.79 for observation checklists.

**1.2. Operational Design.****Preparatory phase**

During this phase, a review of the literature covering various aspects of the research problem was done by using available articles, periodicals, magazines, and books to be acquainted with the research problem to develop the study tools and content.

**Pilot study:**

A pilot study was carried out involving eight nurses and six children of the total study sample to test the validity and reliability of the study tools, time needed to fill in, study tools applicability and feasibility. Modifications were done as revealed from the pilot study by adding or omitting some items, the nurses involved in the pilot study were excluded later from the study.

**Ethical consideration:**

Informed consent was obtained from the ETHICAL committee before starting the study, an official permission letter was obtained from the Dean of Nursing Faculty Ain Shams University to directors of the previously mentioned setting. The researcher was explained the objective and aim of the study to subjects included the study. The researcher was assured that no harm will occur. Subjects was informed that they were allowed to choose to participate or not in the study and they have the right to withdraw from the study at any time. The researcher was assured maintain anonymity and confidentiality of subjects' data, the study subject are secured. Subjects consent was obtained to participate or not in the study and they have the right to withdraw from the study at any time.

**Field Work:**

The actual field work was carried out over a period of 8 months from beginning of May up to the end of December 2019. The researcher was available in the study setting 3 days/week from 9:00 a.m. to 5:00p.m. and the actual field was divided in to four phases:

**I. Assessment phase:**

In this phase, the researcher was using the constructed tools in collecting the data about nurses' knowledge and practices related to care of children with cardiac surgery (pre-test). The purpose of the study and its expectations were explained by the researcher to the studied nurses before starting interviewing and data collection. The questionnaire was filled in by the nurses; the time needed to fill in the questionnaire depended on nurses' knowledge, the average time ranged between 45: 60 minutes. The observation checklist was filled in by the researcher during observation of nurses' practices (re-demonstration) and the time needed to filling in the checklist depended on nurses' own practices of the procedures, each procedure time ranged between 3 to 5 minutes .

**II. Planning phase:**

The protocol was designed on the light of the literature review and modified according actual needs of nurses to improve their knowledge and skills regarding to postoperative care among children with cardiac surgery. The content of nursing management protocol included knowledge about anatomy and physiology of the heart, congenital heart diseases, cardiac surgery, and the nursing management for children with congenital heart disease post-operative nursing. As well, the nursing management protocol included practices related to the vital signs, chest physiotherapy, suction for children post-operative cardiac surgery, the measuring central venous pressure, care of chest tube, and care of urinary catheter. Constructing the nursing management protocol content was then followed by selecting the suitable teaching methods and appropriate media for teaching this content. In addition to the nursing management protocol, illustrated booklet was designed by the researcher in Arabic language to serve as a referral guideline for nurses giving care for children with cardiac surgery. The nursing management protocol illustrated booklet was evaluated for its content validity and clarity by a panel of experts, professors in the field of pediatrics nursing. In the light of their comments, the necessary modifications were carried out and the final form of the guiding booklet was administered.

**III. Implementing phase:**

The total number of sessions was six. Two sessions for theory and four sessions for practices, the duration of theoretical session was 60 minutes. While the duration of practical session ranged from 40:50 minutes. The researcher provided coffee break for nurses attended at the half of session. The total time was 5 hours for each group. The studied nurses were divided into ten groups; each group included 7 to 8 nurses. At the beginning of the first session, an introduction about the objectives and expected outcomes from nursing management protocol, and each session started with a summary feedback about the previous session, at the end of each session the researcher inform nurses about the date and time of next session according to their time in the Pediatric Intensive Care Units (PICUs). Different teaching methods were used such as; discussion, brain storming, lecture, small group discussion, demonstration and re-demonstration. Suitable media was used such as; handouts, power point, checklists, Real equipment, Video\ CD, and booklet .

**IV. Evaluation:**

Upon the completion of the nursing management protocol. The post test was done for nurses to evaluate the outcomes of the nursing management protocol using the same tools.

**1.3. Administrative Design.**

An official permission to conduct the study was obtained through an issued letter from the Dean of the Faculty of Nursing, Ain Shams University to the administrators of the previously mentioned setting concerning the title objective, study technique and tools (seeking for their co-operation).

**1.4. Statistical Design.**

Data collected from the studied sample was revised, coded and entered using computer. Data entry and statistical analysis was fulfilled using the statistical package for social sciences (SPSS). Data was presented using descriptive statistics in the form of frequencies, percentages. Chi-square test (X<sup>2</sup>) was used for comparisons between qualitative variables, and Cochran's Q test is used to determine if there are differences on a dichotomous dependent variable between three or more related groups. P value denoted level of significance where a p value 0.01 or less was considered as highly statistically significant, a p value 0.05 or less was considered as statistically significant whereas a p value > 0.05 was considered to be non-statistically significant.

**IV. RESULTS AND FINDINGS**

**Table (1): Distribution of the studied nurses according to their characteristics (n= 76).**

Table (1) showed that, the mean age of nurses enrolled in this study was  $30.28 \pm 4.14$  years and mean years of experience of them was  $7.98 \pm 4.49$ . The same table represented that, almost less than two thirds (61.8%) of nurses was Staff Nurse, and less than one third (31.5%) of them had Technical Institute.

**Table (2): Distribution of studied children according to their characteristics (n= 67).**

Items	No =76	100%
<b>Age in year</b>		
25 ≤ 30 years	38	50
30 < 35 years	30	39.5
35 years and more	8	10.5
<b>Mean ± SD</b>	30.28 ± 4.14	
<b>Gender</b>		
Male	23	30.3
Female	53	69.7
<b>Marital status</b>		
Single	42	55.3
Married	31	40.8
Divorced/widow	3	3.9
<b>Job Position</b>		
Staff Nurse	47	61.8
Nurse Practitioner	19	25
supervisor Nurse	10	13.2
<b>Qualification</b>		
Diploma	21	27.6
Diploma & specialist	9	11.8
Technical Institute	24	31.5
Bachelor	15	19.7
Bachelor & diploma	7	9.2
<b>Years of Experience</b>		
Less than 5years	21	27.6
5 to less than 10 years	40	52.6
10 to less than 15 years	8	10.5
15 and more	7	9.2
<b>Mean ± SD</b>	7.98 ± 4.49	
<b>Attained training program about:</b>		
Post-operative care	4	5.3

Items	No=67	100%
<b>Age/ years</b>		
Less than 4 year	34	50.7
4 > 8 years	14	20.9
8 ≥ 12 years	19	28.4
<b>Gender</b>		
Male	41	61.2
Female	26	38.8
<b>Area</b>		
Rural	48	71.6
Urban	19	28.4
<b>Admitted to school or nursery</b>		
Enrolled in school or nursery	22	32.8
Didn't go to school or nursery	45	67.2
<b>Reason for didn't go to school or nursery N.=45</b>		
Less than school age	34	75.6
A cause of absenteeism was related to deterioration of health.	11	24.4

Table (2) revealed that 50.7% of the studied children were less than 4 year and less than two thirds of them (61.2%) were male. also this table showed that less than three quarters (71.6%) of studied children from rural and 24.4% of them didn't go to school or nursery due to health deterioration.

**Figure (1): Percentage distribution of studied children according to their medical diagnosis:**

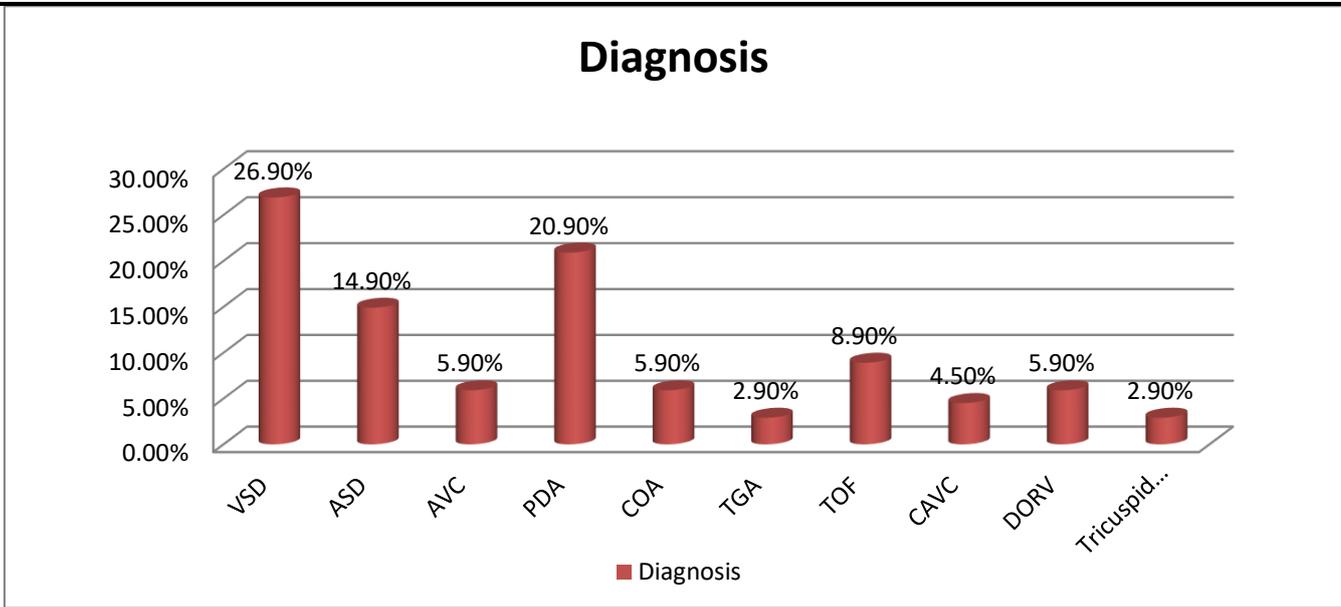


Figure (1) showed that for the VSD (ventricular septal defects) was the most diagnosis which represents slightly more than one quarter (26.9%) of the studied children followed by PDA which represent less than one quarter (20.90%) of the studied children.

**Table (3): Frequency and percentage distribution of total knowledge score of subscales among studied nurses.**

Items		Pre		Post		Follow up	
		N	%	N	%	N	%
Information about the anatomy and the physiology of the heart	Unsatisfactory	60	78.9	28	36.8	31	40.8
	Satisfactory	16	21.1	48	63.2	45	59.2
Congenital heart defects	Unsatisfactory	53	69.7	18	23.7	27	35.5
	Satisfactory	23	30.3	58	76.3	49	64.5
Knowledge about heart surgery	Unsatisfactory	42	55.3	4	5.3	15	19.7
	Satisfactory	34	44.7	72	94.7	61	80.3
Knowledge about postoperative nursing care of heart surgeries.	Unsatisfactory	46	60.5	15	19.7	24	31.6
	Satisfactory	30	39.5	61	80.3	52	68.4
Nurses' information about nursing care for a child's ventilator	Unsatisfactory	33	43.4	10	13.2	17	22.4
	Satisfactory	43	56.6	66	86.8	59	77.6
Nurses' Information on Oxygen Therapy	Unsatisfactory	64	84.2	34	44.7	28	36.8
	Satisfactory	12	15.8	42	55.3	48	63.2
Nurses' information about chest tube care	Unsatisfactory	54	71.1	30	39.5	33	43.4
	Satisfactory	22	28.9	46	60.5	43	56.6
Nurses' information regarding CPR.	Unsatisfactory	63	82.9	35	46.1	35	46.1
	Satisfactory	13	17.1	41	53.9	41	53.9
Nurses' information about the central venous catheter	Unsatisfactory	37	48.7	23	30.3	28	36.8
	Satisfactory	39	51.3	53	69.7	48	63.2

Table (3) showed that the studied nurses 21.1%, 30.3%, 44.7%, 39.5%, 56.6%, 15.8%, 28.9%, 17.1% and 51.3% of the studied sample had satisfactory knowledge regarding information about the heart and blood circulation, congenital heart defects, heart surgery, postoperative nursing care of heart surgeries, nursing care for a child's ventilator, oxygen Therapy, chest tube care, CPR and central venous catheter respectively at pre then increased to 63.2%, 76.3%, 94.7%, 80.3%, 86.8%, 55.3%, 60.5%, 53.9% and 69.7% respectively but declined to 59.2%, 64.5%, 80.3%, 68.4%, 77.6%, 63.2%, 56.6%, 53.9% and 63.2% at follow up implementation of nursing protocol.

Figure (2): Percentage of the total knowledge score among the studied nurses.

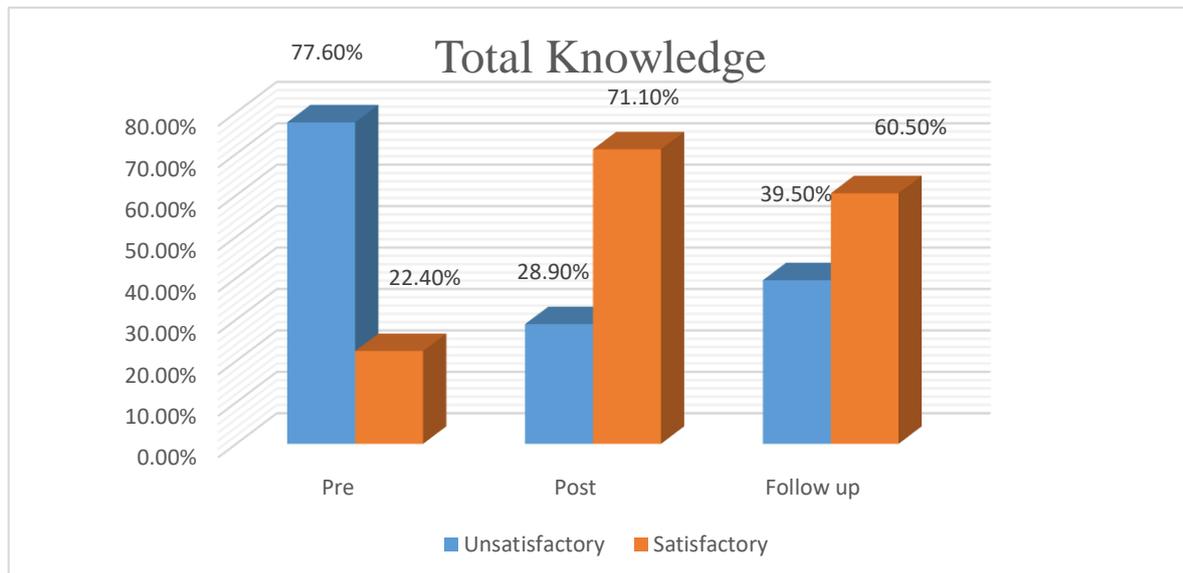


Figure (2): it was clear from this figure that about 22.40% of the studied nurses had satisfactory knowledge regarding care of the children undergoing cardiac surgery at the pre implementation of nursing protocol. Meanwhile, 71.10% had satisfactory knowledge at post protocol intervention and declines to 60.50% at follow up phase.

Table (4): Frequency and percentage distribution of total practice score of subscales among studied nurses.

Items		Pre		Post		Follow up	
		N	%	N	%	N	%
Assessing Vital Signs	Incompetent	43	56.6	22	28.9	28	36.8
	Competent	33	43.4	54	71.1	48	63.2
Use a Pulse Oximetry	Incompetent	43	56.6	27	35.5	35	46.1
	Competent	33	43.4	49	64.5	41	53.9
Naso/ Oropharyngeal Suctioning	Incompetent	47	61.8	20	26.3	25	32.9
	Competent	29	38.2	56	73.7	51	67.1
Oxygen therapy	Incompetent	55	72.4	16	21.1	25	32.9
	Competent	21	27.6	60	78.9	51	67.1
Central Venous Pressure Assessment	Incompetent	49	64.5	19	25.0	26	34.2
	Competent	27	35.5	57	75.0	50	65.8
care of Urinary Catheter	Incompetent	48	63.2	17	22.4	46	60.5
	Competent	28	36.8	59	77.6	30	39.5
Wound Dressing	Incompetent	47	61.8	19	25.0	20	26.3
	Competent	29	38.2	57	75.0	56	73.7
Chest Tube Drain	Incompetent	44	57.9	17	22.4	19	25.0
	Competent	32	42.1	59	77.6	57	75.0

Table (5) showed that 43.4%, 43.4%, 38.2, 27.6%, 35.5%, 36.8%, 38.2%, 42.1%, and 32.9% of the studied nurses had Correct performance regarding assessing vital signs, use pulse oximetry, naso/oropharyngeal suctioning, oxygen therapy, central venous pressure assessment, care of urinary catheter, wound dressing, and care of chest tube drain respectively at pre then increased to 71.1%, 64.5%, 73.7%, 78.9%, 75.0%, 77.6%, 75.0%, 77.6%, and 77.6% respectively but declined to 63.2%. 53.9%, 67.1%, 67.1%, 65.8%, 39.5%, 73.7%, and 75.0%, 61.8% at follow up implementation of nursing protocol.

Figure ( 4): Percentage of the total performance score among the studied nurses.

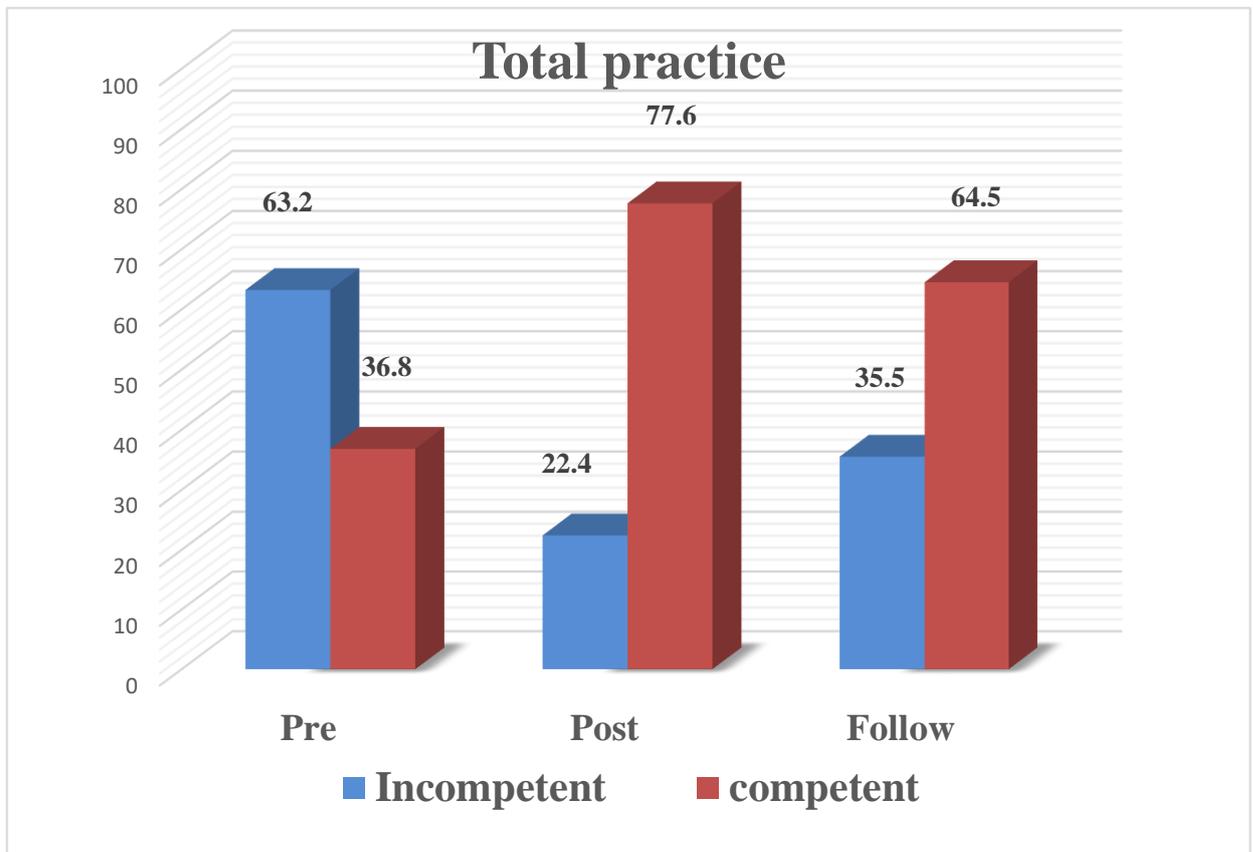


Figure (4): as shown from this figure that, at pre implementation of nursing protocol slightly more than one third of the studied nurses 36.8% had a competent level of total performance regarding skills for children undergoing cardiac surgery. Meanwhile, Competent level increased to slightly more than three quarters (77.6%) at post protocol intervention and competence of nurses declined to 64.5% at follow up implementation of nursing management protocol.

Table (6): Effect of nursing management protocol on the studied nurses’ knowledge and practice regarding Care of the Children Undergoing Cardiac Surgery.

Items		Mean ± SD	Cochrane test (Q test)	P value	Sig.
Total knowledge	Pre	1.22 ± 0.41	61.45	0.000**	H.S
	Post	1.71 ± 0.45			
	Follow up	1.60 ± 0.49			
Total practice	Pre	1.36 ± 0.48	26.35	0.000**	H.S
	Post	1.77 ± 0.41			
	Follow up	1.64 ± 0.48			

Table (6) clarified that there was highly statistically significant difference between total knowledge for pre, post and follow implementation of nursing management protocol (Q= 61.45 & p=0.000). In addition, there was highly statistically significant difference between total practice for pre, post and follow implementation of nursing management protocol(Q= 26.35 & p=0.000).

Table (7): Post-hoc analysis for Effect of nursing management protocol on studied nurses’ total knowledge and total practice regarding Care of the Children Undergoing Cardiac Surgery

Items	Mean difference	P value
Total knowledge	Pre – Post	0.48
	Pre - Follow up	0.38
	Post- Follow up	0.10
Total practice	Pre – Post	0.40
	Pre - Follow up	0.37
	Post- Follow up	0.13

Table (7) indicates that there is a highly statistically significant difference between total knowledge for pre and post implementation of nursing management protocol (p=0.000). Also, a highly statistically significant difference between total knowledge for pre and follow implementation of nursing management (p=0.000). Adding to that, there is a highly statistically significant difference between total practice for pre and post implementation of nursing management protocol (p=0.000). As well as, a statistically significant difference between total practice for pre and follow implementation of nursing management (p=0.002)

## V. DISCUSSION

The current study was a quasi-experimental study, aimed to evaluate the effect of nursing management protocol on postoperative care among children with cardiac surgery through: assessing nurses' knowledge and practices regarding postoperative care among children with cardiac surgery, designing and implementing nursing protocol regarding postoperative care among children with cardiac surgery, and evaluating the effect of this protocol regarding postoperative care among children with cardiac surgery.

As regarding characteristics of the studied nurses, the results of the present study revealed that, half of the studied nurses were in the age group  $25 > 30$  years and more than half of them had  $5 > 10$  years of experience with a mean year of experience  $7.98 \pm 4.49$ . Moreover, less than one third of the studied nurses held Secondary Nursing Education.

These results were in agreement with that of *Eskandeer et al. (2013)*, who studied "Intensive Care Nurses' Knowledge & Practices regarding Infection Control Standard Precautions at a Selected Egyptian Cancer Hospital" and found that, more than half of the nurses had more than five years of experience. The finding was in line with *Bayomi (2020)* who conducted a study entitled "Permanent pacemaker implantation: Effect of intervention protocol on nurse's knowledge, practices, and patient's outcomes." and concluded that concerning level of education about half of them had diploma degree.

These were in disagreement with findings of *Essani and Ali (2011)* who carried out a study entitled "Knowledge and Practice Gaps among Pediatric Nurses at a Tertiary Care Hospital Karachi Pakistan" and reported that, most nurses were between 20 to 30 years of age, minority of them had BS degree in nursing and the mean years of experience were 2.6 years. Also, these results were in disagreement with *Thabet E, et al. (2019)* who found in thesis entitled "Assessment of Nurses' Knowledge and Practices Regarding Temporary Pacemaker Patient's Care at Assut University Hospital in Egypt," that the majority of nurses had ages ranging from 18 to 23 years and more than half of them were certified from nursing institute.

As regards characteristics of studied children, the current study revealed that, more than half of the studied children aged less than 4 years. This finding was in agreement with those of *Abdel- Razek et al. (2020)*, who recently conducted a study entitled "effectiveness of early warning sign's detection educational sessions for nurses on clinical outcomes of post open cardiac surgery children" and mentioned that, less than one third of the studied children's were in the age group from 3 to 6 years of age. Meanwhile, this finding was dispute with *Morsi (1997)*, who conducted a study entitled "The effect of preoperative instructions of the postoperative outcomes for children undergoing heart surgery" and reported that, the age of children was 7 to 16 years old.

The results of the current study revealed that, less than two thirds of children were males. This was supported by *Badri (2015)*, who found in a study entitled "Effect of Nursing Intervention on Stressors and Coping Patterns of Children Undergoing Cardiovascular Surgeries and their Caregivers" that, less than two thirds of the studied children were males. On the other hand, this was incongruent with that of *Ujuanbi (2016)*, who performed a study entitled "Prevalence of Congenital Heart Diseases among Primary School Children in the Niger Delta Region of Nigeria, West Africa" revealed that more than half of children were females. These results might be due to the differences in the study settings.

Concerning the residence of studied children, the findings of the present study clarified that, less than three quarters of study group were living in rural areas. This was corresponding with those of *Badri (2015)*, who reported that, more than half of both study and control groups were living in rural areas. On the same context, this was parallel with *Mahmoud et al (2020)*, who found in a recent study entitled "Quality of life among Children with Congenital Heart Diseases" that, the highest percent of studied children were from rural area. It could be explained by that, the hospitals in rural areas are not well prepared to carry out this type of surgeries.

Concerning the medical diagnosis, VSD (ventricular septal defects) was the most common diagnosis which represents slightly more than one quarter of the studied children.

This was highly supported by *Abd El Samiea (2011)*, who conducted a study entitled "Nurses' Performance Regarding Care of Children Undergoing Cardiac Surgery" and stated that, about more than one third of the studied children had VSD. Also, these results were parallel to that of *Lemanu et al. (2013)* who found in a study entitled "The effect of preoperative exercise on cardio-respiratory function and recovery after surgery" that cardiac disorders specially VSD, were the second cause of children's admission to the hospital in the USA. In the same context, this was matched with *Badri (2015)*, who cleared that, less than one third of the study group and less than one quarter of the control groups had VSD.

The current results showed PDA was the second most common type of CHD after VSD which represent less than one quarter. Meanwhile, this was incongruent with *Catta (2009)*, who carried out a study entitled "the essentials in the postoperative evaluation of congenital heart disease" and stated that, Fallots tetralogy was the second most common type of CHD between preschool and school children in London. These results might be due to the differences in the sample size, patient's characteristics and disease prevalence.

The current study revealed that TGA represented relatively low percentages of CHD. Similarly, *Connolly, D. (2010)* conducted a study entitled "Postoperative Complication in Children after Cardiac Correction for Congenital Heart Disease" and reported that, TGA were less common between school children in USA.

Concerning the nurses' knowledge about the anatomy and the physiology of the heart, nearly two thirds of the studied nurses had satisfactory knowledge post protocol intervention. This was similar to *Badri (2015)*, who cleared that nearly two thirds of the studied subjects had a good knowledge after application of the program. On the same context, *Mostafa et al. (2017)*, who carried out a study entitled "Effect of Training Program Regarding Care of Patients Undergoing Open Heart Surgery on Nurses' Performance Approach" revealed that, more than half of them had unsatisfactory knowledge at pre phase of the training program, as well as there were improvement of subject's knowledge in the post and follow up phase.

Regarding the studied nurses' knowledge about heart surgery, more than half of the studied nurses had unsatisfactory knowledge pre implementation of nursing protocol. Satisfactory knowledge was achieved by the majority post protocol intervention and most of studied nurses at follow up phase. This was in agreement with *Mostafa et al. (2017)*, who revealed that, more than half of the studied nurses in pretest had unsatisfactory knowledge regarding open heart surgery, while post implementation of the training program, more than half of them had satisfactory knowledge, as well as in the follow up phase, with a highly statistical significant difference at all phases of implementing the training program.

Concerning the nurses' knowledge regarding nursing care of children connected with mechanical ventilation, more than half of the studied nurses had satisfactory knowledge. Meanwhile, most of them had satisfactory knowledge at post protocol intervention and declines to more than three quarters at follow up phase, with highly statistically significant difference (P. value < 0.05). In the same line *Shehab et al., (2018)*, conducted a study entitled "Nurses Performance about Safety Weaning from Mechanical Ventilation of Critically Ill Adults and Children" and concluded that more than half sector of the studied nurses had inadequate knowledge and practice regarding mechanical ventilation of critically patient at intensive care units.

Further validation by *Ali R., et al (2020)*, who found, in a recent study entitled "Effect of Educational Protocol about Resuscitation Process on Nurses' Performance" that, more than two third of studied sample had unsatisfactory knowledge during pre-education, while the majority of them had satisfactory knowledge level post three months.

The results of the current study revealed that, more than three quarters of the studied nurses had unsatisfactory knowledge regarding care of the children undergoing cardiac surgery at the pre implementation of nursing protocol. This was parallel to *Hafez (2014)*, who found that, most of the studied subject had insufficient knowledge before the program implementation.

This lack of knowledge may be due to that, there was around one third of the studied nurses have less than 5 years of experience. Moreover, there was no center or source for acquiring knowledge whether from doctors, head nurses, nor attending training courses and even no guidelines or any protocol of nursing intervention about postoperative care of children with cardiac surgery. This would affect negatively on the nursing care provided for children. Additionally, it might lead to complications among the children and might lead to several problems to the nurse providing the care.

In this study, there was statistically significant difference between pre-, post and follow-up nursing management protocol regarding knowledge. Significant improvements were demonstrated at the post and follow up implementation of nursing management protocol as it was noticed that, less than three quarters of them had satisfactory knowledge at post protocol intervention and declines to less than two thirds at follow up phase regarding total knowledge. This result reflected that these nurses were in real need for such information. Moreover, the acquired knowledge was retained with declines throughout the three-month follow-up, when it found that, majority of the nurses still had sufficient knowledge.

This indicates the positive effect of the intervention protocol on the knowledge of nurses, and this was further supported by multivariate analysis which established the intervention as a significant independent positive predictor of the nurses' knowledge gained. A similar impact of an intervention on changes on nurses' knowledge was demonstrated in a study in Ain Shams University *Ali, et al., (2015)* who conducted a study entitled "Nurses' Knowledge and Practice Regarding Implantable Cardiac Devices in Egypt" and reported that self-learning package had statistically significant positive effect on nurses' performance (Knowledge and Practice) regarding caring for patients with pacemaker.

Regarding the studied nurses' practice, less than half of the studied nurses showed competent practice in measuring vital signs pre protocol implementation compared to less than three quarters of them post implementation which declined to two thirds at follow up of protocol implementation. This was similar to *Mohamed et al. (2020)*, who found, in a recent study entitled "Impact of Nursing Intervention Protocol about Polytrauma Care during the Golden Hour on Nurses' Performance" that, there was a statistically significant difference in practice level regarding immediate nursing interventions with marked improvement post protocol implementation among studied nurses.

More than one third of the studied nurses had correct performance regarding use of pulse oximetry at pre then increased to more than three quarters respectively at post implementation of nursing protocol but declined to more than half at follow up period with high statistical significance difference. These finding were similar to those of *Odah M., et al. (2020)*, who carried out a study entitled "Effect of an Educational Program About Acute Respiratory Distress Syndrome on Critical Care Nurses' Performance" and reported that, there was a highly statistically significant difference between nurse's practice about pulse oximetry during three program phases pre-test, immediately post-test and three-month post-test.

Concerning the nurses' practice of chest physiotherapy, less than one third of the studied nurses had competent practice at pre protocol implementation compared to more than half of them at post implementation which declined to half of them at follow up period with statistical significance difference. These findings were similar with those of *Mohammed (2018)*, who carried out a study entitled " effect of instructional guidelines on studied nurses' practice caring of neonate suffering from meconium aspiration" and revealed that, more than half of the studied nurses showed competent practice in applying chest physiotherapy at pre implementation of guidelines compared to most of them at post implementation which declined to more than two thirds of them at follow up period with statistical significance difference between pre and post implementation of nursing protocol.

Considering the practices of the studied nurses regarding care of Endo-Tracheal Tube, one third had competent practice at pre protocol implementation compared to slightly more than three quarters of them post implementation which decreased to less than two thirds at follow up of protocol implementation with highly statistically significant difference. These findings were in agreement with those of *Odah M., et al., (2020)*, who recently conducted a study entitled " Effect of an Educational Program About Acute Respiratory Distress Syndrome on Critical Care Nurses' Performance " and mentioned that, there was a statistically significant difference between nurse's practice about daily endotracheal tube care during three program phases pre-test, immediately post-test and three-month post-test. Conversely, these finding contrasting with those of, *Abd EL-Samiea. (2011)* who stated that the great majority of the nurses had competent performance of endotracheal tube care with percentage 94% irrelevant to protocol implementation.

These findings were corresponding with those of *Odah M., et al. (2020)*, who demonstrated that there was a statistically significant difference between nurse's practice about daily suctioning during three program phases pre-test, immediately post-test and three-month post-test.

One third of the studied nurses showed competent practice in central venous pressure assessment pre protocol implementation compared to more than three quarters of them post implementation which declined to less than two thirds at follow up period. This was contrasting *Abd El Samiea (2011)*, who mentioned that, the great majority of the nurses had competent performance in relation to measuring central venous irrelevant to protocol implementation.

The present study findings showed that there was improvement in nurses' practice post protocol intervention. regarding assessing urinary catheter care, removing urinary catheter, wound dressing, chest tube care, and chest tube removal. The present study showed that, at pre implementation of nursing protocol slightly more than one third of the studied nurses had a competent level of total performance regarding skills for children undergoing cardiac surgery. Meanwhile, competent level increased to slightly more than three quarters at post protocol intervention and competence of nurses declined to less than two thirds at follow up implementation of nursing management protocol, with highly statistically significant difference between total practice for pre, post and follow implementation of nursing management protocol ( $Q= 26.35$  &  $p=0.000$ ).

The improvement in nurses' practices after the intervention was also noticeable since their practices before implementation of the training program were even worse corresponding to knowledge. There were more than three quarters of the nurses have unsatisfactory practice at the pre-program phase. While there was a significant improvement demonstrates at the post-program phase when it finds that more than half of the nurses have satisfactory practice regarding open heart surgery nursing care. Like knowledge, the adequate practice continues throughout the follow-up phase and the attendance of the program is the only independent predictor that positively influences the practice score. These findings may highlight the importance of the nursing management protocol in increasing the nurses' performance regarding care of children undergoing cardiac surgery. This result could be due to the clarity of the protocol content, demonstration and re-demonstration of practices.

The incompetent performance before protocol implementation might be due to the absence of a training program, booklet and stander for care inside each unit during the period of protocol implementation. In the same line *Khalil (2018)* reported that this might be related to many factors as nursing workload, lack of availability of assessment tools, lack of education on assessment tools, lack of familiarity with tools, lack of protocols and guidelines management and no designing area for charting. This was agreed with *Mohammed et al., (2018)* who showed that the practice score of nurses exposed to an educational program was higher than their pre practice score.

From the researcher point of view, the findings of the present study reflected the importance of the education, evaluation and presence of nursing protocols, guidelines in different PICU to increase the knowledge and performance of the nurses about cardiac surgeries.

Finally, the findings of the present study supported the research hypothesis which that nursing management protocol will enhance nurses' performance regarding postoperative care among children with cardiac surgery Post and follow up implementing nursing protocol than on pre implementing nursing protocol.

## VI. CONCLUSION

Summing up, it can state the present study findings affirm the importance of the nurses' continued education and awareness and revision of protocol of care for nurses working at cardiothoracic surgery ICU. The findings concluded that: Before implementation of nursing management protocol Less than one quarter of the studied nurses had satisfactory knowledge and more than one third of the studied nurses had a correct performance level regarding care of children undergoing cardiac surgery. Meanwhile, after nursing management protocol implementation, nurses' knowledge and practice regarding care of the children undergoing cardiac surgery are significant improved. Also, indicated that there were highly statistically significant differences between total knowledge for pre and post implementation of nursing management protocol. Adding to that, there were a highly statistically significant difference between total knowledge and practice for pre and follow implementation of nursing management.

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