

Impact of Nursing Management Protocol on Selected Postoperative Outcomes among Children with Open Heart Surgery at Cairo University Specialized Pediatric Hospital

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Abstract: Open-heart surgery is a common medical procedure that can save lives and improve the quality of heart. The current study was conducted to evaluate the impact of nursing management protocol on selected postoperative outcomes among children with open heart surgery at Cairo University Specialized Pediatric Hospital. The study utilized a pre- post-test quasi-experimental research design. A total sample of 70 children who were undergoing open heart surgery was selected from the surgical unit. Data required for the study were collected through the use of three data collection tools developed by the researcher. The first one is structured interview schedule which includes the sociodemographic data about children and their families it also involve history of child's illness. The second one was the postoperative assessment data sheet to assess the children during postoperative phase. It includes established child postoperative outcomes criteria related to: (1) respiratory functions such as: rate, depth, pattern, cough, oxygen saturation, PaO₂ and PaCO₂; (2) wound condition; (3) renal functions and characteristics of urine; (4) chest tubes drainage system. The third one was the designed nursing management protocol. It is apparent from the current study's results that, there were highly statistically significant differences between the means of the readings in the pre and post application of the nursing management protocol at first and second days after surgery regarding respiratory rate, pulse, temperature, systolic and diastolic blood pressure. As well as, there were highly statistically significant differences between the means of readings in the pre and post application of the nursing management protocol at first and second days after surgery as regards oxygen saturation, Pao₂, Pco₂, serum creatinine and urea amount of chest drainage/hr. The study results concluded that, the effectiveness of the designed nursing management protocol on improving postoperative outcomes among children who participated in the current study. The study recommended the integration of the designed nursing management protocol in the care of children undergoing open heart surgeries in postoperative cardiac intensive care units.

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1. Introduction

Development of the heart takes place during the first 8 to 12 weeks of gestation. It is considered the vulnerable period of gestation for cardiac malformation. The specific type of cardiac malformation produced varies depending on the environmental trigger and its timing within the vulnerable period. When the heart or blood vessels near the heart do not develop normally before birth, a condition called congenital heart disease occurs. Most alterations in cardiovascular function in children are the result of defects in the heart that are present at birth as congenital heart diseases (CHDs) (Walsh, 2010).

Crocetti and Barone (2008) viewed that, CHDs remain a major public health problem in the United States and other industrialized nations. Eight of every 1000 live born infants have a congenital cardiovascular malformation, for some the defect is of little clinical significance; for others surgical

palliation and repair permit a longer life. In spite of dramatic advances in treatment over the last fifty years, cardiac defects account for a large proportion of infant mortality. CHD is the major cause of death (other than prematurity) in the first year of life. According to the American Heart Association (2008), approximately 35,000 babies are born each year with some type of CHDs.

Based on data from the Medical Record and Statistical Affairs Department in the intensive care unit for postoperative open heart surgery at Cairo University Specialized Pediatric Hospital (CUSPH) (2010), there are 184 child admitted to pediatric intensive care unit, 63% of those children went to the rehabilitation room in the same hospital, 14.7% of them went to home, and 22.3% of them were dead after surgery.

The etiologic factor in CHD is not known, in more than 90% of cases. However, several factors are associated with a higher than expected incidence of

the defect. These include prenatal factors such as maternal rubella infection during pregnancy, maternal alcoholism, maternal age over 40 years, and maternal insulin-dependent diabetes. Heart defects are found in a much higher percentage of stillbirths, spontaneous abortions, and low-birth-weight infants, especially those small for age. Children with CHD are also more likely to have extracardiac defects, such as tracheoesophageal fistula, renal agenesis, and diaphragmatic hernias (**Haws, 2009; Rice & Creehan, 2009**). CHD results from malformations of the heart that involve the septums, valves, and large arteries. They are classified as a cyanotic or cyanotic defect. A cyanotic defect occurs when a left-to-right shunt is present that allows a mixture of oxygenated and unoxygenated blood to enter the systemic circulation (**Peate, & Whitin, 2009**).

Open heart surgery, refers to operations performed on the heart that require a child being placed on the heart-lung bypass machine. It is a common surgical procedure that can save lives and improve the quality of heart. Heart surgery is aimed at improving the functioning of a heart that is working abnormally (**Ruppert & Kernicki, 2010**). **Dworki (2010)** stated that, open heart surgery is a major operation and the hours following surgery are considered critical.

Heart surgery is a stressful situation for families and needs special preparation. Leaving the child at the hospital for surgery is a harmful for the child and the family. Preparing a child and the family for surgery is a necessity. Preparing a child for heart surgery can be a challenge for the whole family. As well as the child involved, parents and siblings also need assistance and information to help them cope (**Berkowitz, 2009**). Nurses play key role in improving quality of child care. Cardiothoracic surgical nurses play a major role in preparing children and families for operations. In health care facilities, where cardiac surgery is performed routinely, preoperative instructions and psychological support are an integral component of nursing care. Ideally, nurses who will provide care in the post operative period perform pre operative teaching and counseling. The assigned nurse can assess the child and communicate information to other nursing staff. In addition, the nurse conveys to the child the knowledge and skills of those who will be providing post operative care and establishes a relationship with the child and family before surgery (**Gardner, 2009**).

Wong (2010) defined the nursing management protocol as 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

protocol is guidelines, formatting tips and templates which are readily available. Nursing management protocol is to identify the minimal best practice expectations. Nursing management protocol is essential for the delivery of nursing care and clinical practice. A protocol for postoperative care is useful to anticipate and prevent postoperative complications while minimizing utilization of hospital resources.

Significance of the Study

In Egypt, there are scarce researches about the postoperative nursing management protocol on postoperative outcomes among open heart children at CUSPH. Moreover, it has been evident that the postoperative open heart children are at high risk for many of postoperative complications mainly respiratory ones, wound infection, bleeding specially from chest tubes, and / or renal dysfunctions. These complications have its impact on the child and his or her family physically, psychologically, socially, and / or financially, which consequently increase the child's hospital stay adding to hospital costs.

So, the implementation of the nursing management protocol for open heart children will hopefully set a standard care that can be followed to improve physiological function, respiratory qualifications, wound healing and renal functions for those children. Also it is hoped that findings of this study might help in assuring quality of care and providing evidenced data that can develop nursing practice and research.

Aim of the study:

The aim of the current study was to evaluate the impact of nursing management protocol on selected postoperative outcomes among children with open heart surgery at CUSPH.

Research Hypothesis:

The following hypothesis was tested:

Postoperative outcomes are better among open heart children after receiving of the designed nursing management protocol as compared to postoperative outcomes before receiving the protocol.

2. Subjects and Methods

Research Design:

The study utilized a quasi-experimental research design. One group pre-post test design was utilized to carry out the current study. The group was treated as a study group and its own control group at the same time.

Sample:

Total sample of 70 children who were undergoing open heart surgery were selected from surgical unit at CUSPH. Sample size was calculated

according to the rule of the sum which means multiply numbers of variables by variables that equals 70 children. The group was assessed before and after receiving of the designed nursing management protocol.

Inclusion criteria of children:

1. Their age was more than 3 years, both gender,
2. They had CHDs, and were undergoing open heart surgery for the first time,
3. They didn't have any other health problems which need any other surgical intervention.

Setting:

The current study was conducted in the postoperative cardiac intensive care unit (PCICU) at CUSPH.

Tools for Data Collection:

The following tools were used to collect the required data, it developed by the researchers after extensive reviewing of the related literature:

1. Structured interview schedule: included the sociodemographic data about child and his/her family and data related to child's illness. It involved 64 questions which divided into main three parts:

- A. The first part contained 15 questions related to the sociodemographic data about the child and his/her family such as age, gender, level of educationetc.
- B. The second part included 27 questions that describe the child's disease as diagnosis, duration of illness, clinical manifestations, times of hospital admission and medications. Data were collected through interviewing the mothers and children and from the child's medical files.
- C. The third part comprised 22 questions that describe how children prepared to perform the open heart surgery such as time of preoperative preparation, steps of preoperative preparation, and others.

2. Postoperative assessment data sheet: to assess the children during postoperative phase. It developed by the researcher. It involved 110 questions. Questions from 1-91 were dealt with the assessment the child's postoperative outcomes related to (1) respiratory assessment such as: rate, depth, pattern, breath sound, cough, oxygen saturation, PaO₂ and PaCO₂; (2) wound assessment such as: condition of surrounding skin, presence of wound secretion (exudates presence, exudates amount, and odor), pain assessment using Wong Baker pain rating scale, presence of drainage system, and signs of infection; (3) renal assessment such as renal functions, and (4)

chest tubes drainage system such as: amount, color and consistency. Questions from 92-110 were developed to assess dangerous signs or complications after open heart surgery such as tachycardia, oliguria, arrhythmia, dyspnea, orthopnea, shortness of breath, peripheral edema, hypoxia, cyanosis, tachypnea, heart murmur, pulmonary edema, hypothermia or hyperthermia, pneumothorax, and hemothorax.

Description of the nursing management protocol:

The implementation of the designed nursing management protocol was took place on the second and third postoperative days after extubation. It was concentrated upon implementation of nursing activities such as respiratory care, wound care, chest tubes care, and renal care. It involved the following objectives (monitor the child's condition, maintain maximum level of mobility, promote optimal respiratory status, promote wound condition, promote renal function, minimize the chest tube drainage, minimize the occurrence of complications, and support the child psychologically).

Validity and Reliability:

Data collection tools were revised by a panel of five experts in the field of pediatric cardiology and pediatric nursing to test its content validity. Modifications of the tools were done according to the panel judgment on clarity of sentences, appropriateness of content and sequence of items. Regarding reliability, the reliability coefficients' alpha between questions was 0.6.

Data Collection Procedure:

Ethical approval was obtained from the relevant research ethical committee in the faculty of nursing, Cairo-University, to approve the study. All participants were informed about the study in the order to obtain their acceptance to participate in the study; the researcher explained the benefits and possible risks of the current study. The researcher informed them that all data gathered during the study considered confidential. The parent informed about their rights to withdraw from the study at any time without any effect on their children care. An official permission to conduct the current study was obtained from the directors of CUSPH. The written informed consent was obtained from parents of children who were undergoing open heart surgery. The interview conducted for all children to fill the sociodemographic sheet on individual bases. The time spent to fill the structured interview schedule ranged between 30 to 45 minutes for each mother. The researcher gave each child respirometer and trained them how to use it. The researcher guided the mother to encourage the child to use it before eating and each 4-6 hours in the preoperative period.

Children went to perform the open heart surgery after that they admitted to PCICU for

postoperative open heart surgery at CUSPH. The designed postoperative nursing management protocol was implemented. The protocol enabled the children with open heart surgery to maintain and promote the state of body homeostasis, attain wellbeing, and achieve the desired surgical outcomes. So, the overall aim of the postoperative nursing management protocol highlighted the specific needs of those children and enhancing the selected postoperative outcomes (respiratory functions, wound condition, renal functions and chest tubes drainage system). The implementation of the designed postoperative nursing management protocol was based on each child's priority for care.

These nursing interventions covered the following objectives (monitor the child's condition, maintain maximum level of mobility, promote optimal respiratory status, promote wound condition, promote renal function, minimize the chest tube drainage, minimize the occurrence of complications, and support the child). The expected outcomes from these nursing interventions were: to perform breathing and coughing exercises accurately; perform active and passive exercises; display clear breath sound; maintain normal respiratory rate and depth; show no signs and symptoms of wound infection; show no signs and symptoms of renal dysfunction; show no signs and symptoms of respiratory dysfunction; maintain vital signs within normal range; minimize chest tube drainage; prevent fluid and electrolyte imbalance and display laboratory function tests within normal range.

To ensure the consistency and continuing of care given to the participated children, the researcher gave instructions about the content of the nursing management protocol to the nurses who are caring for postoperative open heart children in the PCICU. These instructions were given through one session for two groups of nurses. Each group was about from 7-10 nurses. The session was taken about 60-90 minutes. The researcher gave each nurse Arabic illustrated booklet to review the instructions.

The postoperative assessment data sheet was completed four times; the first and second times measured on the second post-operative day after extubation (before and after the implementation of the designed postoperative nursing management protocol) and the third and fourth times measured on the third post-operative day (before and after the implementation of the designed postoperative nursing management protocol). The time spent to fill the postoperative assessment data sheet and implement the designed postoperative nursing management protocol ranged between 3 to 4 hours for each child. The data collection took nine months from July 2010 to March 2011 to be completed.

Pilot study:

The pilot study was carried out on 7 children with CHD in the PCICU for postoperative open heart surgery at CUSPH to test the applicability and clarity of the questions of the study tool, estimate the time needed to complete the questionnaire, and to add or omit questions. Some modifications for the questions were done. That sample was excluded from the total of study sample.

Statistical Analysis:

The collected data were categorized, tabulated, and analyzed using the computer program (SPSS Version 15). Numerical data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. Comparison of means was performed using paired-sample t-test. Level of significance was set at $p < 0.05$.

3. Results

Concerning the sociodemographic characteristics of children, the current study proved that, more than two thirds (68.6 %) of children were aged from 3 to less than 6 years old, the mean of their age was 6.1 ± 1.4 year. Regarding to their gender, more than half of them (52.9 %) were females. The study results revealed that, the highest percentage of children (72.9%) were from rural areas. In relation to children's rank within the family, it was found that more than two thirds (38%) of them were ranked as the second child. It is evident from the current study that, more than two thirds (68.6%) of children were enrolled in school or nursery school.

Figure (1) revealed that, the majority of children (81.4 %) were diagnosed as having CHD immediately after birth. Figure (2) illustrated that the most common diagnosis among children was ventricular septal defect (VSD) (57.1 %) followed by atrial septal defect (ASD) and tetralogy of Fallot (TOF) (14.3%, 12.9 % respectively).

It is evident from table (1) that, the maximum percentage of children was suffered from tachycardia and arrhythmia (90 % & 67.1% respectively). Regarding to perfusion symptoms the same table proved that, the highest percentage (61.4%) of children suffered from bluish discoloration and the minority (8.6%) of them had clubbing fingers. On the same line, all children (100%) suffered from easy fatigability, difficult feeding and loss of weight.

It is obvious from the results of current study that, more than half of children (55.7%) hadn't previous hospital admission. In relation to times of previous hospital admission, about two thirds of children (61.3%) were hospitalized for two times. Regarding to the causes of the previous hospitalization, the maximum percentage of children

was admitted to hospital to perform surgery and for investigations (41.9 %, 38.7 % respectively).

In relation to length of stay in PCICU after open-heart surgery, table (2) proved that, nearly half of children (48.6%) stayed from one to four days, while, 40%, 11.4% respectively of them were stayed from four days to less than one week and more than one week. On the other hand, more than half of children (51.4%) transferred to home, while, 48.6% transferred to rehabilitation room.

As regards the information given to children before surgery it was evident from the results that, the vast majority of children (92.9 %) had no information about their surgeries. Children were informed about surgery by their parents and their physician, unfortunately, no one of them was informed by their assigned nurse. All children (100%) not prepared psychologically for surgery. On the other hand, the highest percentage of children was physically prepared for surgery regarding to X- ray, ECG, laboratory investigations and vital signs (87.1 %, 58.6 %, 91.4 % & 100 % respectively). No one of children had physical preparation in the form of chest physiotherapy, breathing and physical exercises.

Regarding to postoperative assessment among children before and after the implementation of the nursing management protocol, table (3) highlighted that, the means of the respiratory rate before and after implementation of the nursing management protocol at first day were 35.66 ± 2.74 , 34.3 ± 2.5 breath/minutes respectively. There were statistically significant difference between them ($t=2.22$, p value ≤ 0.05). As well as the means of the respiratory rate before and after implementation of the nursing management protocol at second day was 34.2 ± 2.6 , 33.4 ± 2.6 breath/minutes respectively. There were statistically significant difference between them ($t=1.25$, p value ≤ 0.05).

It is apparent from the same table that, the means of the child's pulse rate before and after implementation of the nursing management protocol at first day was 103.6 ± 8.4 and 101.8 ± 7.1 beat/minutes respectively. Furthermore, the means of the pulse rate changed to 99.6 ± 5.8 and 97.7 ± 5.6 beat/minutes respectively at second day. There were statistically significant difference between the means of pulse rate before and after implementation of the nursing management protocol at first and second days ($t=2.8$, p value ≤ 0.05 and $t = 0.019$, p value ≤ 0.05 respectively). There were statistically significant difference between the means of child's body temperature before and after implementation of the nursing management protocol at first and second days ($t=2.9$, p value ≤ 0.05 and $t = 1.7$, p value ≤ 0.05 respectively). On the other hand, there was no

statistically significant difference between the means of the child's systolic and diastolic blood pressure.

Table (4) revealed that, 21.4% of children had deep respiration after implementation of the nursing management protocol at first day compared to 61.4% of them at second day. Less than one fifth of children (17.1%) had clear breath sound at first day after implementation of the nursing protocol, this percentage increased to 34.3% at second day. On the same context, 20% of the children had regular respiration after implementation of the nursing management protocol at first day compared to 60% of them at second day. There was statistically significant difference between the depth of respiration, the breath sound at first and second days after implementation of the nursing management protocol ($X^2 = 1.09$, p value ≤ 0.05 and $X^2 = 0.24$, p value ≤ 0.05 respectively).

It is obvious from the current study results that, 14.2% of children had clinical signs of wound inflammation (swelling and redness) at first day either before or after application of the nursing management protocol. While, this percentage decreased to 11.4% at second day. Regarding to the presence of exudates, nearly one quarter of children (24.3%) had exudates from wound in the form of blood or serous fluid after application of the nursing management protocol at first day, compared to 12.9% at second day.

All children (100%) had pain at first day after application of the nursing management protocol while, this percentage was decreased to 82.9% at second day. As regards children intensity of pain, it was found that, 73.4% of children had moderate pain at first day after implementation of the nursing management protocol compared to 44% at second day. In relation to chest tube drainage, it was found that, about one third of children (31.4%) drained blood from chest tube at first day after implementation of the nursing management protocol, decreased to 20% at second day.

Concerning the postoperative complications, it is clear from table (5, 6) that, the highest percentage of children (71.1%) had tachycardia after implementation of the nursing management protocol at first day, decreased to 50% at second day. As well as, nearly three quarter of children (71.1%) had oliguria at first day compared to 42.9% at second day. On the same line, 64.3% of children had tachypnea after implementation of the nursing management protocol at first day, decreased to 42.9% at second day. Concerning hyperthermia, the majority of the children (80.0%) had hyperthermia before the implementation of the nursing management protocol at first day in comparison to (50%) at second day. There was statistically significant difference between

the rate of tachypnea at first and second day after implementation of the nursing management protocol ($X^2= 0.66$, p value= <0.05).Regarding to heamothorax, 7.1% of children had heamothorax before implementation of the nursing management

protocol at first day, while 4.3% of them had heamothorax at second day. There were no statistically significant differences between the incidence of heamothorax at first and second day after implementation of the nursing protocol.

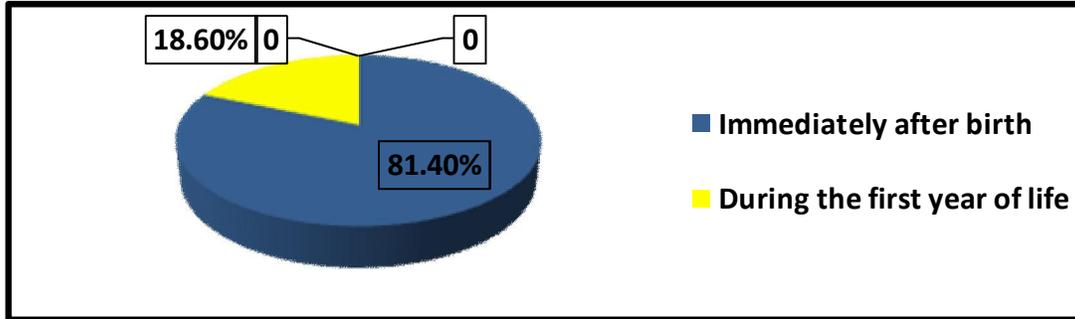


Figure (1) Percentage Distribution of Timing of Child's Diagnosis

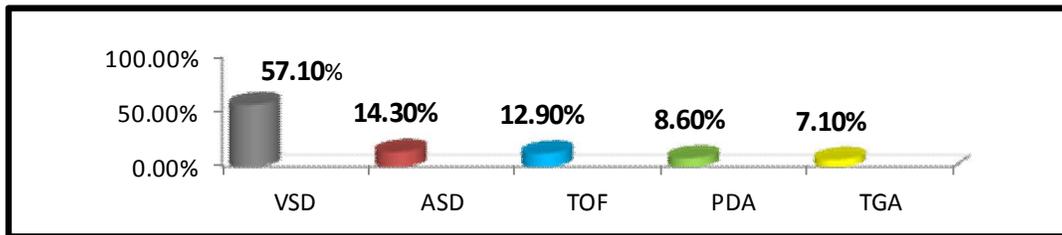


Figure (2) Percentage Distribution of Children' Diagnoses (n=70)

Table (1) Percentage Distribution of Child's Disease Symptoms: (n=70)

Symptoms	Yes		No	
	No	%	No	%
Cardiac symptoms:				
-Tachycardia	63	90	7	10
- Arrhythmia	47	67.1	23	32.9
Perfusion Symptoms:				
- Skin bluish discoloration	43	61.7	27	38.6
- Clubbing fingers	6	8.6	64	91.4
Respiratory symptoms:				
-Hyperpnoea	7	10	63	90
- Dyspnea	6	8.6	64	91.4
Others:				
-Peripheral edema	6	8.6	64	91.4
- Easy fatigability	70	100	0	0
- Oliguria	6	8.6	64	91.4
- Difficult feeding	70	100	0	0
- Loss of weight	70	100	0	0

Table (2) Percentage Distribution of Length of Stay in PICU: (N=70)

Item	(n=70)	
	No.	%
Length of stay in PICU:(n=70)		
1- 4 days	34	48.6
< 4 days	28	40.0
< one week	8	11.4
Referral after PICU to:(n=70)		
Home	36	51.4
Rehabilitation room	34	48.6

Table (3) Comparison between Means of Vital Signs before and after Implementation of the Nursing Management Protocol at First and Second Days (n=70):

Items	1 st Day				2 nd Day			
	Pre	Post	t-test	p	Pre	Post	t-test	p
Respiratory Rate	35.66±2.74	35.3±2.5	2.22	0.02*	34.2±2.6	33.4±2.6	1.25	0.03*
Pulse rate	103.6±8.4	101.8±7.1	2.8	0.03*	99.6±5.8	97.7±5.6	0.019	0.01*
Temperature	37.8±0.24	37.8±0.20	2.9	0.02*	37.7±0.18	37.6±0.18	1.7	0.04*
Systolic blood pressure	78.36±6.3	78.35±6.3	2.3	0.08	80.4±6.5	82.4±6.6	2.07	0.5
Diastolic blood pressure	58.4±3.9	58.4±3.9	2.1	0.09	58.4±3.8	58.9±3.7	1.09	0.4

Statistically significant at p<0.05

Table (4) Percentage Distribution of Depth and Rhythm of Respiration and Breath Sound before and after Implementation of Nursing Management Protocol at First and Second Days (n=70):

Items	1 st Day				2 nd Day			
	Pre		Post		Pre		Post	
	No	%	No	%	No	%	No	%
Depth of respiration:								
Deep	5	7.1	15	21.4	25	35.7	43	61.4
Shallow	65	92.9	55	78.6	45	64.3	27	38.6
$X^2 = 1.09$ P value = 0.04*								
Rhythm of respiration:								
Regular	5	7.1	14	20.0	24	34.3	42	60.0
Irregular	65	92.9	56	80.0	46	65.7	28	40.0
$X^2 = 0.11$ P value = 0.06								
Breath sound:								
Clear	5	7.1	12	17.1	20	28.6	24	34.3
Wheezing	65	92.9	58	82.9	50	71.4	46	65.7
$X^2 = 0.42$ P value = 0.03*								

Table (5) Percentage Distribution of Postoperative Complications before and after Implementation of the Nursing Management Protocol at First and Second Days(n=70):

Items	1 st Day				2 nd Day			
	Pre		Post		Pre		Post	
	No	%	No	%	No	%	No	%
Tachycardia								
Present	54	77.1	50	71.4	40	42.9	35	50.0
Absent	16	22.9	20	28.6	30	57.1	35	50.0
$X^2 = \text{fisher}$ P value = 0.09								
Oliguria								
Present	54	77.1	50	71.4	45	64.3	40	42.9
Absent	16	22.9	20	28.6	25	35.7	30	57.1
$X^2 = \text{fisher}$ P value = 0.1								

Table (6) Percentage Distribution of Postoperative complications before and after Implementation of the Nursing Management Protocol at First and Second Days, cont., (n=70):

Items	1 st Day				2 nd Day			
	Pre		Post		Pre		Post	
	No	%	No	%	No	%	No	%
Tachypnea:								
Present	54	77.1	45	64.3	35	50.0	30	42.9
Absent	16	22.9	25	35.7	35	50.0	40	57.1
$X^2 = 0.66$ P value = 0.04*								
Haemothorax:								
Present	5	7.1	5	7.1	3	4.3	3	4.3
Absent	65	92.9	65	92.9	67	95.7	67	95.7
$X^2 = \text{fisher}$ P value = 0.9								
Hyperthermia:								
Present	56	80.0	50	71.4	40	57.1	35	50.0
Absent	14	20.0	20	28.6	30	42.9	35	50.0
$X^2 = \text{fisher}$ P value = 0.09								

4. Discussion

Regarding to sociodemographic characteristics of children and their families, the results of the current study revealed that, more than two thirds of children were aged from 3-<6 years. This result is supported by Afifi and Mohamed (2009), who investigated that the hospital admissions in CUSPH and found that the majority of children who are undergoing cardiac surgery were at 4-6 years old. As regards children's gender, the current results indicated that more than half of them were females. This could be attributed to that Egyptian families, and families in third world in recent years, are paying attention and seeking medical advice for both boys and girls offspring's. This is parallel with Ali, et al.,(2010) who investigated breast feeding pattern among infants with CHDs at CUSPH mentioned that, girls had half percentage among children with CHDs. The results of the current study showed clearly that, relatively high percentage of children was from rural areas. It could be interpreted as the hospitals in rural areas not well prepared to carry out this type of surgeries so; hospitals in Egypt refer cases to the CUSPH for better health facilities and equipment.

The highest percentage of children was diagnosed as having VSD, ASD and TOF. This result was supported by Ali, et al., (2010) who mentioned that, VSD and TOF are the highly admitted percentages to medical wards in CUSPH. The same explanation was mentioned by Arthur, et al.,(2010), who investigated the effect of preoperative intervention on preoperative and postoperative outcomes in open-heart surgery and reported that, cardiac disorders specially VSD, were the second cause of children's admission to the hospital. As well, Ahmed, et al., (2010) concluded that, heart diseases are representing a major health problem among Egyptian children.

The current study results showed that, a relatively high percentage of children were suffered from tachycardia, arrhythmia, hyperpnoea, dyspnea, skin bluish discoloration, clubbing fingers and easily fatigability. These findings are supported by Chien (2009), who investigated CHD corrective surgery and postoperative complications showed that, symptoms which indicate the need for surgery included skin or lips discoloration, cyanosis, clubbing fingers, arrhythmia, hypoxia and difficult breathing. Moreover, empirical evidence and previously cited literatures commented that, tachycardia and arrhythmia were symptoms of CHDs and postoperative cardiac surgery complications (Lotfy, 2012).The same explanation was mentioned by Yalcinbas (2012) who emphasized that, postoperative cardiac children are more at risk for developing

pulmonary complications than other surgical patients because of the effects of lung heart machine.

In relation to length of stay in PCICU, the current study proved that, nearly half of children stayed in PCICU from one to four days. These findings were matched with Arthur, et al.,(2010) who proved that, postoperative length of stay in PCICU was decreased to two or three days after preoperative interventions.

As regards the information given to children about open-heart surgery, the results revealed that, the minority of children had knowledge about their surgery. On the contrary, Valkenet, et al., (2011) emphasized that; knowledge about surgery preoperatively was the first step for positive recovery. Based on the results of the current study, no psychological preparation was provided for all children. This finding is contradicted with Thakaret, Yared, and Hinoki (2010) who stressed that, the psychological preparation for the child and his/her family is very important to be done by pediatric physician, nurse, psychologist and social worker. As it had positive effects on healing process of wound and the pain relief.

Regarding postoperative outcomes among children before and after implementation of the nursing management protocol, it was found that, there were obvious highly statistically significant difference between rate, depth and rhythm of respiration and pulse rate, temperature at first and second days. These results were in accordance with Catta (2009), who mentioned that there is a possible difference in vital signs after performance appropriate care and follow up during postoperative evaluation of CHDs. The author added that, postoperative evaluation of CHDs is an essential to ensure continued advances in survival and quality of life.

Clearly, the current study revealed that, there were highly statistically significant difference in the presence of pain and its severity at the first and second days after implementation of the nursing management protocol. Empirical evidence and previously cited research literatures commented that, several previous studies have shown that worrying about longstanding pain is more distressing, difficult to dismiss, and distracting as compared with non-pain-related worrying (Wicksell, et al., 2008; Blount & Loiselle, 2009).Moreover, Maron (2009) and Peter (2010) stated that, postoperative children are threatened by many sources of stress from the internal and external environment. These stresses affect their ability to cope with their illness, work, and social life, therefore aggravate the children's physical and psychological condition related to produce pain.

Apparently, the current study indicated that, there were highly statistically significant difference in the content and color of chest tube drainage at the first and second days after implementation of the nursing management protocol. This result support the current evidences by Kwiatkowski and Manno, (2010) and Menache, et al.,(2010) who mentioned that, physical exercises and physiotherapy effect positively on functioning of chest tubes, amount of its drainage, and the content from it. So, the nurse must be had an active role to care of chest tubes.

It is evident from the current study that, the clinical signs of wound inflammation (swelling and redness) were decreased after implementation of the nursing management protocol. It could support the effectiveness of the nursing protocol in reducing the incidence of wound infection. On the same context, Kwiatkowski and Manno (2010) reported that, daily wound care and proper hygienic care which are following aseptic practice can prevent the incidence of wound complications.

Clearly, the current study evident that, the incidence of the postoperative complications (tachycardia, tachypnea, hyperthermia, oligurea and heamothorax and...etc.) among children was decreased after implementation of the nursing protocol. The evidences of post operative complications at second day were better than the evidences at first day after implementation of the nursing protocol which supported the current study hypothesis (postoperative outcomes are better among open heart children after receiving of the designed nursing management protocol as compared to postoperative outcomes before receiving the protocol). These findings support recent evidence by Middleton (2011) who mentioned that the implementation of a multidisciplinary supported evidence-based protocol initiated by nurses is effective for achieving better outcomes. It is cost effective and improving patient recovery.

Conclusion

The results of the current study add to the growing body of evidence that supports the effectiveness of the implementation of the nursing management protocol for children after open-heart surgeries. The study concluded that, the evidence of postoperative complications was decreased after the implementation of nursing management protocol which indicates better postoperative outcomes among children with open-heart surgery and the effectiveness of the designed nursing protocol.

Recommendations

Based on the findings of the present study, the following recommendations were formulated:

Educational program about preoperative and postoperative preparations for children undergoing open heart surgery must be conducted for all nursing and medical staff to improve the postoperative outcomes of children.

Education must begin with the mothers\child family members at the first day of hospital admission about the open heart surgery to secure them and help them to cope effectively with children.

Replication of the study should be conducted on a larger sample including different urban and rural areas and in other pediatric hospitals is needed for generalization of the reached results on the population.

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